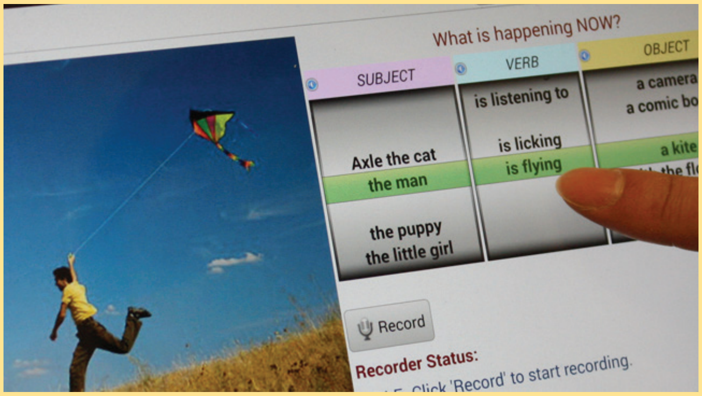
# Research@CSE Interactive Systems




The Interactive Systems group at the University of Michigan investigates Human Computer Interaction (HCI), Educational Technology, Multimedia, and Social Computing. HCI is a large and diverse field and the faculty cover many important areas, including strengths in the fundamentals of HCI as well as exciting new technologies and services.

The scientific fundamentals include the domains of human perception and cognition and human factors, social activity, and learning. The applications cover a wide span: user interface design methods, computational sound and music systems, collaboration systems, and educational computing in K-12 settings, with a special emphasis on mobile and ubiquitous computing.

## COLLABORATIVE AND SOCIAL COMPUTING

**Faculty: Mark Ackerman, Walter Lasecki**

Computing has become social. Many computational systems and environments involve some element of user control; increasingly that user control is socially oriented, where digital traces and the crowd allow better interaction. My research focuses on social computing (including crowdsourcing) and other collaborative technologies) and pervasive (ubiquitous) computing. My group is currently working on topics such as health; ways to find people; new collaborative ways for reusing informal information; user control for pervasive devices, especially using other people's digital traces.

## COGNITIVE PRINCIPLES AND MODELS IN USER INTERFACE DESIGN

**Faculty: David E. Kieras**

Developing systems to be easy to use and effective can be accomplished by a simple guess-build-test approach, but this is often slow and expensive. A better approach is first, base the interface design on concepts and principles from human factors and cognitive psychology. Examples: why finding an object on the screen is easiest if it has a distinctive color rather a particular icon; why the mouse and touchscreens are more effective for selecting objects than joysticks, trackballs, or keyboards. Then second, analyze and predict the effectiveness of the design using simulated humans that are based on a cognitive architecture for human perception, cognition, and action, similar to those developed in artificial intelligence. My research focuses on developing such modeling techniques both for the initial design of the system functionality, and the evaluation of specific detailed interface designs.

COMPUTER SCIENCE AND ENGINEERING
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## COMPUTATIONAL MODELING OF HUMAN EMOTION

**Faculty: Emily Mower Provost**

Emotion has intrigued researchers for generations. This fascination has permeated the engineering community, motivating the development of affective computational models for classification. However, human emotion remains notoriously difficult to interpret both because of the mismatch between the emotional cue generation (the speaker) and cue perception (the observer) processes and because of the presence of complex emotions, emotions that contain shades of multiple affective classes. The goals of my research are motivated by these complexities. I study methods to provide a computational account of how humans perceive emotional utterances ("emotion perception") and combine this with knowledge gleaned from emotion estimation studies ("emotion recognition") to develop a system capable of interpreting naturalistic expressions of emotion utilizing a new quantification measure ("emotion representation"). The focus of this research is to provide a computational description of human emotion perception and combine this knowledge with the information gleaned from emotion classification experiments to develop representations that are both human and machine interpretable. Proper representation and quantification will support the development of affective assistive technologies, new algorithmic development, and will further our understanding of the emotion production and perception processes.

## MOBILE LEARNING

**Faculty: Elliot Soloway**

By 2017 every app and every webpage will be Social 3.0-ified, i.e., will be collabrified. By collabrified we mean that an app (or website) can support two or more individuals, each individual working on his/her device, co-located or more likely not co-located, verbally conversing while working inside the app. While Web 2.0's hallmark was support for asynchronous collaboration, the next thing will be Social 3.0 – support for synchronous collaboration. We have developed a suite of educational productivity tools that are collabrified (Android: WeCollabrify, iOS: WeMap, WeKWL) and are in daily use in classrooms around the world.

## CROWDSOURCING AND HUMAN COMPUTATION

**Faculty: Walter Lasecki**

Human computation incorporates human intelligence into algorithmic processes. It is, at its core, the study of structured work. While workflow, process management, and organizational theory has been developed in great depth previously, the introduction of computer science and computational theory has given us a new lens through which to view organized human efforts, and combine it with the efforts of automated systems. Crowdsourcing — the practice of making an open call to a group of workers to complete a task, often through social computing channels — has created the opportunity to create large-scale human computation systems that are far more capable than current automated systems, but are still available on-demand, at a moment's notice. At Michigan, we are advancing the frontiers of what can be accomplished with human computation and crowdsourcing: exploring how to create systems that respond intelligently, in real-time, and with consistency over time.

## AUDITORY SIGNAL PROCESSING AND ENGINEERING (ASPEN)

**Faculty: Gregory H. Wakefield**

How we hear determines what we hear. Therefore, any systematic understanding of interactive systems involving audio must begin with the human listener and what they perceive. My research, and that of my students, integrates what we know about hearing with what we know about sound producing objects to create and develop a variety of interactive systems. Our most recent efforts are in the areas of immersive spatial audio, vocal pedagogy, and sound quality engineering. We are also interested in exploring fundamental aspects of auditory perception, ranging from elementary pitch perception to the perception of more complex, stochastically organized sounds, and in the integration of what we learn from these studies into models of cognitive architecture.


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## TEMPORAL INFORMATICS AND VISUALIZATION

**Faculty: Eytan Adar**

My research interests include Internet-scale systems, social network analysis, text mining, and visualization. I work on temporal informatics: the study of the change of information – and our consumption of it – over time. One example is Zoetrope, a way of interacting with the Web that takes into account the fact that Web pages change frequently and it is nearly impossible to find data or follow a link after the underlying page evolves. Zoetrope enables interaction with the historical Web that would otherwise be lost to time by allowing users to interact with content streams. That is, users can look back though previous versions of Web pages and generate visualizations and extractions of the temporal data. I have also done important work on a range of other topics, including social network analysis.

## FACULTY IN INTERACTIVE SYSTEMS

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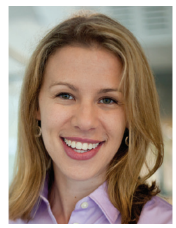

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