

# Fusing Longitudinal Sensor Data for Individual Self-Assessment

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**Industrial Partners:**



## Premise

The University of Notre Dame and the University of California-Irvine are assembling a multi-disciplinary team for the MOSAIC project. Our team brings expertise with respect to large scale multi-modal user studies across a wide variety of health and social dimensions instrumented via various smart sensors including smartphone / laptop agents, health sensors (Fitbit Charge HR, Zephyr chest strap), and social media agents. Our team has conducted multiple studies ranging from fifty to over five hundred users across college-aged and professional populations.

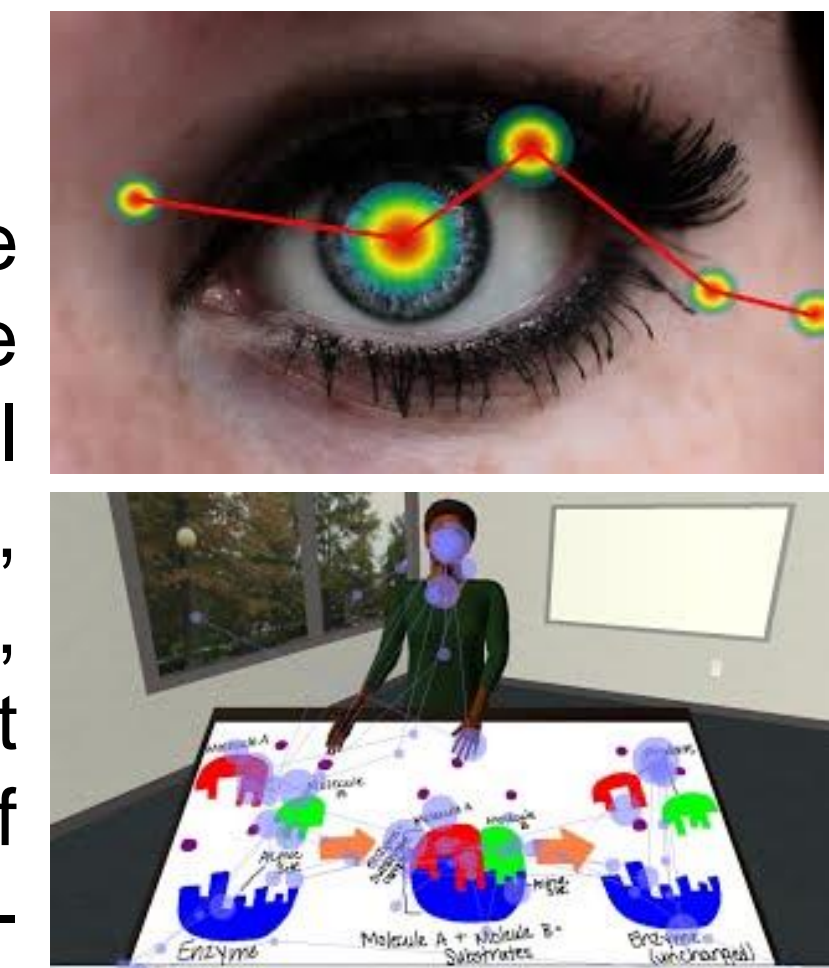
## Instrumenting Large Populations – NetSense / NetHealth

The NetSense and NetHealth studies have instrumented sizable undergraduate populations of incoming freshmen at the University of Notre Dame for the purpose of instrumenting social network and digital communication interactions. The NetSense study (2011-2015) funded by NSF provided two hundred students from their freshmen through senior year with free cellular service in exchange for complete monitoring of metadata, proximity, social media, and phone usage for the purpose of exploring tie creation and tie persistence in the face of always-on networking. The NetHealth study (2015+) grew the study to over seven hundred students and provided each individual with a Fitbit Charge HR to explore the interplay of physical activity (PA), sleep habits (SH), and social interactions.



## Mind Wandering and Engagement

How does engagement emerge from the complex three-way interactions among the learners themselves (i.e., individual differences), the instructional materials (i.e., text difficulty), and the learning activities (i.e., task control and task value)? Research at Notre Dame is tracking the dynamics of emergent engagement trajectories via state-of-the-art technologies and methods from affective computing, eye tracking, and nonlinear dynamical systems. Further, we aim to blend basic research focused on why, when, and how minds wander with advances in eye tracking, mental state estimation, and conversational learning technologies to advance a new genre of attention-aware learning technologies that automatically detect and combat wandering minds.



## Collaboration Needs

We are seeking both academic and industrial partners to augment our capabilities with respect to analytics and sensing in the areas of visualization and the extraction of emotionality in communications.

**End User Visualization:** We seek expertise with regards to the presentation of QS data for self-reflection and personalization as our prior work has focused exclusively on non-intrusive mechanisms for data gathering (minimal interaction with participants).

**Extraction of Emotionality:** We seek expertise with regards to the extraction of emotion via audio, video, or text (social media, SMS). In particular, we seek sensing capable of full day monitoring without requiring sensor recharging or excessive bandwidth consumption. Probabilistic or triggered sensing expertise is also acceptable.

## Workplace Rhythm, Multitasking, and Productivity

Work at the University of California-Irvine has explored the interplay of interactions in the workplace as they relate to rhythm, multitasking, and productivity. Various groups of professionals (30-40+) and campus students have been instrumented with a variety of bioharnesses coupled with on-system instrumentation to explore productivity and computer interactions.



In the first case, researchers explored engagement and challenge in work relate to focus, boredom, and rote work. Overall, the study found more focused attention than boredom in the workplace. Focus peaked mid-afternoon while boredom was highest in early afternoon. People were happiest doing rote work and most stressed doing focused work. The study shows how rhythms of attentional states are associated with context and time, even in a dynamic workplace environment.

In the second example, researchers explored how three email use patterns: duration, interruption habit, and batching, relate to perceived workplace productivity and stress over 12 workdays. The work found that the longer daily time spent on email, the lower was perceived productivity and the higher the measured stress. People who primarily check email through self-interruptions report higher productivity with longer email duration compared to those who rely on notifications.

## Goal: Simple, Effective Self-Assessment

We seek to create a system for longitudinal self-assessment that leverages our existing expertise and study populations to combine not only instrumentation of one's health including sleep / physical activity (ex. Fitbit) but also sensing of one's digital / social interactions (proximity, computer / smartphone interactions, social networks). With these combined pieces of information, we will then selectively augment sensing capabilities during sensing at low and high stress periods (ex. Zephyr Bioharness) to create detailed analytics of stressors and productivity metrics of an individual.

With said analytics, we intend to create personalized models to present to the user as well as interventions for the purposes of reducing stress and enhancing productivity. We intend to explore both the reduction and management of transient as well as chronic stressors via smartphone and wearable interventions. Interventions will be delivered both in reflective mechanisms (reflect at end of mid-day, work day) as well as just-in-time interventions that can be delivered as appropriate for the context of the situation.

Evaluations and study populations will draw upon cohorts at the University of Notre Dame, the University of California-Irvine, and professional populations with past histories for the two faculty leads as well as any potential research partners.