"Revoked just now!": Users' Behaviors toward Fitness-Data Sharing with Third-Party Applications

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Background

- **Wearable activity trackers (WATs)** more and more numerous.
- Life and activity monitoring.
- Risk of malicious and curious usage.
- **Users can share their data** with **third-party apps (TPAs)**.
- Understanding how WAT users share their data will help developing effective **privacy-enhancing technologies (PETs).**
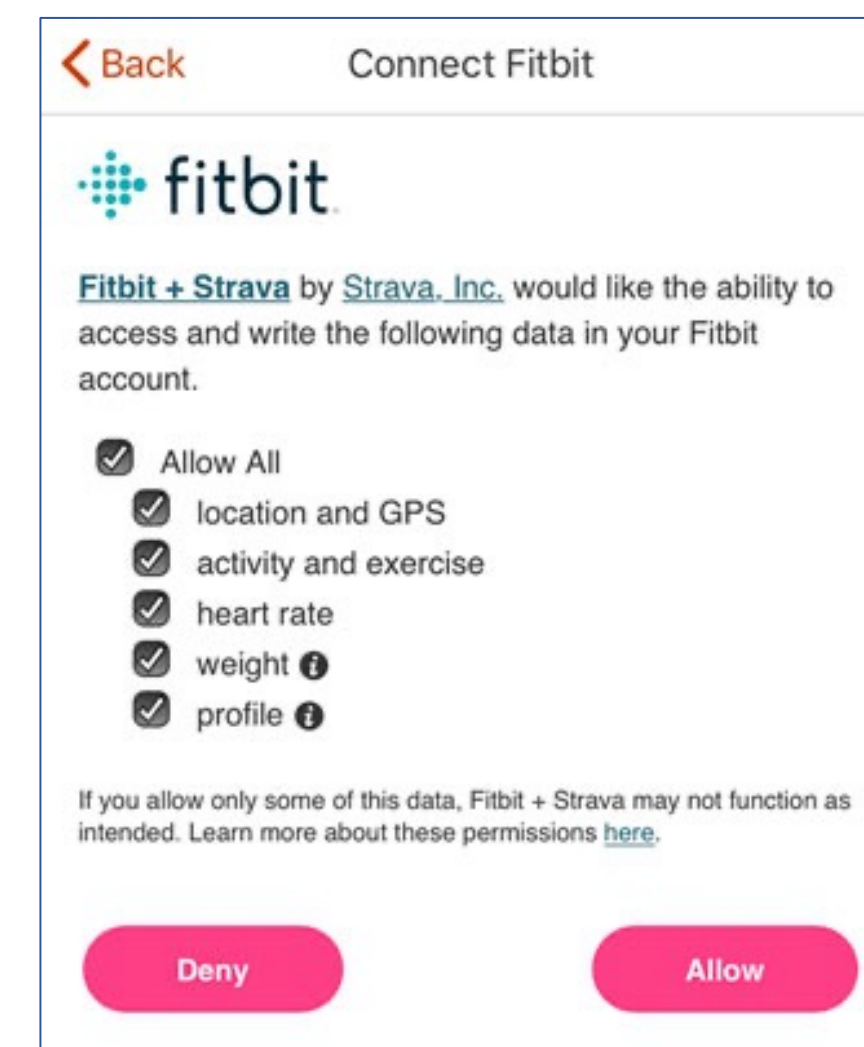
Research Questions

- To what extent and how do **WAT users** use and manage the access of fitness-related TPAs? To what extent are they **aware** of the **data shared** with these **TPAs**?
- To what extent are users **aware** of the availability of their personal information and fitness data on their fitness-tracking **profiles** (data types and visibility/audience)? Which types of data do they **share**, and **with whom**?
- What are users' **attitudes** toward existing and potential (e.g., granular sharing) **PETs** for controlling their fitness data shared with TPAs?
- What are users' **mental models** regarding fitness-data collection and **sharing processes** between WATs and TPAs?

Methodology

Screener Survey
- 2504 WATs users
- 70% are sharing their data with TPAs

Main Survey
- 628 WATs users (sharing with TPAs)
- ♀ 61%, ♂ 37%, ⚧ 2%
- 53%, 38%, 9%

Type of Questions
- Closed-ended questions on WAT usage
- Closed-ended question on data-sharing habits
- Open-ended question on data-sharing habits
- True/False statements
- Drawings

Type of Collected Data
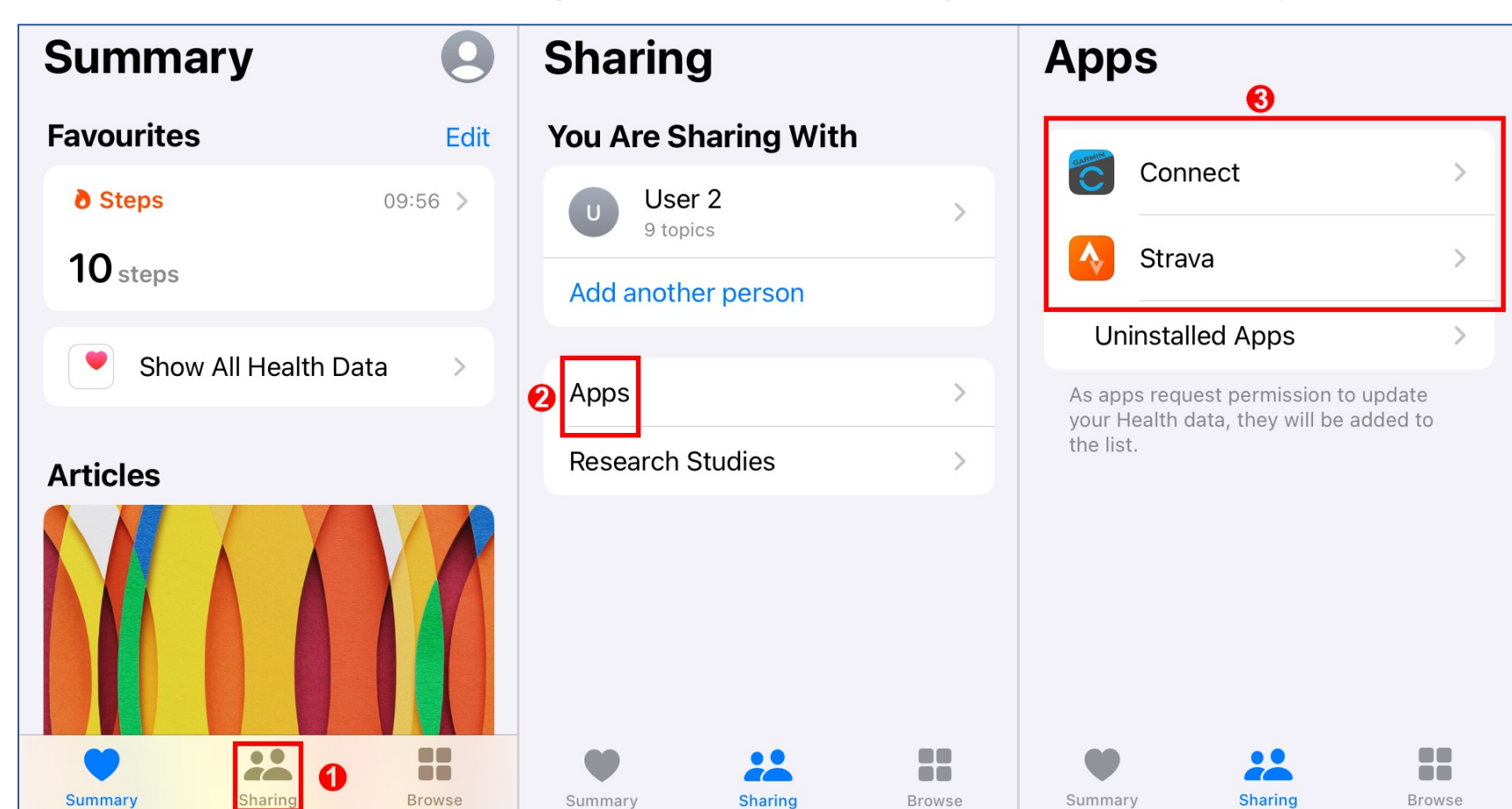- Quantitative
- Qualitative

Data About
- Behavior
- Knowledge & mental models
- Likelihood to use PETS

Beliefs VS Reality
Difference between what users thinks they do and what they *actually* do
- 2 questions
- "By the top off your head…" (beliefs)
- "After checking in the settings…" (Reality)

Results

Sharing with Third-party Apps (TPAs)

According to the difference between the number of TPAs WAT users think they share data with and the number of TPAs they *actually* share data with,

↓ **49%** of the users **underestimate** this number.

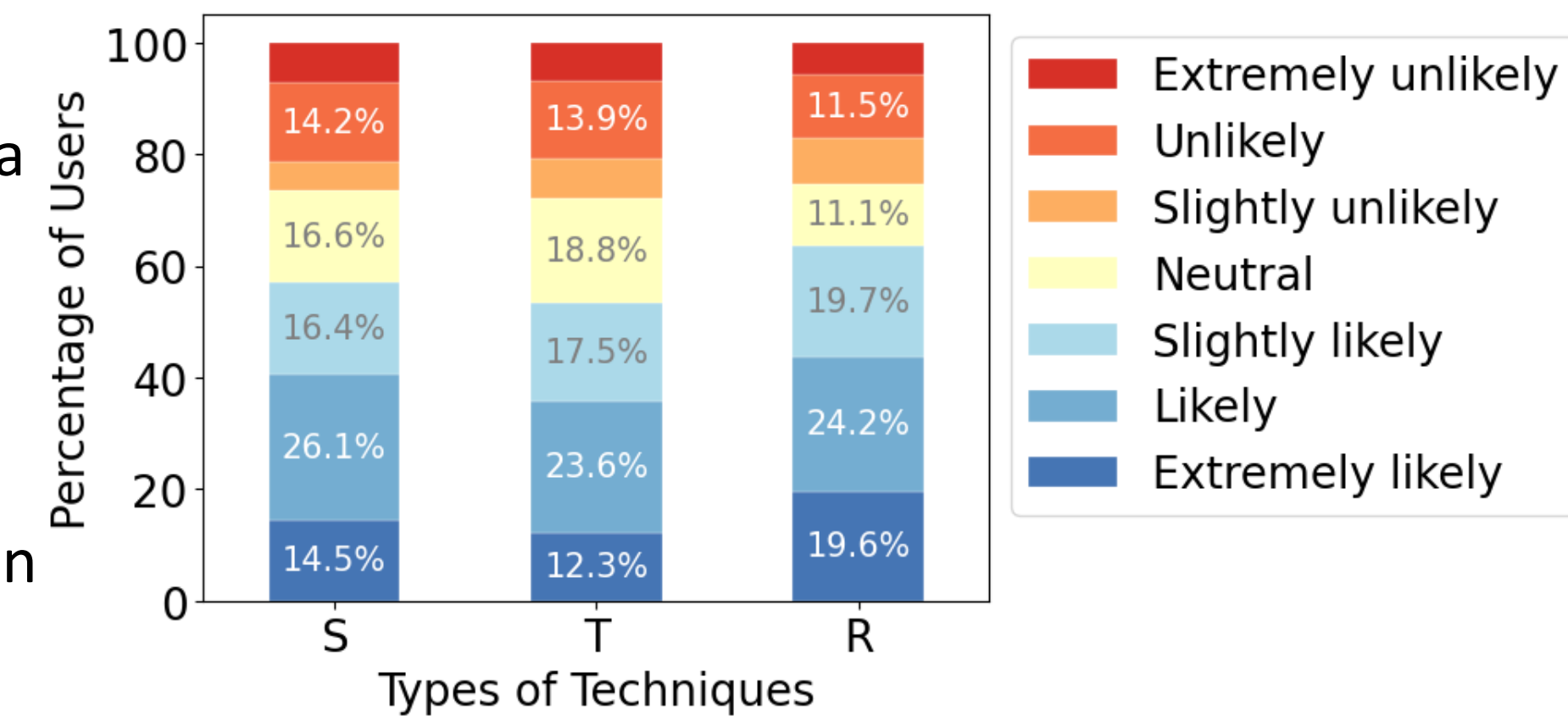

- Most (21%)
- Some (32%)
- All (37%)
- None (10%)
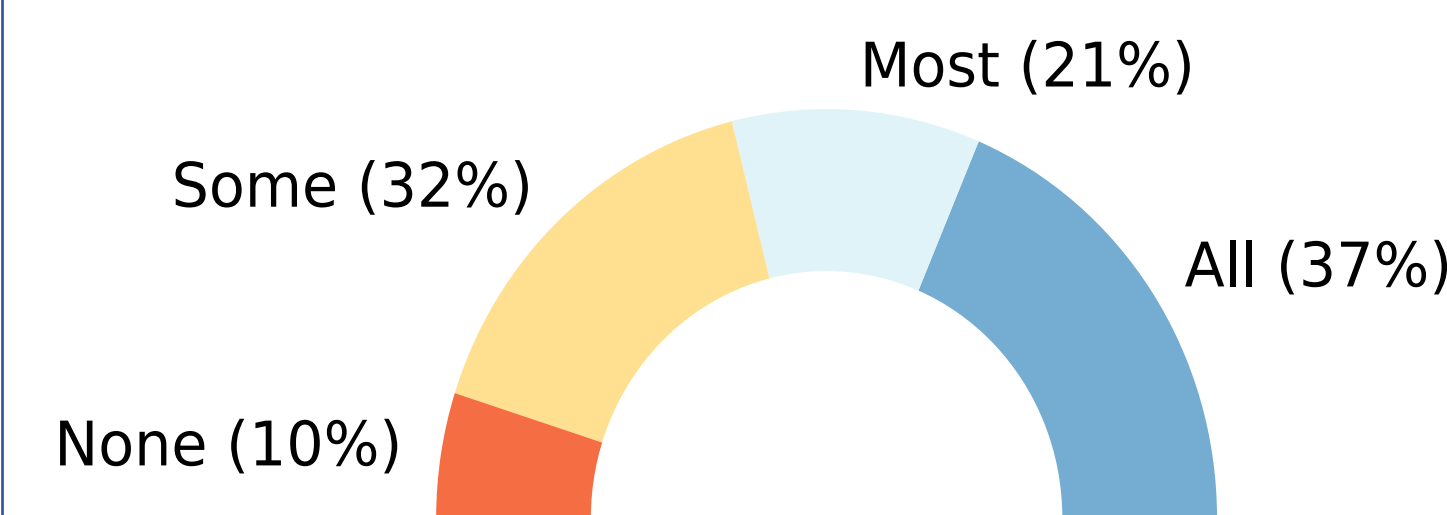
The ratio of respondents who (still) actively use all, most, some, or none of their TPAs show us that **63% of them do not use all** their TPAs.
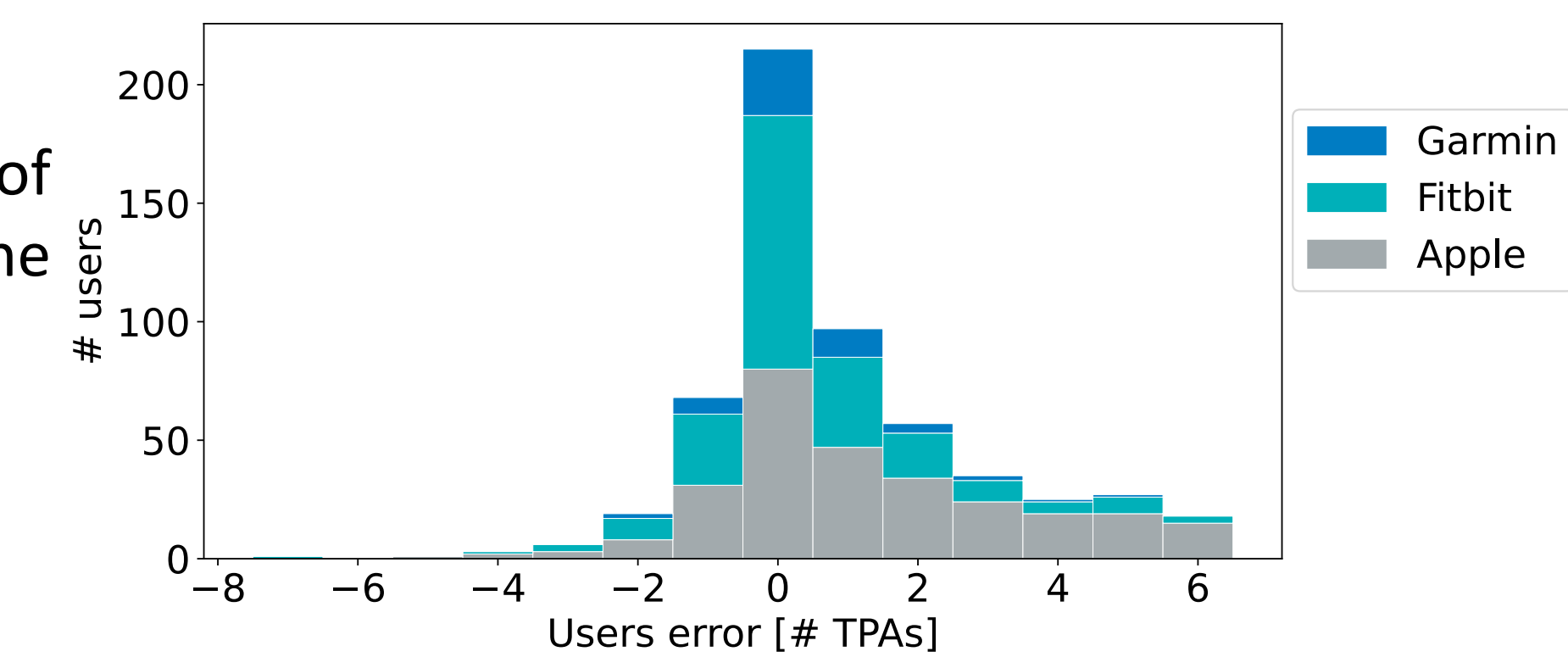
Users Want to Use PETs

- **reducing spatial granularity (S)** of their fitness data (e.g., sharing rounded values),
- **reducing time granularity (T)** (e.g., sharing data aggregated by minutes/hours/days)
- **reminder notification system (R)** to periodically remind users to check their data sharing permission

	S	T	R
Extremely unlikely	14.2%	13.9%	11.5%
Unlikely	16.6%	18.8%	11.1%
Slightly unlikely	16.4%	17.5%	19.7%
Neutral			
Slightly likely	26.1%	23.6%	24.2%
Likely			
Extremely likely	14.5%	12.3%	19.6%

Why Some Users do not Revoked Data-Access of Unused TPAs

30% of them are comfortable to share data (not interested in access management)
29% of them forgot about installed TPAs (might revoke later)
19% of them are not familiar with data sharing and access management

"I forgot and didn't realize the apps had access until completing this survey." [W, 18-29 y.o., Apple]

"I find it troublesome to revoke their access." [M, 18-29 y.o., Apple]

### User's Knowledge & Mental Models (MM)

67% think that TPAs are not able to access the data that was collected before they granted access
62% think that, when the access is revoked, TPAs are still able to access the data collected before

Respondents produced **drawings** to Represent the users's **understanding** about data sharing

✓ 40% were correct ⚠ 4% had missing information ✗ 56% are incorrect

MM examples
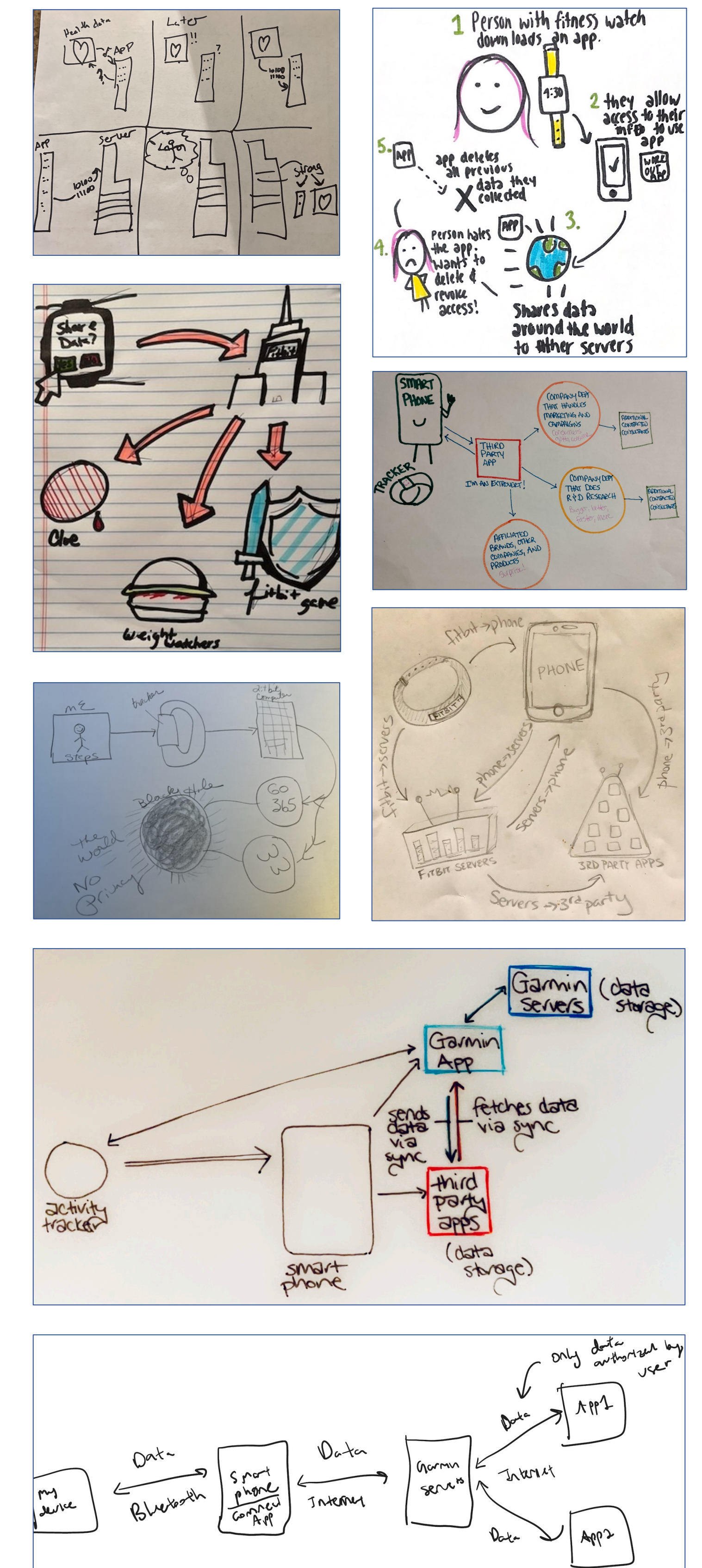
Discussion

A large majority of **WAT users do not completely understand** the actual process of **data sharing with TPAs**. Such a limited understanding could lead to an uninformed user making a decision that could have **serious privacy implications**. For example, a given user could share every type of data, without checking what a TPA actually does, while thinking that no previously collected data would be shared. In this way, the TPA will be able to collect much more fitness data than expected by the user in the first place, and even without their knowledge of it.

Implementation of **PETs**, as well as **transparency-enhancing technologies (TETs)** could be helpful in such case. For example, to help users improve their mental models when using their app, service providers could display visual information as drawings, thus representing where and how the collected data is transferred. Another solution would be to use our results to highlight the most problematic areas and to add information to help users better understand specific points about data sharing. To help the user better manage their data sharing, one could either implement tools to allow data granularity reduction or to periodically remind the user to check their settings. As suggested by our results, such methods are **likely to be adopted by most of the users**.