

NSF HCC-small: Design Methods: How They are Understood, Selected, and Used by Practitioners

Erik Stolterman
Professor of Informatics
School of Informatics and Computing
Indiana University, Bloomington
estolter@indiana.edu

Martin A. Siegel
Professor of Informatics
School of Informatics and Computing
Indiana University, Bloomington
msiegel@indiana.edu

Design is today seen as a successful approach for innovative and creative product and service development. There are many attempts at improving interaction design and human-computer interaction practice by developing new approaches, methods, tools and techniques that would bring a more refined design approach to professional practice.

Indeed, many of the proposals to the NSF-HCC program are aimed at developing methods, techniques, and tools that are based on a sophisticated understanding of the fundamental nature of human-computer interaction and of design. These attempts are based on a belief that when well-developed design methods are made suitable for professional practice, they will lead to more creative and innovative products and services.

Our research proposal is focused on an overlooked aspect in the field of HCI and interaction design which has to do with the way practitioners understand, evaluate, select, and adapt design methods (approaches, methods, techniques, and tools) for their design process needs. Even though design as an approach has achieved a lot of attention lately, we have found that little has been done to examine what design methods practitioners actually use, why they use them, and how they think about and understand these methods.

We also believe it is crucial with research aimed at examining the intentions, goals, principles, strategies and thinking among *those who develop new design methods*. How do these developers understand the professional practitioner who is supposed to use the design method, what do they see as essential qualities of a practical and useful design method, and how do they design their methods to cope with the practicalities and problems of getting their methods used in practice?

In this proposal, we will examine the relationships among three entities:

- (i) the developers of design methods;
- (ii) the design methods themselves; and
- (iii) the professional design-practitioners using these methods.

One might imagine that the relationships among these entities are well understood. Yet, it has been argued that design methods proposed by method developers do not fit practice as experienced by practicing professionals (Rogers, 2004; Stolterman, 2008; Sutcliffe, 2000). There also seems to be, among method developers, a sense that users of their methods do not use their methods in the way that they are intended and that such “misuse” leads to failures and distrust in methods in general (Rogers, 2004; Stolterman, 2008; Cross, 2008).

It is clear that the way professional practitioners use methods, tools and techniques in their design work, influences the outcome of the process; that is, design methods influence the design outcome. This observation is also an assumption among those who develop new methods. They believe that if professionals are provided with good design methods they will,

with higher certainty and improved predictably, be able to create better and more innovative designs. However, often design method developers “complain” that practitioners do not use the design methods that they have developed or that they don’t use them in the “correct” way. At the same time, professionals “complain” that the design methods offered are not always “practical” and “useful”. This situation is well described in Rogers (2004) who summarizes the studies of professional’s use of methods and what she calls the *mismatch between existing methods and the needs of the professionals*. She writes “It would seem that quite a different frame of reference is needed – one which focuses more on the process of design and how the different kinds of designers, themselves, want to be supported.” Rogers (2004).

This means that it does not matter if new and radically improved methods are developed if they are not understood by, selected by, and used by professionals. Based on this reasoning we propose to study how professionals understand design methods, how they think about them, what they consider to be important criteria for choosing a particular design tool, or employing a new technique or framework..

In light of this situation, we argue that there is a need for a deeper understanding of actual design practice and, in particular, the way professionals *understand, choose, adapt, and use design methods*. This argument resonates with what has been advocated by Rogers (2004) and Sutcliffe (2000). Sutcliffe argues that the field of HCI has to change its way of developing methods to be more in line with how professionals work and think. He writes “First, the complexity of theory has to be hidden from the designer, while providing advice that is comprehensible yet faithful to predictions of theoretical models. Secondly, advice has to be generalised so it can be reused in a wide range of contexts.” Similar arguments have been made by Rogers (2004). However, the problem with adapting methods to practice and practitioners is that there are very few studies of practice and even less about practitioner’s use of methods. This proposed study is aimed at filling that gap with the purpose to support future design method development.

Our notion of a *design method* is intentionally broad. We define a design method (in this proposal) as any intellectual or practical support that a practitioner might use to support the design process in a positive way, encompassing everything from everyday “methods”, techniques, and tools for idea generation and collaboration, such as the “pen and paper”, whiteboard, brainstorming, dialoguing, to methods and applications for sketching and refining ideas. We also include formal, axiomatic, and algorithmic methods that are designed for design purposes, as well as intellectual tools, such as methods, approaches, frameworks, and techniques that support the design process as a thinking reflective process, as well as abstract theories.

We decided to use this generous and broad definition of design methods as it enables us to study everyday practical situations in which practitioners might have the opportunity to use anything from a fairly simple loosely defined method to a highly structured and formal method or a theoretical concept or framework. We have in our preliminary research seen that these types of choices are real and frequent, and not always easy to understand and predict (Stolterman et al, 2008; Stolterman et al, 2010).

In the proposed research we will focus on design methods that are meant to support the *generative, creative, and innovative activities* of a design process. In most situations this means that we will focus on the early phases of the design process. Again, this decision is based on our previous research and our expertise.

Our notion of the *design method developer* is also quite generous. We include academics that develop design methods based on research findings as well as industry professionals who develop methods based on professional experience. Of course, the developer of a particular

design method is not always a well-defined individual, it can be a result of an academic research group or a company methods department or some other entity.

Our notion of the *professional designer-practitioner* is in this context also broadly defined. We consider all forms of interaction designers, experience designers, developers, and engineers who are engaged in the design and development of human-computer interactive systems and artifacts to be included in our definition. Based on our own background and specialty, we have a particular focus on interaction designers as a professional group. In this field there has been an explosion of new design methods over the last twenty years and we consider us to be knowledgeable when it comes to that development and use of those methods. We do however believe that the results from our research will be relevant and valuable for a broader range of related areas, such as software design and engineering design, and even other design disciplines.

In order to study practice and professionals, we have developed collaborations with designers and developers in five companies. These professionals have accepted to participate in the study by being study subjects. The professionals are from the following companies: Disney Animation Studios, Adobe, Microsoft, Autodesk, and Adaptive Path.

The overall *goal* of this proposal is to develop an understanding of design methods from the perspective of the practicing professional, that is, an understanding of how professionals *think about, select, and use design methods*.

We believe that our proposed studies will help to create an understanding of what has to be considered in method development for new methods to be useful and used. The outcome of our studies could potentially benefit method developers, as well as organizations that want to make decisions about what methods to use, but also individual designer-practitioners who would benefit from this knowledge to better understand the use of methods. And finally, and maybe most importantly, we see the knowledge coming out of these studies to be invaluable in the education of students involved in any form of design activities.

Study Context and Overview

There is a lot of research and development done in academia, organizations, companies, and by individuals aimed at producing new design methods for practicing professionals. Many of these efforts are not guided by any generally agreed upon scientific understanding of how designer-practitioners think about and use design methods, and even less on how these designer-practitioners choose their methods and what aspects influence their choices. At the same time there is a growing interest among designer-practitioners in design methods. It is a frequent topic at professional conferences and workshops, and in professional magazines and websites.

A research proposal like this requires deep and substantial knowledge about design theory and about professional designerly thinking and behavior among practicing designers and developers. It also requires substantial knowledge about design methods, their nature and how to categorize and describe their constitution. We would argue that we, as a research group, are highly suited for this kind of research. We will later present some of the previous relevant research in which we have been involved.

We have designed our research in such a way that it would give us a possibility to examine the nature and role of design methods as they are intended by their creators *and* how they are selected and used by designer-practitioners. Our overall research proposal is divided into five major studies and activities. These activities include:

- (i) analytical studies of design methods aimed at the development of a conceptual framework for describing, analyzing, and categorizing design methods;
- (ii) analytical studies of research results that have an explicit intention to have “implications for design;”
- (iii) interview studies with designer-practitioners about their understanding, selection, and use of design methods;
- (iv) interview studies with design method developers; and
- (v) theoretical and conceptual development on the nature of design methods, on how they are developed, and their use in practice.

These five activities are described more in detail later in this proposal.

By examining the reasons behind the development of design methods, their constitution, and their use in practice, we believe we can create a well-grounded understanding of the complex relationship between the *development* of methods, the *design methods* themselves, and *their use in practice*. This means that we will explore questions such as: why design methods are desired, what designer-practitioners are seeking, what the methods say that they deliver, why they are selected, who creates them, how they are evaluated by practitioners, why they are designed the way they are, and so on.

We believe that our studies will lead to the following outcomes:

- a conceptual framework/typology of design methods;
- a theoretical understanding of how designer-practitioners think about, select, and use design methods;
- a theoretical understanding of how design method developers approach method development;
- insights and principles suitable for designer-practitioners on how to strategize and handle their choice and use of design methods;
- insights and principles suitable for organizations on their strategic choices of design methods; and
- educational guidelines suitable for interaction design (and related areas) on how to professionally think about and handle design methods.

Related Research

Design methods are researched in different ways in different fields. We have for this proposal focused on three areas. These three are (i) general design research, (ii) interaction design/HCI, and (iii) engineering design. These fields provide different perspectives that are valuable to this proposed research. General design research provides a theoretical foundation about how to understand design as a process of inquiry and action with a focus on the creation of something new and innovative. We consider interaction design/HCI as the core field of our studies. Engineering design is a more traditional field where methodological development has been under way for many years and is established as a strong academic discipline and where it is also possible to find existing typologies of methods.

General Design Research

Several influential design thinkers have historically addressed the relation between design practice and methods. Herbert Simon made an argument in his famous writings on design (Simon, 1969). He argued that traditional scientific methods have limitations and that we could only talk about “bounded rationality” when it comes to design. He also made a clear and important distinction between the nature of the “real” world (the realm of science) and the artificial world (the realm of design). Rittel and Webber (1974) argued further that real-world problems have the characteristic of being “wicked problems,” and as such they are not

“solvable” with prescriptive detailed methods instead they have to be approached using completely different means. Donald Schön (1983) developed a similar but more radical idea. According to Schön, people try to use “technical rationality,” often instantiated in prescriptive methods, to solve problems that are not “solvable” or, to be more precise, that are not even “problems.” Design is about “problem setting,” not about “problem solving,” according to Schön. He also argued that design is all about “messy situations.” In messy situations, the methodological underlying principles developed within the tradition of science are not necessarily suitable; in fact, Schön claimed that they cause more problems than they solve (Schön, 1983). Schön specifically developed his argument in relation to education. He argued that if “technical rationality” is used as the foundation for professional higher education, it hinders students from developing real design competence and design skills, while allowing them to be trained in techniques and skills not appropriate in design (messy) situations.

If we turn to contemporary contributions of the theory and philosophy of design we can find excellent texts that provide fundamental understandings of design in relation to methods. There are a number of researchers that have provided insights that are already considered to be seminal (Cross, 2001; Dunne, 1993; Krippendorff, 2006; Nelson & Stolterman, 2003; Lawson, 2005; Rovee, 1987; Pye, 1995; Schön, 1983). These texts, taken together, outline an intellectual progression from an early engineering-based understanding of design, fostered in a scientific tradition, that has developed into a modern designerly-oriented understanding of design practice. These authors do *not* provide *one* clear understanding or theory of design; instead they give us several different, and sometimes even contradictory, explanations of what defines the foundations of design. But, they all argue that there exists something that we can label a designerly approach, and that design is a unique human activity deserving its own intellectual treatment. They all also agree that such an approach is different from the scientific approach and is solidly based in design practice and in the situated and the concrete. These authors also assert that tools and methods that create predefined ways of approaching reality are not always helpful in design. Instead, all tools, techniques, and methods supposed to support design practice have to be intentionally incorporated as part of a situated designerly approach by the acting designer. As a consequence of this, it becomes important for those who produce support for design practitioners to make that “incorporation” into the designer’s own approach possible. We read these design researchers as all making a strong case for a deeper understanding of design practice in line with what we propose here.

Interaction Design/HCI

Since our specific area of study will be in interaction design, we have looked more carefully at what has been done in this field. Although there are no studies specifically focused on how these designer-practitioners select their design methods, there are, however some studies that have analyzed methods for generative stages in design. Hoeben & Stappers (2001) explored the importance of sketching on traditional media during the conceptual phases of a design project. The authors conclude that designers often prefer traditional methods instead of computer-based methods. This result is something that is highly relevant to our research question and also something that is supported in our own pilot study (Stolterman et al, 2010). A study by Rosson et al, (1998), concluded that different stages of the design process—including generative stages—were better suited to a particular range of methods and techniques, from physical and software tools to theoretical approaches and activities. Dow et al, (2006), pose the question how professional designers externalize ideas for off-the-desktop computing and how these in turn inform next generation design tools. With a focus on ubiquitous computing, they present a set of guidelines for the developers of conceptual design tools. A study by Johnson & Carruthers (2006) focused on creativity and the design of methods that support creativity. An outcome of this study was a set of guidelines for software tools that supported particular creative tasks. There is also some more general theoretical work done on the relationship between designers and their methods (Löwgren & Stolterman, 1999; Löwgren & Stolterman, 2004; Buxton, 2007; Lawson, 2005; Stolterman et al, 2008).

Engineering Design

In engineering design a well-known examination of methods can be found in Cross (2008). Cross is world famous as a researcher and scholar on the nature of design methods and designerly thinking. His writings on “designerly thinking” and “designerly knowing” have had a major influence not only in the field of engineering design but also in a broader context of general design theory (Cross, 2001). Buede (2009) also presents a comprehensive approach in understanding the many facets of engineering design based on an understanding of design as an integrated and synthesizing approach. This book also gives plenty of examples of why these design methods are needed and how to use them. Buede also stresses the whole design life cycle as well as the need to address the whole life cycle of the engineered product. There are several other books that are aimed at presenting design as a process and methods for each of the design phases, some are highly referenced and used and of course used in teaching, such as, Pahl et al, 1995; Ertas & Jones, 1993; Dym, 1994; and Chakrabarti, 2002. Apart from these broader and general writings, there are numerous papers and books dedicated to the introduction of individual design methods.

One aspect of design methods that has been researched in more depth is the issue of *method validation*. Within this area, researchers are trying to find ways to validate if design methods actually are efficient, if they lead to the intended results, etc. There are different approaches used for method validation. Frey and Dym (2006) provide an overview of existing approaches when it comes to engineering methods validation. The authors discuss the value of the different approaches and make the case that medicine can be used as a model, with its focus on *evidence-based methods*, for how design methods can be validated. They also argue that it is crucial to the field to explore new ways of validation. They write, “Professional practitioners need validation processes to determine which methods to employ, as well as when and how to employ them” (Frey & Dym, 2006). In a series of articles, Kitchenham (1996) developed and presented an ambitious evaluation approach for the evaluation of software engineering methods. The author writes, “We assume that there are several alternative ways of performing a software engineering task and we want to identify which of the alternatives is best in specific circumstances. In some cases, comparison will be made against a theoretical ideal (i.e. a gold standard).” There are many other attempts at validating and describing design methods (among them, Olewnik & Lewis, 2005; Chakrabarti, 2002; Cross, 2001).

Based on this related research we are confident that there is an existing knowledge gap when it comes to the actual practical use of design methods and especially on how these methods are perceived and selected by designer-practitioners. We believe that our proposed research could benefit and inform both developments of new design methods as well as the method validation research area.

Earlier Research

Our research group has many years of studies and research on the nature of design and especially on the design process and the designer-practitioners’ competence. We have a research background in informatics and interaction design. Over the years we have studied engineers, architects, industrial designers, computer scientists, interaction designers, product designers, and organizational designers.

Our research has been published in academic settings and brought to a broader audience through books that have influenced the international design research community (Nelson & Stolterman, 2003; Löwgren & Stolterman, 2004; Fitzgerald, Russo & Stolterman, 2002; Stolterman, 2008). Some of our studies on the design process and competence have been performed at large companies, such as ABB and Boeing (Stolterman & Nelson, 2004). These empirical studies of design practice have also informed the choice of approach and activities for this project.

The focus in all our previous research has been on the relation between the overall understanding of the design process and how an appropriate approach is chosen and adapted into methods and techniques for the design situation at hand by the practitioner (Stolterman, 1984; Löwgren & Stolterman, 2003; Löwgren & Stolterman, 1999; Stolterman, 1992). Our research publications constitute foundational work on the nature of design and design methods. This previous research and publications will also constitute the philosophical and theoretical foundation for the proposed research.

We have the privilege of having three distinguished collaborators that bring unique competencies into this project:

- *Professor Nigel Cross*
Nigel Cross is Professor of Design Studies and Head of the Department of Design and Innovation at the Faculty of Technology, The Open University, UK. Cross is a leading international expert on engineering design methods.
- *Professor Harold G. Nelson*
Harold Nelson is the visiting Nierenberg Distinguished Professor of Design at Carnegie Mellon's School of Design. Nelson is an internationally recognized expert in design and systems theory.
- *Professor Peter Todd*
Peter Todd is a Professor of Informatics, Professor of Cognitive Science, and of Psychological and Brain Sciences, at the School of Informatics and Computing, Indiana University, Bloomington. Todd is an internationally recognized expert in decision-making and rationality.

Each of these collaborators will bring their particular expertise to the project. They will not be part of the everyday activities (such as the individual studies) but have and will assist in

- (i) the set up of the research studies;
- (ii) the establishment of the framework of the studies;
- (iii) definitions of core concepts; and
- (iv) in the interpretations of the findings.

They have all agreed to function as discussion partners, critical readers, and reviewers of our results and findings.

Rationality and Decision-making

In our project we will study how designer-practitioners decide on what design methods to use. We will not be able to study these professionals in action, that is, when the decisions are actually made, so we will focus on secondary data, primarily analysis of interviews and documents. For this purpose, we have chosen a theoretical framework of rationality and decision-making that gives us an analytical tool suitable for the examination of human decision making.

Based on earlier research by our collaborator (Gigerenzer & Todd, 1999; Todd and Gigerenzer, 2003) we approach human decision-making as a question of rationality and especially *ecological rationality* and *social rationality*. This approach and understanding of rationality and decision-making recognizes the complexity of decisions as influenced not only by the mental capacity and knowledge of the decision maker but also as a consequence of environmental and contextual aspects. Based on this theory, the decision maker (in our case the professional designer) applies an *adaptive toolbox of heuristics* when making complex

real life decisions. A developed understanding of different forms of rationality makes it possible to understand human behavior and “to discover the heuristics that guide adaptive behavior” (Gigerenzer & Todd, 1999, p 25).

The adaptive toolbox of heuristics also include forms of heuristics that we find especially appropriate for our analytical purposes, and those are heuristics that are based on *emotions*, *social norms*, and *imitation* (Gigerenzer & Todd, 1999, p 31). We believe that in our examination of the interview studies we will be able to use the concepts developed by Todd and Gigerenzer (2003) as an analytical tool for the inspection of the reasons and arguments behind the decisions made by the professionals.

Some Findings from Our Pilot Study

Even though our pilot study was small, it provided us with a good foundation for the design of this proposal. Some of the findings, however preliminary and unsubstantiated, have helped us to formulate, shape, and refine this proposal. The study consisted of ten interviews with designer-practitioners working with software design, application design, and interaction design. The interviews were quite open ended since they were mainly designed to be exploratory and to serve as a base for the development of this proposal.

Based on our preliminary findings from our pilot study, we conclude that there is no simple way to comprehensively explain the rationality, the reasons and arguments that truly guide a designer-practitioners’ choice and use of methods (Stolterman et al., 2010). One, and perhaps the most important, result from our pilot study is that the way designer-practitioners select their design methods is influenced by their personal character, their educational background, their experience of design, and the social situation and context in which the design process takes place. This means that there are *internal subjective reasons* as well as *external objective reasons* guiding the decisions by the professionals. These finding relate well to the theory of ecological rationality (Todd & Gigenrenzer, 2003) which gives us support for the plan to utilize ecological rationality theory as a tool for analysis of the planned interviews of designer-practitioners. The overall finding of our pilot studies is that *the relationship between designers and their methods is far more complex than expected*.

We found for instance that a common way to argue for the choice of methods is to advocate a clear and known relationship between an *identified problem*, a *suitable method*, and an *expected outcome*. This is a clearly “rational” approach to choosing a method. It is rational to choose a method that fits the problem at hand and that can deliver the expected outcome. However, such an approach requires that the designer can (i) clearly define a problem, (ii) has a deep knowledge of suitable and available methods, and (iii) has a sense of what the expected outcome will be. Even though this sounds rational we found that it was not common that all these preconditions were in place and therefore we suspect that this rational approach, even though highly advocated by the designer-practitioners, is not always reflecting the true or complete reasoning behind the choice of a method. We found several other reasons that were less “rational”, such as:

- *Familiarity*. Some designer-practitioners had a tendency to choose methods that they were familiar with and already knew how to use, regardless the fit with the task at hand.
- *Prescriptive(ness)*. Some designer-practitioners valued methods that were not perceived as overly prescriptive, since they valued the possibility to adapt the method in relation to the situation at hand.
- *Branding/identity*. We found that in some cases, a choice of method becomes part of the individual’s identity or “brand” as a professional.
- *Method and community*. We found that choosing a method is sometimes a way of identifying yourself as a practitioner within a particular professional community.

- *Background, culture and education.* Choice of method also appeared to be strongly correlated with the background and education of the designer-practitioner, and with the professional culture at the workplace.

From these preliminary results it became clear that designer-practitioners do not always reveal the true reason for why they select a particular method, or they do it reluctantly. In many cases this has to do with preconceptions about what are *legitimate reasons* behind a choice of method. Theoretically this has been famously developed by Argyris & Schön (1974) when they contrasted what practitioners “say they do,” *espoused-theory*, with how they actually do it, *theory-in-use*. We have in earlier work explored this idea with the notion of *methods-in-action* (Fitzgerald, Russo, & Stolterman, 2002), which draws the attention to the methods actually used.

Overall, our pilot study, even though small, made it clear that the way designer-practitioners select and use design methods is highly complex and a result of many factors. This also supports our assumption that if new methods and tools are developed for designers, there has to be a deep understanding of the nature of design practice so that the new methods fit with the “real” reasons designers use when selecting their design methods.

The Proposed Research Approach and Activities

Our proposal consists of five main activities that will be mostly conducted in parallel. These activities are designed to separately help us develop knowledge about the use of design methods, but they are also designed to each contribute to the overall purpose and to make it possible to contrast and compare the results to make them stronger. The activities we have planned are:

- (i) analytical studies of design methods;
- (ii) analytical studies of research results that have an explicit intention to have “implications for design;”
- (iii) interview studies with professionals about their understanding and use of design methods;
- (iv) interview study with design method developers; and
- (v) theoretical and conceptual development on the nature of design methods and their use.

For a schedule and timetable of these activities see Figure 1.

Study 1. Analytical Studies of Design Methods

These proposed *analytical studies* are intended to lead to an improved understanding of how to *categorize* and *describe* design methods. We see the final result of these studies to be an analytical framework of design methods.

In these studies we will analyze a manifold of design methods representing different forms, types, and categories. The goal is to develop a more precise analytical framework that will support descriptions and analysis of design methods in line with the way they are understood and used by practitioners.

We will primarily analyze design methods that are intended for the *initial stages of the design process* with a focus on the *creative* and *innovative aspects* of that process. This choice is based on (1) the fact that we already have extensive expertise and knowledge about design methods for this stage of the design process, and (2) the belief that we from a practical perspective need to limit our scope when it comes to methods.

The purpose with these analytical studies is twofold. We see these studies as (i) a way to further our general *understanding* of design methods, while developing (ii) a more detailed analytical and descriptive *language* possible to use to classify, compare, and contrast design methods from the perspective of the practitioner. These analytical studies do not require sophisticated set-ups or special equipment; this means that we will be able to conduct a large number design method analyses.

Activities:

- We plan to do one set of analysis of design methods in the first 6 months, and then two more sets during the project (see Figure 1). That means that we will have three sets of analytical studies when the project is finished. We anticipate that each set will include somewhere around 10-20 methods, which will result in an overall analysis of 30-60 design methods.
- Some of the properties of the design methods that will be analyzed are: purpose, for whom the method is developed, for what contexts, what functions, what skill is required to use the method, what resources are required, how much time is needed, in what form are the results from the method, evidence of use in practice, etc. We have in a small pilot study experimented with what aspects and properties might be of importance (Stolterman et al, 2008).
- Each design method aimed at the initial conceptual stages of the design process will be documented, analyzed, and described. This material will be used to develop a *library of design methods profiles*.
- As part of these studies we will also establish a *methodological approach* for this kind of analytical study, and we will develop appropriate ways of presenting the results, such as suitable descriptions of *method profiles*.
- We plan to *develop a web site* where we will make our design method profiles and our methodological approach publicly available. This means that they can be used by other researchers, and for educational purposes, and by practitioners. We also plan to invite colleagues to conduct similar studies and share their results on the web site. The goal is to develop a publicly available, dynamic and growing library of design method profiles suitable for educational and professional purposes.

Study 2. Analytical Studies of Research Results Intended to have Implications for Design

These proposed *analytical studies* are intended to lead to a better understanding of what researchers in the field of HCI see as important contributions to practice. The approach will be to analyze the last two years of CHI proceedings, especially the sections in papers that have the title “Implications for design” (or similar). The purpose is to see what kind of knowledge or contributions researchers believe have practical implications.

Activities:

- We plan to analyze the published papers from the last two CHI conferences (CHI is the premier and largest conference in the field of HCI).
- Each contribution will be documented, analyzed, and described. This material will be used to develop an understanding of *what kind* of contributions researchers see as valuable to practitioners and in *what form* they present those contributions.

- The results from these analyses will be compared and contrasted to the results from the interviews with the designer-practitioners on what they expect from useful methods.

Study 3. Interview Studies with Designer-practitioners about Their Understanding and Use of Design Methods

We will conduct a set of *interview studies* with professional application developers, software engineers, and interaction designers at five companies that in different ways are involved in innovative design of new interactive artifacts. The companies that we have established collaboration with and that have agreed to provide us with professionals to interview are Disney Animation Studios, Adaptive Path, AutoDesk, Adobe, and Microsoft.

These companies design and develop different products and services. They range from companies that design advanced tools for highly skilled in-house professionals (Disney), to those who design with a particular client in mind with a reputation of designing innovative interactive products (Adaptive Path), to those who design highly advanced technical products for professional users in a distinct field (AutoDesk), to those who design influential technical products that reach a broad market and diverse users (Adobe and Microsoft).

We plan to interview five professionals in each company, that is, all together 25 interviews. These professionals will be seen as individuals and not as representatives of their companies. We will interview them about how they view and understand design methods, what kind of implicit or explicit strategies they apply when they choose methods for their own practice. We will also have them do methods analysis to get a sense of their particular view of methods which will also help us better understand how to interpret their statements.

Activities:

- The interviews will be semi-structured. We will interview the professionals with a focus on:
 - cognitive aspects, that is, how they think and reason about design methods;
 - behavioral aspects, that is, how they select, use, and adapt design methods;
 - emotional aspects, that is, how they feel about design methods; and
 - strategies, that is, how they strategize and plan when it comes to dealing with design methods.

This means we will interview them about:

- about their view when it comes to design methods in general;
 - what particular design methods that they actually use;
 - why they selected them;
 - how they evaluate design methods; and
 - what they see as distinct features of good/bad and useful/useless design methods.
- The interview protocols will be developed in detail during the first months of the project and will be based on the results from our pilot study and our initial methods analysis.
 - We plan to do two rounds of interviews, one with the three companies in San Francisco and one with the two companies in Seattle. The first round of interviews will probably be done late in the first year or early in the second year, while the second round will be done in the second half of the second year (see Figure 1).

- The interviews will be recorded, and transcriptions will be done when needed. The interviews will be analyzed with the purpose to reveal and formulate an understanding of how professionals understand, chose, and use design methods.
- We also plan to offer presentations of our findings to the involved companies since we consider that as an opportunity to get extra feedback on our work and results.
- We will also examine these companies' official (or internal) design process documents (if existing and available) to see if there are any signs of *company principles* and *policies* when it comes to the choice of design methods.

Study 4. Interviews with Design Methods Developers

As a complement to the interviews with professional users of design methods we intend to interview design methods developers. Design methods can take on many shapes and forms as we mentioned earlier and they can also have quite different purposes. These interviews will be aimed at understanding how method developers see the purpose of design methods, what constitute a good and useful design method, how methods can and should be evaluated, how they think about the user of their method, etc.

We aim to interview around ten method developers. We hope that some of these developers will be found among those currently funded by the NSF-HCC program.

Activities:

- The interviews with design method developers will be semi-structured and focused on:
 - why they think their method is needed and for what purpose;
 - who they see as the primary users of their method;
 - how they view and understand the users of their method;
 - what they see as major problems and challenges when developing design methods;
 - what they see as properties of a good and useful method; and
 - how they think design methods should be evaluated and selected by designer-practitioners.
- The interview protocols will be developed in detail during the last part of the first year and the interviews will be conducted during the second year.
- We plan to do around 10 interviews in this category. We have not yet started the process of identifying the interview subjects. We plan to do this during the first year of the project.
- The interviews will be recorded, and transcriptions will be done when needed.
- We also plan to offer presentations of our results to the method developers (or their organizations) who have accepted to be interviewed. We believe this to be a possibility of us to get extra feedback on our work and results and for them to learn more about how other method developers are thinking.

Study 5. Theoretical and Conceptual Development

Throughout the project we will conduct conceptual and theoretical development around the findings from the different studies with the purpose of creating a framework for understanding the nature of design methods and their use. This work will of course include

literature research and other activities, such as seminars, PhD workshops, and a CHI workshop. The process of developing the theoretical and conceptual foundation is crucial to the analysis and interpretation of the results from the other studies. This activity will be ongoing during the time of the project (See Figure 1).

Educational Efforts

Since we believe that our results will be usable to designer-practitioners we see it as necessary for us to develop our results in a pedagogically appropriate way. We know from experience that students are concerned with what methods to use for what tasks and they feel as if they do not have the competence to make that kind of choice. We believe that our project will produce not only theoretical results but more importantly a framework and an approach that students themselves can apply as a way to examine and understand design methods, not in a blind recipe-like fashion but rather in appropriate use contexts.

We are fortunate to be at a school with broad educational responsibilities in interactive design on all levels, undergraduate and graduate. Our successful graduate master's program in HCI Design (Siegel & Stolterman, 2008), in particular, will incorporate our studies and findings in our courses and teaching, not only through our own courses but also in collaboration with our colleagues. We see this more than as a way to educate our students, but as an important way to evaluate and get feedback on our results. We view students as one of the primary user groups of our results.

We have already developed assignments within a course on Design Theory that relates to our proposal. One assignment is to conduct interviews with designers about their understanding of the design process and particularly their view on methods and tools. Another assignment presents the students with the task to develop a "design process model" that can support design practitioners. These assignments have already contributed to this research and they can definitely be developed further. One potential direction is to develop support for students to conduct interviews with practitioners and to analyze methods. This support will then be presented and made available on the project's web site.

Even at the undergraduate level students will make use of these results. In an introduction to HCI course, we encourage students to "play the whole game of HCI design" (Perkins, 2009) by drawing their picture or schematic of the entire design process including methods, techniques, and tools; the goal is to have students "own" their design process. The master's course, Interaction Design Practice, uses this instructional tool as well. These drawings evolve throughout the semester, and we will display them on the project's web site. Others will be invited to add their drawings.

We also will establish a research group for master's students who have a strong interest in design methods, both in their development and in their use by designer-practitioners. We expect that we will be able to create several sub-groups who would work with issues related to the proposal.

We also have ongoing research on general aspects of design practice with colleagues in other universities and we expect to be able to involve them and their students in the process as part of the evaluation of the results.

Finally, we will make all the findings and results of the different studies available on the web, including our research methods. We will encourage anyone to participate by initiating similar studies and present their findings on our site too.

Evaluation of Results

The project will produce results from each study while the overall result will be developed by comparing and contrasting the results from each study. We are confident that each of our studies will produce interesting results and we will of course report these results and publish them during the time of the project. This means that we will get feedback on our initial studies throughout the project and we expect this feedback to help us further develop and refine our later studies.

We also will use the developed web site as a way of getting feedback into our project. We see the possibility of opening up the results to the public as a way of getting more data and information, especially since we are studying designer-practitioners in a way that will be of interest to them. We also see this as an important aspect of the evaluation of our results.

As a final part of our studies we will conduct a more formal *triangulation study* (see Figure 1). Of course, we will conduct less formal triangulation studies all along where we compare and contrast the results from the main empirical studies. However, the final triangulation study will serve as a form of overall evaluation of our results and of the different studies. We anticipate that such a formal triangulation will make it possible not only to evaluate our individual results but also the research approach as a whole.

We consider this final triangulation study to be our summative evaluation of our framework and also of the overall contribution to the field. The summative *evaluative measures* we will apply are related to:

- the design methods profiles, that is, how valuable the analytical examination of design methods has been in supporting a better understanding of designer-practitioners' use of design methods;
- the framework appropriateness, that is, how well the framework has served our purpose and as an analytical tool for the intended research; and
- what extent the results are original and valuable in relation to our intended goal and to the field of research in general.

	Year 1 First half	Year 1 Second half	Year 2 First half	Year 2 Second half	Year 3 First half	Year 3 Second half
Analytical studies of methods	First set of analysis		Second set of analysis		Third set of analysis	Final analysis and writing
Analytical studies of research results		Analysis of CHI proceedings		Analysis of CHI proceedings		
Interviews with Practioners		First round of interviews		Second round of interviews		Final analysis and writing
Interviews with Method Developers			First round of interviews		Second round of interviews	Final analysis and writing
Theoretical studies	Ongoing	Ongoing	Ongoing	Ongoing	Formal triangulation evaluation	Final analysis and writing
Educational efforts		Testing of analytical method in class	Developing web site	Testing of analytical method in class		Final analysis and writing

Figure 1. Summary and timetable of activities.

Outcome and Impact

The rationale behind our examination of design methods is based on the assumption that more knowledge is needed about how designer-practitioners actually use design methods in order to improve the development of new methods that fit the expectations and needs experienced by practitioners.

We believe that our studies will lead to the following concrete outcomes:

- a conceptual framework/typology of design methods;
- a theoretical understanding of how professionals think about, select, adapt, and use tools;
- a theoretical understanding of how design method developers approach method development;
- insights and principles suitable for practitioners on how to strategize and handle their choice and use of design methods;
- insights and principles suitable for organizations on how to make strategic choices of design methods; and
- educational guidelines suitable on how to professionally think about and handle design methods.

These outcomes will be written in the form of research papers and submitted to suitable scientific conferences and journals.

We anticipate that there are at least four benefits from developing an understanding and a framework that includes appropriate concepts for describing and discerning types and use of design methods. We anticipate that the knowledge developed can be used for:

- *predictive* purposes (supporting designer-practitioners in their decisions on what methods to select and use);
- *analytic* purposes (supporting analytical examinations of existing and future design methods);
- *theoretical* purposes (supporting further research and development of new design methods); and
- *educational* purposes (supporting the education of reflective and knowledgeable professionals, both in academic and professional settings).

Maybe the most practical benefit of our project is the increased understanding of design practice. The interviews with designer-practitioners about their view of their design process and their methods will increase predictability and possibility in method development and make it more targeted and adapted to the views and expectations of practitioners. This would hopefully lead to more used and more useful design methods.