

Open Trackers for (Open) Science

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The Why

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- Why activity trackers are used by researchers - tracking of activity, heart rate, location, interactions, emotional assessment
- passively, (almost) non-intrusive - longitudinal studies (several weeks) - real life data

The Why - Fields of Research

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- Psychology: Organizational and Work, (Mental) Health, Developmental, Educational - Criminology: Reintegration of ex-detainees - Sports Science: Physiotherapists, Training Schedules - Medical Research: Gerontology, Reconvalescence, Psychiatry

Use Case I: Schools

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Use Case III: School Children

Aim: monitor play behavior of children during break time

Current means: observations, proximity sensors

Use of wearables: collecting raw accelerometer data, GPS location data, proximity data, emotional momentary assessment (EMA)

Use Case II: Ex-Detainees

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Reintegration of Ex-Detainees: adults, daily life, feedback,
integration in process

Slide:

Use Case I : Ex-Detainees

Aim: stay out-of-trouble

Current means: contracts with coach and regular meetings,
phone calls

Use of wearables: to help self-control behaviors that might lead
to criminal behavior

Use Case III: Dementia Care

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Use Case III: Dementia Care

Aim: monitor activity levels and location (outdoors) of residents in dementia care ward

Current means: observations, studies with accelerometers (research devices), step counters

Use of wearables: collecting raw accelerometer data and GPS location data

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Summary of Use Cases

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Children Ex- Detainees Nursing home residents Acc EMA GPS
call logs (etc)

Age Somatic Health Mental Health

Wake-up Activity

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Imagine you were a parent and enrolled your child in a study, you enrolled yourself in a therapeutic program or were asked to enroll your parent living with dementia: Which alarm bells will this trigger and which problems do you see?

Alarm Bells and Considerations

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Design: durable, "normal" looking (avoid stigma)

Data Privacy: full control over their data by the client

The How - Current Solution

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- Data Privacy Solutions - only for offline/closed system devices
- lab setting only - Use research platforms by Garmin or fitbit to access data - Using customer grade products and code the software yourself

Introduce Medical Research Devices

Introduce Consumer Grade Devices

The How - BigTech

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- Apple Watch

General: Investigator Support Pilot and Apple watch limited grant program

<http://researchkit.org>

<https://github.com/researchkit/researchkit>

<https://developer.apple.com/videos/play/wwdc2019/217/> docs:

<http://researchkit.org/docs/docs/Overview/GuideOverview.html>

Tasks: seven categories: motor activities, fitness, cognition, speech, hearing, hand dexterity, and vision All from Clinical Neuropsychology - Cognitive and fitness testing activities the clinician in me asks: are those validated tests? Validated againsts paper-pen tests or lab tests that those are based on It might be returning the raw accelerometer information collected during those tasks (???) You can also design your own

The How -Using Big Tech

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Examples of research using these wearables - because many people use them, they are already there!

<https://innovations.stanford.edu/wearables>

<https://corona-datenspende.de>

Example of research of using these wearables - because study participants like them, they are modern and sleek – Sleep

Psychosis Study

The How - Summary

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Summary: We have solutions for:

Lab Studies - Short term studies - bulky, precision technology
and access to the raw data

Big Data Studies - wide spread use of consumer grade devices
and access to summary statistics

(Long term) studies looking to explore data explain systems
test hypotheses generate theories and hypotheses

Technology to be used in therapy and coaching that allows for
personalized therapy

And all of that while having full control over data shared and
adhering to the principle of minimal data collection.

The How - What has been done

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Nesbitt?

- Examples of Mobile Phone studies: - Kiukkonen, N., Blom, J., Dousse, O., Gatica-Perez, D., Laurila, J.: Towards rich mobile phone datasets: Lausanne data collection campaign. In: Proc. ACM Int. Conf. on Pervasive Services (ICPS). Berlin, Germany (2010) - Danish study - Sandra Servia-Rodrez et al. 2017.

Mobile sensing at the service of mental well-being: a large-scale longitudinal study. In WWW '17. 103-112.

MEDEA project - Asked about implementation

Edon project (Alzheimer UK)

<https://edon-initiative.org/organisation/> – asked abt choices

<https://www.radar-ad.org>

<https://radar-base.org/index.php/data-sensors/supported-devices/> – overview of supported

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The How - What has been done

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Own Solution - Samsung

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The How - What has been done

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Own Solution - Samsung

The How - What has been done

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Own Solution - Samsung

Possibilities - Positives

Negatives and Downsides/ Limitations

The Future

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- Data Privacy is paramount - Research platforms allow access to some but not all data - API's do not allow access to all data
- Modularity to ensure only those sensors that are needed are included (and that they ARE included) - Costs are high - open science might be an answer?

The Future

- Show design process until now - mission and network of stakeholders - Multifaceted problem - Difficult to get people on board, who commit and stay on board - certainly at beginning - How do you build a OS / Open Hardware community? - What are the benefits - especially when trying to get academics involved - incentive structure is not built for such projects