

Designing Therapeutic Care Experiences with AI in Mind

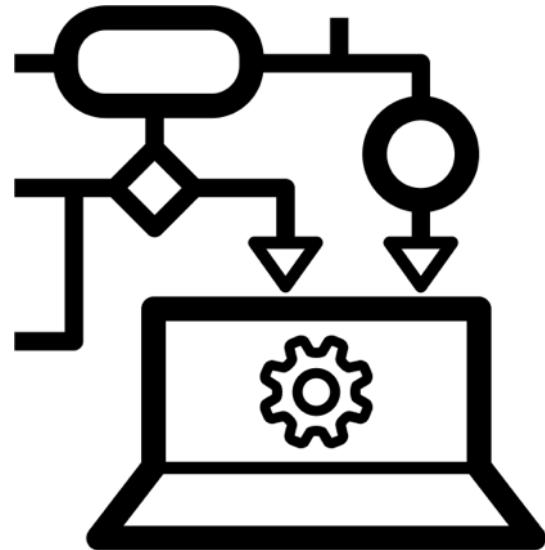


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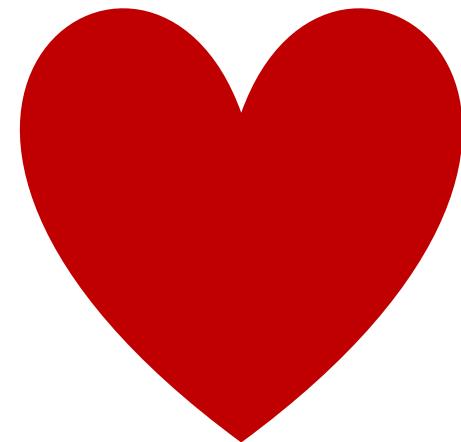


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Mayo Clinic Center for Innovation ©2018 MFMER

AAAI Spring Symposium on the User Experience Design of Artificial Intelligence
Stanford University
3.26-28.2018



+



Conceptualizing the entire care experience from the person's point of view

Scalability

Understanding + Acceptance

Conceptualizing the entire care experience from the person's point of view

Interpreting Data

Trust + Ethics

Designing Therapeutic Care Experiences: Two cases

Interactive Neurorehabilitation for Stroke

Creating adaptive systems for
unsupervised interactive stroke
rehabilitation in the home

Meta Therapy

Exploring personalized talk therapy and
crowdsourced therapeutic techniques
for digital mental health

Designing Therapeutic Care Experiences: *Interactive Neurorehabilitation for Stroke*

OUR APPROACH



SENSING SOLUTIONS

Low cost sensing solutions for capture of sensorimotor activity during therapy and daily life



INTERACTIVE INTERFACES

User friendly interfaces for patient driven therapy at the home



AI + HUMAN INTELLIGENCE

Combining artificial and human intelligence for semi automated adaptation of therapy

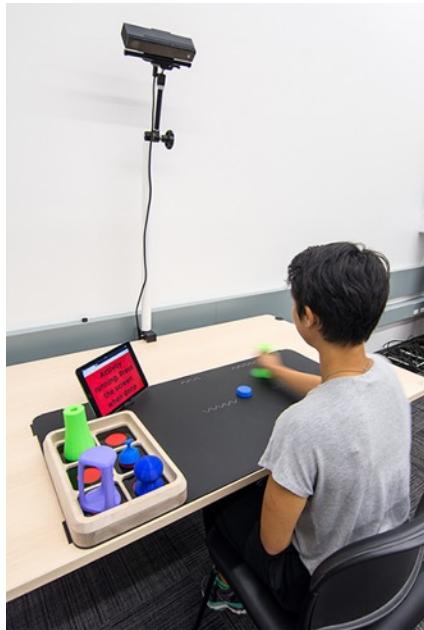


ADAPTIVE THERAPY

High end systems for adaptive interactive therapy in the clinic

<http://vtinr.com>

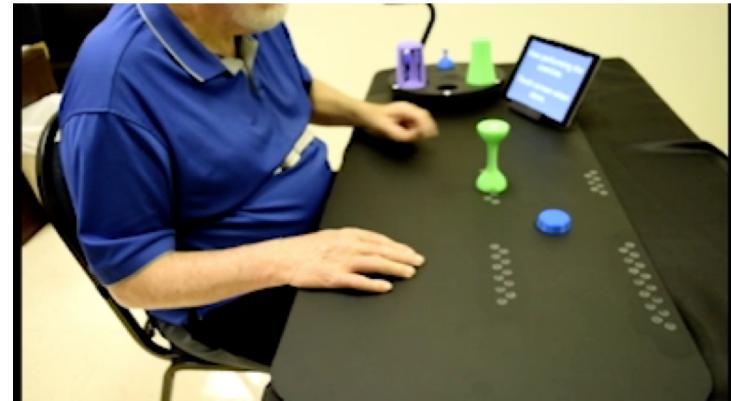
Designing Therapeutic Care Experiences: *HOMER System*



Aisling Kelliher, Jinwoo Choi, Jia-Bin Huang, Kris Kitani, Thanassis Rikakis. HOMER: an interactive system for home based stroke rehabilitation, In Proc. ASSETS '17.

Designing Therapeutic Care Experiences: *Study at Emory Rehabilitation Hospital*

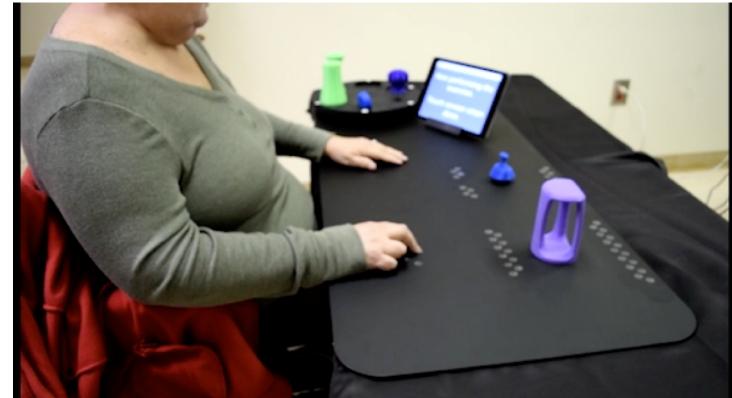
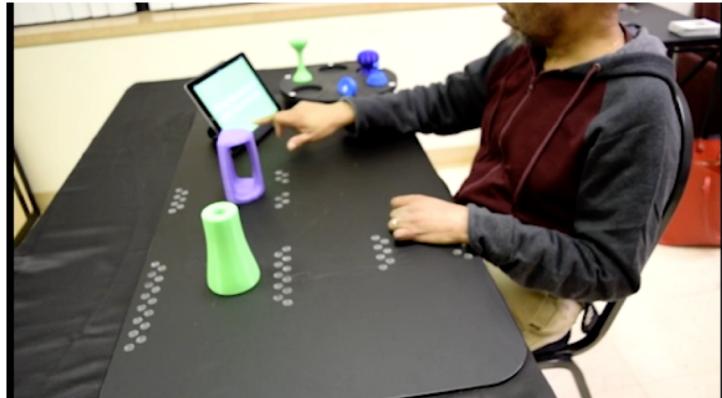
Getting the data!



Thanassis Rikakis, Aisling Kelliher, Jinwoo Choi, Jia-Bin Huang, Kris Kitani, Setor Zilevu, and Steve Wolf. 2018. Semi-automated home-based therapy for the upper extremity of stroke survivors, forthcoming at PETRA 2018, June 26 – 28, Corfu, Greece

Designing Therapeutic Care Experiences: *Study at Emory Rehabilitation Hospital*

Getting the data!



Designing Therapeutic Care Experiences: *Interactive Neurorehabilitation for Stroke*

Getting to consensus and developing an ontology

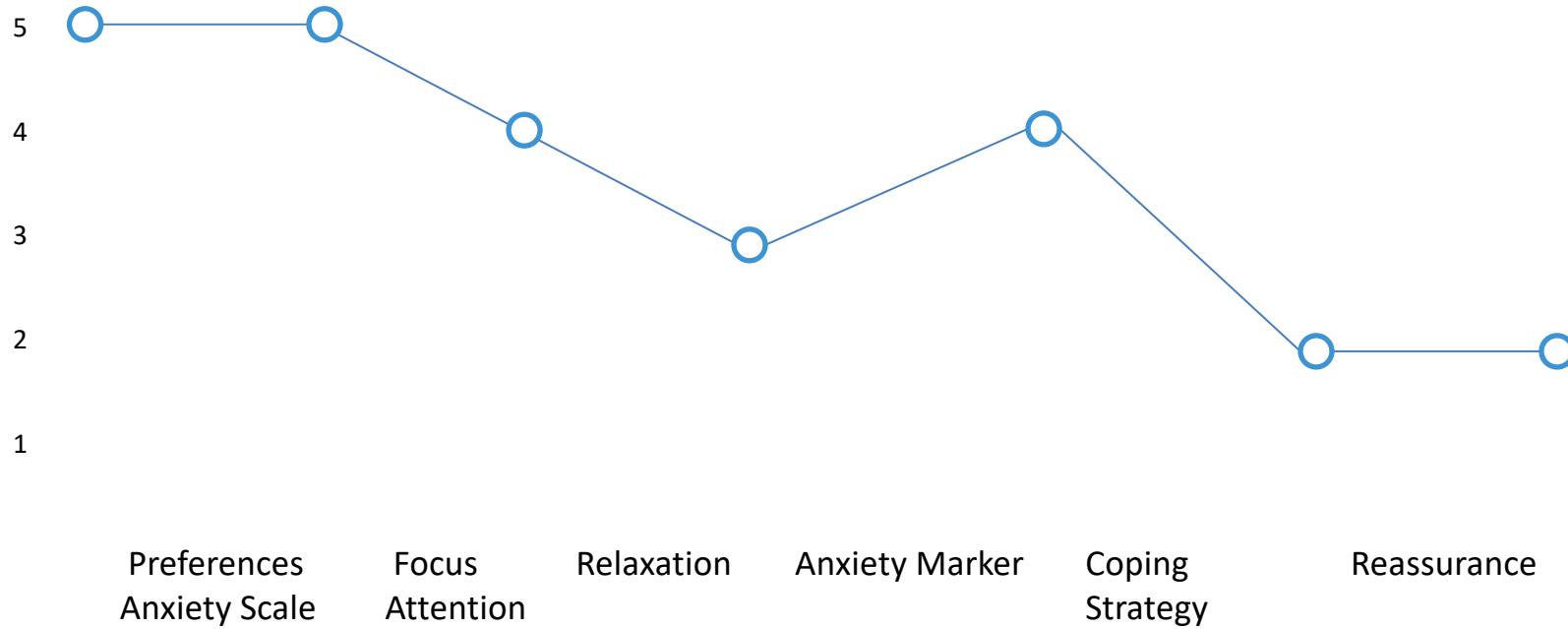


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4	IPT1	P3Session3CAM01.mov	2:47	2:52	R&R1	P3Session3GP01.mov	NULL	NULL
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7	R&R2	P3Session3CAM01.mov	3:00	3:04				
8								
9	Task2Try2	Filename	In Point	Out Point	Task2Try2	Filename	In Point	Out Point
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13	IPT2	P3Session3CAM01.mov	9:57	10:15	IPT2	P3Session3GP01.mov	NULL	NULL
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Design Therapeutic Care Experiences: *Meta Therapy*

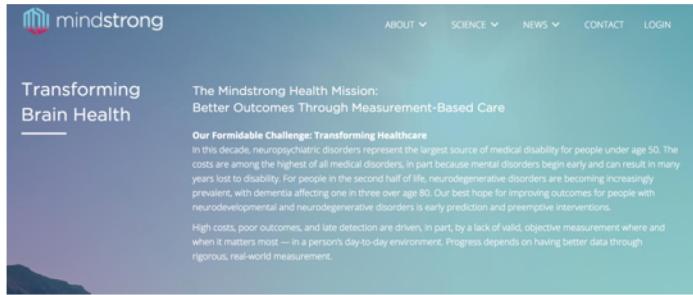
What if we could crowdsource therapeutic techniques, worldwide, and use machine learning to create the best therapy for any condition or individual patient based on feedback from patients, provider input, and biological data, such as fMRI or cortisol levels?

Design Therapeutic Care Experiences: *Meta Therapy Experiment*



Design Therapeutic Care Experiences: *Digital Mental Health Today*

Opinion

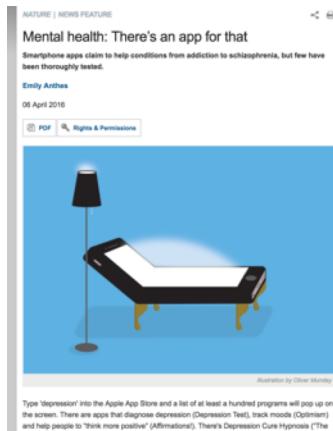


The Mindstrong Health Mission: Better Outcomes Through Measurement-Based Care

Our Formidable Challenge: Transforming Healthcare

In this decade, neuropsychiatric disorders represent the largest source of medical disability for people under age 50. The costs are among the highest of all medical disorders, in part because mental disorders begin early and can result in many years lost to disability. For people in the second half of life, neurodegenerative disorders are becoming increasingly prevalent, with dementia affecting one in three over age 80. Our best hope for improving outcomes for people with neurodevelopmental and neurodegenerative disorders is early prediction and preemptive interventions.

High costs, poor outcomes, and late detection are driven, in part, by a lack of valid, objective measurement where and when it matters most — in a person's day-to-day environment. Progress depends on having better data through rigorous, real-world measurement.



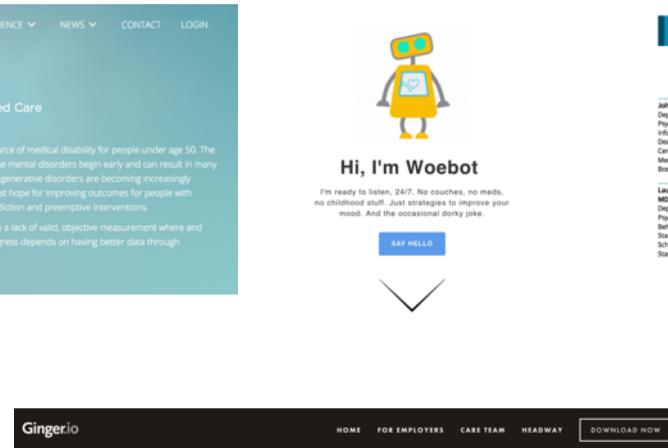
Mental health: There's an app for that

Smartphone apps claim to help conditions from addiction to schizophrenia, but few have been thoroughly tested.

Emily Anthes
06 April 2016

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Type 'Depression' into the Apple App Store and a list of at least a hundred programs will pop up on the screen. There are apps that diagnose depression (Depression Test), track moods (Optimism) and help people to 'think more positive' (Affirmations). There's Depression Cure Hypnosis ('The #1 Depression Cure Hypnosis App in the App Store'), Gratitude Journal ('the easiest and most



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Receive replies to your messages just in minutes, not hours. Chat with your coach wherever you are, whenever you want.

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We aim to find the best type of care for you. Using tools backed by machine learning, we'll tailor your care to your unique needs and goals.

Measurement Matters

VIEWPOINT

Needed Innovation in Digital Health and Smartphone Applications for Mental Health Transparency and Trust

"The success of the paradigm... is at the start largely a promise of success.... Normed science consists in the actualization of that promise..."

Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 1962, p. 101

The promise of smartphone applications and connected technologies for mental health to advance diagnosis, augment treatment, and expand access has received much attention. Mental health disorders represent the leading cause of the loss of years of life due to disability, and the mortality rate also contributes to employee absenteeism and lost productivity in economically established countries such as the United States. The potential of smartphone applications to offer new, at-your-fingertips tools and resources for mental health care is clear.

But the potential is not the only reason why it is hard to ignore smartphone applications. The reality of applications for clinical care is already here. More than 10,000 mental health-related applications are available to download, and that number increases daily. As smartphones become increasingly pervasive and available, they become increasingly attractive for mental illness, the accessibility, immediacy, affordability, and bold marketing claims of applications will drive more patients to use them.

This new reality is worrisome: studies suggest that most mental health apps do not measure up to what does not conform to clinical guidelines. Some may even offer dangerous recommendations, such as one application that advises people experiencing a bipolar manic episode to drink hard alcohol before bedtime to assist with

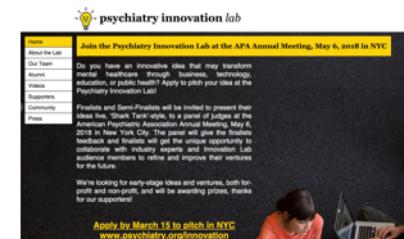
by a lack of transparency and trust. The situation exists partially because the US Food and Drug Administration (FDA) has taken a "hands-off" approach toward health applications, meaning that mental health applications are not subject to federal regulation. The Dietary Supplement Health and Education Act, Section 3050, "Carrying Medical Software Regulations," indicates that this hands-off approach will continue and become more lax.

Astonishingly, the Apple iTunes and Android Google Play Store are the default arbiters and agents responsible for the distribution of health applications, with no regulation or oversight. These stores have well-known star ratings nor number of downloads correlate well with health application quality.¹ In early September 2016, Apple announced that it would no longer allow certain health applications into its marketplace. This announcement was made without explanation, leaving many public interests related to health applications in the dark.

But the potential is not the only reason why it is hard to ignore smartphone applications. The reality of applications for clinical care is already here. More than 10,000 mental health-related applications are available to download, and that number increases daily. As smartphones become increasingly pervasive and available, they become increasingly attractive for mental illness, the accessibility, immediacy, affordability, and bold marketing claims of applications will drive more patients to use them.

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Another recent first step is the greater engagement of professional societies. For example, the American Psychiatric Association recently released a smartphone application evaluation model that does not



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Do you have an innovative idea that may transform mental health care, businesses, technology, education, or public health? Apply to join your idea at the Psychiatry Innovation Lab!

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INFO

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Six Key Considerations for designing the *care experience* with AI

1. How does human behavior, captured and analyzed and interpreted by AIs influence care opportunities and decisions?
2. How, or should, humans and AIs reach consensus on interpretations of data (when sometimes even humans can't agree)?
3. How are both personalization and scalability redefined and designed in an era of big data, missing data, and sparse data?

Six Key Considerations for designing the *care experience* with AI

4. How should we design autonomous and semi-autonomous systems that provide therapeutic value and will be anticipated, accepted, and embraced by human actors in diverse environments?
5. How should AIs be designed, adapted, and regulated as trusted members of care teams?
6. How can design help identify, anticipate, and address ethical issues that may emerge when AIs are involved in care?

Thank you

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Credits: Machine Learning image by H Alberto Gongora from the Noun Project