

# Open Trackers for (Open) Science

Daniela Gawehns, Froscon 2020.



**Universiteit  
Leiden**  
The Netherlands

## Outline

2 | 22

Who uses Activity Trackers for Research?

- Three use cases

- Activity: Alarm bells

Which hardware and software options exist? (And why are some more problematic than others?)

What are current solutions?

What's next?

- Activity: Next steps and avenues

## The Why

3 | 22

- 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

4 | 22

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

Open Trackers for (Open) Science

Who uses Activity Trackers for Research?: Three use cases

## Use Case I: Schools

5 | 22

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

6 | 22

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

7 | 22

### 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

Open Trackers for (Open) Science

Who uses Activity Trackers for Research?: Three use cases

## Summary of Use Cases

8 | 22

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

Age Somatic Health Mental Health



## Wake-up Activity

9 | 22

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?

Open Trackers for (Open) Science

Who uses Activity Trackers for Research?: Activity: Alarm bells

## **Alarm Bells and Considerations**

**10 | 22**

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

Data Privacy: full control over their data by the client

Open Trackers for (Open) Science

Which hardware and software options exist? (And why are some more problematic than others?)

## **The How - Current Solution**

**11 | 22**

- 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 [ShimmerSensing.com](https://ShimmerSensing.com)

Actigraph Picture from Stelios Paper Empatica

Introduce Consumer Grade Devices

Open Trackers for (Open) Science

Which hardware and software options exist? (And why are some more problematic than others?)

## The How - BigTech

12 | 22

- 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

Open Trackers for (Open) Science

Which hardware and software options exist? (And why are some more problematic than others?)

## **The How -Using Big Tech**

**13 | 22**

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

Open Trackers for (Open) Science

Which hardware and software options exist? (And why are some more problematic than others?)

## **The How - Summary**

**14 | 22**

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.

Open Trackers for (Open) Science

Which hardware and software options exist? (And why are some more problematic than others?)

## **The How - What has been done**

**15 | 22**

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 - Dear Daniela The project was delayed and will start in the autumn. We have not met and decided things yet sorry. C

Edon project (Alzheimer UK)

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

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

Open Trackers for (Open) Science  
What are current solutions?

## **The How - What has been done**

**16 | 22**

Own Solution - Samsung



Open Trackers for (Open) Science  
What are current solutions?

## **The How - What has been done**

**17 | 22**

Own Solution - Samsung

Open Trackers for (Open) Science  
What are current solutions?

## **The How - What has been done**

**18 | 22**

Own Solution - Samsung

Possibilities - Positives

Negatives and Downsides/ Limitations

Open Trackers for (Open) Science  
What are current solutions?

## Open Source Operating System

19 | 22

<https://asteroidos.org/news/>

Open Trackers for (Open) Science  
What are current solutions?

## The Future

20 | 22

- 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

21 | 22

- 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

Open Trackers for (Open) Science  
What's next?: Activity: Next steps and avenues

## Wake-up Activity

22 | 22

Activity with Audience: collect possible solutions to move forward