

Self-Improvement Technology

INF 241 - Week 4

Dennis Wang

Self-Improvement Technology

- Picking up our discussion from Monday about longitudinal evaluation of behavior change technology...
- What constitutes the **success** of a persuasive technology? -> change / improvement?

Thomas Fritz, Elaine M. Huang, Gail C. Murphy, and Thomas Zimmermann. [Persuasive Technology in the Real World: a Study of Long-Term Use of Activity Sensing Devices for Fitness](#). CHI 2014



Thomas Fritz

- Associate Professor at University of Zurich, Department of Informatics
- Ph.D. in the Software Practices Lab at the University of British Columbia (2011)
- Studying **software developers** and on using **personal and biometric data** to improve software developers' productivity and well-being
- This is his most cited paper (400+)



Elaine M. Huang

- Associate Professor at University of Zurich, Department of Informatics
- PhD at Georgia Institute of Technology with **Elizabeth D. Mynatt** (2006)
- Sustainability, IoT design in home

Thomas Fritz, Elaine M. Huang, Gail C. Murphy, and Thomas Zimmermann. [Persuasive Technology in the Real World: a Study of Long-Term Use of Activity Sensing Devices for Fitness](#). CHI 2014



Gail C. Murphy

- Professor in the Department of Computer Science / Vice-President Research & Innovation at the **University of British Columbia**.
- Research in **software engineering** with a particular interest in **improving the productivity of knowledge workers**, including software developers



Thomas Zimmermann

- Sr. Principal Researcher at Microsoft Research (Researcher at the time of publication)
- Research interests: **software engineering**, data science, and recommender systems
- Coming to our department's seminar talk next week

Thomas Fritz, Elaine M. Huang, Gail C. Murphy, and Thomas Zimmermann. [Persuasive Technology in the Real World: a Study of Long-Term Use of Activity Sensing Devices for Fitness](#). CHI 2014

- **Recent ubiquity of commercial systems** allows us to learn about use in truly “in the wild” contexts and understand how practices evolve over long-term, naturalistic use
- **In-depth semi-structured interviews** with 30 long-term user (3-54 month experience)
- Rich understanding of the **influence and role** of wearable persuasive technology for activity tracking
- **Perspectives and practices** of long-term use that add depth to the findings of previous experimental and shorter term deployments of related technologies
- Offers a set of targeted **implications** for designing personal informatics technologies intended for long-term use.

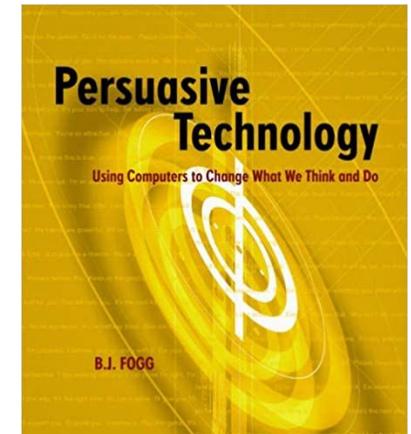
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Motivating Works

- Commercial wearable activity trackers
- Persuasion strategies (Fogg)
- Providing data about people's physical activity raises consciousness of increases activity at least in the short term
 - Fish 'n' Steps, UbiFit, and Chick Clique
- Participants' extreme focus on numerical goals and numerical data
 - People focus on numbers rather than the activities the numbers represent
 - Appropriate credit for activities is essential for encouraging physical activity



Figure 1. Nike+ Fuelband (left) and Fitbit Ultra (right)



Thomas Fritz, Elaine M. Huang, Gail C. Murphy, and Thomas Zimmermann. [Persuasive Technology in the Real World: a Study of Long-Term Use of Activity Sensing Devices for Fitness](#). CHI 2014

Following Works

- Designing for long-term support - *Supporting "Changes"*
 - Motivating maintenance as well as change
 - Supporting the identification and evolution of appropriate social networks
 - Supporting changes in activity and metrics
 - Supporting the evolution of rewards

Mashfiqui Rabbi, Katherine Li, H. Yanna Yan, Kelly Hall, Predrag Klasnja, and Susan Murphy.
ReVibe: A Context-assisted Evening Recall Approach to Improve Self-report Adherence. IMWUT
3, 4. 2019



Mashfiqui Rabbi

- **Postdoc/Applied Research Scientist, Health AI, Apple Inc.**
- Postdoc at Statistics Department, Harvard University (2016-19) / University of Michigan (2016-17)
- Ph.D. in Information Science, Cornell University (2016) with Tanzeem Choudhury
- Research Interest: Adaptive intervention in the mobile health space



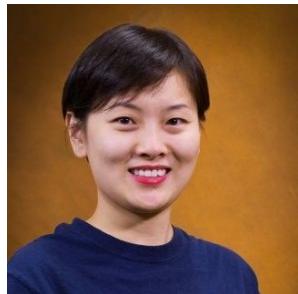
Katherine Li

- **PhD student** in Biostatistics at the University of Michigan School of Public Health
- The project was conducted around 2016-18 while the paper was published in 2019.

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ReVibe: A Context-assisted Evening Recall Approach to Improve Self-report Adherence. IMWUT

3, 4. 2019



H. Yanna Yan

- Quantitative UX Researcher at Facebook
- Ph.D. in Survey methodology at University of Michigan



Kelly Hall

- ORISE Fellow at Centers for Disease Control and Prevention
- Master's of Public Health (MPH) in Yale School of Public Health, BS in University of Michigan, RA under Dr. Susan Murphy

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Predrag Klasnja

- Associate Professor of Information, University of Michigan
- Ph.D. in Information Science at the University of Washington, advised by Wanda Pratt
- Study how technology can help people to better manage their health and to more effectively communicate with their healthcare providers



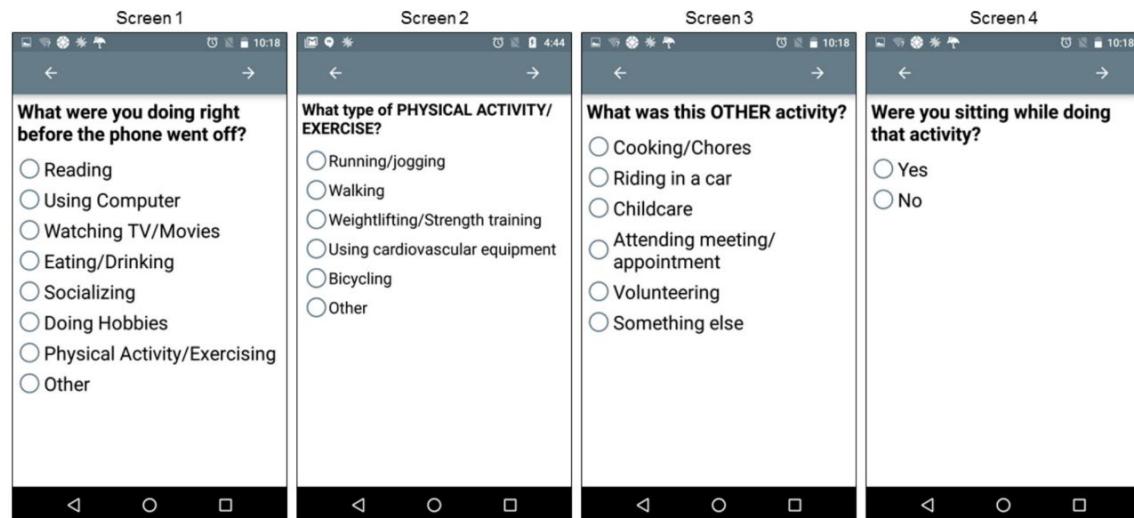
Susan A. Murphy

- Professor of Statistics, Radcliffe Alumnae Professor at the Radcliffe Institute, Harvard University
- Was Professor of Statistics / Psychiatry at University of Michigan (2014-2017)
- Research Interest: Experimental design and causal inference to inform sequential decision making, particular with regards to **sequencing treatments in health and in mobile health intervention development.**

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Ecological Momentary Assessments (EMA)

- Collect in-the-moment data (feelings/experiences) in ubiquitous computing and mobile health
- Interruption -> **High-burden**



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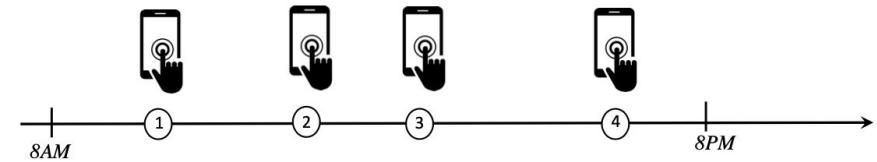
3, 4. 2019

Motivating Works - Approaches to improve self-report effectiveness

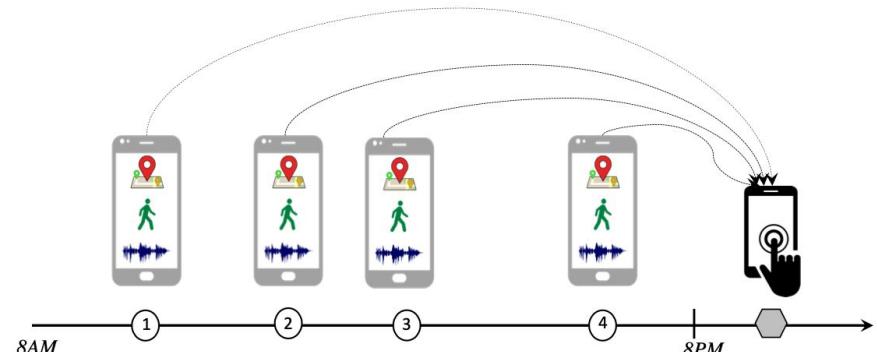
- Provide financial incentives
- Lower the burden of EMAs
 - shortening the EMA questionnaires
 - asking EMAs only at interruptible moments
 - extra non-smartphone-based device
- Use of context to improve recall of memory
 - role of context in constructing and recollecting human memory is well documented in psychology

Mashfiqui Rabbi, Katherine Li, H. Yanna Yan, Kelly Hall, Predrag Klasnja, and Susan Murphy.
ReVibe: A Context-assisted Evening Recall Approach to Improve Self-report Adherence. IMWUT
3, 4, 2019

- Frequently interrupt the user results in poor long-term adherence
- Propose an **“Evening Recall Approach”** assisted by contextual information (location, physical activity, and ambient sounds)
- Conducted a 14-day study (N=54)
 - Whether providing contextual information improves evening recall accuracy
 - Whether adherence rates to evening recalls (assisted by context or not) were greater than adherence rates to EMA



(a) Ecological momentary assessment



(b) Evening recall

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Future Works

- Explore how this **difference in recall** varies for different types of experiences
- Create more **semantically meaningful context** which can provoke better recall
- Designing **better representations of contexts** that support better recall of memory.

Florian Künzler, Varun Mishra, Jan-Niklas Kramer, David Kotz, Elgar Fleisch, and Tobias Kowatsch. [Evaluating the State-of-Receptivity for mHealth Interventions](#). IMWUT 3, 4. 2019



Florian Künzler

- **PhD student at ETH Zurich**
- Focus on design and evaluation of digital health interventions in the context of diet and physical activity coaching



Varun Mishra

- **Ph.D. candidate in the Department of Computer Science at Dartmouth College**, working with Prof. David Kotz
- mHealth sensing and intervention, developing novel sensing and intervention systems for smartphones and wearable devices

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Jan-Niklas Kramer

- **PhD student at ETH Zurich**
- Design and evaluation of digital health interventions related to physical activity and diabetes from a health psychology perspective



David Kotz

- Pat and John Rosenwald **Professor** in the Department of Computer Science at **Dartmouth College**
- Visiting Professor in the Center for Digital Health Interventions at ETH Zurich, Switzerland

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Elgar Fleisch

- Professor of Information and Technology Management at
ETH Zurich and the University of St. Gallen



Tobias Kowatsch

- Assistant Professor for Digital Health at the University of St.Gallen and the
Scientific Director of the *Center for Digital Health Interventions*
 - Digital health interventions (e.g. just-in-time adaptive interventions)
 - Digital clinical pathways and working alliance between patients, relatives, health professionals and digital coaches (e.g. healthcare chatbots, conversational agents)
 - Digital biomarker (e.g. detection of emotions, stress, breathing or personality traits)

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Motivating Works

- **Interruptibility and Engagement:** "interruptibility management", "context-aware notifications", and "smart notifications"
 - explored context like location, activity, boredom, personality, phone interaction and more
- Receptivity to interventions (**JITAI framework** defined by Nahum-Shani et al)
 - **JITAI (just-in-time adaptive interventions):** suites of interventions that adapt over time to an individual's changing status and circumstances with the goal to address the individual's need for support, whenever this need arises
 - **Receptivity:** person's ability to receive, process, and use the support (intervention) provided

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1. Explored the role of intrinsic factors / contextual factors / platform in users' **responsiveness** towards mHealth interventions
 2. How **outcome of the intervention** relate to receptivity
 3. Can we build machine-learning models to **infer when participants are receptive towards interventions?**
-
- Conducted a deployment study with 189 participants, over a period of 6 weeks in free-living conditions

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Following Works

- Further explore how receptivity detecting mechanism work in real life settings
 - *Detecting Receptivity for mHealth Interventions in the Natural Environment, 2020*
- Examine mHealth Intervention for **different conditions** (different health conditions, goals, contexts, etc.)
- **Conversational Agents** as Mediating Social Actors

Discussion Themes - I

Long-term support for motivating self improvement

(Arthur, Dennis, Jo, Lika, Myles)

- Does a successful persuasive technology continue to offer value by supporting and scaffolding the behavior over time? Or does it serve as a 'gateway' technology, training and routinizing new practices to the point that the technology itself is no longer necessary?

Discussion Themes - II

Detecting context for adaptive intervention

- **Is the idea of detecting context for adaptive intervention techno-centric or user-centric?**

it is easy to imagine that if even more about the context could be understood, **the combination of context-awareness and machine learning prediction could enable this type of intervention to be used in much higher-consequence situations (Colby)**

limited in its engineering approach - clearly defined / quantified user's receptivity and context. User's willingness to accept the message is ignored in this paper. Therefore, **it's difficult to conclude that users failed to interact with the message because of some intrinsic or contextual variables**, or because the content from the previous intervention (Lika)

Discussion Themes - III

The potential issue of numerical representation

- **What are the potential issues of numerical representation? What are some alternative ways of designing representations for reward?**

"reward system for motivation should not purely rely on numerical value" (Lika)

"people put faith in "Fuel Points" without knowing what they are or how they are calculated" (Neeraj)

"interested to see how much some of the participants cared about the numbers representing their progress" (Jason)

Discussion (Other questions)

- **Privacy concern** about collecting contextual information for adaptive intervention
- What the "**cycle of being receptive to the interventions**" means to designing self-improvement technology
- Potentially recruited "**too self-motivated**" users in using these devices in Fritz et al., 2014

Conclusion Remark

- Extended our discussion from Monday about how technology could support behavior change
- Long-term support for self-improvement technology
- Contextual information in mHealth Intervention / JITAL