Computing in Mental Health

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ACM 978-1-4503-4082-3/16/05. http://dx.doi.org/10.1145/2851581.2856463

Abstract
18.5% of adults in the US suffer mental illness. Just under half of all adults will experience mental illness at some point in their life. These compelling statistics have prompted computing researchers and practitioners to work toward developing technologies that can support those with mental illness and promote thriving universally. For example, wearables and sensors can help detect mental states, smartphone apps can be used to expand the reach of interventions, and our understanding of the impacts of everyday technology on our mental health can contribute to a future of technology design for flourishing. This interdisciplinary workshop will provide the opportunity for mental health professionals and technologists to come together to explore how new computing technologies can support mental health and promote psychological flourishing.

Author Keywords
Mental Health; Positive Computing; ehealth; Social Media; Wearables

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous;

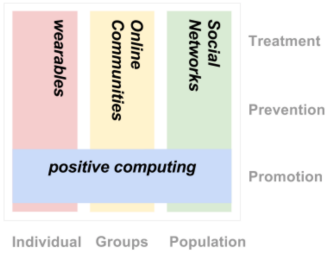

Figure 1: Design for mental health in two dimensions based on target audience (individual, groups or populations), and goals (promotion, prevention and treatment), with example applications

Background

Prevalence of mental illness currently or within the past year, among US adults is 18.5% [16]. LIfetime prevalence of any mental illness is 46.4% [13]. But there are effective ways of helping. Strong evidence supports the idea that technology based mental health interventions can be effective [11]. For example, 21% of 12-17 year-olds and 34% of 18-25 year-olds reported searching the Internet for information to help themselves, with 78% of them feeling that the internet had helped; 85% would recommend it to a friend or family member; and 94% felt somewhat or very satisfied with the information they received [5]. These are promising results given that most of the interventions so far have been relatively simple in the way they use data.

A burgeoning community is now looking at how to use new forms of interaction and data from sensors, from social media and other databases to understand more about the psychological wellbeing of populations, to detect people at risk, to personalize and deliver interventions and generally providing new models of care. Figure 1 delineates a two dimensional representation that may help view the different forms of human-computer interaction being used to improve mental health. At the bottom are mental health promotion initiatives, for example that of Positive Computing [7] that explores way to design technologies to support psychological wellbeing. These may target individuals, groups or even the whole population. In the middle we have technologies used in prevention campaigns, ie. to help people with a particular risk profile.

At the top we have the computational approaches to treatment, i.e. helping those that are ill, such as the use of Embodied Conversational Agents [3] or computer based CBT [1]. The horizontal axis reflects the difference on computing techniques where the interaction is focused on an individual versus those that focused on groups. This differentiation is often needed as certain activities (e.g. talking with a counselor or writing a journal) need the privacy. Although data may also be analyzed at a group level these interventions are designed to target help a particular person generally on their own or with a person providing help.

Certain interventions, particularly those that are unsolicited, may need to be targeted to a group (e.g. all people in a particular online community) rather than an individual. Finally, some studies have focused on understanding the impact of technologies on the wellbeing of the population [4] or on interventions aimed at the general population (e.g. public media campaigns).These categories are not precise or definite, but as the community and research literature grows they are useful to move a field forward, identifying well studied and neglected areas. The projects presented in this workshop will contribute to this or other taxonomies participants find useful. We will bring together researchers from academia, government and corporations interested in using technology to support mental health, discuss their projects, and explore how these innovations can translate to societal impact.

Research practice supporting impact

New technologies are challenging long held views on how to provide support to those suffering mental illness and to reduce the number of people who fall ill. These developments require multidisciplinary approaches that bring together researchers and practitioners in human-computer interaction, machine learning, Natural Language Processing (NLP), psychology and psychiatry and other social sciences. Computing professionals are being challenged to find new ways to innovate in the new field of eHealth, particularly on how new technologies can be used to improve mental health, the topic of this workshop.

The field is progressing through a combination of "invention" and "discovery" [15]. Invention has been defined as the "accumulation and creation of knowledge that results in a new tool, device, or process that accomplishes a specific purpose." While discovery is the "creation of new knowledge and facts about the world." (ibid).

The discovery that user generated data such as social media is relatively good reflection of people's moods and behaviors [10] has supported inventions, for example in new forms of health surveillance. These inventions will improve the data collected by organizations such as the Center for Disease Control and Prevention (CDC). CDC and other organizations have based their surveillance on population and health care surveys that are costly and take long time to be collected and processed. These inventions have the potential to revolutionize health care systems around the world by improving what we know about the health of populations, but also providing new forms of personalized care.

Current innovation in the field goes beyond health surveillance and into interventions. The discoveries that led to the development of Cognitive Behavioral Therapy are the antecedent to computer based approaches like those used in Embodied Conversational Agents [3, 2] and in other computer based CBT [1]. A number of theories are being used for the new forms population health surveillance, each potentially leading to different forms of innovative solutions. Different theories are also used in the development of interventions. Arguably, much is yet to be known about how and when to provide help (often unsolicited) to people who are believed to be at risk, and about issues of privacy [12]. We anticipate workshop participants will bring further theoretical frameworks to the table and a goal of the workshop will be bringing these various approaches and perspectives together. The map above allows to see the range of possible contributions to this area. We describe in more detail three of the areas where Human-Computer Interaction (HCI) researchers are already contributing to: wearable interfaces, online communities and designing for wellbeing through positive computing.

Wearables, Interfaces & Interventions for Mental Health

Computer interfaces and wearables can be designed to work in harmony, eliciting behavioral signals or even nudging behavior change itself. This is a complex endeavor that can benefit from the contributions of the CHI community.

Though the use of mobile phones and wearable sensors for mental health has proliferated [17], significant challenges remain in increasing their adoption and embedding them unobtrusively in the natural lifestyle of subjects in the wild. Furthermore, the design of interfaces meant to collect self-reported information as accompanying context to the continuous measurement of signals via wearables without disrupting the end-user also remains a challenge, particularly for long-term end-user adoption. Interface design for real-time retrieval of wearable signals at the caregiver's end can also be challenging, particularly with regard to signal processing and machine learning to identify and remove noisy bursts of data.

Deployment of mental health interventions through mobile phones and social media based on real-time collection of in-the-wild subject data is yet another challenging arena, but one with great promise as evidenced by successful small-scale studies using reflective user interaction on social networks [9] and crowdsourcing as a means to deliver CBT [14] via the internet.

Online Communities

Certain designs aim to help groups of people who might have similar mental health risk patterns, or other psychological traits in common. Designing interfaces that take into account the psychological wellbeing of a group addresses some of the challenges of aiming an unsolicited intervention to an individual.

On the one hand we can design treatment interventions such as online peer-support groups. [11] reviewed their effectiveness in 31 papers (28 trials) and found that 62.5% reported a positive effect on depressive symptoms (although only 20% used control groups). Regrettably psychological reviews tend to focus only on efficacy, so the coding did not analyze computational innovations that might have been used. None of the studies reviewed, for example, used NLP techniques.

Counseling teams are increasingly being designed for. Moderator Assistant [6] for example aims to provide better support to counselors in such peer-support groups. In similar fashion Fathom [9], helps counselors who provide help through SMS interventions (Crisis Text Line). Fathom uses topic models, a statistical modeling technique to track the evolution of themes in a conversation, in real time. The models were being built with 8106 conversations held by 214 counselors. The evaluation did not yet include the topic maps with the full data set but consisted of understanding the experiences of 7 counselors using the system: they all found it most useful and had few feature requests. Due to the emotional nature of their work groups of mental health professionals (counselors, psychiatrists, etc) have a higher risk of burnout. Besides helping them be more efficient in their support work designers can take into account their wellbeing. This is an understudied area.

Positive Computing

Some of the most popular apps are specifically designed to support a factor known to have an impact on wellbeing, for example Internet based positive psychology interventions [18].

Designing technology for mental health goes beyond these "dedicated" interactions [7]. As technology becomes ubiquitous, it holds the capacity to influence almost every aspect of our lives. Not only can technology have both positive and negative influences on our productivity and access to and ability to learn new information, and it can also influence our emotions, our motivations, overall life satisfaction and wellbeing [7]. Since designers are increasingly aware of the impact technology has on mental health they are taking it into account in their designs. This is an area being called positive computing or design [7, 8] They can design to prevent negative effects (e.g. antisocial behaviours, stress); as when a social network changes its interface to reduce cyberbullying, or it can be used to promote other factors.

Workshop Organizers

Rafael A Calvo (main contact) is Professor at the University of Sydney, and ARC Future Fellow. He worked at the Language Technology Institute in Carnegie Mellon University, Universidad Nacional de Rosario (Argentina) and on sabbaticals at the University of Cambridge and the University of Memphis. Rafael also has worked as an Internet consultant for projects in the US, Australia, Brasil, and Argentina. He is the author of two books and over 100 publications in the fields of learning technologies, affective computing and computational intelligence. Rafael is Associate Editor of the IEEE Transactions on Learning Technologies, the IEEE Transactions on Affective Computing and the Journal of Medical Internet Research (JMIR-HF). Rafael is Editor of the Oxford Handbook of Affective Computing and

co-author of 'Positive Computing' (MIT Press) with Dorian Peters.

Karthik Dinakar is a PhD candidate and Reid Hoffman Fellow at MIT. He is a computer scientist in the fields of machine learning, natural language processing and human-computer interaction to compute for empathy. His graduate work involves applying probabilistic graphical models and to model, understand and predict adolescent distress, crisis counseling and self-harm. He is interested in causal inference, large-scale single-subject experiment designs, bayesian graph theoretic machine learning for embedding clinical science in the naturalistic settings that people live in everyday.

Rosalind W. Picard is founder and director of the Affective Computing Research Group at the MIT Media Laboratory and faculty chair of MIT's Mind+Hand+Heart well-being initiative. She is co-founder of Empatica, creating wearable sensors and analytics to improve health, and Affectiva, providing analytics to measure and communicate emotion. Picard is the author of the book Affective Computing, which helped give rise to a field by that name, and has authored or co-authored over two hundred scientific articles and chapters spanning HCI, computer vision, pattern recognition, machine learning, wearable sensors and affective computing. She is an IEEE Fellow, and was named by CNN as "One of seven Tech SuperHeroes to watch in 2015". Picard is a recipient of several best paper prizes, including work on machine learning with multiple models (with Minka, 1998), a best theory paper prize for affect in human learning (with Kort and Reilly, 2001), a best Face and Gesture paper prize for work with facial expressions (with McDuff, Kaliouby and Demirdjian, 2013) and a best UBICOMP paper for an automated conversation coach (with Hoque et al, 2013).

Pattie Maes is the Alexander W. Dreyfoos (1954) Professor at MIT's Media Laboratory and the department head for the Program in Media Arts and Sciences. She founded and directs the Media Lab's Fluid Interfaces research group, whose goal is to design and develop computer interfaces that are a more natural extension of our minds, bodies and behavior. Prior to joining the Media Lab, Maes was a visiting professor and a research scientist at the MIT Artificial Intelligence Lab. She holds bachelor's and PhD degrees in computer science from the Vrije Universiteit Brussel in Belgium. Her areas of expertise are human-computer interaction and artificial intelligence. Maes is the editor of three books, and is an editorial board member and reviewer for numerous professional journals and conferences. She is the author of over 100 publications as well as several patents. In 2011, FastCompany named her one of most influential designers. Newsweek magazine named her one of the "100 Americans to watch for" in the year 2000.

Website

A website available at chi2016MentalHealth.media.mit.edu has been created and will be used to process submissions. All position papers, project descriptions and videos will be published on the site before the workshop gets underway.

Pre-workshop Plans

We expect this workshop to be large due to the profile of the panelists. Most participants will be researchers/ developers and mental health professionals, but will not present papers. In lieu of paper presentations, participants, selected through review, will be asked to create a short 3 minute video based on their position paper. Videos and papers will be distributed via a workshop webpage. The website will also contain information about all participants to the workshop acting as a community building exercise.

Workshop Structure

Together we will look at examples of new technologies to support mental health and psychological wellbeing. The workshop themes are listed in the Call For Participation section.

- Introduction & Welcome (9-9:30)
- 3 Invited speakers. 20min each (9:30-10:30)
- coffee break (10:30-10:45). Posters to be placed around the room.
- 15x3 min presentations (10:45-11:30)
- Lunch + posters. We will arrange for lunch to be delivered to the venue. Posters presentations. 11:30-1pm
- 2 Invited speakers (1-2pm)
- Panel discussion + Q&A (2-3:30pm)
- Coffee and discussions (3:30-4:00pm)
- Open discussion on emergent themes, issues and moving the community forward.

Panelists

We have confirmed participation of the following distinguished panelists:

- Dr. Tom Insel, Director of the National Institute of Mental Health
- Dr. Eric Horvitz, Managing Director, Microsoft Research
- Dr. Helen Christensen, Director Black Dog Institute, Australia
- Dr. Matthew Nock, Professor of Clinical Psychology, Harvard University
- Dr. Robert Morris, Co-founder of Koko, Crowdsourcing for Mental Health

Post-Workshop Plans

All participants will be invited to submit an extended academic paper. We have already received approval for a special issue of Journal of Medical Internet Research (Human Factors) based on extended versions of workshop submissions. The decision regarding the best venue for this edited volume will be left to the participants of the workshop.

Call for Participation

Prevalence of mental illness currently or within the past year, amongst US adults is 18.5%. LIfetime prevalence of any mental illness is 46.4%. Aware of these needs, Human-Computer Interaction researchers and practitioners are developing new technologies to support those who need help and support innovative health promotion campaigns. For example, computers can be used to make inferences about people's mental states from their sleep patterns collected through wearable sensors, and from what they write on Facebook, Twitter and other social media. These inferences can be used to help mental health professionals provide better quality help, and are at the heart of new models of care. In this multidisciplinary workshop we explore how new computing technologies can support mental health and psychological wellbeing.

Participants can register by submitting a 1 page description of their work, showing evidence that they work in this area (whatever the disciplinary focus). For those seeking to

present their work, we also invite submissions of papers in the CHI notes style, with a maximum of 4 pages summarizing work in the following:

- Intelligent User Interface and interaction design for mental health & psychological wellbeing
- Design of experiments in the wild for wellbeing measurement & interventions
- Supporting mental health professionals: autonomy, competence, resilience, empathy & compassion
- Design for computer based CBT (participatory design, contextual enquiry, etc)
- Crowdsourcing for mental health
- Reflective User Interaction
- Wearable computing in mental health: sensors and quantified self
- Positive Computing

The submissions will be managed via the workshop website: http://chi2016MentalHealth.media.mit.edu/ for details. Extended versions of the papers accepted will be considered for special issue of JMIR - Human Factors

Important Dates:

- Paper Submission deadline: 20 January 2016
- Acceptance notification: 1 February 2016
- Workshop: 8 May 2016

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