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User-Centered Design for Information Professionals

Anna Noakes Schulze

Most information professionals would agree that user-centered design makes an important contribution to high quality information systems. However, there is no general agreement about how to define the term “user-centered design,” or how best to implement user-centered design strategies in the development of systems and services. This paper describes a wide range of meanings associated with user-centered design in information studies and in other cognate disciplines, and argues for a more coherent and widely accepted definition. It proposes that a general definition of user-centered design drawn from the literature of human-computer interaction (HCI) could serve as a basic framework for system design and support interdisciplinary work. It also describes some useful methods of implementing this framework in the development of user-centered information systems.

The field of library and information studies (LIS) has long taken pride in its rich tradition of user-centered systems and services. In recent years, the idea of user-centeredness has become exceedingly popular in the literature of this discipline and many cognate disciplines as well. “User-centered,” “user-centric,” and “user-focused” are all expressions to be found in the spoken and written communication of scholars of every stripe. Although user-centered design is widely supported in theory, in practice its conceptualization and implementation differ widely. HCI specialist John Karat has remarked that much like “family values” the term “user-centered design” has become “a concept that everyone subscribes to, but for which there seems to be no agreed-upon definition.”¹ The meaning of user-centered design is extraordinarily diverse, and depends greatly on the discipline, background, and research interests of its pro-

ponents. This paper introduces the concept of user-centered design and its broad range of meanings across disciplines. It suggests ways in which information professionals can draw from a more interdisciplinary perspective on user-centered design. Finally, it outlines an approach to user-centered design from the literature of HCI that can be readily adapted by information professionals for the design of user-centered information systems.

User-Centered Design

There are many fields and subfields that interact in the design and implementation of information systems: information retrieval, information needs and uses, HCI, and systems engineering are just a few. In these and many other fields the concept of user-centered design is endowed with a diverse range of both

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common and arcane meanings. In different contexts and circumstances, user-centered design may refer to the following meanings:

- Enhancing system performance—Engineers, computer scientists, and information retrieval specialists have all tackled user-centered design from the perspective of enabling systems to deliver better results to users. Research into cataloging, indexing, and textual information retrieval, not least of all the eternal struggle to improve recall and precision together, have all contributed to the design of systems that serve users better.² However, many would agree that a focus on system performance metrics alone more accurately signifies a system-centered approach than one which is truly user-centered.
- Designing for particular users—At the heart of this approach is an understanding that one size does not fit all. Different user groups have fundamentally different requirements. As we have seen in the literature of LIS, both past and current, the needs of novice users are not the same as those of expert—or even moderately expert—users.³ Users with differing levels of technical aptitude, or working in different domains will not have the same needs.⁴ This fact is explicitly recognized by researchers and practitioners in HCI who posit user-requirements gathering as an essential starting point in user-centered design.
- Understanding the user—Both information and HCI researchers

share in a rich stream of ongoing research on user-needs assessment. The HCI specialist arrives at an understanding of users and their needs by examining their:

1. culture, meaning the organizational characteristics and context in which they work;
2. capabilities, including their abilities, competencies, resources, and limitations, and;
3. tasks, or what users do in the present, what they intend to do in future, and how a proposed system may change the patterns of communication and work activity.

The HCI expert can attain a profound understanding of users and their needs by examining culture, capabilities, and tasks in the aggregate.⁵ These methods of understanding users and their needs have been refined and tested over decades of research.

Understanding the User

Information professionals are also deeply engaged in understanding the user, although they approach this understanding from a slightly different angle. They want very much to get into the users' heads—to understand their motivations, behavior, and capabilities.⁶ They want to identify the information needs that users may not fully express, or even understand themselves.⁷ They also want to be aware of the physical, affective, and cognitive states that users encounter in the

Spring 2001

process of information seeking.⁸ Although different, the respective approaches of information researchers and researchers in HCI can be integrated to great advantage. Finally, user-centered design can also mean:

- Continual user input into the design process—This is the most common and comprehensive interpretation of user-centered design in the HCI literature, as advocated by Gould, Lewis, Nielsen, Landauer, and many others. This approach encompasses all of the meanings of user-centered design listed above and places the users at the center of an integrated, iterative design process that involves them before, during, and after a system is developed and built.

This emphasis on early and continual contact with the potential users of a system is echoed by Shackel in his discussion of user-centered design:

Designers must understand who the users will be and what tasks they will do. This requires direct contact with users at their place of work. If possible, designers should learn to do some or all of the users' tasks. Such studies of the user should take place before the system design work starts.⁹

Karat maintains that "all techniques that involve users in design can be called user-centered design techniques."¹⁰ However, what best defines the concept of user-centered design to his mind are two chapters in the *Handbook of Human-Computer Interaction* by Gould, and by Whiteside, Bennett, and Holtzblatt, respectively.¹¹ Gould's chapter describes four principles for designing usable systems:

- early focus on users and tasks, through direct and ongoing contact;
- empirical measurement, i.e., testing against established nontrivial performance measures;

- iterative design, in which successive prototypes are tested and refined; and
- integrated design, or the simultaneous coordination of these principles throughout the design process.¹²

These various descriptions of user-centered design give a sense of the wide range of meanings it is endowed with whether across or within disciplines. Researchers and practitioners need to be aware of these meanings in different contexts in order to teach effectively, to work productively with other researchers, and to communicate with others from the cognate disciplines concerned with user-centered design.

There is an ever-increasing emphasis on interdisciplinarity in the information professions. However, this concept is often misunderstood, or confused with multidisciplinary. Belkin makes a useful distinction between the two terms. Multidisciplinarity involves a bringing together of experts from different fields to work on aspects of the research problem most relevant to their own discipline. Belkin reminds us that true interdisciplinarity is a different matter altogether. It involves a coherent melding of the theory, methods, practices, and general expertise of many cognate disciplines within the individual scholar and practitioner.¹³ As the various parties involved in user-centered design begin to research and assimilate the literature of their respective fields, one can trace the early stages of an ideological convergence. The day may still come when we all speak the same language when we speak of user-centered design. What is lacking as yet is a comprehensive, integrated theory of user-centered design that is applicable across cognate disciplines.

Information professionals who aspire to be the designers of user-centered information systems share a great number of natural advantages. They have a

long tradition of strength in the areas of document representation, organization of information, information needs, and information-seeking behavior. Regarding the latter, they have dissected users' search strategies, examined patterns of query formation, and modeled their cognitive states in the process of information seeking.¹⁴ All of these strengths can contribute to good design of information systems. However, what has often been lacking in the resulting information systems is good usability. In his influential book, *Usability Engineering*, Nielsen defines system usability as multifaceted and comprising the following:

- learnability: the extent to which the system is easy for the user to learn;
- efficiency: the extent to which the system is efficient to use, enabling high productivity;
- memorability: the extent to which the system is easy to remember, so that the user doesn't have to relearn it after a lapse in use;
- errors: the extent to which the system has a low error rate in general, is free of catastrophic error, and facilitates recovery from user error; and
- satisfaction: the extent to which the system is pleasant to use.¹⁵

For most users, an information system that has good usability will allow for a quick assessment of what the system offers and how it works. The user should be able to determine what needs to be done in order to obtain the needed information in a reasonable amount of time and without much duress.

The poor usability of many information systems may be due to an approach to the design of information systems that emphasizes function (system features) over form (interface design). Information professionals tend to focus attention primarily on designing the system functionality, such as the choice of access points, Boolean searching, truncation,

stemming, proximity and adjacency operators, and many others. Users are offered a choice of modes or techniques in their information searching tasks—browsing and direct searching, keyword and field delimited queries, and so on.

Unfortunately, this level of care and attention does not always extend to the design of user interfaces for these systems. Information professionals are often guilty of making information systems that are confusing, unintuitive, and unhelpful for the users they mean to serve. For good usability, it is essential that the system's form give consideration to its function.

The single most crucial role of the user interface is to communicate the value of the system to the user. From the user's perspective, the interface is the system. A good interface directs the user's attention to important information, makes it obvious what a user needs to do, and provides help and guidance throughout the information-seeking process. If the interface fails to accomplish these objectives, the user may perceive the overall system as a failure—no matter how well its functionality was designed. What information professionals can, and should, do is draw relevant knowledge from cognate disciplines such as HCI so as to enhance their ability to provide useful, efficient, and timely access to information. This cognate knowledge can be used to develop a more holistic approach to user-centered design that balances the demands of system form and function.

University of Michigan researchers Gary and Judy Olson have defined user-centered design in a way that embodies the meaning and spirit of Belkin's definition of interdisciplinarity while providing a framework for the practice of user-centered design:

User-centered system design consists of observation and analysis of users at work, assistance in the design from

relevant aspects of theory, and iterative testing with users.¹⁶

None of the concepts expressed in this definition is inherently foreign to traditions of LIS research into user-centered design. Rather, they are highly compatible with, and complementary to, the information professional's long-established mission of providing users with well-designed, useful, and powerful information systems. Furthermore, this definition of user-centered design allows for the inclusion and melding of design theory from many disciplines within its framework. To reiterate, the concept of user-centered design according to the Olsons comprises three key elements:

- observation and analysis of users at work
- assistance in the design from relevant aspects of theory
- iterative testing with users

Each of these points will be examined in turn below, to clarify what they entail and to outline some of the basic methods that information professionals can use to advantage in the development of information systems.

Observation and Analysis of Users at Work

User-centered design is predicated on the observation and analysis of users at work in their natural setting. We can never assume that it would be sufficient to estimate who users are, what they do, and what they need without early, direct, and continual contact. We must have contact with the actual or the intended users of the systems we design. Demographic data alone would not be sufficient, nor can we presume that users are just like us, and want all the things that we would want in their place. Observations, interviews, and focus groups are all useful and effective

methods for gaining important knowledge about users, their tasks, and the environment in which they operate.

Furthermore, we need to analyze the users' goals and procedures as they perform their work. This means understanding the steps, sequence, and patterns of use involved in user tasks. It necessitates developing concrete, detailed examples of what users do in the present and scenarios of possible future use. In doing so, we can begin to define problems in the information flow and any constraints that must be considered in the design process. User tasks can be unpacked and analyzed by generating scenarios, storyboards, and more specific kinds of analysis such as activity diagrams and data flow diagrams.

Assistance in the Design from Relevant Aspects of Theory

Design theory is inherently interdisciplinary. It begins with an understanding of the most salient aspects of human information processing. These include memory and its limitations, reaction time, and characteristics of human visual processing. We need to acquaint ourselves with general design guidelines such as those expounded by Norman.¹⁷ These include such principles as providing affordances, which are visual cues in the design that suggest what the user needs to do. In order to be effective and successful designers of information systems, we need to be aware of graphic design principles, particularly those that apply to the design of graphical user interfaces.¹⁸ In addition, we need to understand and exploit the physiological, perceptual, and cognitive guidelines for the use of color.¹⁹

Iterative Testing with Users

Iterative testing with users should occur throughout the development cycle of an information system. As soon as the actu-

al or intended users have been identified, they can begin to participate in the design process. Mock-ups, storyboards, and other kinds of simulations can be used to convey the look and feel of a system before a single line of code is written. This allows users to identify possible problems and deficiencies that would be very costly to correct once the designers have committed to a fully functional system and interface. These methods help to support cycles of rapid prototyping and feedback in which the design concept is incrementally refined. Usability testing provides invaluable input in the latter stages of the design process. This method involves user testing of the system under realistic conditions and with typical user tasks.²⁰ Where usability testing includes performance metrics that the system must achieve (such as, "80 percent of users must be able to formulate their query in the first twenty seconds at the interface") then the process is referred to as usability engineering.²¹

Conclusion

The professional and scholarly horizons of information professionals are expanding profoundly at this time. With an increasing emphasis on interdisciplinary work, researchers will need to borrow or adapt the best ideas from diverse cognate disciplines. Educators will need to ensure that a deep-rooted knowledge of user needs and user-centered design principles is an integral part of the design of information systems in the classroom.²² Practitioners must continue to develop and hone their professional skills in user-needs assessment, interface design, project management, and evaluation methods. All information professionals will need to work toward an integrated, interdisciplinary theory of user-centered design in order to contin-

ue providing users with systems and services that better serve their needs, now and in the future.

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