Open Trackers for (Open) Science

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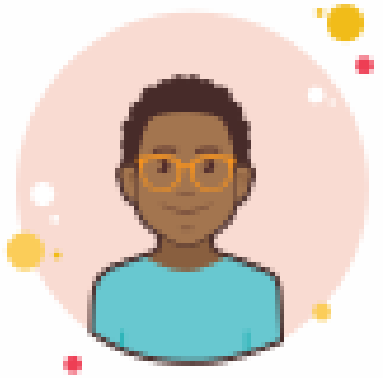
Outline

Three Personas I

Persona I : Mark



Three Personas II

Persona II : Janine

Three Personas III

Persona III : Karla

Three Personas

Summary Feedback

The Why

What makes those activity trackers so attractive?

- tracking of activity, heart rate, location, interactions, momentary emotional assessment
- passively, (almost) non-intrusive
- longitudinal studies (several weeks)
- real life data

Summary of Use Cases

	Children	Ex-Detainees	Nursinghome
Data Collection			
Accelerometer	X	X	X
EMA	X		
GPS/Location	X	X	X
Call Logs		X	
Participants			
Age	< 13	20-60	> 65
Somatic Health	healthy / hoh	healthy	geriatric patients
Mental Health	some special education schools	some psychiatric patients	dementia

The How - Balancing Acts

The How - Current Hardware Options

Medical Research Devices

- Shimmersensing.com
- Actigraph
- Empatica

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Consumer Grade Devices

- Apple OS
- Wear OS
- fitbit
- Tizen
- astroid

The How - BigTech

Apple Watch
Researchkit: Tasks (e.g., Stroop Task, Walk as quick as you can) No background data collection
Healthkit: Access Health data via this kit
CoreMotion: ”Core Motion reports motion- and environment-related data from the onboard hardware of iOS devices, including from the accelerometers and gyroscopes, and from the pedometer, magnetometer, and barometer.”
–¿ open questions: will data be sent only btw app and researcher? which temporal granularity of raw sensor data output is achievable? what is the reliability/ validity of the in-built cognitive assessments?

The How - BigTech

Garmin https://www.fitabase.com - company providing researchsupport https://www.fitabase.com/how-it-works/faq/ https://www.fitabase.com/resources/knowledge-base/learn-about-fitbit-data/data-resolutions/ granularity of data available
https://developer.garmin.com/health-api/overview/ Health API and Health SDK
Health SDK allows custom recording of Heart Rate, Activity Types - and most probably also accelerometer and gyroscope data (but no confirmation or link information for any of this)
Health API gives access to a range of data collected, activity types, sleep, heart rate; I am pretty sure that extraction of raw accelerometer data is not possible via this

The How - BigTech

- Fitbit https://healthsolutions.fitbit.com/researchers/ https://healthsolutions.fitbit.com/researchers/faqs/ https://www.fitabase.com - company providing researchsupport broad product lineup with devices that track a variety of metrics, including step count, floors climbed, distance, calories burned, active minutes, sleep time and stages, and heart rate Either summary data per account: https://help.fitbit.com/articles/en$_{US}$/Help$_{a}$rticle/1133.htm or via web API for accessing data from Fitbit devices and anyone can develop an application to access data from a device - in higher temporal resolution, including GPS data (Heart Rate, Sleep, Activity Patterns) –¿ Intraday support can extend the detail-level response to include 1min and 15min for Activity, and 1sec and 1min for Heart Rate

The How -Using Big Tech

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

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 17 | 24

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 - The project was delayed and will start in the autumn.
Edon project (Alzheimer UK)
https://edon-initiative.org/organisation/ – will make review of their tech choice open
https://www.radar-ad.org https://radar-

The How - What has been done

Own Solution - Samsung

The How - What has been done

Own Solution - Samsung

The How - What has been done

Own Solution - Samsung
Possibilities - Positives
Negatives and Downsides/ Limitations

Open Source Operating System

https://asteroidos.org/news/

The Future

- Data Privacy is paramount - Research platforms allow access to some but not all data - API's do not allow access to all data - Interoperability - Robust Findings - independent of tech - Validity of measurements - Research questions independent of tech/ pre-trained black boxes - 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? - Using big tech at exploratory research level might be fine - but where are you going with this – access only to those who can afford it and dependent on companies to not change the modeling? - Usually we are working towards sth - let's make sure it is in accordance with what we want to create with the tech– also already at exploratory levels

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

Wake-up Activity

Activity with Audience: collect possible solutions to move forward