Extending human intelligence for optimal performance

Pattie Maes
Today’s devices put the world’s information at our finger tips
But they do not help with:

- attention
- motivation & grit
- informed decision making
- creativity
- memory
- emotional wellbeing
- ...

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Smartphones may be changing the way we think

Those attention-grabbing digital devices are like a new appendage. How are they changing us?

By Laura Sanders 12:21 PM, March 17, 2017

Is Your Smartphone Killing Your Creativity?

Sure, your beloved gadget allows you to work during every spare moment, but is the price of increased productivity dramatically lower creativity?

By Jessica Stillman  Contributor, Inc.com  @EntryLevelRebel

Your Smartphone Reduces Your Brainpower, Even If It's Just Sitting There

A silent, powered-off phone can still distract the most dependent users.
Can we design personal devices that are minimally disruptive and support optimal functioning?
3 technologies will radically change our relationship and interaction with personal devices
Technology #1: sensors that collect data about the user and their context have become small, wearable, and can be processed in real-time.

Google Clips

Muse EEG

Emphatica E4

Sensors
- Photoplethysmography (PPG)
- Continuous Heart Rate (HRV, Stress, Relaxation)
- 3-axis Accelerometer
- Movement, Activity
- Temperature + Heat flux
- Activity, Context Info
- Electrodermal Activity (EDA)
- Skin Conductance (Arousal, Excitement)
Technology #2: artificial intelligence technology can analyze sensor data in real-time, modeling the user, understanding their context and providing relevant information.

- **Yolo real-time object recognition**
- **Google LENS real-time translation**
- **Brightbeat: real time tracking and influencing of breathing rate through modulation of sound and display brightness**
Technology #3: new display technologies can provide real-time information in minimally disruptive ways (audio, visual, haptic, scent)

Bose audio AR Frames

Essence scent delivery

North Focals

Google Glass Enterprise edition 2
Smart, better integrated devices will offer opportunities to support people with optimal performance, including improved attention, decision making, memory, learning, creativity, motivation, and emotion regulation.
ATTENTION
AttentivU: a biofeedback system for real-time monitoring and improvement of attention

Kosmyna, Morris, Sarawgi, Nguen and Maes, IEEE BSN’2019, CHI’Adj 2019
AttentivU in the Classroom

Kosmyna and Maes, EMBC 2019
AttentivU in the car: fatigue level before and after feedback

Kosmyna et al., Automotive UI conference 2019
INFORMED DECISION MAKING
AlterEgo - Silent speech interface

Publications: Kapur et.al. IUI 2017, NeurIPS 2019
without any voice or discernible movements, enabling the user to communicate with devices,
AlterEgo: Signal capture, processing, results

Kapur et al., NeurIPS 2019 & IUI 2017
MEMORY & LEARNING
NeverMind: Using augmented reality glasses to facilitate encoding of memory

Publication: Rosello et.al. UIST 2016
1967 Green Bay Packers
1968 Green Bay Packers
1969 New York Jets
1970 Kansas City Chiefs
1971 Baltimore Colts
1972 Dallas Cowboys
1973 Miami Dolphins
1974 Miami Dolphins
1975 Pittsburgh Steelers
Figure 29: Recall accuracy for the experiment task using NeverMind compared to the paper based task.
WordSense -
learning a second
language in
everyday life

increased
engagement and
increased recall
Words in Motion

learning action verbs while performing the gestures
Kinesthetic Word Learning in MR - Christian Vazquez

Kinesthetic learning is more “sticky”
CREATIVITY
Paper Dreams - enhancing creativity through interaction with an AI system

Publication: Bernal et.al. NeurIPS 2019
Paper Dreams for chemists
User Study N=26

Figure 8. On average, users indicated that the Paper Dreams interface helped them diverge their stories from their original idea more than the digital interface of Adobe Sketch.

Figure 9. Based on the distribution of the Likert scale survey question “How much did the interface help or didn’t help you develop your story?”, users indicated that the Paper Dreams interface was more helpful in developing their story than Adobe Sketch.
MOTIVATION
Wearable Wisdom

A context-aware, audio-based system for mediating wisdom from personal mentors to users

Publication: Pataranutaporn, submitted to CHI 2020
WELLBEING
HeartBit
Enhancing emotional regulation
Mindfulness and self-awareness
Building empathy
Next generation devices will seamlessly support users for optimal performance.
Philosophy
Enhance quality of life
By translating brain & behavioral science for real world use
While engaging in critical conversations

Design guidelines
Design with target users
Enable rather than enforce
Teach rather than make dependent
Keep data private and local
Thank you

@FluidInterfaces

fluid.media.mit.edu