Hearables in Hearing Care: Discovering Usage Patterns Through IoT Devices

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12/07/2017

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Why and how do hearing aid users interact with their hearing device?

What challenges and opportunities does IoT devices bring in tracking the everyday life of hearing impaired people?

"… the prevalence of any hearing impairment in **US adolescents aged 12–19 years is 19.5%**…"

This translates to approximately **6.5 million US adolescents** with hearing impairment in **2005–2006**, a **31%** increase (Shargorodsky et al. 2010).

70.1 million Americans (33%) have either bilateral or unilateral hearing impairment (Curhan and Curhan 2015).

Motivation


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Smartphones Open a New World for Medical Researchers

Doctors say abundant health data gathered by phones produces better, more timely studies

Most medical studies depend on participants to self-report. But smartphones can track activity and other health-related data passively and dispassionately.
ILLUSTRATION: OTTO STEININGER FOR THE WALL STREET JOURNAL

By Charles Wallace

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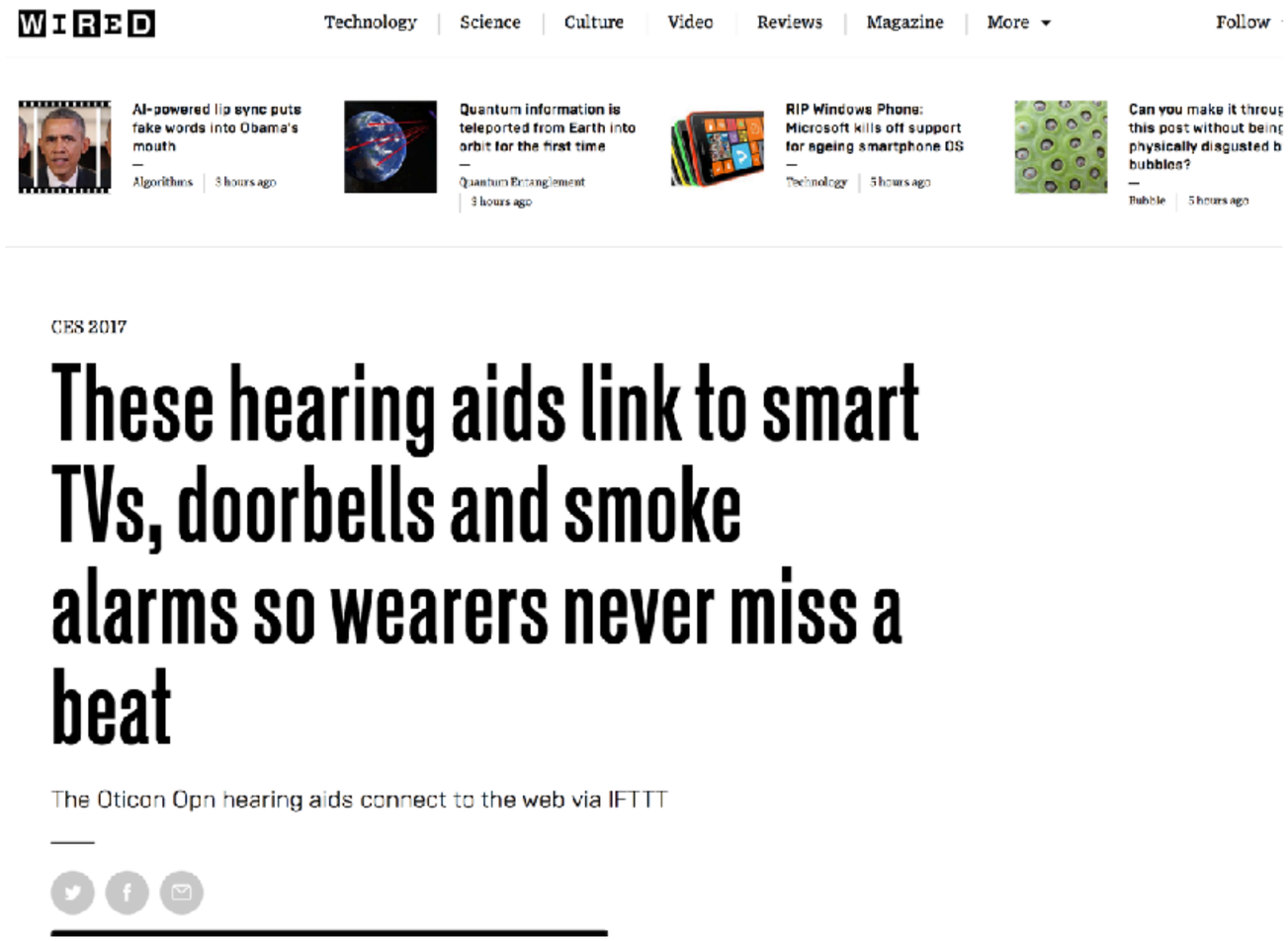
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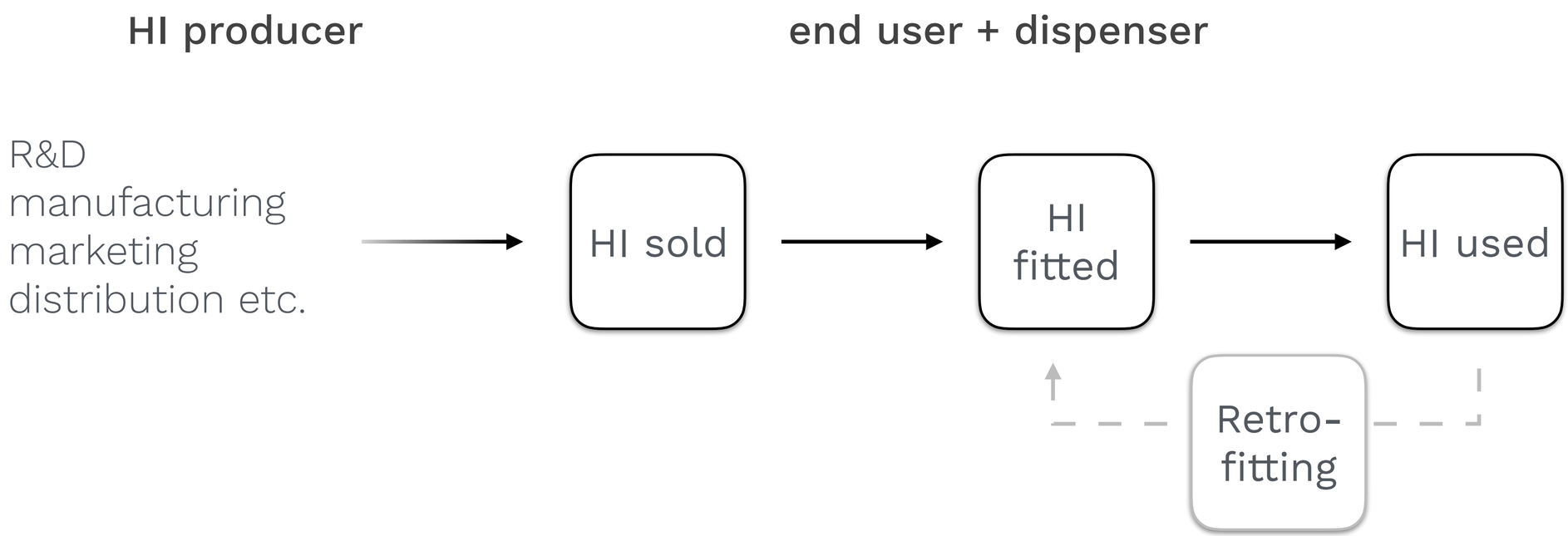
CES 2017

These hearing aids link to smart TVs, doorbells and smoke alarms so wearers never miss a beat

The Oticon Opn hearing aids connect to the web via IFTTT

syannykov, CC

Current solution

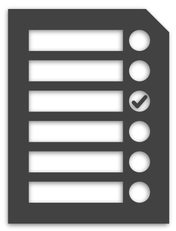


current solution

diary

accumulative data from hearing device

memory



paper notes

phone notes and recordings

heuristics

Adidas

Current solution

dependency on
clinical ressources

dependency on
“active” user participation

Discrete ◄——●——► **Continuous**

disability
fixing a problem

empowerment
(re-)gain abilities

how do we empower users to get “a size that fits me”,
rather than a “one size fits all”

Why and how do hearing aid users interact with their hearing device?

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Selection of “super users”

6 from pool of 354*

Fitting and setup

1 clinician, 90-120 min.

re-fitting and follow up interview

1 clinician, 90-120 min

described by test subjects as:

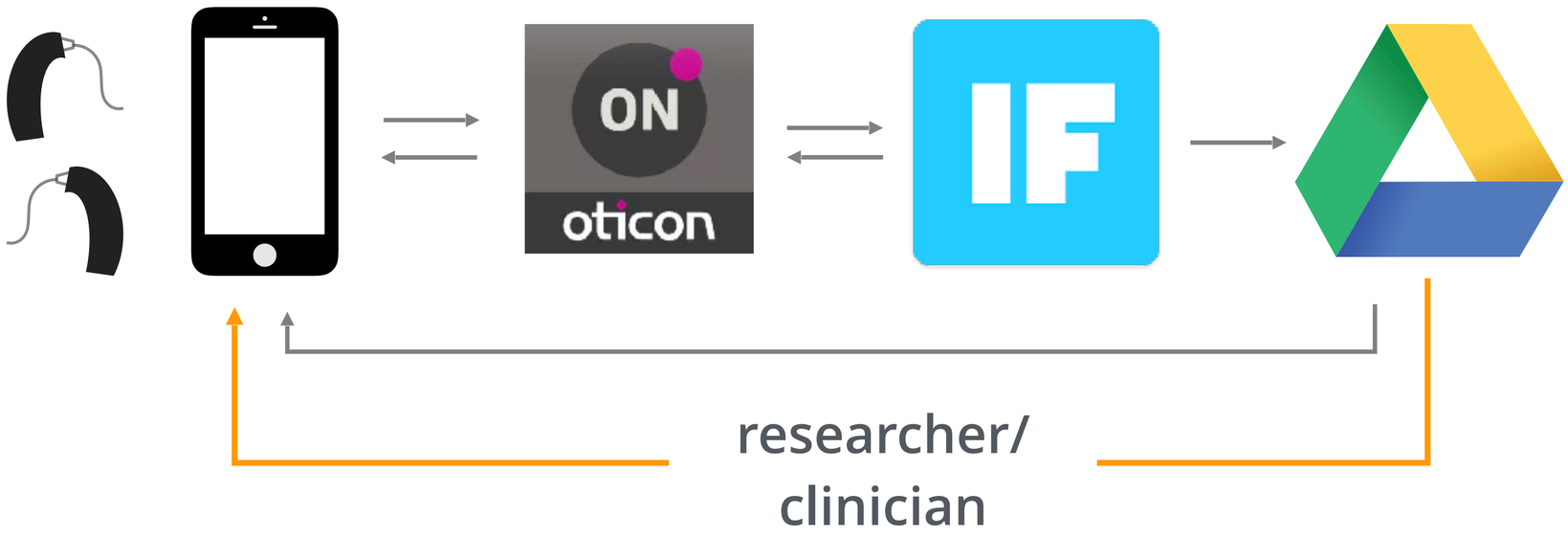
P1: “Most natural sound - as I remember it”

P2: More sharp - “I use it for meetings”

P3: More round - “I use it when there’s noise, and I want to reduce high tones”

P4: More focus - “I use it when I need to focus on one talker - in a bar, meeting etc.

Methodology



hearing aid users shows unique usage patterns
selecting programs is moving on a macro scale

several groups of users:
momentary wearers
diligent wearers
using one program - adapt brain?
using multiple programs - adapt device

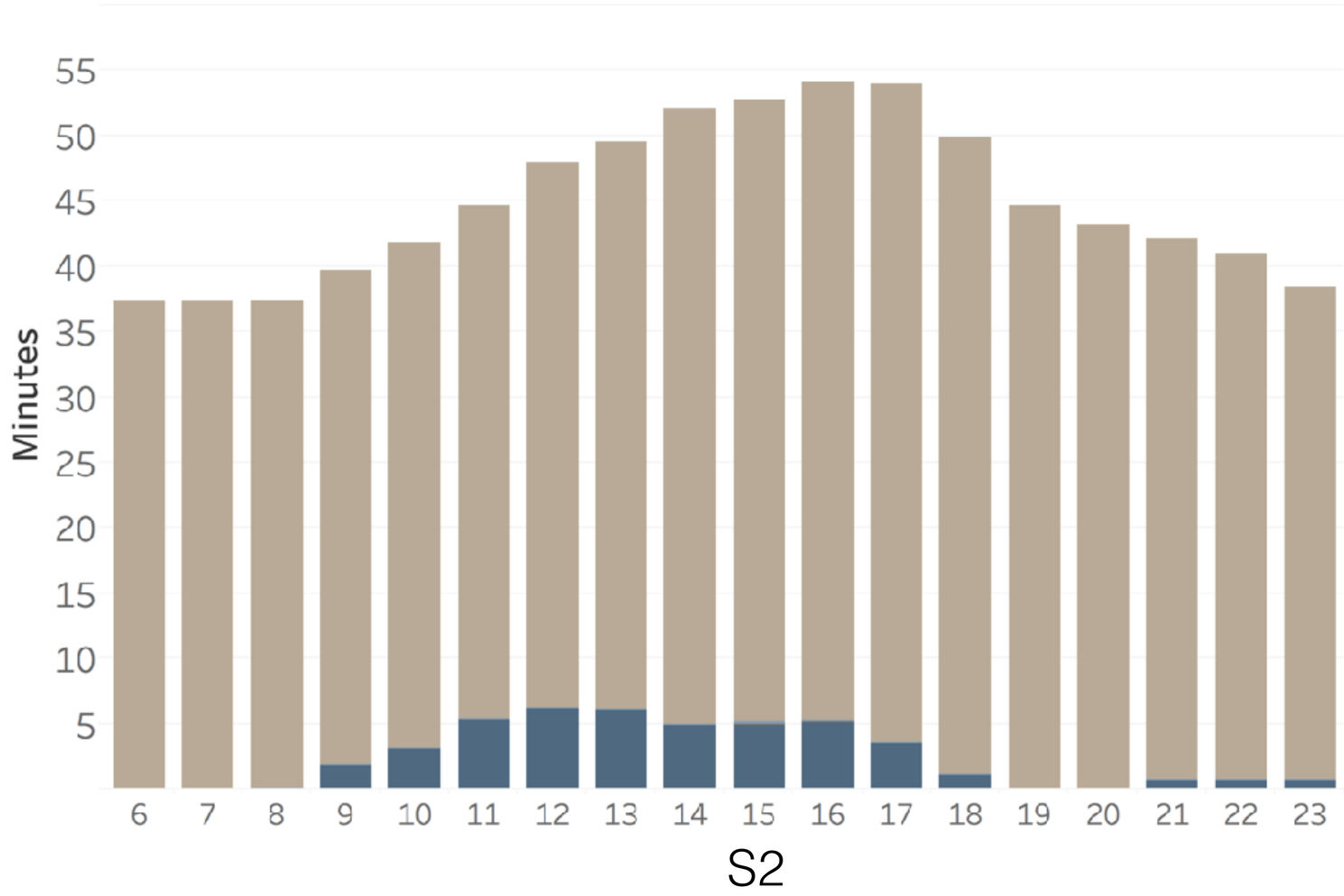
S2: “When I wake up I put on the hearing aids, and leave them for the day

VS.

S1: “I only wear my hearing aids when I feel **I need help**”

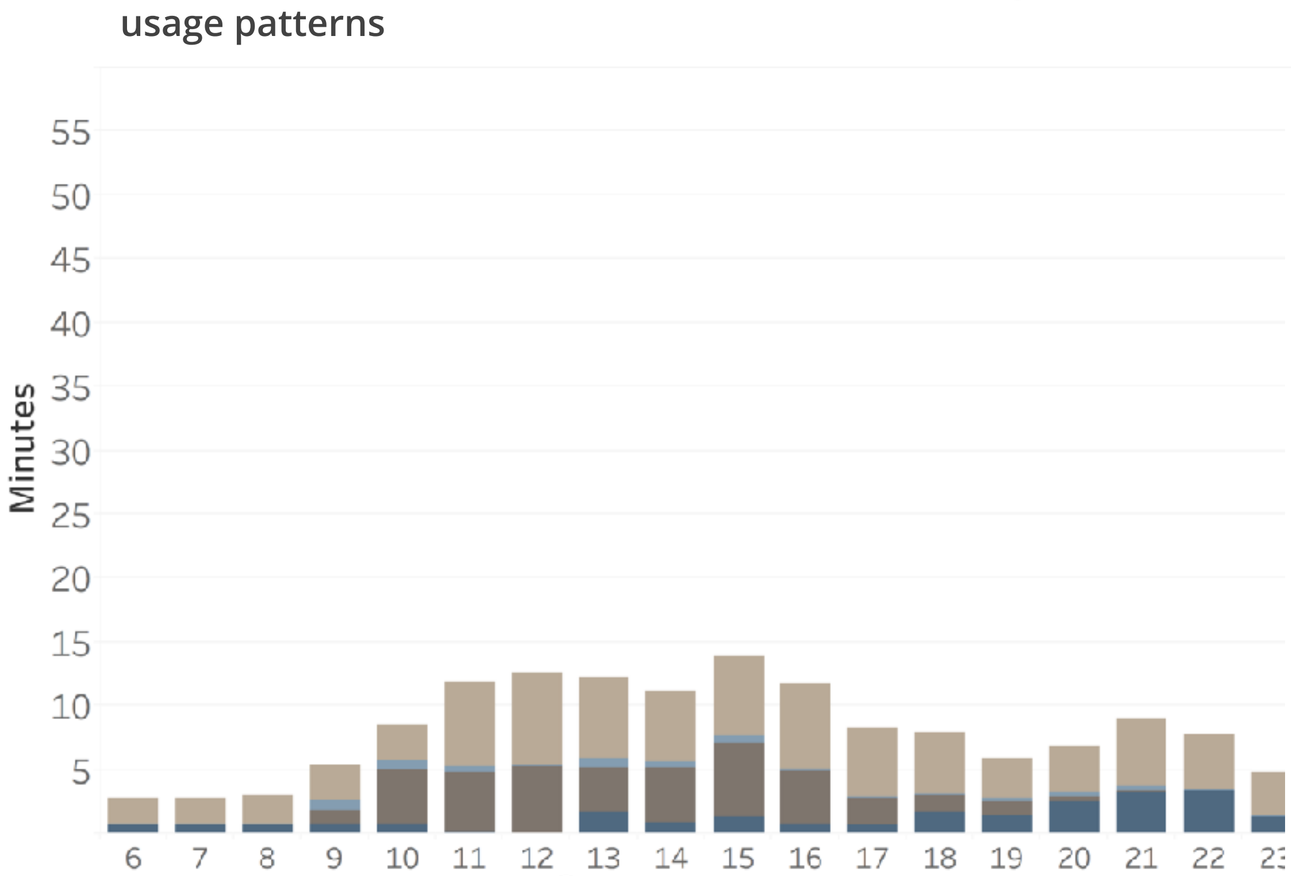
Dilligent users, more than 20 min in avg

usage patterns

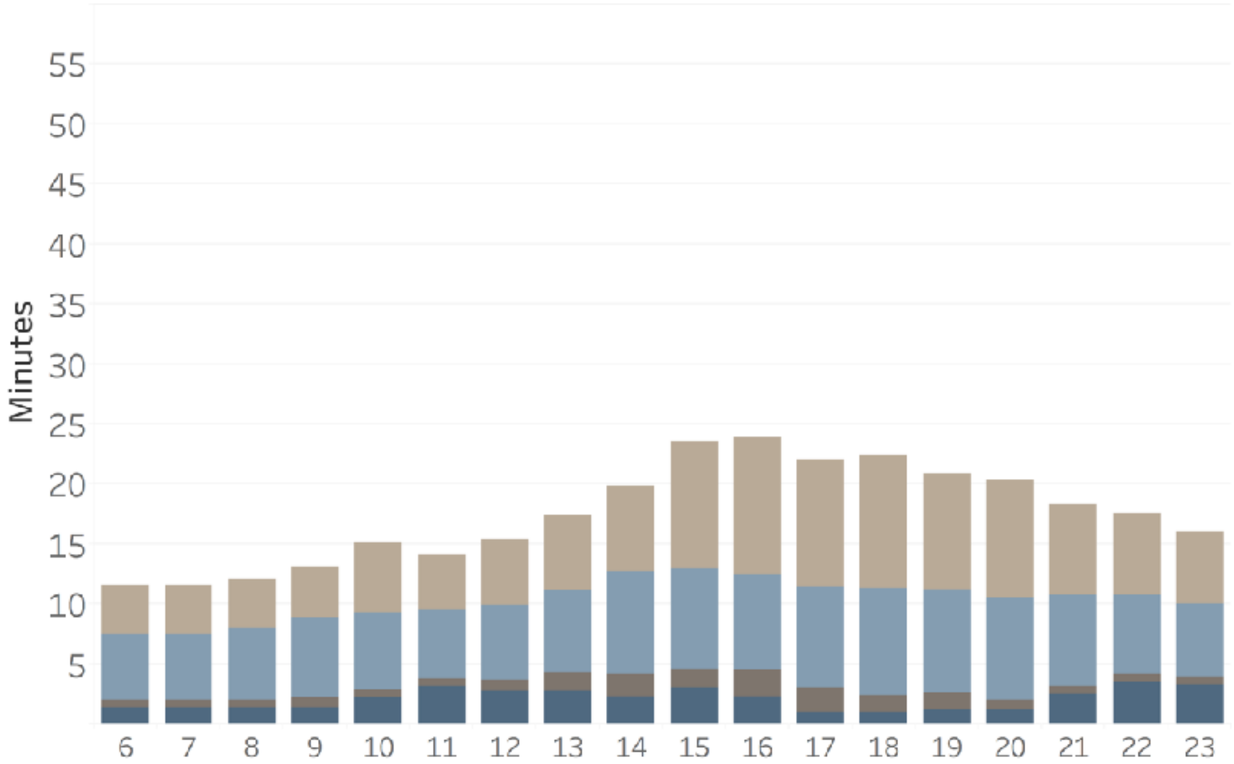


S1: “In **meetings** I either use P2 for better **speech intelligibility**, or P4 for a narrower **focus**. I only use the hearing aids when **I need help**”

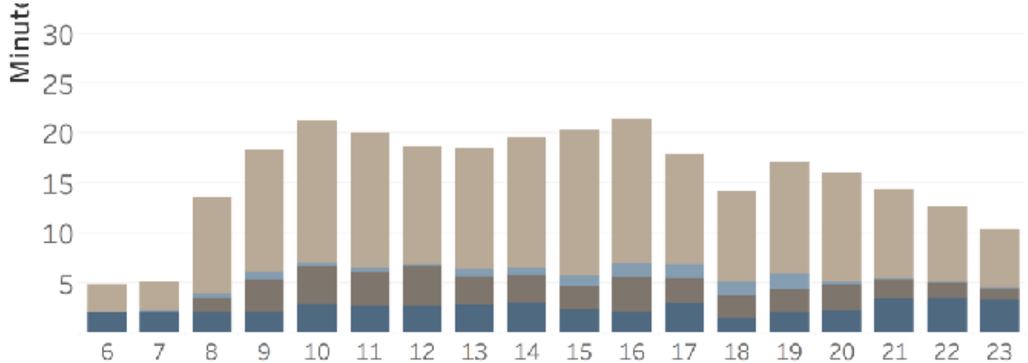
momentary users, less than 20 min in avg



S1



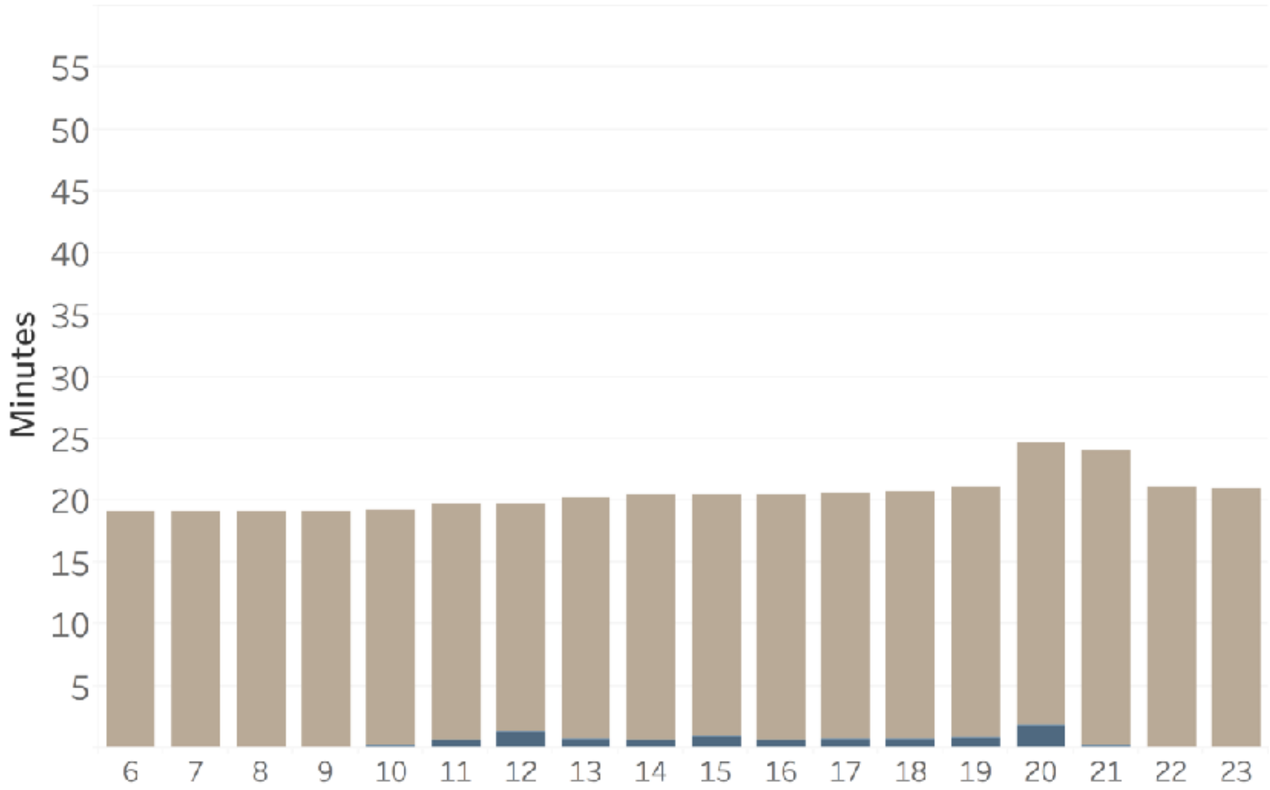
S5



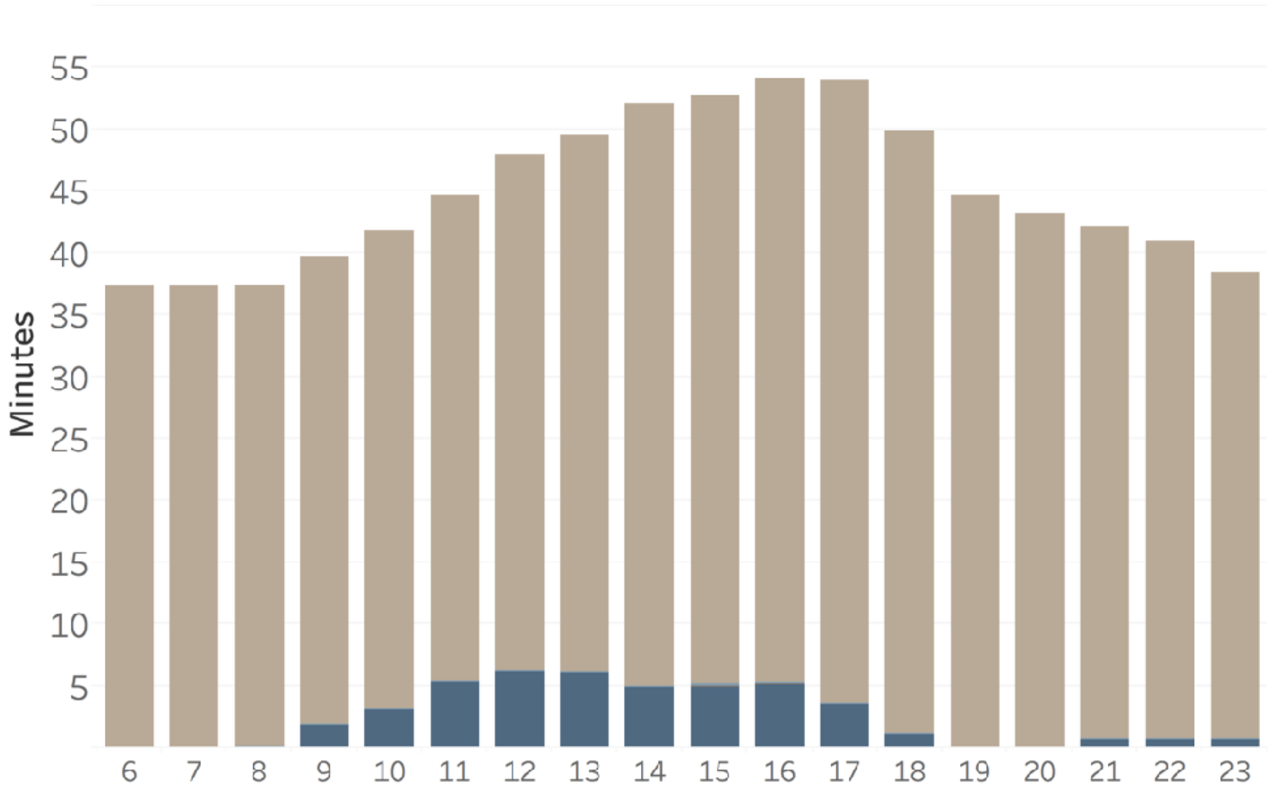
S7

using one program

usage patterns



S3



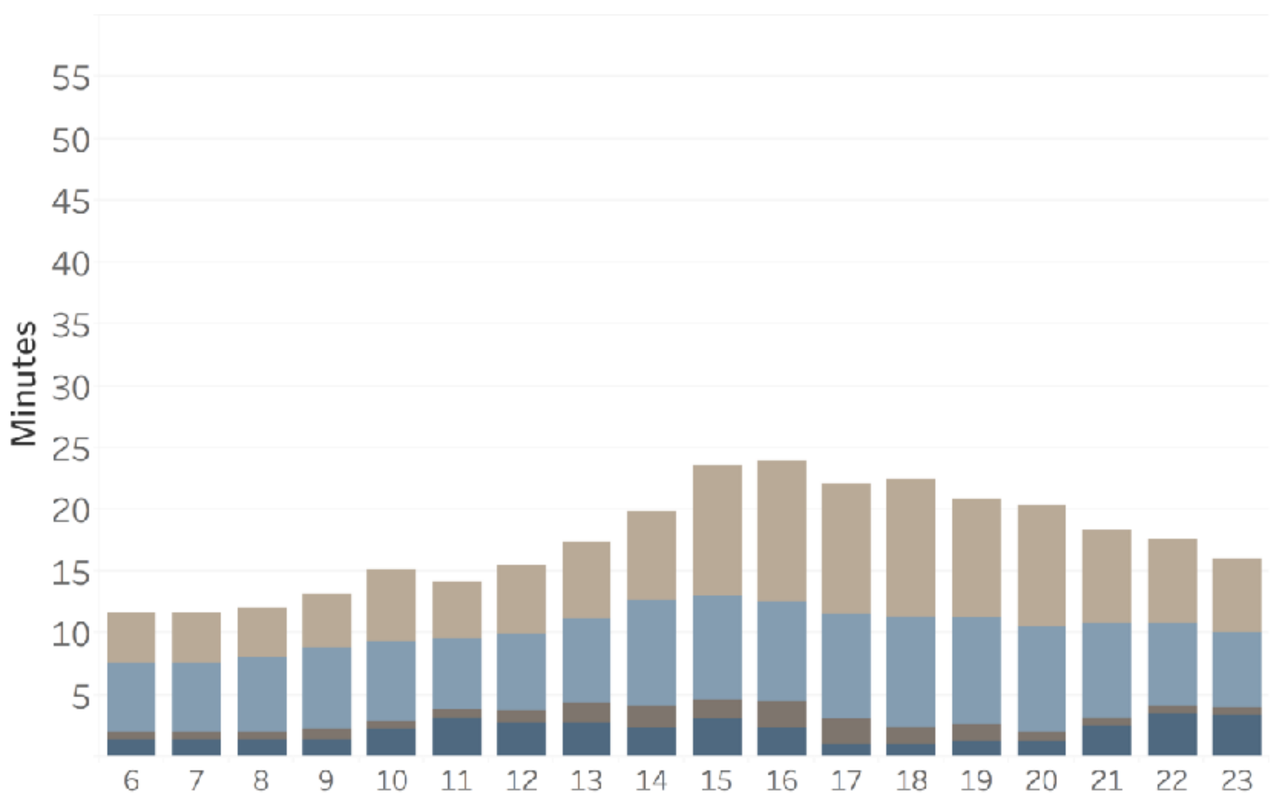
S2

S7: “When I play bridge I use P3 or P4 to **follow conversation** and the game”

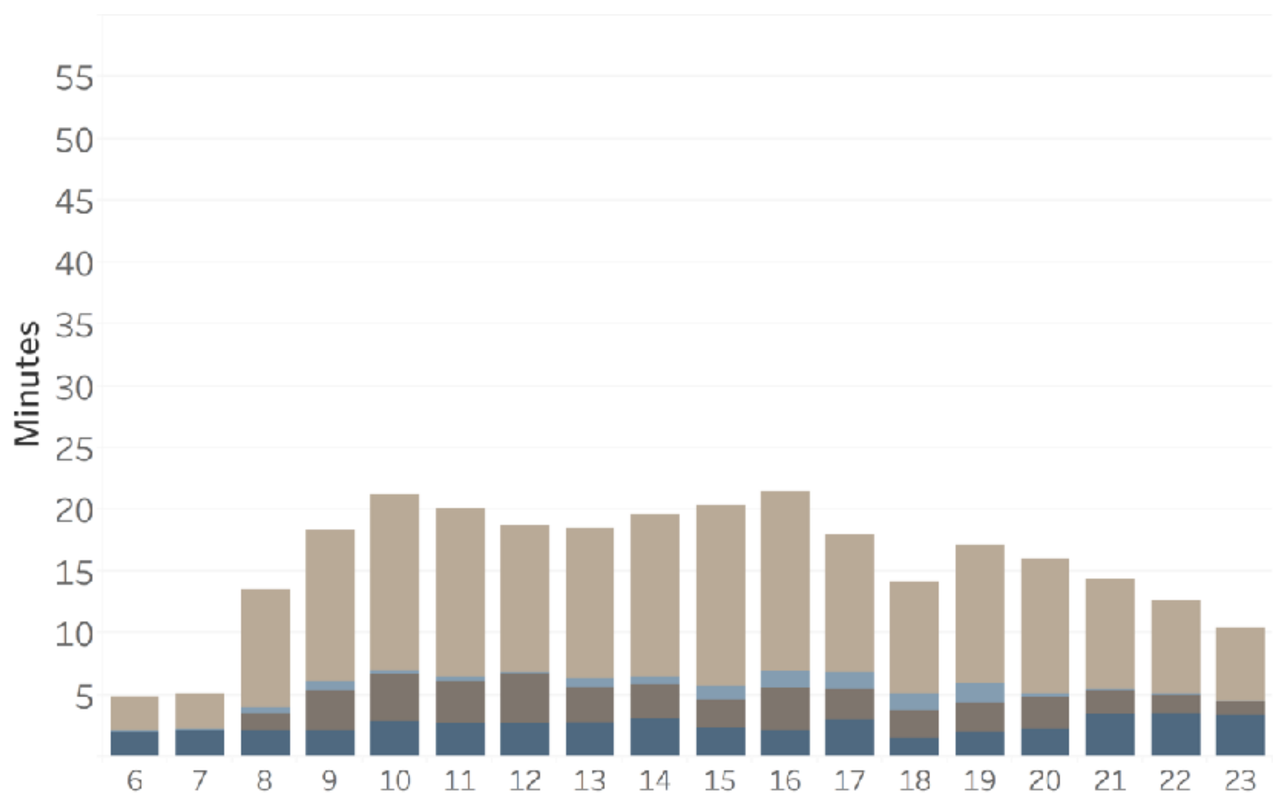
S5: “At work I attend many **meetings**. The hearing aids help me to **focus**.”

Using multiple programs - adapt device?

usage patterns



S7



S5

is there a change in context and behavior i weekends?

S2: “I don’t really need my hearing aids in the **weekends**. **I’m not as challenged**.”

S4: “**Weekends are off time**, so I just leave the hearing aids off.”

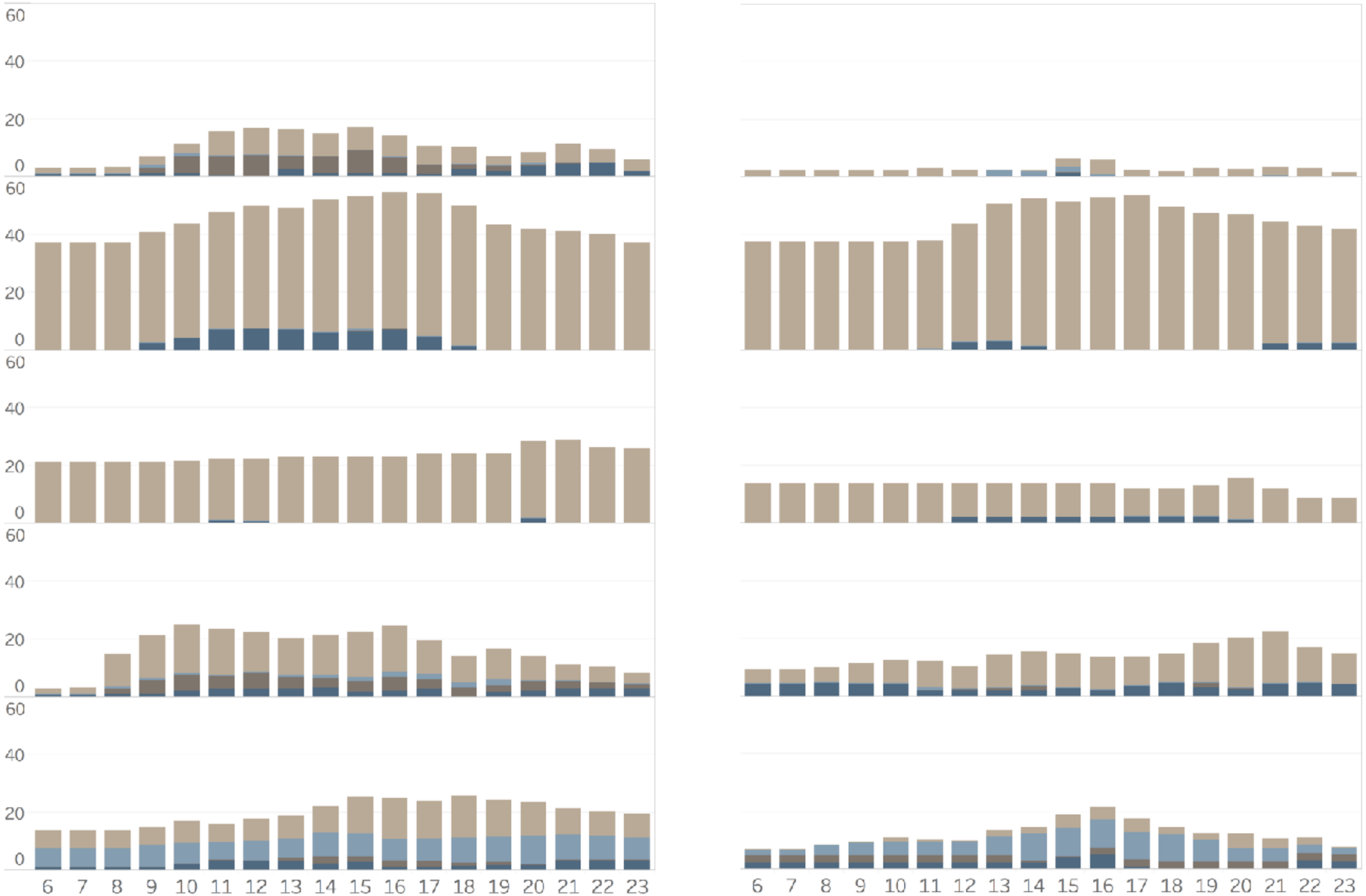
S1

S2

S3

S4

S5

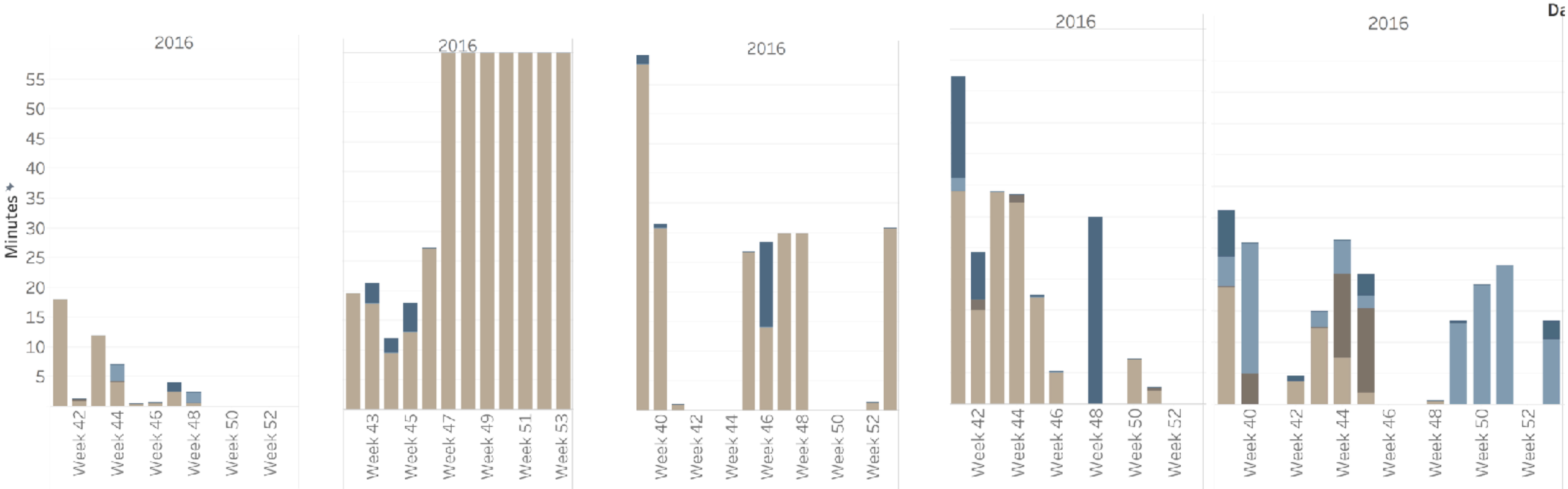


Weekdays

Weekends

how is behavior affected by context over time

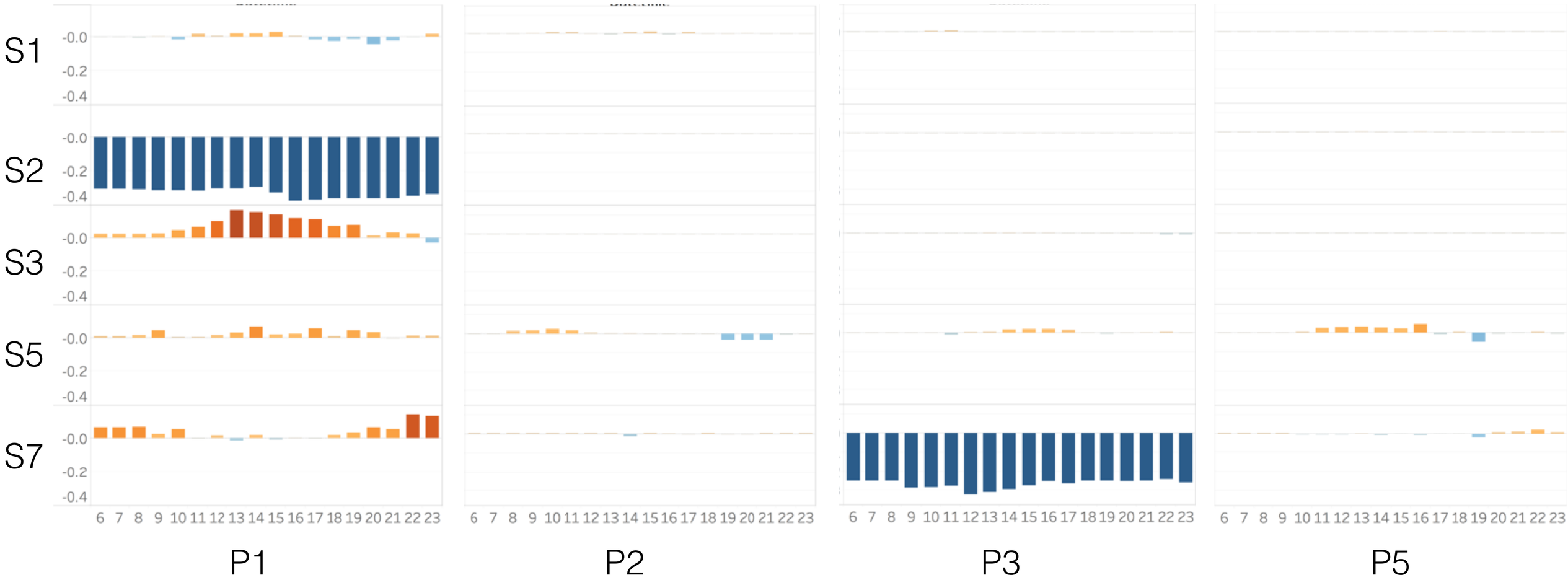
usage patterns - over time



S1 S2 S3 S5 S7

for some users, the volume control helps in zooming in and out

usage patterns - volume



unique behavioral and usage patterns
relates to context and activities
weekends are less challenging

one program **does not** provide **sufficient support** in **changing context**

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