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## 2<sup>nd</sup> Symposia on Computing and Mental Health

**Rafael A. Calvo**

Positive Computing Lab  
School of Electrical and  
Information Engineering  
The University of Sydney  
Sydney, NSW 2006 Australia  
Rafael.calvo@sydney.edu.au

**Karthik Dinakar**

MIT Media Lab  
Cambridge, MA USA  
karthik@media.mit.edu

**Rosalind Picard**

MIT Media Lab  
Cambridge, MA USA  
picard@media.mit.edu

**John Torous**

Department of Psychiatry  
Beth Israel Deaconess Medical  
Center,  
Harvard Medical School  
Boston MA  
jtorous@bidmc.harvard.edu

**Abstract**

The World Health Organization predicts that by the year 2030, depression and other mental illnesses will be the leading disease burden globally. The rapid penetration and advancement of mobile phones and technology have given rise to unprecedented opportunities for close collaboration between computation researchers and mental health practitioners. The intersection between wearable computing, design of naturalistic observation experiments and statistical causal inference offers promising avenues for developing technologies to help those in mental distress; yet human factors inquiry and design are often the missing ingredients in this powerful mix. This second inter-disciplinary workshop will provide an opportunity for researchers in mental health, computation and causal inference to come together under the much needed auspices of human-centric design, towards the development and deployment of new technologies mental health technologies and interventions.

**Author Keywords**

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

**ACM Classification Keywords**

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

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## Introduction

There is increasing focus within the human-computer interaction community on the impact of technology design on mental health, be it a deliberately crafted intervention or an unintended consequence. Advances in wearable and social computing have made new forms of active and passive monitoring of human behavioral footprints possible, promoting renewed interest in (1) experiments that observe and intervene on behaviors in naturalistic settings, including single-subject experiments, and (2) causal inferential statistics for observational data. An effective leverage of these advancements to new mental health technologies, however, hinges on good human-centric analysis and design – to understand the needs of the target population and design effective interventions to support mental health. The evaluation of technologies to support mental health has also proved challenging, (3) underlining the importance of utilizing long established methods in human-computer interaction such as contextual and participatory design in deeply understanding the intended population prior to the design and deployment of these technologies. These methods should inform factors that becoming increasingly important in health applications, such as user autonomy and agency [4]. This workshop provides an opportunity for the growing community of researchers in clinical psychology and psychiatry, causal inference and computer science to come together, under the umbrella of HCI, as depicted in Figure 1. Researchers and practitioners from academia, government, not-for-profit organizations and industry interested in computing for mental health bring their ideas, projects and questions on how these disciplines can work more intimately to create effective mental health technologies.

## Background

The 1<sup>st</sup> CHI Symposia on Computing and Mental Health [1], held in San Jose, CA, on May 7<sup>th</sup> 2016, focused broadly on bringing together clinical psychology and computation communities around topics of wearable computing, online communities and social networks at either the individual, group or population level. Submissions were clustered into three categories, namely prevention and treatment of mental health conditions and promotion of positive mental health [2]. The response to our call for papers was overwhelming, with close to 80 submissions, with a final accepted papers tally of 12 for full presentations and 16 poster presentations after three person blind review process. Well over 100 participants attended the workshop.

The workshop elicited enthusiastic participation with feedback centered on a few important future directions: (1) a near unanimous desire to continue the workshop in the coming years to sustain this growing community, (2) the need for better design of experiments for prevention, treatment and promotion of mental health and a need for more rigorous evaluation of behavioral interventions of the exploding array of mental health technologies, and (3) the need for human-computer interaction methods and human-centric design in helping casual inference in mental health applications. The workshop showed we can bring together leading researchers and practitioners in computer science, human-computer interaction and the mental health community, with a sizable presence of clinical psychologists, psychiatrists and those with lived experience. This represents a growing community, a “new partnership between psychology, social sciences and technologists” [3] that is important to nurture and grow.

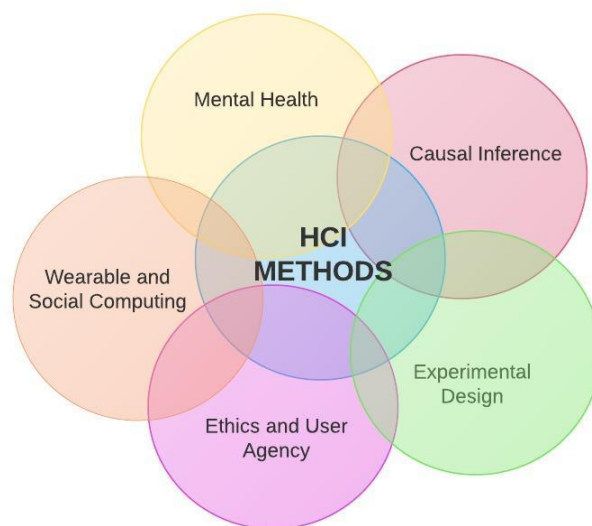


Figure 1: This workshop will focus on bringing together wearable & social computing, design of experiments, causal inference and mental health researchers under the necessary auspices of HCI methods to support effective development and deployment of mental health technologies.

### **Wearable and Social Computing**

An explosion in wearable and social computing for both passive and active monitoring of human behavior, aka digital phenotypes, is leading to new technologies to support mental health. For example, psychophysiological sensors such as galvanic skin conductance, novel contact and non-contact mechanisms to estimate heart-rate, smile-tracking, and other signals are inspiring technologies for stress management, activity monitoring, sleep tracking and even relapse prediction [5]. On online social networks,

machine learning researchers and clinical psychologists are working together to address pressing mental health problems such as depression and suicide [6]; new forms of crisis counseling via texting and chatting are seeing novel efforts between computer scientists and clinical therapists to boost the quality of counseling and to even 'help the helpers' [7,8].

Despite the burgeoning and expanding advances in this space towards supporting mental health, they are not without challenges; some voices the clinical psychology and psychiatry communities are vocal on the need for better design of these technologies by deeper understanding the target populations as well more rigorous evaluation of the interventions [9], felt most acutely in the explosion of smartphone apps meant to support mental health. In this workshop, we intend to focus on these challenges.

### **Design of Experiments for Naturalistic Observation**

In naturalistic experiments, participant behaviors are observed 'in the wild', as they go about their everyday lives rather than in-laboratory studies. For example, large scale tracking of behavioral breadcrumbs on online social networks and passive sleep tracking, where participants are observed in their everyday settings. Naturalistic observation with interventions entails the use of an intervention to support certain behaviors. For instance testing if a psychological intervention can improve circadian rhythm and sleep in bipolar populations [10]. While naturalistic observation with interventions has limitations – namely difficulty in controlling for variables and conditions in participants' natural settings and in unintentional altering of observed behaviors even without an intervention, the

advent of wearable and social computing has made it possible for large scale participant recruitment. This combined with the fact that the use of mobile phones is becoming nearly ubiquitous with greater penetration and reach has made naturalistic observation with interventions far easier than it used to be.

The use of single-subject or N=1 experiment designs using wearable and social computing is also experiencing a renewed interest. The design of N=1 experiments is tailored to explore the effectiveness of interventions on a single participant, where she or he is both the treatment and the control. There are now a growing number of N=1 studies using wearable and social computing for mental health, with the advantage of recruiting a large number of participants than what was possible even in the 1990s. For example, single-subject experiment designs to study the deployment of technologies to evaluate interventions in the mitigation of self-harm [11]. We submit that the design of experiments for naturalistic observation, where clinical researchers and practitioners work closely with researchers in wearable and social computing should be an important area of focus for the CHI community.

### **Causal Inference for Observational Data**

In mental health, making strong causal assertions from environments that are beyond laboratory settings are often limited to large scale randomized control experiments where there are apriori control and treatment groups. However, there is now renewed interest in deriving strong causal inferences from data arising from observational studies, which don't have an apriori control and treatment group [12]. The advent of massive data arising from psychophysiological sensors and online communities,

such as social networks makes causal inference from observational data particularly attractive, and also a strong tool to evaluate the deployment of mental health applications. For example, the SNAPSHOT study from MIT seeks to measure sleep, networks, affect, performance, stress, and health, including several measures of emotional and psychological wellbeing [13]. The SMART study at Beth Israel Deaconess Medical Center and The Harvard School of Public Health seeks to predict relapse in schizophrenia from location, activity, social, voice, and use data from subjects' personal smartphones [14].

### **Why HCI Methods are Key**

The wearable and social computing, casual inference, machine learning and clinical psychology communities rarely interact with each other, yet are each important ingredients for rigorous and effective mental health technologies. We posit that human-computer interaction methods and human-centric design must play a greater role in binding these communities together to support the development of mental health technologies. HCI methods bring a wealth of knowledge and know-how in understanding the needs of populations, towards systematic ways of mapping user needs and gaps, and well-established processes to design technologies to fill this gap. For instance, the use of contextual inquiry and design by an interdisciplinary team of clinicians, computer scientists and statistical casual inference can help in (1) discerning the landscape of needs and behavioral attributes of the target population, (2) a systemic design process for the right timing and selection of behavioral interventions and (3) the design of essential experimental variables for casual inference in measuring the effectiveness of interventions. We

submit that this is an exciting area for the CHI community, and can have a very positive impact in the development and deployment of mental health technologies.

### Organisers

**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 Affective Computing and the Journal of Medical Internet Research Human Factors (JMIR-HF). Rafael is co-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". Pi- card 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).

**John Torous, MD** is co-director of the digital psychiatry program at Beth Israel Deaconess Medical Center, a Harvard Medical School affiliated teaching hospital, where he also serves as a staff psychiatrist and clinical informatics fellow. He has a background in electrical engineering and computer sciences and received an undergraduate degree in the field from UC Berkeley before attending medical school at UC San Diego. He completed his psychiatry residency at Harvard. Dr. Torous is active in investigating the potential of mobile mental health technologies for psychiatry, developing smartphone tools for clinical research, leading clinical studies of smartphone apps for diverse mental illnesses, and publishing on the

research, ethical, and patient perspectives of digital psychiatry. He serves as editor-in-chief for the leading academic journal on technology and mental health, JMIR Mental Health (<http://mental.jmir.org/>), currently leads the American Psychiatric Association's work group on the evaluation of smartphone apps.

### Website

A website at [MentalHealth.media.mit.edu](http://MentalHealth.media.mit.edu) has been created and is being used to store the proceedings from last 2016 and will do for 2017. EasyChair will be used to manage the submissions for short papers. Long papers will be selected from those accepted for publication in JMIR, an open access journal. 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)
- 2 Invited speakers. 30min each (9:30-10:30)
- Coffee break (10:30-11:00). Posters to be placed around the room.
- 10x3 min presentations (11:00-11:30)
- 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

- Jamie Druitt, Founder (Talklife)
- Bob Filbin. Chief Data Scientist CrisisTxtLine
- Prof David Mohr (Northwestern)
- Dorian Peters - UX practitioner & Designer (Univ of Sydney)
- Prof Richard Ryan (Rochester and Australian Catholic University)

### Post-Workshop Plans

We will discuss with participants the idea of a 2<sup>nd</sup> special issue, and further workshops. We have created

a LinkedIn group and hope an ongoing interdisciplinary community will emerge.

### 250-word Call for Participation

The World Health Organization predicts that by the year 2030, depression and other mental illnesses will be the leading disease burden globally. The rapid penetration and advancement of mobile phones and technology have given rise to unprecedented opportunities for close collaboration between computation researchers and mental health practitioners. The intersection between wearable computing, design of naturalistic observation experiments and statistical causal inference offers promising avenues for developing technologies to help those in mental distress; yet human factors inquiry and design are often the missing ingredients in this powerful mix. This second inter-disciplinary workshop will provide an opportunity for researchers in mental health, computation and causal inference to come together under the much needed auspices of human-centric design, towards the development and deployment of new technologies mental health technologies and interventions.

- Intelligent User Interface and interaction design for mental health & psychological wellbeing
- Design of experiments in the wild for wellbeing measurement & interventions & Positive Computing
- Supporting mental health professionals
- User Centered Design
- Wearable computing in mental health
- Causal Inference

Long papers and presentations will be selected from those already being submitted to a special issue of JMIR. Since JMIR is the highest ranked journal in the field and open access we expect many excellent submissions. The Special issue will be published in time for the workshop. New submissions for long papers and posters will be managed via EasyChair. See the workshop website: <http://MentalHealth.media.mit.edu/> for details. Extended versions of the papers accepted will be considered for another special issue of JMIR.

### Important Dates:

- Submission deadline: 20 January 2016
- Acceptance notification: 10 February 2016
- Workshop: 6 May 2016

### Acknowledgements

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