



TIKTOC RERC
STATE OF THE
SCIENCE
OCTOBER 19-20, 2017

Innovation in the Development of Mobile Apps

Panelists:

Mark Ackerman (University of Michigan)

Ed Cutrell (Microsoft Research)

Dan Ding (University of Pittsburgh)

Ed Durfee (University of Michigan)

Amy Hurst (University of Maryland Baltimore County)

Mark Newman (University of Michigan)



Goals of the Panel

To identify, enumerate, articulate, and/or discuss:

- Trends in relevant technological innovations (human-computer interfaces, artificial intelligence, sensors, ...)
- Strategies for identifying and tailoring new technologies for the target community
- Approaches to engaging multiple perspectives and stakeholders in the development process
- Directions for future innovations to improve transition to independence and self management

Some Areas of Technological Innovation

- Technology for sensing the world (Mark Newman)
- Technology for improving accessibility (Amy Hurst)
- Technology for training and education (Dan Ding)
- Technology for fostering interaction among people (Ed Cutrell)
- Technology for drawing on community knowledge (Mark Ackerman)
- Technology for assisting/augmenting human cognition (Ed Durfee)



What technical trends or innovations are you excited about, that you see as offering potential advantages for adaptive technology in mobile apps?

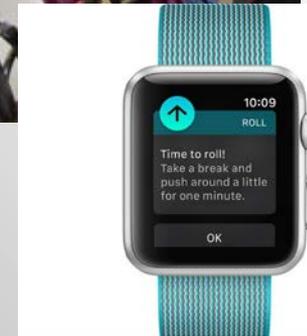
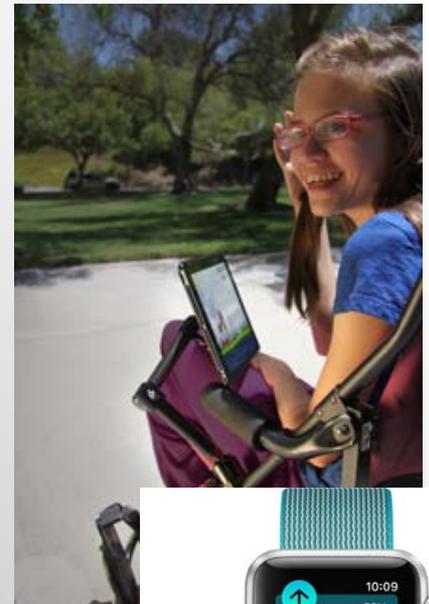
Sensing the World (Newman)

- Ubiquitous computing
 - Computing = everyday life
 - Mobile devices + sensing + networking + cloud services
- Personal informatics
 - Self-reflection
 - Goal tracking and self improvement
 - Beyond steps: sleep, mood, movement, nutrition, hydration
 - Semi-automated tracking: automated sensing + intelligent self-report



Sensing the World (Newman)

- Expanding access and participation
 - Adapting COTS technology to non-mainstream populations
- End-user configuration
 - Personalized assemblies of tracking tools, goals, feedback
 - Rapid reconfiguration as goals change



- Supporting collaboration
 - Data sharing
 - Collaborative tracking
 - Problem solving



Improving Accessibility (Hurst)

- Adoption and appropriation of DIY assistive technology
 - What impact can / does rapid prototyping technology play?
 - How can we *make* these tools accessible?
 - How can we teach “making” skills to assistive technology users?
 - Are there entrepreneurship opportunities?
- Assistive technology that automatically adapts to user needs
 - What control do end-users want over adaptive assistive technology?
 - What information are end-users comfortable providing for real-time assessment of ability?
 - How much detail do end-users want about their current ability?



Training and Education (Ding)

- Multi-featured and use health behavior theories
- Self-monitoring
 - Automatic via sensors (external and phone-based)
 - Manual via assessment checklist or journaling
- Gaming
 - Role-playing serious games
 - Simple games
 - Virtual prize
- Tailored/individualized contents
 - Automatic based on self-monitoring
 - Pushed by professionals

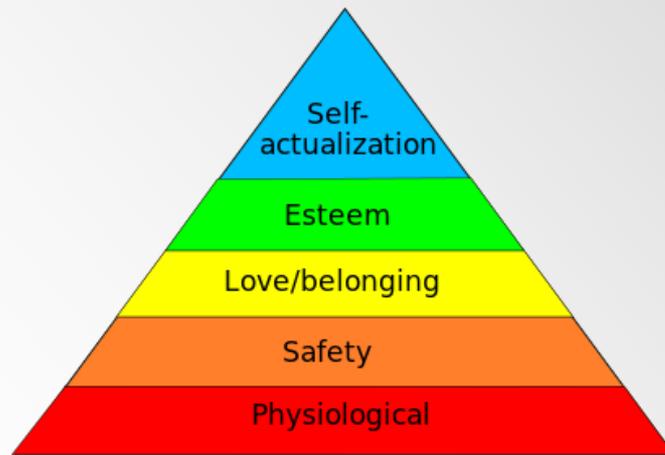
Fostering Interaction (Cutrell)

Disability can be socially isolating and IT can be used to help smooth the connection between people. Users of Augmentative and Alternative Communication (AAC) see this need very clearly.



Fostering Interaction (Cutrell)

For AAC users, we want to improve throughput (faster communication), but ALSO improve expressiveness.



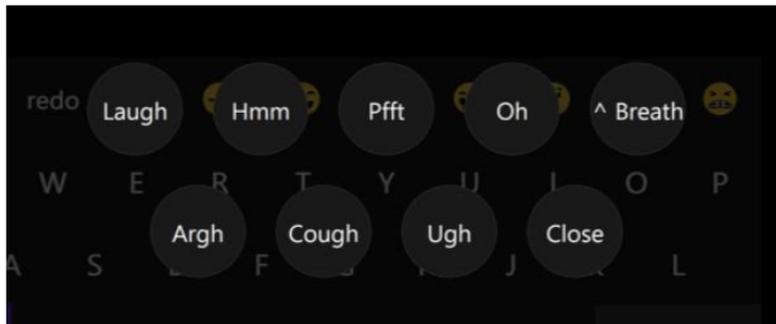
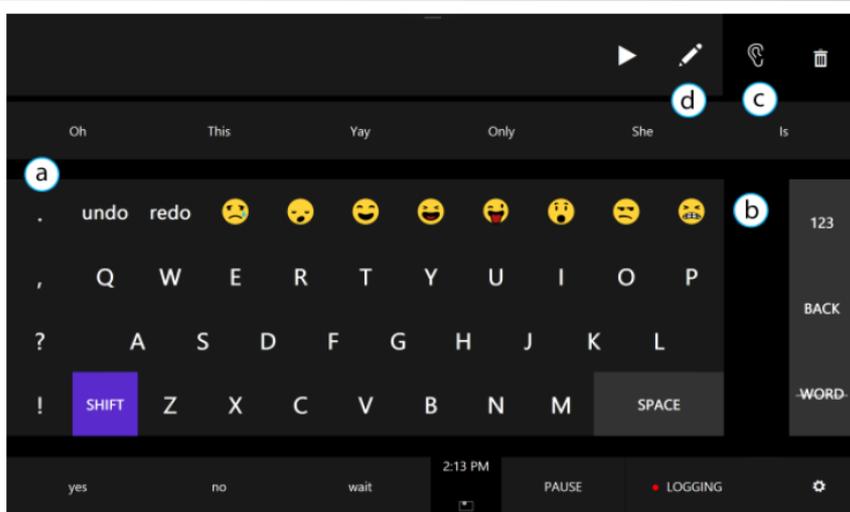
Maslow's Hierarchy of Needs [1943]

Features
1. Sapi 5 compatibility
2. Intelligibility & pronunciation editing
3. Pitch and speed Controls
4. Socially interactive ²
5. Expressiveness
6. Multilingual Capability
7. Loudness
8. Talk to animals
9. Ability to sing

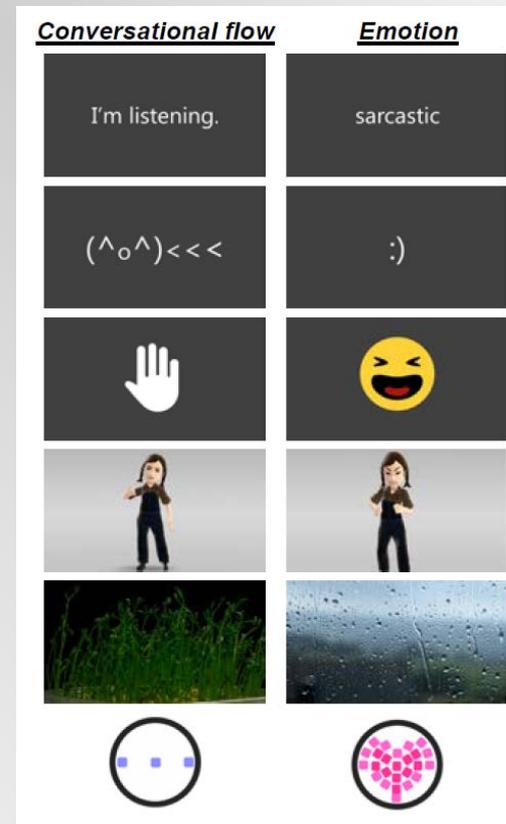
Hierarchy of speech synthesis needs from an AAC user [Portnuff, 2006]

Fostering Interaction (Cutrell)—AAC Expressivity

Voicesetting

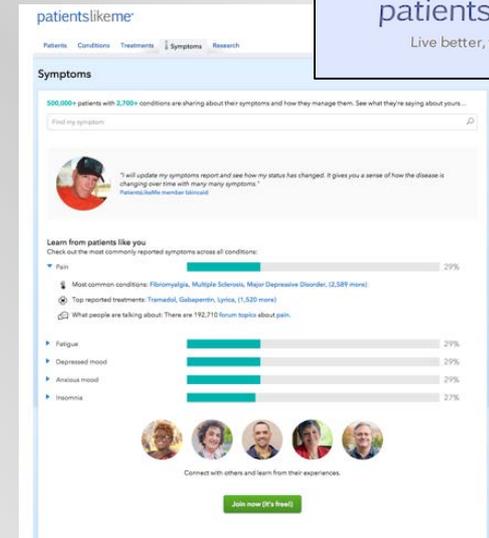


Awareness Displays



Drawing on Community Knowledge (Ackerman)

- Social Computing
- People know stuff!
- Online communities, social networks are now canonical
- What's new?
 - Finding people like you for help
 - Helping people with data and privacy
 - Teaching people how to talk with clinicians
 - Specialized crowds



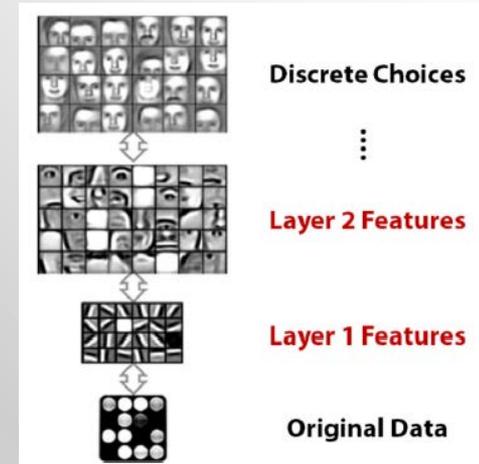
Drawing on Community Knowledge (Ackerman)

- Data and privacy
 - More and more devices with more and more data
 - Who has control of the data?
 - Especially an issue with adolescents
 - What kind of control?
 - Can we help this and how?

Augmenting Human Cognition (Durfee)

Machine (Deep) Learning based on Massive Data

- Amassing volumes of individual experiences
- Finding complex patterns across representational layers
- Using similarities to improve decisions and predictions



Explainable Artificial Intelligence

- Modeling how human's reason (differently than machines!)
- Helping person understand machine's decisions
- Encouraging human participation (not passive acceptance)



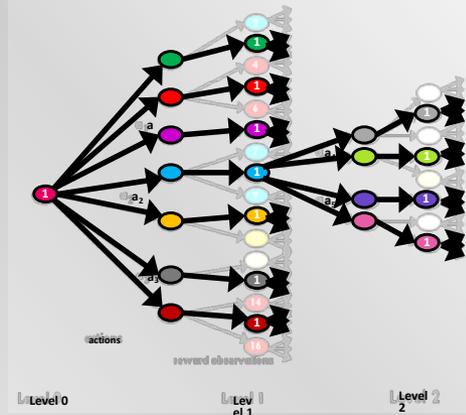
Augmenting Human Cognition (Durfee)

Sequential Decision Analysis

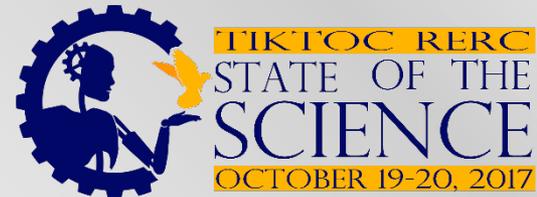
- Exploiting machine's power to envisage/simulate many possible futures
- Informing near-term decisions based on long-term consequences

Safe Intelligent Automated Decision-Making

- Detecting/resolving mismatched expectations between person and machine
- Knowing when to ask for clarification/permission
- Uncovering hidden assumptions
- Purposely focusing on worst-case/outlier outcomes



What practices and methods do you recommend for incorporating novel, innovative technology into adaptive applications? What are some pitfalls and challenges we should be aware of when it comes to translating research and innovation into practical solutions?



Best Practices for Applied Innovation

- Consider end-user habits and preferences instead of only ability (Hurst)
- Assess the technology relevance and practicality in the intended context of use by involving target users (Ding)
- Understand existing practices thoroughly; develop empathy and insight to guide design (Newman)
- Recruit a small set of target users as co-designers and testers. This allows them to travel along with your journey of technical discovery and to spot how designs or ideas might play out in their own context (Cutrell)
- Knowing when to optimize and when to satisfice: adjusting research objectives when moving from academic perspective to applications (Durfee)
- Use technical designs as probes to deepen understanding (Ackerman)



What tools and methods have you found useful for understanding user populations and incorporating their needs and insights into the development project?

Understanding and Incorporating User Needs

- Long-term studies including interviews and field work (and probes) (Ackerman)
- Working with a consumer organization and including a lead user in the development team (Ding)
- Grounding discussion on representative scenarios focused on the central challenges, and redirecting discussion away from tangents (Durfee)
- Longitudinal field work and volunteering (Hurst)
- Diary studies and experience sampling (Newman)
- Advocacy organizations can be great for connecting to users. But care should be taken; these organizations have their own agendas and their goals may not perfectly align with the everyday needs of their membership. Don't take their word as a proxy for the voice of the people they represent (Custal)





How do you bring together different stakeholders and different disciplinary perspectives in the design and research process?

Involving/Integrating Stakeholders and Disciplines

- Teams that combine qualitative user research, technologists and designers can be AMAZING, but it can be very challenging keeping them all on the same page. Epistemological impedance matching FTW! (Cutrell)
- Participatory design – including user representatives on the design team (Newman/Ackerman)
- Understand the individual needs of each stakeholder or discipline, and accommodate them in the design and research process (Ding)
- One successful model: a champion to make it happen, such as Defense Department's tech development for warfighter safety (Durfee)
- Get out of the lab and into the field to minimize our bias as researchers (Hurst)



What directions for technology innovation should be nurtured to have the greatest impact on improving the transition to independence and self-management?

Innovations Worth Investing In

- (Environmental/social/etc) context-aware automation: Self-limited machine behavior to minimally disrupt environmental/social context (Durfee)
- Natural language interaction will be revolutionary for people with motor and visual disabilities. We're just starting to see this with phone and in-home devices like Amazon Echo, Google Home (Cutrell)
- Better coordination within care teams around data and privacy (Ackerman)
- Personalized, meaningful data management and sensemaking (Newman)
- Support convenient, reliable, and accurate self-monitoring via sensors (Ding)
- Education and training for young adults to continue to learn employable skills and technical literacy beyond data entry and disposal (Hurst)

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Audience Help in Completing the Picture!!

Use this panel and upcoming working group to flesh out answers to the goals!

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