

Model-Driven Research in Human-Computer Interaction

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Abstract

How can we build systems that enable users to mix and match tools together? How can people share the results of their explorations with each other, and for innovative tools to be remixed? Widely-used tools such as Web Browsers, Wikis, spreadsheets, and analytics environments like R all contain models of how people mix and combine operators and functionalities. In my own research, system developments are very much informed by models such as information scent, sensemaking, information theory, probabilistic models, and more recently, evolutionary dynamic models. These models have been used to understand a wide-variety of user behaviors in human-computer interaction (HCI), from individuals interacting with a search system like MrTaggy.com to groups of people working on articles in Wikipedia. These models range in complexity from a simple set of assumptions to complex equations describing human and group behavior. In this talk, I will illustrate how a model-driven approach to answering the above questions should help to illuminate the path forward for HCI research.

Synopsis of A Position on Research in HCI

Looking back on the history of Human-Computer Interaction (HCI) as a field, we see fundamental contributions mainly from two groups of researchers: (1) computing scientists interested in how technology would change the way we all interact with information, and (2) psychologists (especially cognitive psychologists) interested in the implications of those changes. This created a combustible environment for great research, because the computing scientists wanted to create great and interesting tools but did not have a great way to measure its impact, yet many classically trained psychologists were looking beyond classic research in the brain and the understanding of human cognition.

One enduring core value in HCI research has been the development of technologies that augment human intelligence. This mission originates with V. Bush, Licklider, and Engelbart, who inspired many researchers at PARC to develop the graphical user interface. Researchers were excited by the possibilities of the computing machinery in producing systems that augmented human intellect. Researcher believed computers were great tools for modeling and understanding human cognition.

During the formation of the field, the need to establish HCI as a science had pushed us to adopt models and methods from psychology, because the models/methods fit the needs. The metaphor of the desktop, files, windows, and the graphical icons on bitmapped displays arrived naturally. The study of how users would respond to icons flashing on the screen, or how users would move a pointing device, paralleled some of the psychological experiments on stimulus and human response that psychologists were already routinely measuring. For example, Fitts' law, models of human memory, cognitive and behavioral modeling methods like GOMS enabled HCI researchers and practitioners to model a single user interacting with a single computer.

But of course, computing has changed. In many cases, we can no longer assume users with only a single display, performing only knowledge work, isolated working by themselves, stationary, and conducting short tasks. As a field, HCI researchers have slowly broken out of the mold in which we were constrained. Instead, we need to build models for not just a single user working in front of a personal computer, but also models for mobile smartphones, location-based services, collaborative work, social media consumption. Model-driven research should seek to predict and to explain the how users are able to reason, combine operations, and generally how they behave in these systems.

For example, the drive to do models and theories for social computing research should further our understanding of how network science, behavioral economics, and evolutionary theories could explain how social systems evolve. In this talk, as examples, I will illustrate how model-driven research have taken me and my research collaborators from modeling users searching for information in websites and eBooks to understanding how users learn using social annotations, and how complex knowledge systems like Wikipedia evolve.

I will illustrate model-driven research in social computing. Our research in Augmented Social Cognition is aimed at enhancing the ability of a group of people to remember, think, and reason; to augment their speed and capacity to acquire, produce, communicate, and use knowledge; and to advance collective and individual intelligence in socially mediated information environments. In particular, we have found that (1) analyses of conflicts and coordination in Wikipedia demonstrate the need to understand evolution of social collaborative environments; and (2) information theoretic analyses of social tagging behavior in delicious.com demonstrate the need to understand human vocabulary systems.

Model-driven research is a fruitful path forward not just to establish a scientific foundation for our field, but, I argue, also a way to invent and engineer systems for end-users.

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