

Comparing Human-Centered Design Methods From Different Disciplines: Contextual Design and PRInCiPleS.

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Today's information systems, for all their technical muscle, result in far more annoyance than organizations or individual users would like. Within the information systems design community, the Human-Computer Interaction (HCI) specialization has developed methods to help software engineers build systems that are more human centered. But the HCI tradition draws mainly from computer science and psychology and lacks much of the understanding of meaning and form, the cultural coherence of design interventions, and other competencies of designers. The purpose of the present study was to compare a leading HCI method, Contextual Design (Beyer & Holtzblatt, 1998), with a recent encapsulation of method from design as it owes to traditions of product design, communications, art, and architecture, PRInCiPleS (Blevis, n.d.). Having compared these two methods, both by analysis and through a case study, we offer insights into how the two methods are improved by mutual acquaintance. Finally, we suggest ways the design tradition can better contribute to information systems design.

Contextual Design (CD) has developed within the information systems design practice of the high-tech industry. CD provides a systematic method whereby interdisciplinary design teams can use data gathered through field observations to arrive at a shared understanding of work processes, participants, and environments. Various models capture this understanding and drive a work redesign and validation process, resulting in a system design.

At the School of Informatics at Indiana University, we teach a design method of our own invention we call the PRInCiPleS method of design. PRInCiPleS is an acronym for Predispositions, Research, Insights, Concepts, Prototypes, and Strategies. The PRInCiPleS steps are analogous to steps of an idealized scientific process – initial hypotheses, prior art, research hypotheses, experiment design, experiments, and peer review; these are simply analogies, not equivalences. PRInCiPleS is inspired by the tradition of design methods at the Institute of Design in Chicago.

The first author has had significant experience applying CD at Hewlett-Packard in the development of Unix servers and software. The second author refined PRInCiPleS in both teaching and industrial contexts. In a case study of digital library systems, we used an approach drawing from both methods. In that study and in subsequent analysis, we found that both methods use field observations, emphasize chains of reasoning, make creative leaps, and rely on iterative refinement through prototype interventions. The methods differ in complementary ways: CD emphasizes a rigorous team process and offers well-defined representations of user data and system design. PRInCiPleS emphasizes compelling communication of design arguments. The most striking difference between the methods is not the methods themselves but the skills of the people who use them. It is this contrast in background, training, vocabulary, and skills that sometimes raises barriers to the successful involvement of designers in the development of information systems.

Although these methods have grown from different roots, their similarities and complementarities suggest designers and HCI practitioners can surmount barriers to effective participation in interdisciplinary, human-centered design of information systems. The two methods can inform each other and construct bridges between design and software engineering, for the benefit of organizations and users of information systems.

Integrating Human-Centered Design Methods from Different Disciplines: Contextual Design and PRInCiPleS

Abstract

The human-computer interaction (HCI) community has developed primarily among those trained in computer science and psychology. Design methodologies within HCI tend to address the needs and interests of those who have been trained in cognitive science, human factors, or software engineering. This paper illuminates the similarities, distinctions and opportunities existing between one of the better known HCI methodologies, Contextual Design, and an encapsulation of the oral tradition of studio-based design methods that we call PRInCiPleS. PRInCiPleS forms part of the curriculum in HCI design at the Indiana University School of Informatics. We present a case study wherein both methods were used, and we draw from that experience and our own analysis to compare and contrast HCI approaches and studio-based design approaches generally, suggesting how each may benefit from the strengths of the other and postulating a coherent integration.

Introduction

Today's information systems, for all their technical muscle, result in far more annoyance than organizations or individual users would like. Within the information systems design community, the human-computer interaction (HCI) specialization has developed methods to help software engineers build systems that are more human centered. But the HCI tradition draws mainly from computer science and psychology and lacks much of the understanding of meaning and form, the cultural coherence of design interventions, and other competencies of designers. The purpose of the present study is to compare a leading HCI method, Contextual Design (Beyer & Holtzblatt, 1998), with a recent encapsulation of method from design as it owes to traditions of product design, communications, art, and architecture, PRInCiPleS (Blevis, 2004). Having compared these two methods, both by analysis and through a case study, we offer insights into how the two methods are improved by mutual acquaintance. Finally, we suggest ways the design tradition can better contribute to information systems design.

Contextual Design

Contextual Design has developed within the information systems design practice of the high-tech industry. Many HCI methods are point techniques for addressing a particular need during product development: user testing, heuristic evaluation, task analysis, personas, use cases, etc. Even articulations of HCI design processes such as are found in Preece, et al. (2002) merely lay out broad stages

of design activity and suggest a broad range of HCI techniques that may be used within each stage.

Contextual Design is one of a very few comprehensive methodologies to emerge within HCI that actually prescribes a set of techniques and representations. Another comprehensive approach which bears mention is Carroll's Scenario-Based Design (Carroll, 2000). Contextual Design is more fully elaborated than Scenario-Based Design, and it has been taught and written about as a coherent methodology for a longer period of time. Contextual Design provides a systematic method whereby interdisciplinary design teams can use data gathered through field observations to arrive at a shared understanding of work processes, participants, and environments. Various models capture this understanding and drive a work redesign and validation process, resulting in an implementable system design. Table 1 shows the six steps of Contextual Design in summary form.

Contextual Design is a team-based design process. After the interdisciplinary design team forms, the team members agree on the work context (type of work or activity) they will explore, and they identify a focus within the context. Contextual Design specifies activities for each step as well as deliverables resulting from those activities.

Contextual Design has been taught and used in the IT industry for over a decade and has been applied to such varied design problems as enterprise portals, system administration tools, and library systems (Holtzblatt, 2001; Rockwell, 1999; Curtis, et al. 1999; Normore, 1999).

PRInCiPleS

At the School of Informatics at Indiana University, we teach a design method of our own invention we call the PRInCiPleS method of design. PRInCiPleS is an acronym for *Predispositions, Research, Insights, Concepts, Prototypes, and Strategies*. The PRInCiPleS steps are analogous to steps of an idealized scientific process—*initial hypotheses, prior art, research hypotheses, experiment design, experiments, and peer review*; these are simply analogies, not equivalences. PRInCiPleS is inspired by the tradition of design methods as interpreted by the second author, a former faculty member at the Institute of Design in Chicago. PRInCiPleS is not as well known in the design world as Contextual Design is in the HCI world. In fact, PRInCiPleS is just our version or account of a representative design method in the sense of design methods that owe to traditions of art, architecture, and product design, but it may serve here to represent those design methods.

Table 1. Contextual Design Steps

Step	Activities and Deliverables
contextual	pairs of design team members observe work practice in the field,

inquiry	co-interpreting data with users
work modeling	back with the design team, replay the story of what was observed while other team members create diagrammatic models to organize and represent what was observed: <ul style="list-style-type: none"> • sequence model – intents, steps • flow model – movement of work between people in the form of communication or artifacts • cultural model – pressures, influences and emotions within the work environment • physical model – workspace layout, computer screen layout, network topology, etc. • artifact model – objects created or used to accomplish work
consolidation	design team looks across multiple sets of models to combine data in a way that shows the larger patterns without hiding details and differences
work redesign	design team uses consolidated models to share findings with the larger community of stakeholders and conducts a visioning session to generate ideas for improving users' work; one or more ideas are selected for storyboarding
user environment design	a system design is created by walking through a storyboard to identify the main components ("focus areas") of the system and the necessary pathways or connections between them
paper prototyping	low-fidelity paper prototypes are generated from the system design; prototypes are taken back into users' contexts and users "operate" the prototypes to see if they work better than their current methods; findings from prototype interviews are used to validate and refine the design

PRInCiPleS is grounded in the notion that what the activity of design *is* matters less than what designs actually *are* (Blevis, 2004). PRInCiPleS is a framework for representing designs as arguments, that is plans or *explanations*. Design is less a process and more an argument. Therefore, the PRInCiPleS steps are steps in an argument rather than steps in a design process. Table 2 describes the steps of a PRInCiPleS design argument. Previous to even the first step is the assumption that there exists a target population of interest to the designer and a focus on some facet of that group's needs or desires.

Table 2. PRInCiPleS Components

Component	Description
predispositions	enumeration of all significant points of view about the population being designed for
research	data from observations of the target population and/or collected instances of the culture being studied

	and/or literature review
insights	interpretations of the research data that express essential opportunities for improvement of the environment of the target population relevant to the designer's focus and values
concepts	an enumeration of design ideas germane to insights gained from research, organized into systems of concepts that work together coherently to create an improvement in the human condition of the target group
prototypes	high (working) and low fidelity (behavioral or exploratory) and physical (appearance) expressions of selected design concepts, useful for concept exploration and refinement
strategies	a proposal for moving forward, not neglecting business, technical, or social and ethical issues

PRInCiPleS has been applied primarily in the context of the Indiana University School of Informatics HCI program. Published accounts of design projects based on PRInCiPleS are available addressing a variety of contexts, including collocated collaborative work (Wang & Blevis, 2004) and sustainable internet participation in areas without electrical infrastructure (Blevis, *et al.*, 2004).

Case Study

The first author has had significant experience applying Contextual Design at Hewlett-Packard in the development of Unix servers and software. The second author refined PRInCiPleS in both teaching and industrial contexts. In a case study of digital library systems, we used an approach drawing from both methods, finding them complementary.

In the case study, following the Contextual Design approach, we conducted contextual inquiry-style observations of voice students engaged in graduate music study. Our focus was on their information needs, particularly as those needs pertained to the music library. Data gathered over 14 separate observational sessions was modeled using the Contextual Design models and then consolidated across observations. At that point, we began following the PRInCiPleS approach to generating concepts, selecting prototypes, and constructing a cohesive design argument.

We cannot present the Contextual Design work models in this short paper. One of the consolidated models has been published elsewhere (Notess, 2004b), and examples of all Contextual Design work models are also available elsewhere (Notess, 2004a, or Beyer & Holtzblatt, 1998). A characteristic of Contextual Design deliverables is that they fit much better on the walls of a room than in a conference paper. We can, however, show a high-level diagram of the design argument we obtained at the end of the process. This diagram is not the public form of the design argument, but it will serve here as a summary of the result

(Figure 1). The final step, Strategy, is omitted from the figure, but the implementation strategy follows from the three prototypes.

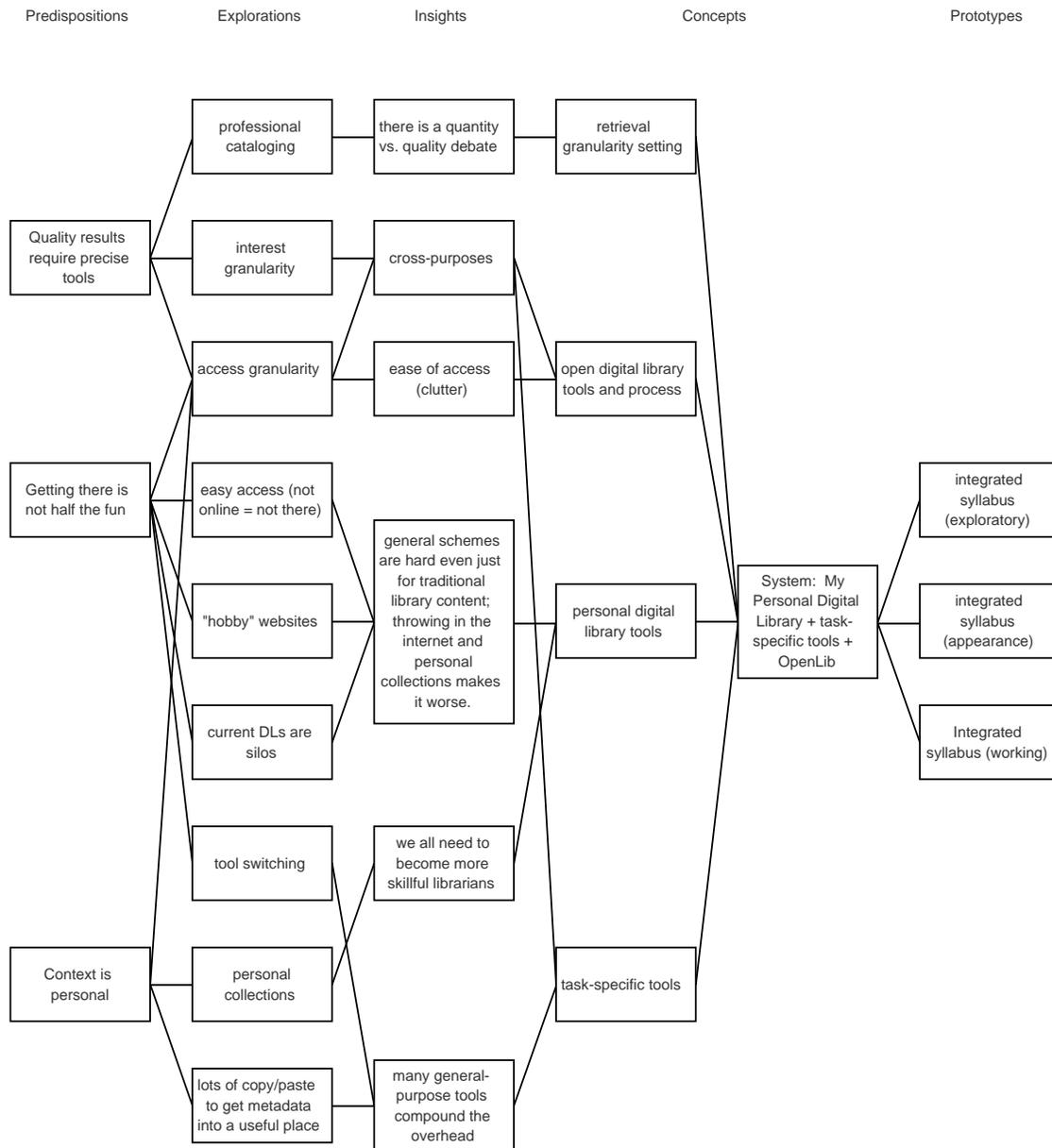


Figure 1. PRInCiPleS-Based Design Argument Summary : Design Intervention Plan for the Digital Music Library

Comparison

As a result of our case study and in subsequent analysis and reflection, we identified the following similarities and differences between Contextual Design and PRInCiPleS.

Similarities:

- initial identification of a target population and focus of attention for exploration
- use of field observations and artifact analysis/collection to understand the target population
- emphasis upon chains of reasoning to keep the design coherent and data-based
- reliance upon creative leaps to generate design alternatives from contextual understandings (in Contextual Design, this occurs in the “work redesign” step; in PRInCiPleS in the transitions from “insights” to “concepts”)
- use of iterative refinement through prototyped interventions

Differences:

- Contextual Design emphasizes a rigorous team process—indeed the necessity of working in an interdisciplinary team—whereas PRInCiPleS does not insist on a team effort.
- Contextual Design specifies the use of well-defined, detailed representations of user data and system design. PRInCiPleS does not specify what the representation should be for these.
- Contextual Design representations are geared toward detailed data for the design team; PRInCiPleS lends itself well to creating compelling communication of design arguments via slide sets and presentations.
- PRInCiPleS requires that a design is defended along a triumvirate of dimensions: technological possibility, enterprise viability, and social value. Contextual Design is centered in user needs and does not directly address these dimensions.
- PRInCiPleS is more a rhetorical framework than a design method. The order of the argument need not dictate the order of the design work.

The most striking difference between the methods is not the methods themselves but the skills of the people who use them. For example, Contextual Design is designed for people whose formal design training may not have been human-centered at all: “In our approach to process design, we recognize that much of what we do is to make explicit and public things that good designers do implicitly.” (Beyer and Holtzblatt, 1998, p. 21). PRInCiPleS assumes its practitioners are working more in a studio-based design tradition, where certain behaviors are assumed, such as concept enumeration: “One of the most salient features of design culture is the ability of its learners and practitioners to generate many divergent concepts and the willingness to discard concepts” (Blevis, et al., 2004). PRInCiPleS assumes the standard design techniques for generating concepts. Neither does it specify the techniques to be used to explore contexts of use or represent data. Contextual Design assumes its practitioners need to have appropriate techniques identified and offers detailed direction for their use.

It is this contrast in background, training, vocabulary, and skills that sometimes raises barriers to the successful involvement of designers in the development of information systems. This is unfortunate, because there is much that is complementary. Table 3 shows the correspondences between the two methods.

Table 3. Correspondences Between Contextual Design and PRInCiPleS

Contextual Design	PRInCiPleS
	predispositions
contextual inquiry	research
work modeling	
consolidation	insights
work redesign	concepts & concept
user environment design	systems
paper prototyping	prototypes
	strategies

Contextual Design as a method can be improved by learning, from PRInCiPleS, how to

- enumerate predispositions
- ensure the world of possible concepts is fully explored before moving ahead with a system design
- embed design ideas and system proposals in business-digestible strategies
- create a concise, coherent design argument

PRInCiPleS as a method can be improved by learning, from Contextual Design, how to

- capture and represent field study data
- make an interdisciplinary team effective in gaining and using a shared understanding of the target population
- scale up to large, complex projects

It is these latter two issues—team and scale—where the design community can learn the most from Contextual Design. In a large information systems project, a designer may feel marginalized by the technologists. There is a strong bias amongst technologists towards problem solving moving rapidly from problem identification to a solution. The designer, by contrast, often wants to seek a broad-based contextual understanding and explore a wide range of alternative interventions iteratively before settling on a design. Contextual Design offers non-designers a step-by-step method for participation in a more studio-like process. Most important, Contextual Design enables all project participants to arrive at a shared understanding of the needs and characteristics of the target population.

Conclusions

Our case study offers just one way Contextual Design and PRInCiPleS can be combined. Depending on the situation, other fruitful combinations can be imagined. For instance, using the Contextual Design user environment design step might have proven to be a useful way to prototype an entire system instead of just one part of the conceptualized system.

Although these methods have grown from different roots, their similarities and complementarities suggest designers and HCI practitioners can surmount barriers to effective participation in interdisciplinary, human-centered design of information systems. The two methods can inform each other and construct bridges between design and software engineering, for the benefit of organizations and users of information systems.

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