The d-school in the i-school: HCI and Design Research

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In the context of a campus-wide strategic planning process, we have been asked to frame the special role of Penn State's Center for Human-Computer Interaction (CHCI) within the College of Information Sciences and Technology (IST). Our response is that HCI should fulfill an important role as a focus for *design research* within our i-school. As support for this response we explore the following propositions:

1. Design research and design science are essential to i-schools.
2. HCI is historically, currently, and inherently a design science of the just right sort to contribute to i-schools.
3. Other constituencies/subunits of i-schools (CS, IS, LIS, STS) are not design sciences, but benefit from organizational proximity of HCI design research.

In this brief paper, we sketch the argument entailed by these propopsitions. Our objective is to better understand and articulate the role of HCI and design research in i-schools.

Design research is essential to i-schools

I-schools span the information disciplines to comprehensively address issues ranging from image processing to social policy. In this vast spectrum, design—defined here as *materializing information to support human activity*—is a fulcrum. One cannot talk about information processing, storage and retrieval, information behavior, the use of information in groups, organizations, or in society, or information economics, policy, and regulation without making strong and substantive assumptions about the specific ways that information can be presented to and manipulated by people. Indeed, whenever there is evolution in user interfaces and application services, other concepts and relations throughout information science must be rethought.

There are perfectly coherent and time-tested information disciplines that eschew a central concern with design as we define it. The core of Computer Science (CS) is focused on information processing, storage and retrieval; presentation and manipulation of information by people, and the design process itself, are peripheral topics in CS. Library Information Science (LIS) has traditionally focused on information retrieval and information seeking at the individual level, while Information Systems (IS) has focused on organizational processes and the impacts of information access and use. But neither has focused on framing and implementing specific design strategies to ameliorate or enhance observed circumstances through transforming human-computer interactions.

The broad vision of i-schools requires coordination of understanding information structures, needs, and impacts with the design of new human-computer interactions. Design and the artifacts that result from design activity represent an important class of boundary objects for knowledge and technology transfer between disciplines and between academe and industry/government. Designs integrate and reify theory and empirical knowledge into

technologies that can be exchanged, implemented, and their effects assessed within different contexts and from different perspectives. Similarly, designs and artifacts help demonstrate the potential utility of research products.

HCI is the right kind of design science

Until the emergence of HCI during the 1980s, the roles for social, cognitive and behavioral science within technology development were few and marginal. The discipline of human factors, institutionalized within Industrial Engineering or Applied Psychology, emerged a generation before HCI, but it was most concerned with human performance and experience with existing technology tools and systems, and focused on artifacts with limited information content (e.g., stairs, furniture, physical tools). This *evaluation* role was often positioned too late in the system development process to have more than minor effects on the design of the technology or on the core applications of technology.

Science and Technology Studies (STS), institutionalized variously in philosophy and sociology; LIS, typically a standalone academic unit, some of which have developed into i-schools; Communication Studies, and IS, institutionalized in business schools; all have provided descriptions of how technology is utilized across a broad range of significant organizational and utilitarian contexts. Particularly in the case of STS, these were often rich analyses of how new technology is shaped by use, and how it reciprocally shapes human practices, relationships, and institutions. Such efforts contribute much to understanding the context of information technology design problems and solutions, but they are even more distant from the activities of system design and development than human factors efforts. And unfortunately technologists were largely unaware that these fields of interest even existed.

In this context, HCI is quite novel. It has been most often institutionalized as an adjunct to, sometimes even within, Computer Science. Its research methods *integrate* the creation of new techniques, technology, and applications with iterative and formative evaluation of their immediate and indirect impacts on collective and individual human activity and experience. The close coordination of creating innovative technology and assessing its consequences for human activity has proven very successful, and has led to transformative applications–desktop user interfaces, the mouse and carefully engineered pointing devices, hypermedia online information, a variety of information visualizations, high quality synthetic speech, and levels of user control of software systems that were unimaginable two decades ago.

Indeed, a paradigm of innovation and application of interactive technologies cyclically coupled to improvisation and assessment in human activity has been incorporated into academic programs in geo-science, IS, CS, LIS, and i-schools, and is generally called HCI. However, this paradigm is not itself a discipline, and when it is incorporated into specific information technology disciplines and projects it is typically *narrowed to the scope of that discipline or project*. For example, HCI in CS most typically means research on software architectures or tools that enable new user interface techniques. We propose that *only in i-schools* can HCI operate with the appropriate scope to be effective as a design science (see also Carroll et al., 2006).

Other i-school constituencies benefit

Incorporating HCI into i-schools yields many benefits for other i-school constituencies, while at the same time broadening and enriching HCI design research. Already the combination of HCI and LIS in i-schools has led to richer conceptions of human-centered design that encompass both the measurement orientation of HCI and the integration of information, organization, technology, policy, and culture of LIS. The interaction of HCI with community informatics has promoted design research that addresses new sorts of public access information systems, and has produced a more finely articulated view of people as the central factor in the interactions between people, information, and technology at different levels of social aggregation.

Traditional CS research considers underlying technologies but rarely addresses design in the sense of envisioning new tools and activities for people. Instead CS design efforts are more likely to lead to self-consistent functionality with unknown implications for people and their activity (e.g., a programming language), or perhaps to a proof-of-concept prototype application that demonstrates a plausible use of a novel technology or technique. Incorporating HCI expertise in such work ensures that the design of effective applications is a first-order concern, and helps to coordinate the development of new technologies with new measurement techniques they necessitate.

IS has an inherent orientation toward action science and affecting change, but generally has accomplished this through organizational interventions of training, management, and technology acquisition. The ability to design and implement new forms of human-computer interactions as part of IS interventions is a powerful enhancement. Other constituencies, like STS, that have traditionally played even more peripheral roles with respect to technology (e.g., focusing on impacts or critically deconstructing meanings) can participate in a more directive fashion when supported by colleagues who do this as a central element of their technical work.

Our construal of the role of HCI in i-schools — as an anchor for design research — has more general implications for how we think of i-school faculty groups. For example, at Penn State, we have often identified faculty groupings concerned with "people and technology", "people and information", or "information and technology". Not surprisingly, such distinctions do little to energize engagement across groupings. Perhaps differentiating faculty groups based on *how* they pursue research questions in the i-space (which is a nexus of information, technology and people), and equally important, *how* their methods and approaches can complement others would be more productive.

Reference

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