

Why Personal Monitoring?

The Influence of Personal Behaviors on Personal Air Pollution Exposures and Acute Health Effects

Edmund Seto, Graeme Carvlin, Yisi Liu, Ching-Hsuan Huang, Jeff Shirai, Elena Austin

ASIC

9/14/2018

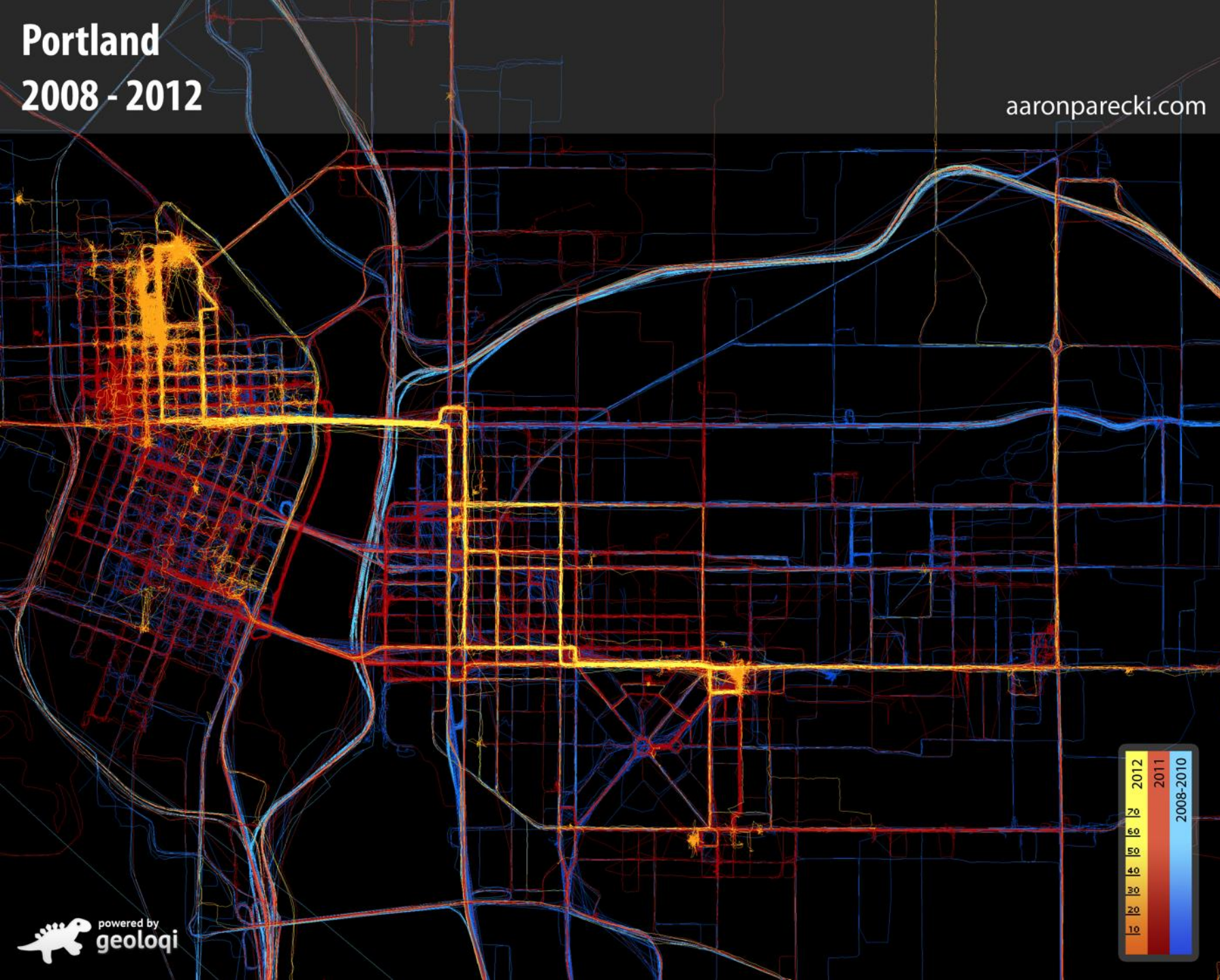


Choice of talk

- Are Air Sensors Useful?
(easy talk to give at Air Sensors International Conference)
- Is Community Air Monitoring Useful?
(not a difficult talk in CA with AB617)
- Is Mobile Air Pollution Monitoring Useful?
(Sorry, I didn't bring my Prius)

Portland
2008 - 2012

aaronparecki.com



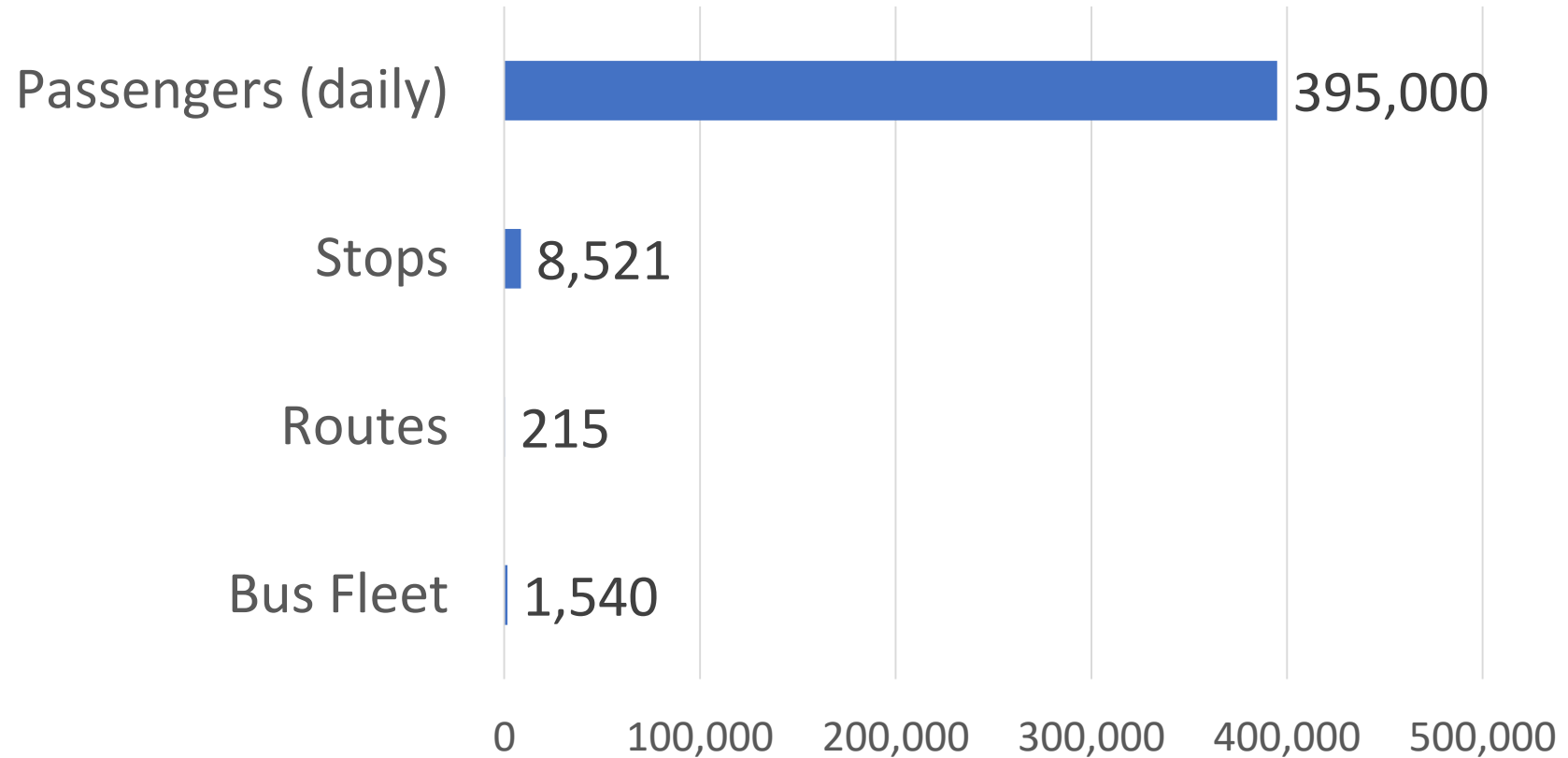
one person,
a GPS,
3.5 years

2.5
million points



More Bigger Data?

Seattle scenario...



How many Aaron Parecki's are there?

- Let's do the math...

If we could convince 1 out of 100 King County Metro passenger to carry a personal air monitor...

$$395,000 \div 100 = 3,950 \text{ potential Aarons}$$

$$2.5 \text{ million points} \div 3.5 \text{ years} = 714\text{K points per year per Aaron}$$

$$3,950 \text{ Aarons} \times 714\text{K points/yr/Aaron} =$$

2.8 Billion Air Measurements per year



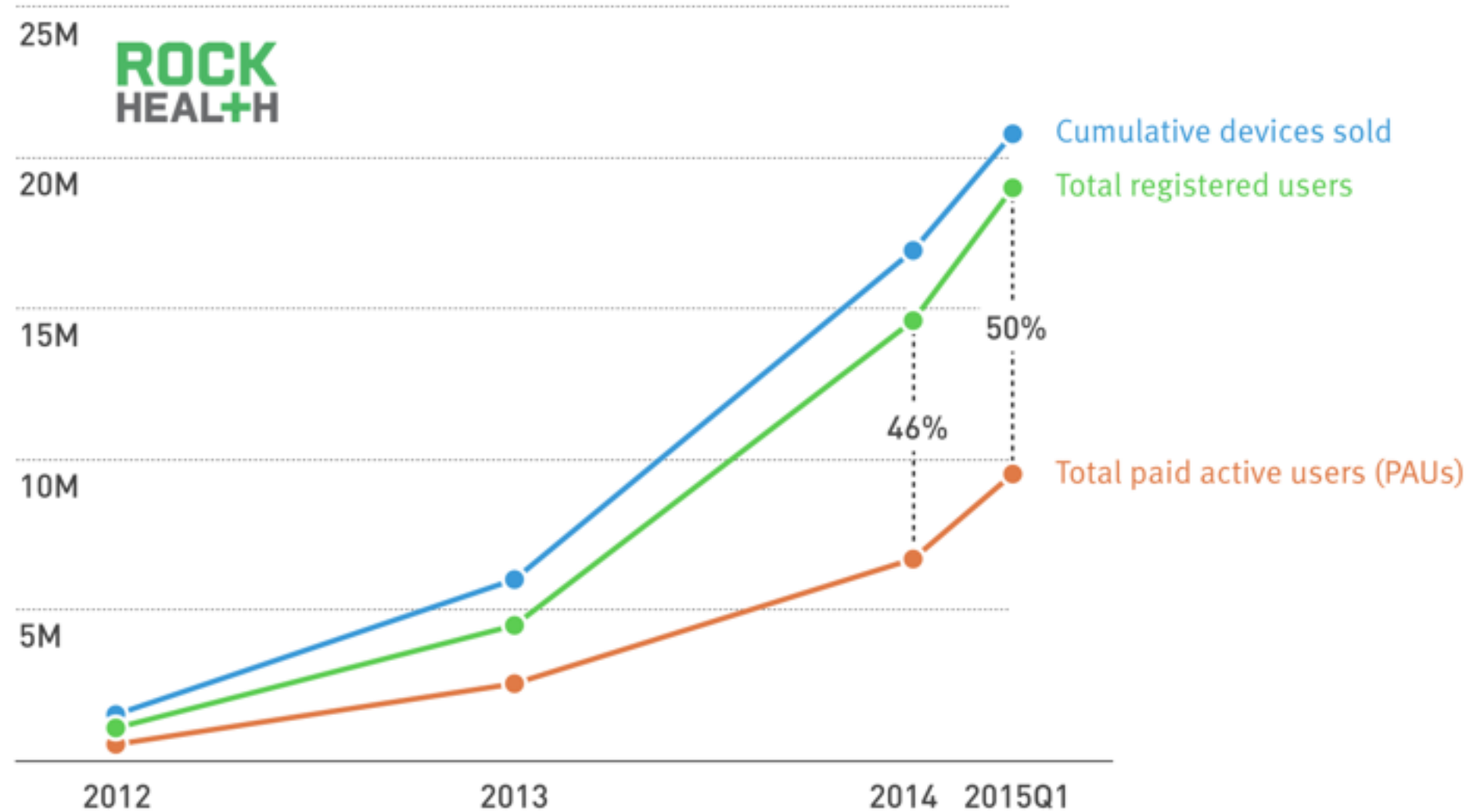
<http://www.skinc.com/catalog/pdf/instructions/37713.pdf>



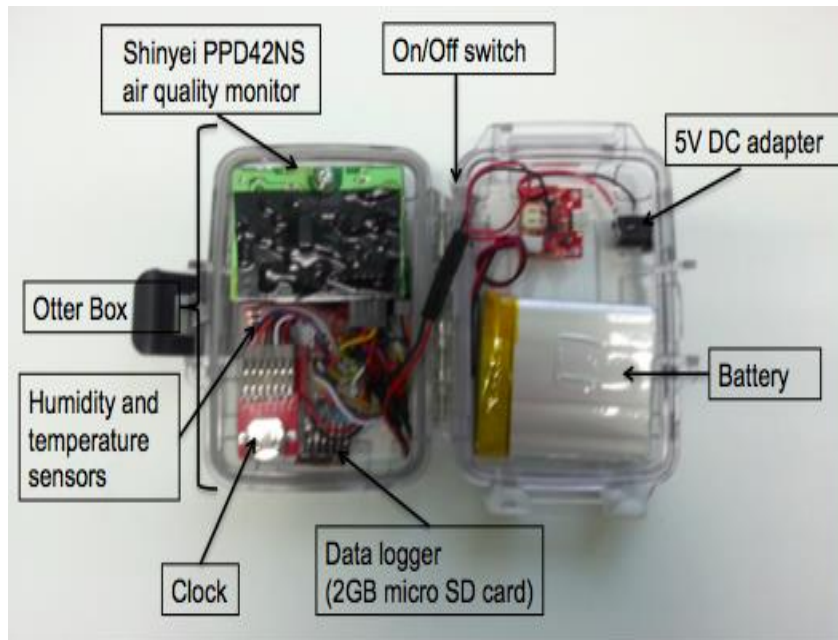
<https://www.telegraph.co.uk/technology/0/best-fitness-trackers-2017/>

FITBIT CUMULATIVE DEVICES AND USERS

2012-Q1 2015



PANDA (circa 2012, David Holstius)



Iterative Development and Testing of the PUWP



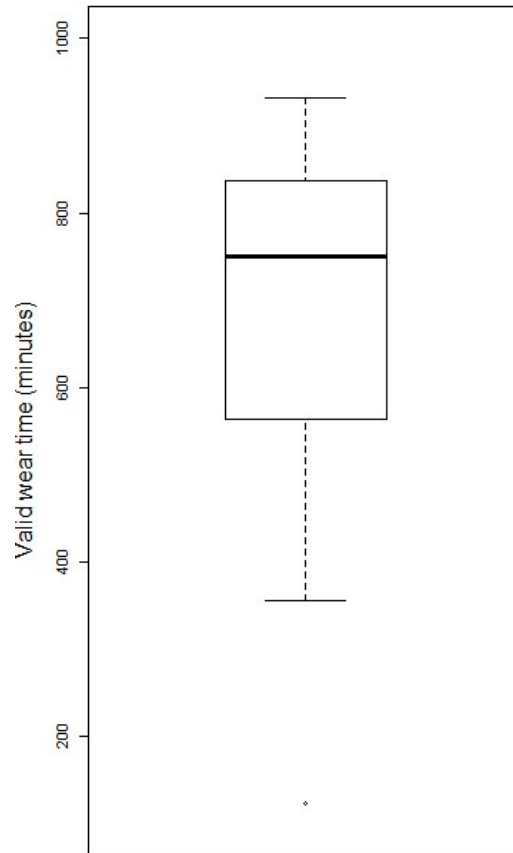
Chronology UW Versions
→

PUWP Compliance

Valid wear time

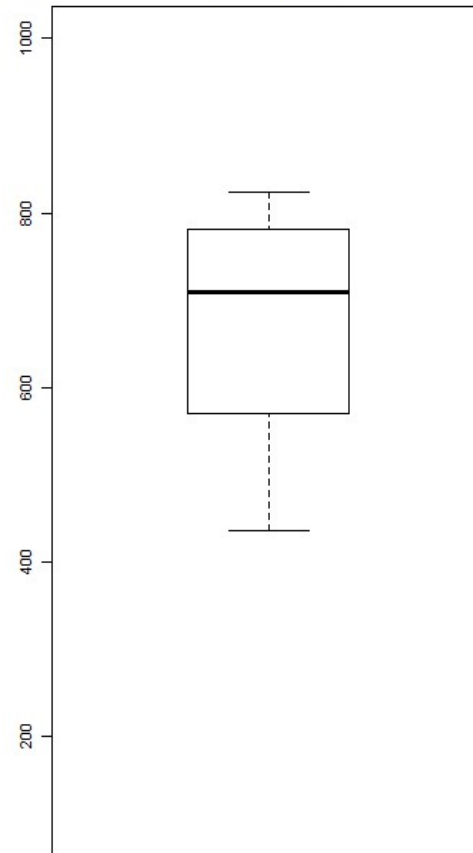
Version 1

Version 1
mean = 671.9



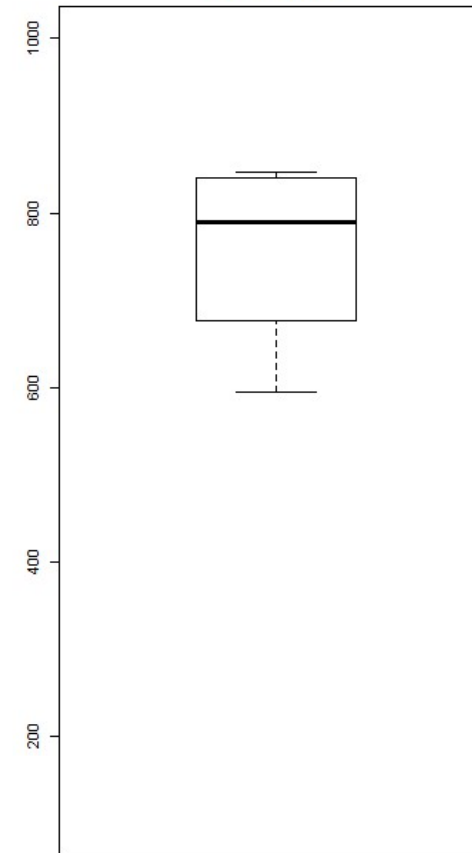
Version 2

Version 2
mean = 672.9



Version 3

Version 3
mean = 755.9

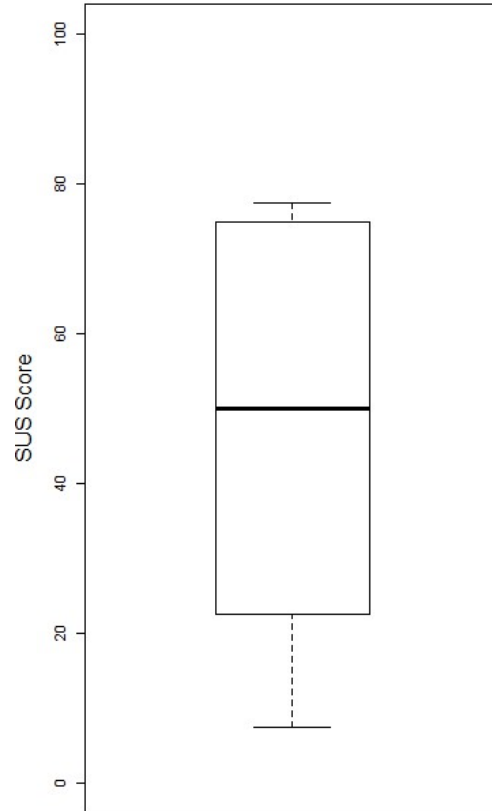


PUWP Usability

SUS Usability Score

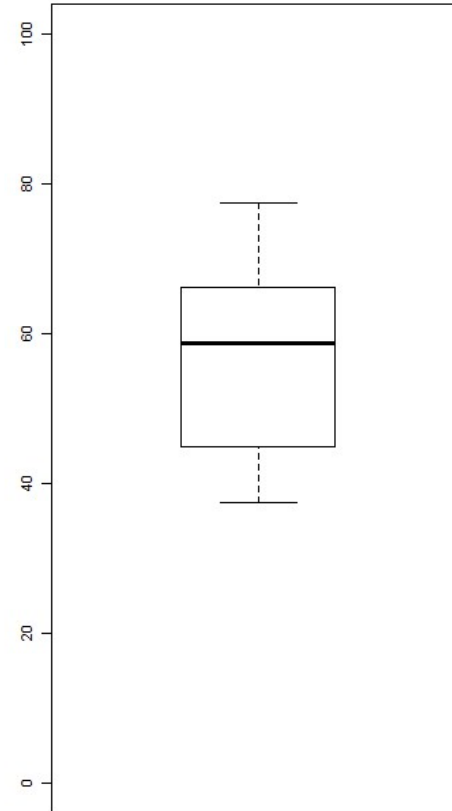
Version 1

Version 1
mean = 48.2



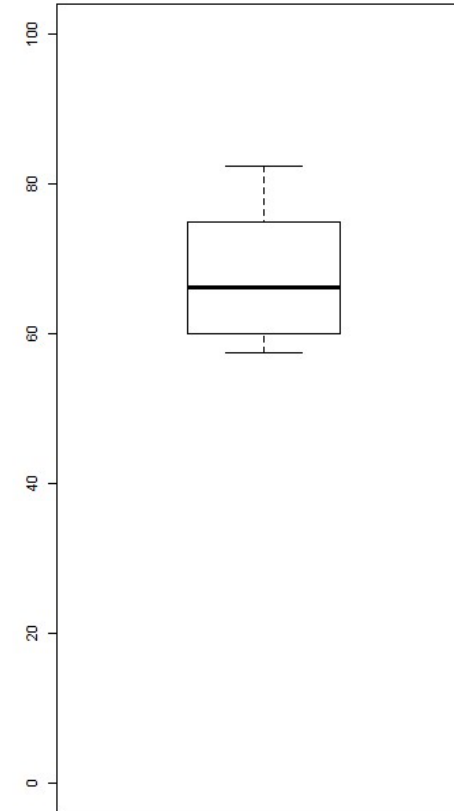
Version 2

Version 2
mean = 56.9

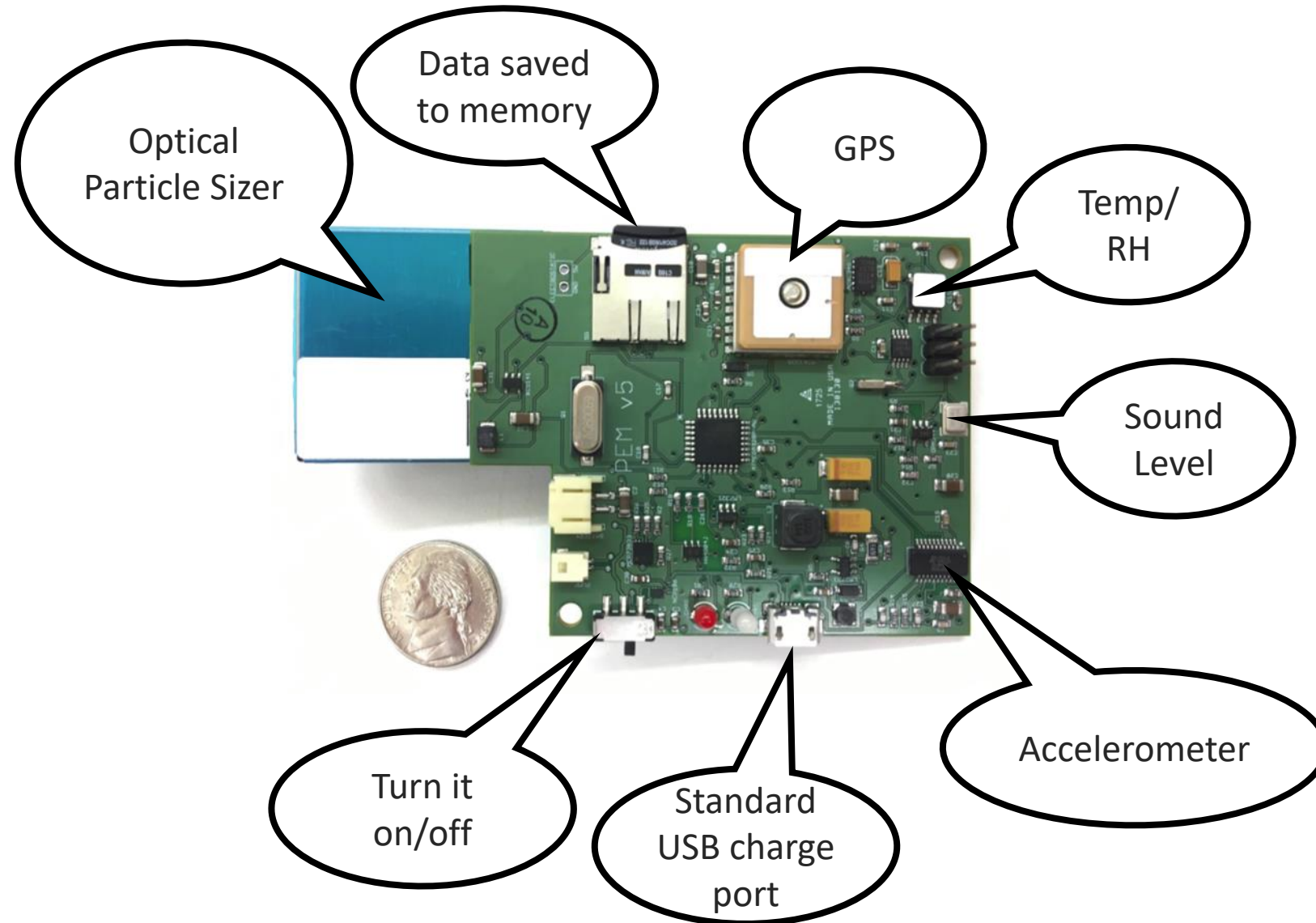


Version 3

Version 3
mean = 67.9

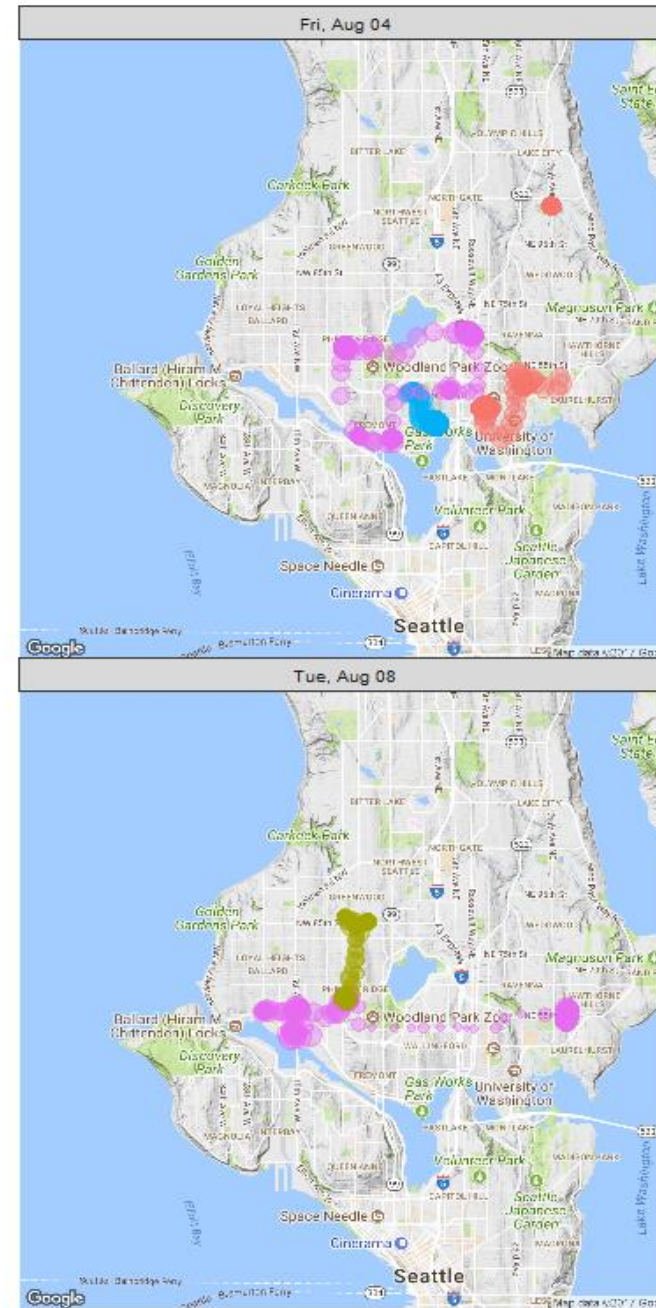
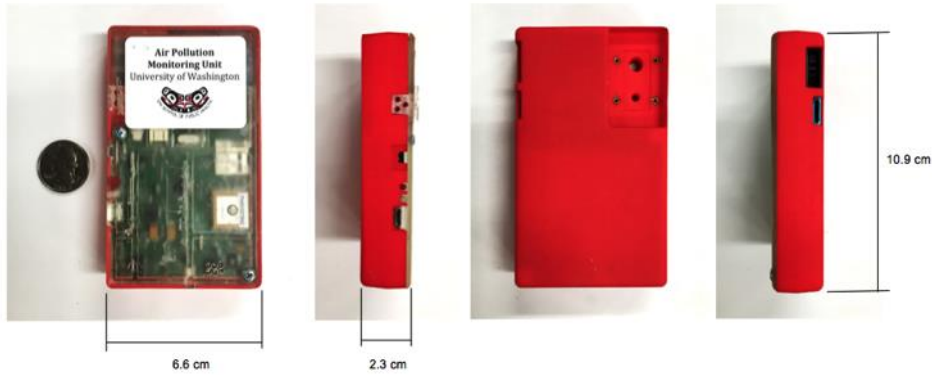


PUWP Monitor Internals

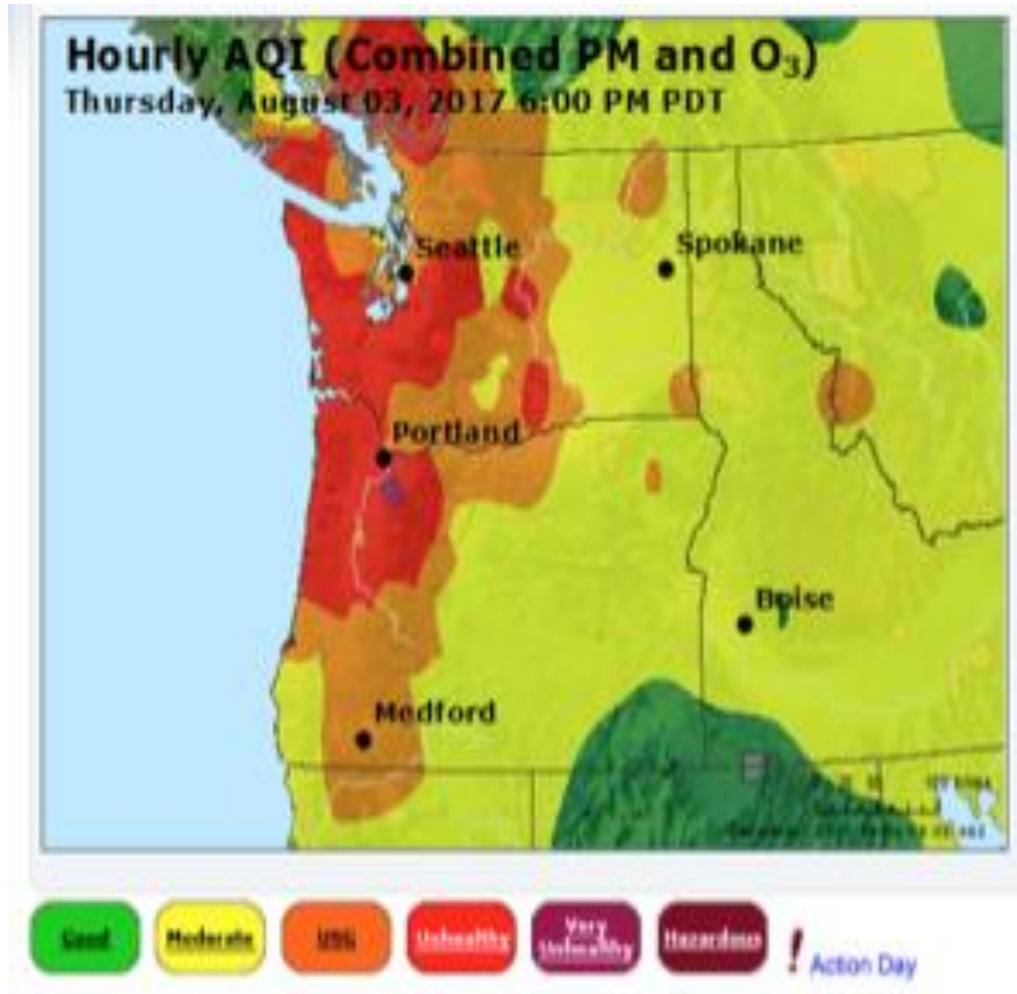


Study of 300 Twins

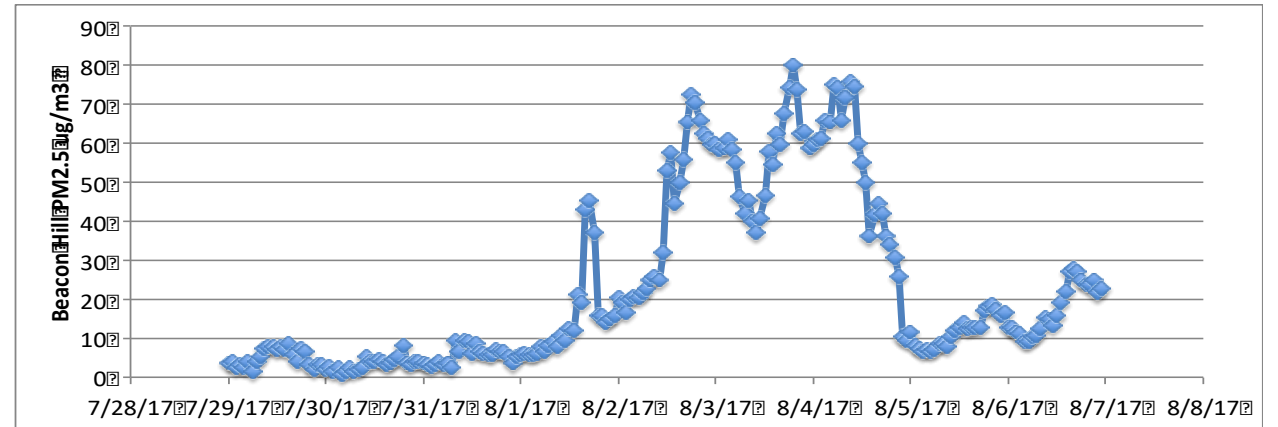
PUWP Personal Monitors



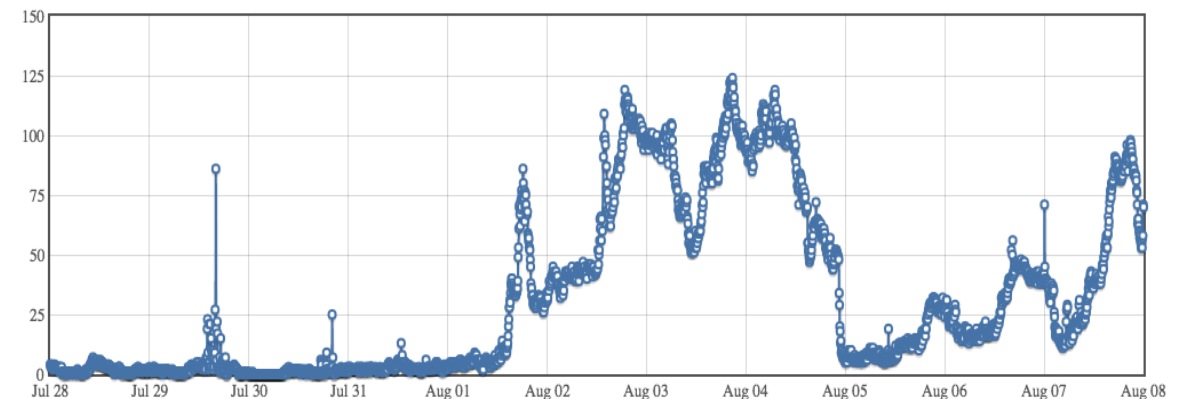
BC Wildfire Event in Seattle, Summer 2017



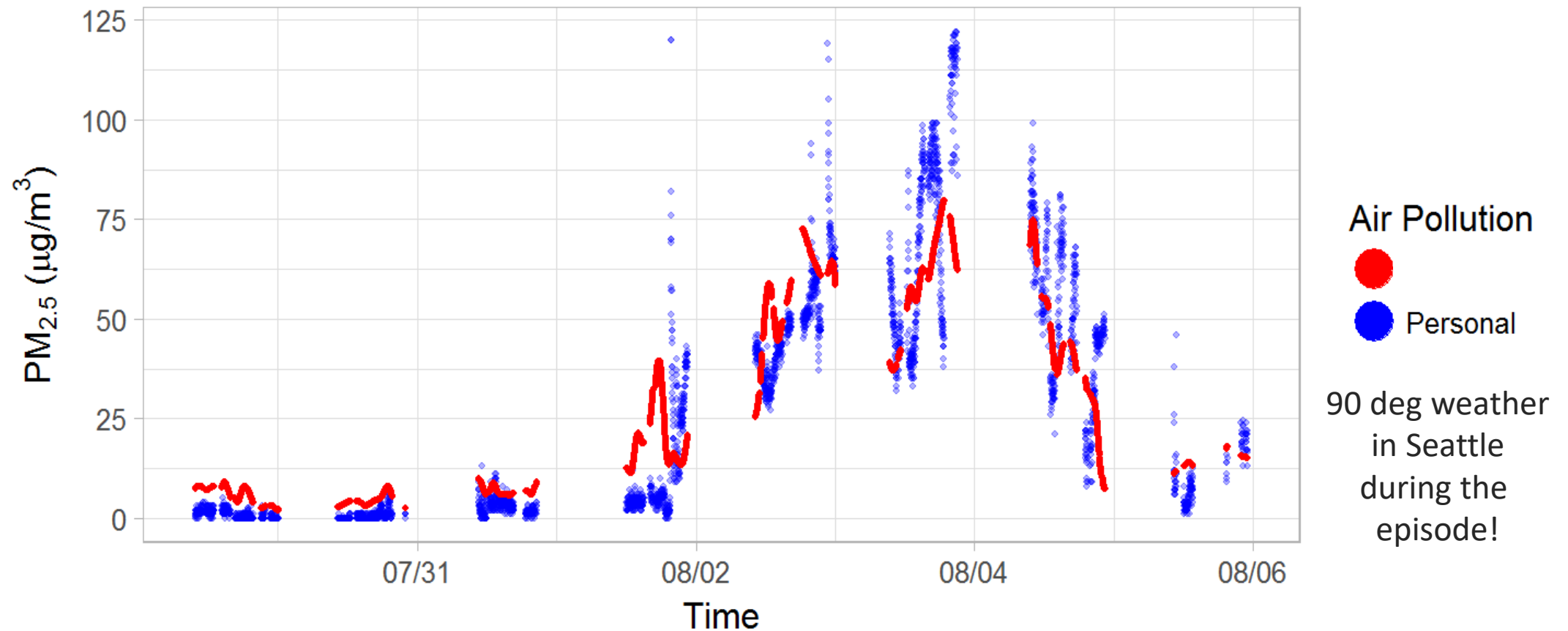
Regulatory Monitoring Data



Community Sensor Data



Personal Exposure vs. Regional Air Quality



- Integrating data from regulatory, community, and personal air monitoring can be useful for understanding air pollution events and exposures at multiple scales.

Dr. Catherine Karr's Study: Home Air in Agriculture: Pediatric Intervention Trial (HAPI)

HAPI Home Air in Agriculture
Pediatric Intervention Trial

Randomized to receive
HEPA filter or sham



Feasibility Testing TEMU in the HAPI Study

Subset of HAPI participants, recruited to test TEMU System

HAPI Home Air in Agriculture
Pediatric Intervention Trial

Randomized to receive
HEPA filter or sham



Stationary
exposure
monitor



Tablet
reported
symptoms



Personal activity
and exposure
monitoring



TEMU PRISMS Asthma Study

TEMU Components from the UW PRISMS Team

Stationary
exposure
monitor



Tablet
parent-reported
symptoms



Personal activity and
exposure
monitoring



PRISMS Data Center

- Secure data sharing
- Data harmonization
- Cohort discovery
- Meta-cohort analyses
- etc.



PRISMS Informatics Platforms

- Technologies for cohort deployments (phones, watches, apps, etc.)
- Integration of data from multiple compatible PRISMS sensor systems
- Merging other study participant data
- Metadata tagging



Sensors from other PRISMS teams

- Activity
- Exposure
- Physiologic response
- Ecological Momentary Assessment
- etc.

TEMU Tablet Data Collection



Field staff visit set-up form

Parent-reported daily questionnaire on asthma symptoms

- Implemented in REDcap
- Meets HIPAA requirements
- Data uploaded to REDcap via cellular network
- Spanish language

Daily Symptom Questionnaire (Asthmatic's Parent)

An example:

As a participant in this study, please answer the questions below concerning the PAST DAY. Thank you!

Please enter your child's first name

Please have Elena take a peak flow measure as demonstrated by your asthma care specialist.
Please record the value here:

Was Elena's school open yesterday ?
 Yes
 No [reset](#)

Did Elena miss any hours of school because of an asthma problem?
 Yes
 No [reset](#)

Did Elena go to the clinic or hospital yesterday because of asthma problems?
 Yes
 No [reset](#)

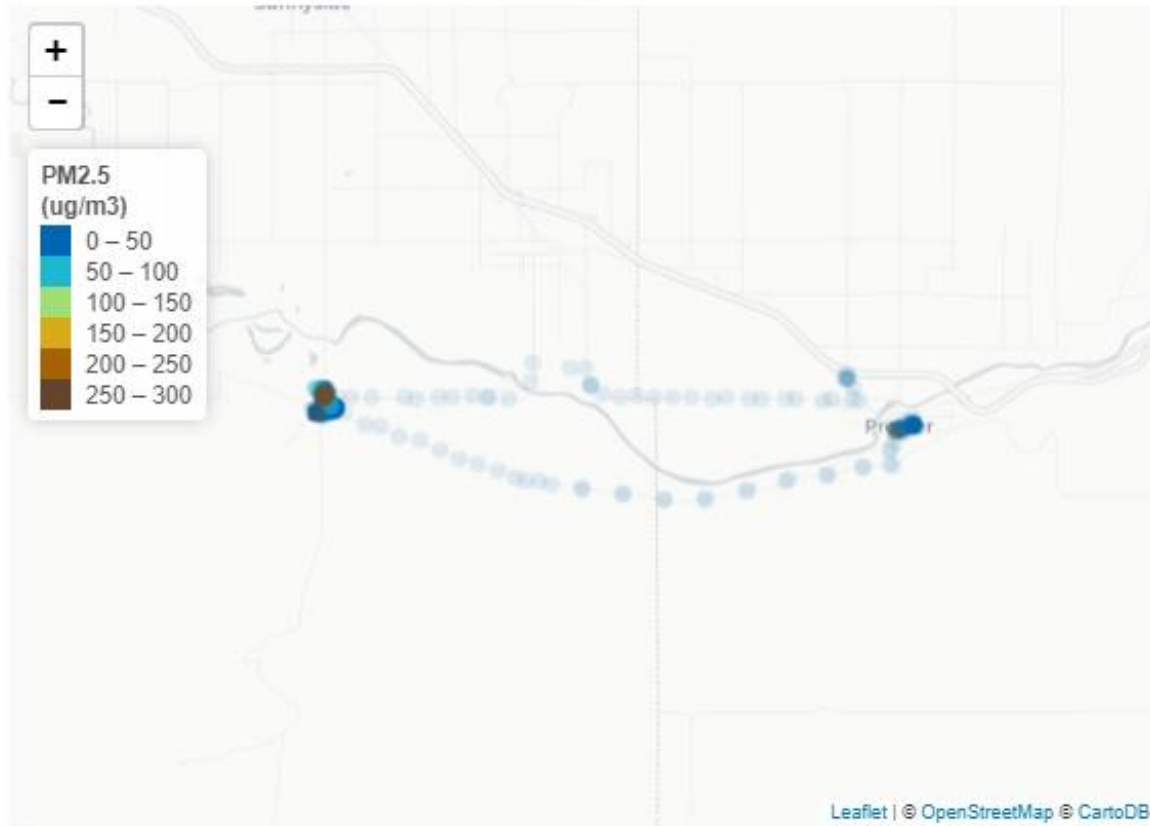
[Next Page >>](#)

← Enter peak flow measurement

← Missed school?

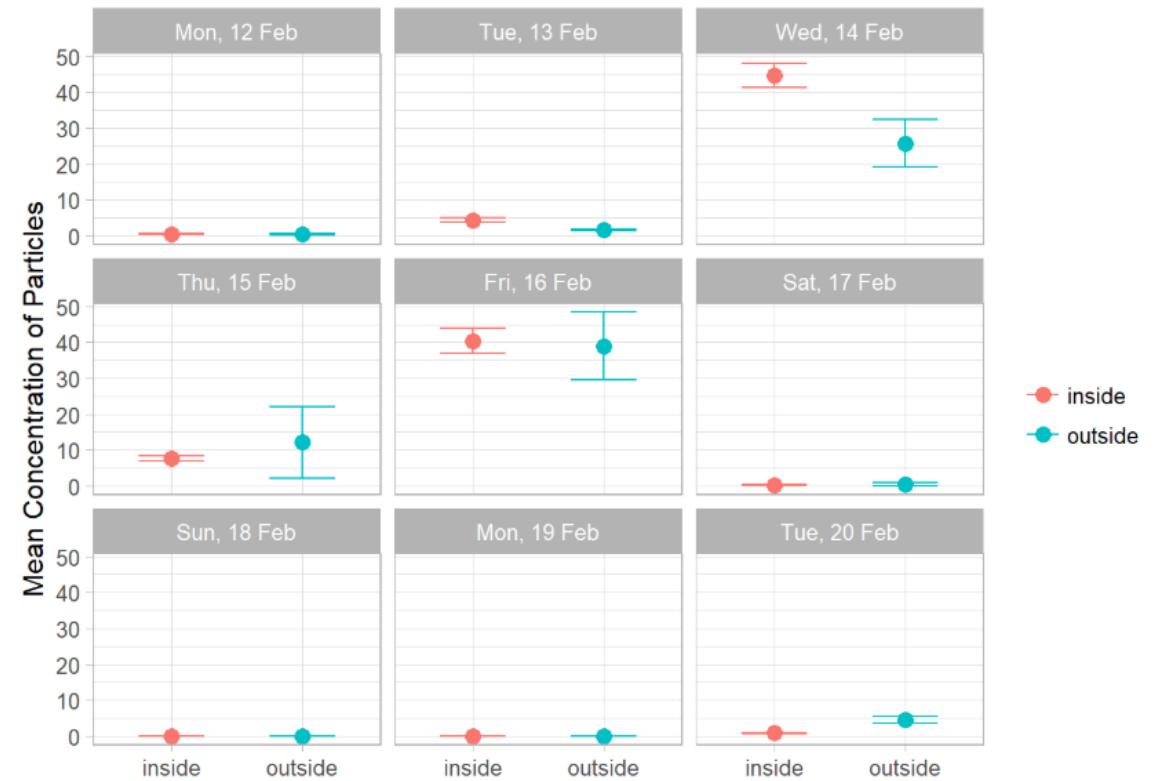
← Clinic or hospital visit?

PM exposure context

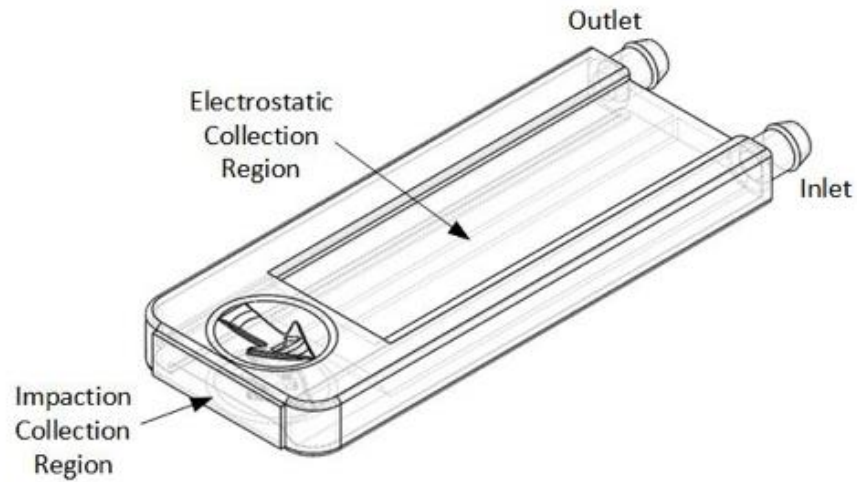


Home and out of home exposure

During the course of your day, you spend time both in your home and outside your home. The chart below shows the mean concentration of particles measured by your monitor.



TEMU Internals - Electrostatic PM Collector



Collect cartridges from participants, and send to lab



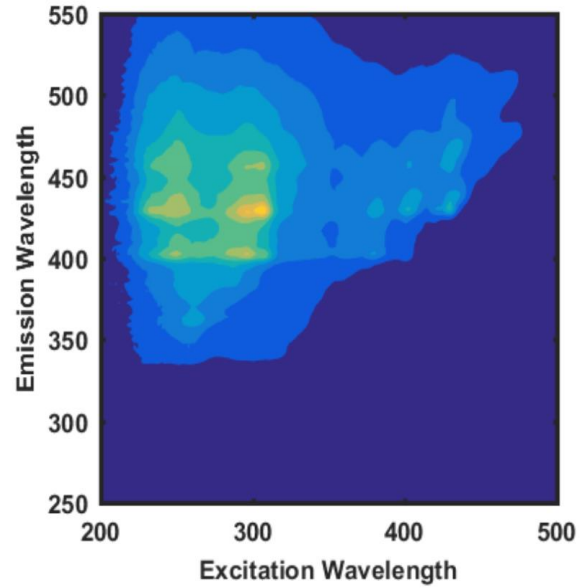
Liquid Extraction



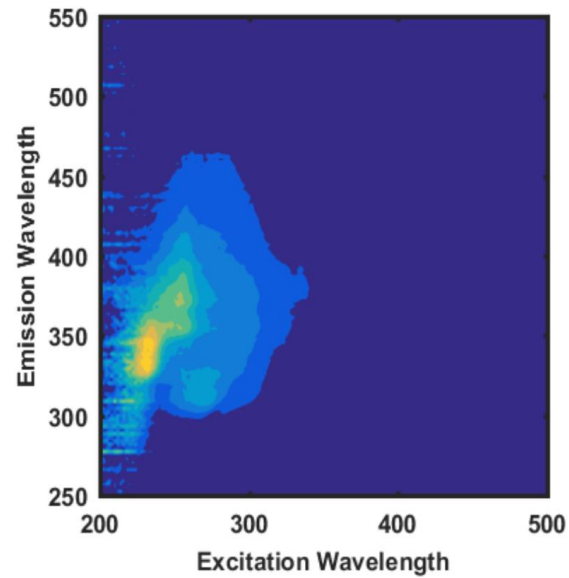
Fluorescence Excitation-Emission Matrix

Excitation Emissions Matrix

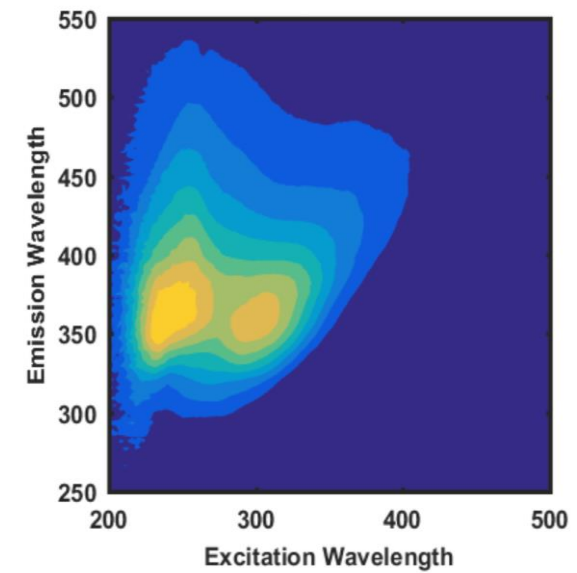
Clean cookstove (wood smoke)



Diesel exhaust



Research cigarette smoke



Summary

- Thinking of Aaron Parecki... one person, lots of measurements
- Thinking of Fitbit... designing for usability
- Starting to integrate personal monitoring in epidemiologic studies, with both biological and digital health endpoints.
- Digital measurements potential provide insights into the behavioral context for exposures
- Speciated measurements potentially provides further context

Acknowledgements

Thanks to Aaron Parecki.

Thanks to the Twin PUWP Collaborators (Glen Duncan's team at WSU, Igor Novosselov's team at UW)

HAPI research team and PRISMS collaborators (Catherine Karr's HAPI team and Igor Novosselov's team at UW)

The Twin PUWP research is funded by the National Institute of Biomedical Imaging and Bioengineering (NIEHS) U01 EB021923

Th PRISMS TEMU research is funded by the National Institute of Biomedical Imaging and Bioengineering (NIBIB) U01 EB021923

Contact: Edmund Seto (eseto@uw.edu)

