Exploring a Theory-Guided Path to the Design of Personal Informatics and Intervention Technologies

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Background

Personal Informatics and Intervention
- Advantages: access, integration, administration
- Rapidly growing interest from HCI communities

- Common application domains: sustainability, social participation, health

The Value of Personalization
- Idiosyncratic differences can influence intervention efficacy
- Successful behavior change depends on personalized solutions

Personalization Strategies
- User-Driven
  - Customization or via self-report
  - Limitations: formulaic, burdensome, infeasible, unreliable
- System-Driven
  - All-time high levels of tech ownership and usage
  - Sensor-loaded personal devices (phones, wearable devices)

Prominent Personalized Intervention Technology Endorsers
- HealthMatch, BeWell, MyBehavior, MoodScope

Shortcomings of Personal Informatics and Intervention Tools
- Data-driven, exhaustive, computationally heavy approaches
- Lack grounding in relevant domain knowledge

Case Studies

Circadian-Aware Technology
- Motivation
  - Sleep disorder "epidemic" (80% of US)
  - Severe consequences on societal and personal levels
  - Mitigation common; minority maintain abstinence
- Circadianology-Informed Social & Mobile Sensing
  - Inferring sleep events
  - Onset, duration, waking
  - Detecting circadian disruption
  - Social jet lag, sleep inertia
  - Measuring circadian rhythms
  - Alertness, cognition, mood

Bipolar Disorder (BD)
- Motivation
  - One of 10 most debilitating illnesses worldwide
  - Drastic swings between opposing mood states
  - Requires personalized support (even at a level of intra-individual variability in this case)

Smoking Cessation
- Motivation
  - Leading cause of preventable death
  - Over 80% of smokers quit; over 1/2 attempted
  - Relapse common; minority maintain abstinence
- Existing digital cessation tools do not adhere to clinical guidelines or provide personalized, adaptive support

Predicting behavior change outcomes
- Constructing theory-driven features from social media data
- Distinguishing users who attain vs. relapse

Self-Efficacy
- Motivation
  - Detecting domain-pertinent psychological traits from online behavioral traces
- Most online communities fail from under-contribution
- Psychological theory suggests self-efficacy highly relevant to online participation domain

Domain-Driven Framework

I. Domain Inquiry

II. Domain-Driven Personalization

III. Domain-Aware Informatics & Intervention Design

Design Implications

Design Tensions
- Adherence vs. overuse
- Agency vs. user burden
- Spectrum of feedback and intervention dimensions

Feedback Dimensions
- Reflective → Persuasive
- Aggregated → Momentary
- Synthesized → Raw
- Private → Social

Conclusions and Contributions

HCI research aiming to sense and coach human behaviors
- Often disconnected from rich bodies of prior theoretical and experimental research in relevant domains (e.g., psychology, behavioral science, biology)
- Often not personalized to innate characteristics and current circumstances

Goal
- Bridge this gap by incorporating domain knowledge into the personalization and design of personal informatics and intervention technology