

# Study design and lessons learned from conducting a four-week app-based diary study in Switzerland

*Caroline Winkler*, Adrian Meister, Basil Schmid, Kay W. Axhausen  
4<sup>th</sup> Mobile Apps and Sensors in Surveys (MASS) Workshop  
June 2023, Manchester, UK



- TimeUse+ was designed to reach a better understanding about how Swiss residents use their time and money. In transport terms, *activity-travel behavior*.
- Transportation researchers rely on travel diaries to collect data. Historically, these are phone interviews covering only a single day, or paper-and-pencil, sometimes for up to a week. A passive tracking approach using GPS is widely popular today.
- Time use research concerns itself with how individuals allocate the finite 24 hours they have each day to different activities. Traditional time use diaries ask participants to jot down what they are doing every 10 minutes, also usually for one weekday and one weekend day.
- In an effort to lessen the burden on participants and to offset some weaknesses of traditional diary studies, passive GPS tracking has become prominent in recent travel diary studies, but have not shown much promise for time use studies.

# Introduction

## TimeUse+

- Habitual behavior and the full variation in a person's movements cannot be accounted for in a single day.
  - Considering one day alone guarantees that certain activities will be under-represented, especially those not taken on each day, like doing laundry. In turn, others will be over-represented
  - Studies suggest at least two weeks of information is necessary to get the full picture of a person's *usual* behavior/it's full extent
  - It's not only about the duration of the activities people perform, but also the timing, spatial variation, other contextual factors, etc. of everything we do, and how these may shift from week-to-week.
    - For instance, work was seen as a rather temporally and spatially rigid activity → COVID-19 changed that

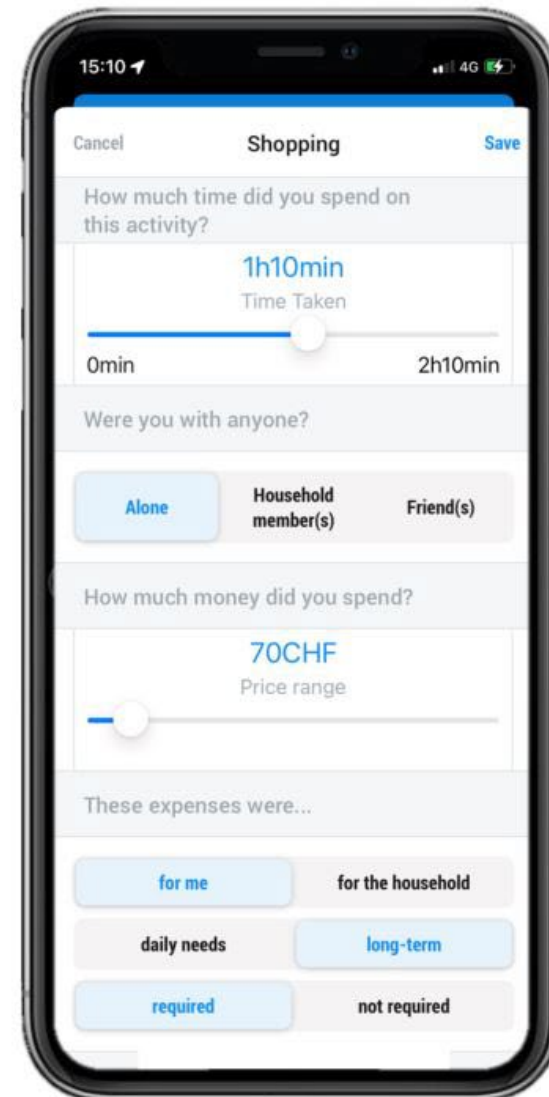
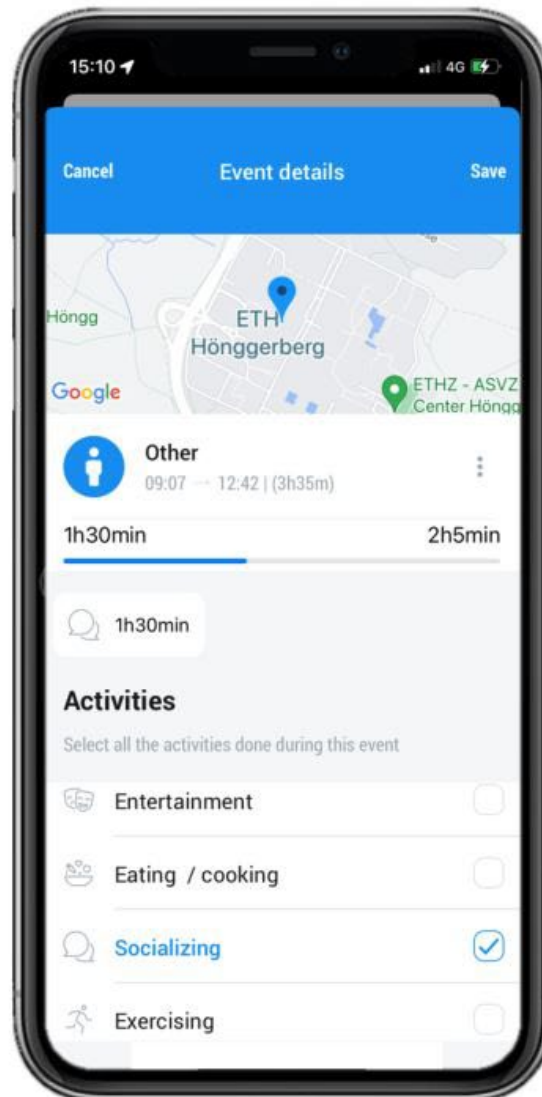
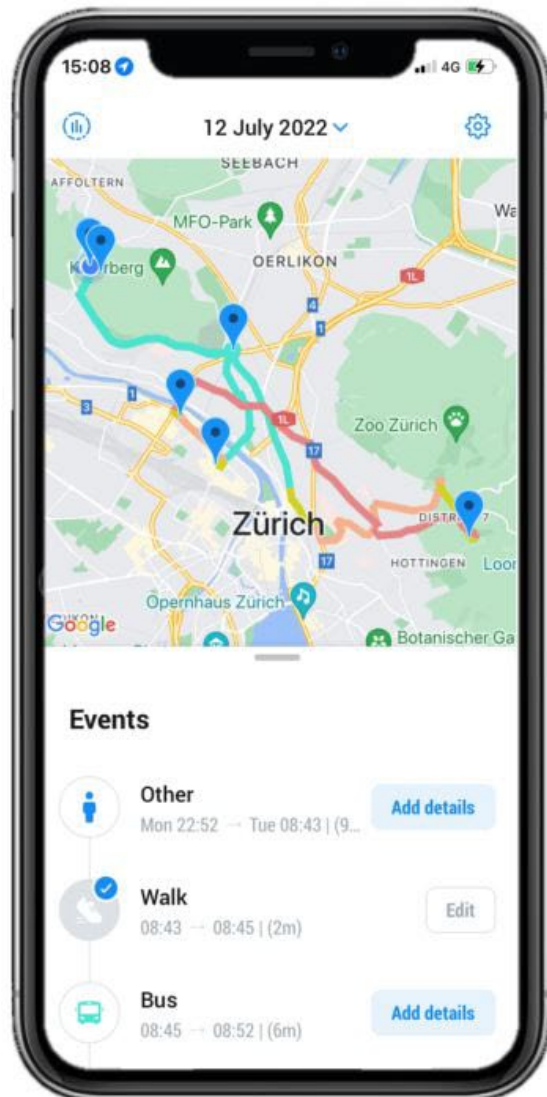
## Method

# TimeUse+

- Just over 63,000 individuals were invited to participate between July 2022 and February 2023 using the Swiss postal service.
- The three major parts of the TimeUse+ study were described:
  - 1. an initial questionnaire (sociodemographic characteristics and mobility tool ownership),
  - 2. a tracking period of four weeks that required participants to validate the passively recorded tracks with activities performed at each location (and while on the move) along with any expenditures,
  - 3. a final questionnaire geared toward long-term expenditures.
- Weekly reports and an in-app statistics screen were used to keep participants engaged along with automated emails that reminded them about their progress.
- Participants who successfully participated in all three parts were promised 50 CHF.



# TimeUse+ app



# Decisions that positively impacted our study: general

- Branding to build trust and providing all relevant materials on one central platform: our website
  - Quick start and validation flyers and onboarding in-app
  - Data protection policy, study manual, and YouTube how-to linked
- Automating milestone tracking: a script run twice daily sent out relevant emails
  - Informed participants on their progress (also avail. in-app)
  - Nudged and eventually kicked out participants who were not validating tracks
  - Used by the research team to track progress
- Having an active four-person team
  - Prepared materials, including canned responses in the ticketing service
  - Large volume of emails dealt with professionally in a timely matter

# Decisions that positively impacted our study: TimeUse+ app

- Developing a smartphone app for both major smartphone operating systems
- Using a smartphone-centric approach with reliable tracking technology from MotionTag
  - Ensured that at least data from GPS tracks would be collected
  - Mixing passive and active data collection allowed us to balance some pitfalls associated with purely objective or subjective data
- Investing time and real-life testing for elements of user interface/user experience
  - Providing the app in three national languages and English
  - Allowing merging and deletion of detected tracks
  - Making changes when necessary to sliders or how data are displayed

# Lessons learned from conducting the TimeUse+ study

- The longitudinal nature of the study makes tracking responses challenging
  - week-long uncertainty about whether someone had dropped out
- People will mostly ignore materials, feedback rated positively, money != motivation
- The assortment of available smartphones on the market complicates everything
- Regarding the app and its development
  - Participants have high expectations for app performance due to familiarity with well-functioning apps
  - Not having a software developer in-house means that
    - You may end up with code that is not well-documented → changes cannot be implemented quickly for next research project to take on
    - You might get ditched mid-project
  - Any large operating system change from Google or Apple could have derailed the



# Lessons learned from preparing the data

- Data from MotionTag are preprocessed and delivered at an event-level (i.e., each tracked movement or place)
- TimeUse+ data have additional rows for each activity reported for a given event. From there, additional processing was necessary because of our:
  - Merging functionality
  - Participants with low-quality data (sanity checks)
  - Time and time zones
- The TimeUse+ data are well-suited for transport research. For time use research,
  - The lack of timing of activities
  - GPS data naturally has missingness
- Application of data for time use analyses is still possible, but requires splitting days (home events) at midnight and filling gaps

# Questions ?

See also:

[www.timeuse.ethz.ch/en/index.html](http://www.timeuse.ethz.ch/en/index.html)

or the related

[www.ivtmobis.ethz.ch/mobis/covid19/en/](http://www.ivtmobis.ethz.ch/mobis/covid19/en/)

And contact me if you'd like to use the data collected or the app's code

Caro Winkler

[Caroline.winkler@ivt.baug.ethz.ch](mailto:Caroline.winkler@ivt.baug.ethz.ch)

# Response rates

<b>Invited persons (N)</b>	<b>63,081</b>
Intro survey (N)	6,856
% of invited	10.87
Qualified (N)	3,859
% of invited	6.12
% of intro completed	56.29
Registered in survey (N)	3,749
% of invited	5.94
% of qualified	97.15
Registered in-app (N)	3,471
% of invited	5.50
% of registered in survey	92.58
Completed final survey (N)	1,329
% of invited	2.11
% of qualified	35.45
% of registered in survey	35.45
% of registered in-app	38.29
% of started tracking	53.55
% of completed tracking	97.51

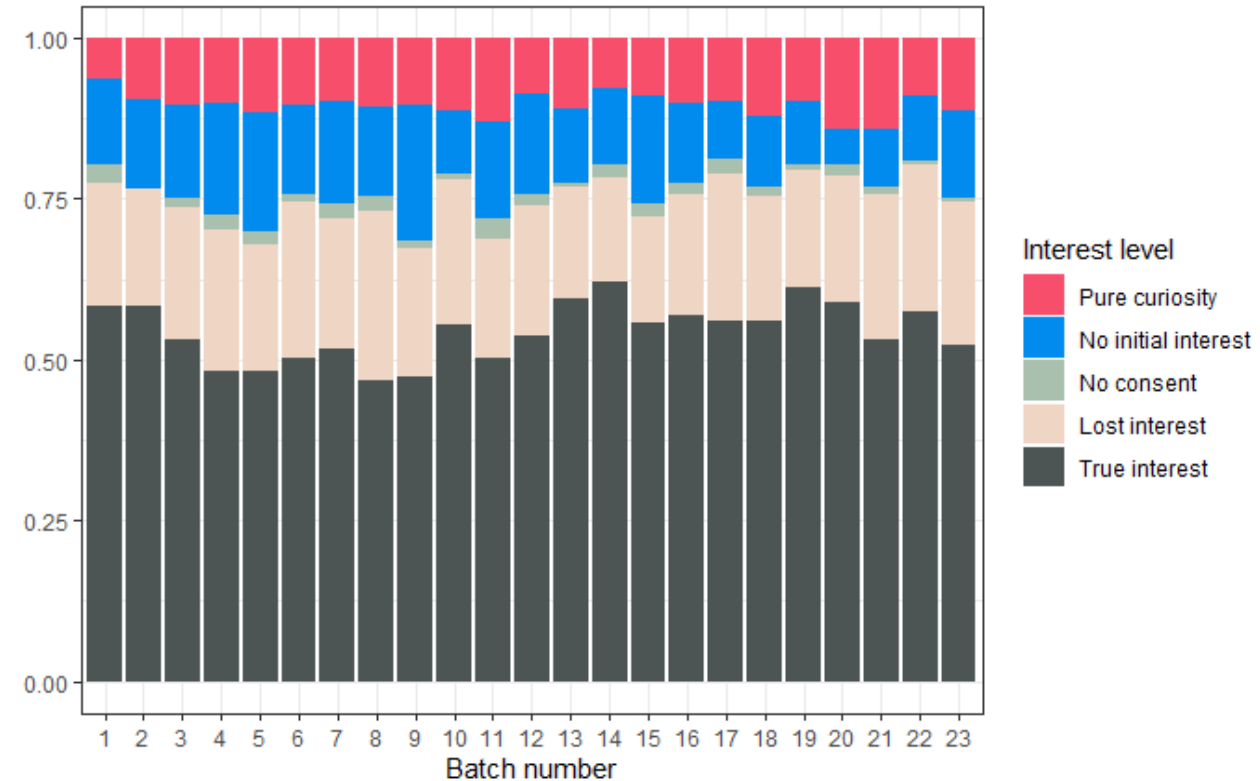


Table 6: Socioeconomic characteristics of main study participants compared to MZMV 2015

Characteristic	Main study, N = 1,330	MZMV 2015, N = 22,022
Sex		
Female	634 (47.7%)	11,296 (51.3%)
Male	696 (52.3%)	10,726 (48.7%)
Age	45.00 (14.34)	51.18 (17.54)
Age group		
18 - 40	527 (39.7%)	6,571 (29.8%)
41 - 55	464 (34.9%)	6,444 (29.3%)
56 - 65	222 (16.7%)	3,678 (16.7%)
66 +	115 (8.7%)	5,329 (24.2%)
Citizenship		
Other	210 (15.8%)	3,868 (17.6%)
Switzerland	1,120 (84.2%)	18,128 (82.4%)
Education		
Low	29 (2.2%)	1,852 (8.6%)
Medium	674 (50.8%)	15,082 (70.3%)
High	625 (47.1%)	4,507 (21 %)

---

### Marital status

Married	714 (53.8%)	12,914 (58.6%)
Single	470 (35.4%)	5,740 (26.1%)
Divorced	103 (7.8%)	2,054 (9.3%)
Married, separated	19 (1.4%)	4 (0 %)
Widowed	13.0 (1.0%)	1,248 (5.7%)
Civil partnership	9 (0.7%)	62 (0.3%)

---

### Occupation

Employed or self-employed	1,040 (78.2%)	14,077 (63.9%)
Retired	112 (8.4%)	5,161 (23.4%)
Other	74 (5.6%)	2,302 (10.5%)
Student	73 (5.5%)	482 (2.2%)
unemployed	31 (2.3%)	-

---

### Workload

1	20 (1.9%)	943 (6.7%)
1 - 2 days	59 (5.7%)	1,044 (7.4%)
2 - 3 days	122 (11.7%)	1,591 (11.3%)
3 - 4 days	194 (18.6%)	1,591 (11.3%)
4 - 5 days	49 (4.7%)	363 (2.6%)
Full time	597 (57.3%)	8,568 (60.8%)
NA	289	7,920



---

## Household Income

4,000 CHF or less	123 (9.3%)	2,665 (12.1%)
4,001 - 8,000 CHF	421 (31.7%)	7,222 (32.8%)
8,001 - 12,000 CHF	420 (31.6%)	4,978 (22.6%)
12,001 - 16,000 CHF	184 (13.9%)	2,202 (10.0%)
More than 16,000 CHF	101 (7.6%)	1,418 (6.4%)
Prefer not to say	79 (5.9%)	3,537 (16.1%)

## Household size

1	201 (15.1%)	4,187 (19.0%)
2	496 (37.4%)	9,053 (41.1%)
3	228 (17.2%)	3,270 (14.8%)
4	310 (23.4%)	3,854 (17.5%)
5 or more	92 (6.9%)	1,658 (7.5%)

# Available data

#	Answer	%	Count
1	I don't want to be tracked	26.37%	347
2	I don't want to receive e-mails	9.73%	128
3	I don't use a smartphone	3.95%	52
4	Other (please specify)	26.29%	346
5	I don't want to provide my personal data	33.66%	443
	Total	100%	1316

For **everyone**: Age, sex, nationality, marital status, household size and age and sex of all household members, residential location type

Reasons for unwillingness for people who showed initial interest

Attrition rates/dates, info on phone type, tracking data, attitudes and values for people who completed the study

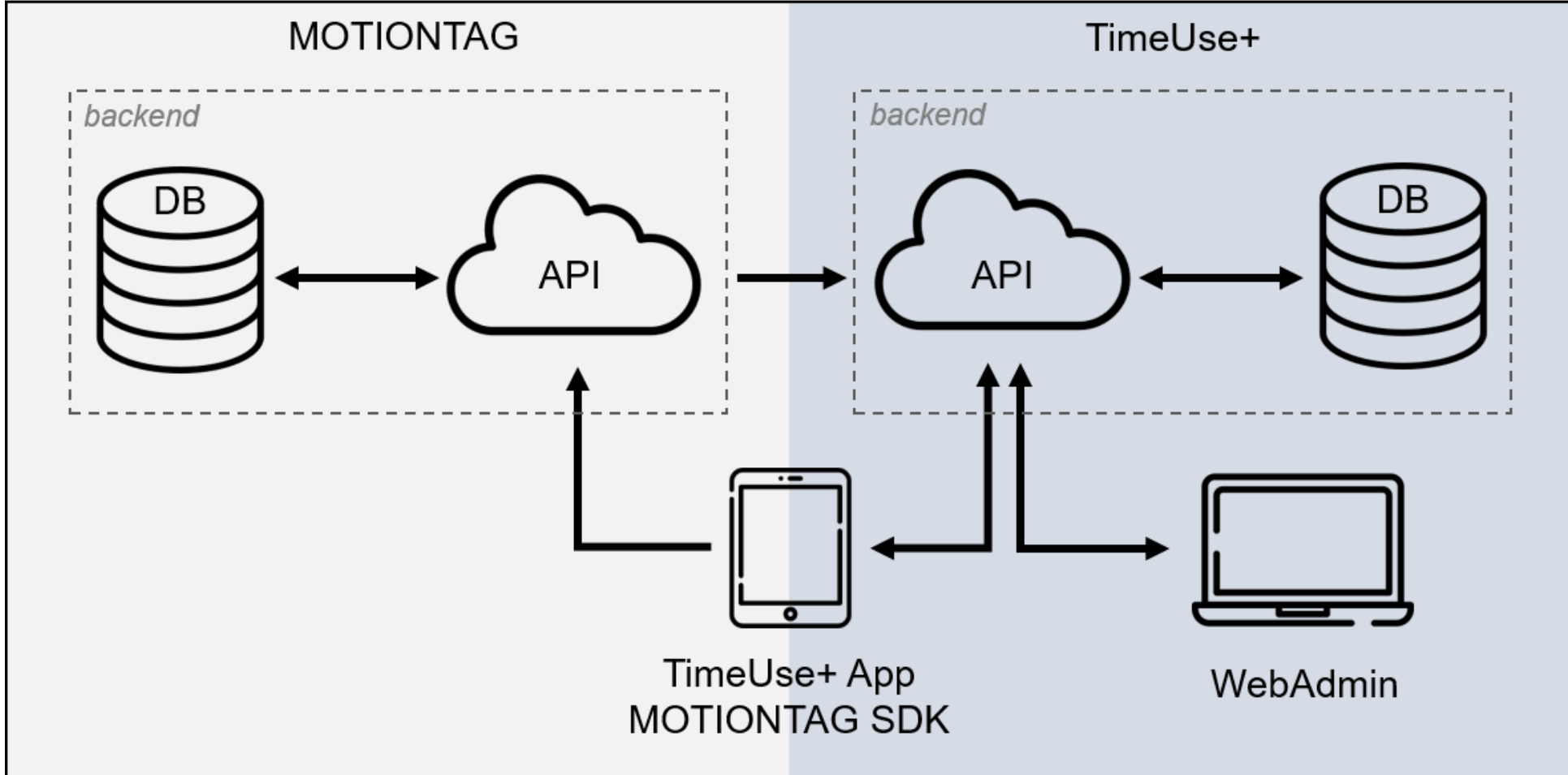


Table 9: Full list of activities

	<b>Simple</b>	<b>Detailed</b>
<b>Home</b>	Sleeping Self-care Eating and cooking Chores Leisure Digital entertainment Working or studying Online Shopping	Sleeping Self-care, Resting Eating and cooking General household work, caretaking Exercising, Socializing, Entertainment Digital entertainment Home-office, Studying Online shopping Other
<b>Other</b>	Shopping Leisure Eating and drinking Waiting Errands Working or studying Overnight stay	Shopping Gastronomy, Entertainment, Socializing, Exercising Eating and cooking (without expenses) Waiting Errands, Caretaking, Person pick up/drop off, Package pick up/drop off Coworking, Studying Sleeping, Resting, Self-care Other
<b>Work</b>	Working Other	Working Other

# List of materials

## FAQ

Erhebungszweck

### Was sind die Ziele der Studie?

Ziel ist, neue Erkenntnisse zu gewinnen, wie Transportsysteme in städtischen Agglomerationen der Schweiz verbessert werden können: Wie kann Mobilität effizienter werden? Was erwarten Leute von Transportsystemen? Wie verändert die zunehmende Digitalisierung des Alltags die Nutzung von und die Ansprüche an Transportsysteme? Weitere Informationen finden Sie im Kapitel 9 der [Anleitung](#).

### Warum ist es wichtig, Daten über Zeitverwendung zu erheben?

### Wer führt das Projekt durch?

### Wie lange dauert die Studie?

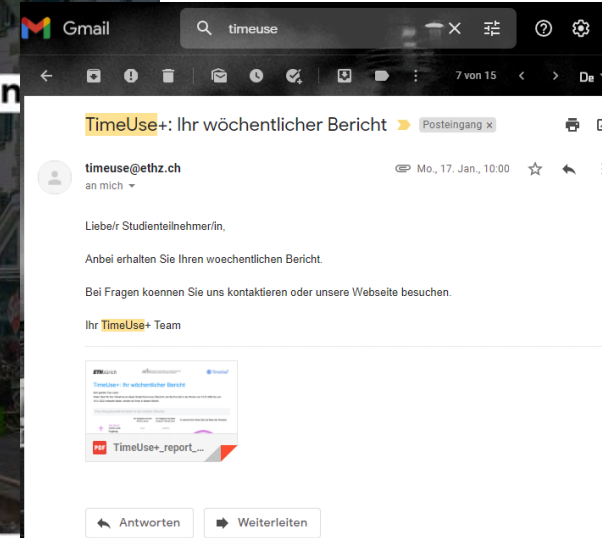
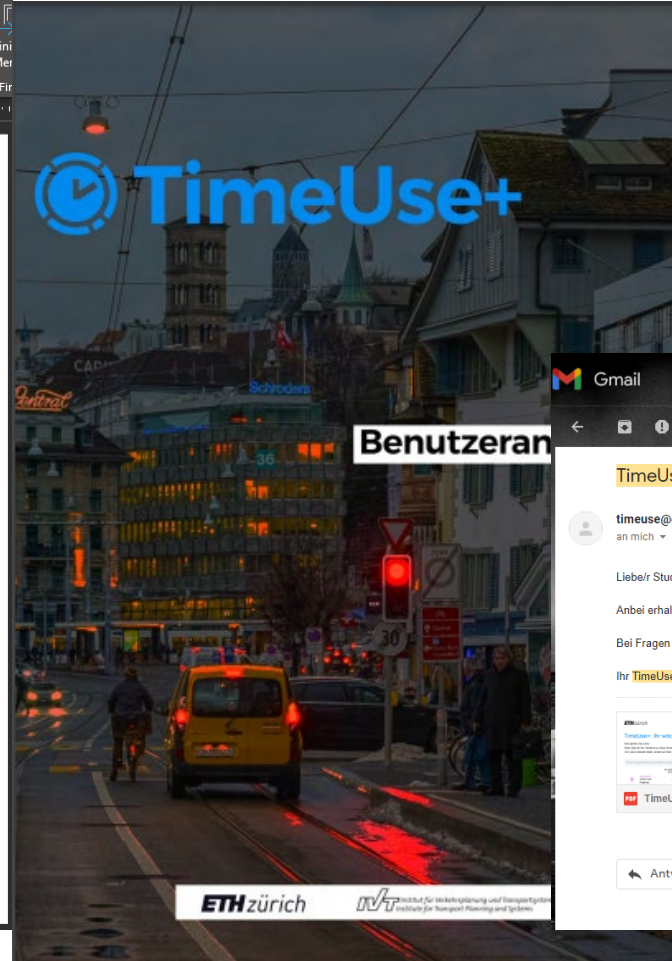
### Wer finanziert die Studie?

### Wie kann ich an der Studie teilnehmen?

### Welche Kriterien gibt es für die Teilnahme?

### Welche Daten sammelt die App?

### Wozu werden diese Daten gesammelt?





# List of materials



Wurden Sie eingeladen, an unserer Studie teilzunehmen?

## Fangen Sie an!

Befolgen Sie diese drei simplen Schritte und fangen Sie noch heute mit dem Tracking an! Vergewissern Sie sich bitte, dass die unten aufgeführten Geräteeinstellungen korrekt sind.



### 1. App Installation



Suchen Sie im Play Store nach **TimeUse+** und **installieren** Sie die App

Halten Sie Ihren Einladungsbrief bereit, denn Sie benötigen den dort angegebenen **Registrierungscode**, um fortzufahren



### 2. Registrierung



Öffnen Sie die App und geben Sie folgendes ein:

- E-Mail**  
beispiel@swissmail.com
- Passwort**  
Mindestens 6 Zeichen
- Registrierungscode**  
Den Sie von uns per Brief erhalten haben

**Probleme? Kontaktieren Sie uns**  
timeuse@ethz.ch

### 3. Anmeldung und Einstellungen

Nach der Registrierung können Sie sich nur mit Ihrer E-Mail und Ihrem Passwort anmelden. Wenn Sie sich zum ersten Mal anmelden, **ist es sehr wichtig, die richtigen Einstellungen zu wählen:**

#### Standort

Ihr iPhone wird nach der Erlaubnis fragen die Standort-Daten zu nutzen



Wählen Sie **Einmal erlauben**

Lassen Sie die GPS-Funktion eingeschaltet und vermeiden Sie den Flugmodus

#### Mitteilungen

Damit halten wir Sie auf dem Laufenden Stand



#### Physische Aktivität

Die Einstellungen werden manchmal bereits durch die App getätigt. Bitte gehen Sie in Ihre Einstellungen und prüfen Sie, ob der Zugriff erteilt wurde. Falls nicht, erteilen Sie bitte den Zugriff auf:

**Einstellungen > Datenschutz > Bewegung & Fitness einschalten**



**FAQs Anleitungen anschauen!**  
timeuse.ethz.ch



## Validieren Sie Ihren Tag!

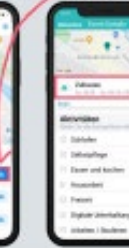
### 1. Wählen Sie auf den Kalender einen rot markierten Tag aus



Es wird eine Übersicht über diesen Tag angezeigt. Dort können sie Events auswählen und validieren



### 2. Wählen Sie ein Event aus und fügen Details hinzu



Ändern Sie den Ort oder das Verkehrsmittel  
Wählen Sie aus alle Aktivitäten die Sie durchgeführt haben

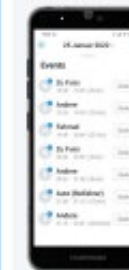
### 3. Angaben zu jeder Aktivität



- Dauer**
- Waren Sie mit jemandem zusammen?**
- Ausgaben**
- Zweck der Ausgabe**
- Gemeinsamer oder individueller Verbrauch?**  
Für den Haushalt umfasste Waren, die für die Familie oder die WG gekauft werden
- Wiederkehrend oder gelegentlich?**  
Mögliche Bedarf sind wiederkehrende Ausgaben zur Deckung des physischen Bedarfs (z.B. Lebensmittel, Kleidung), Costas, Sportausstattung. Urlaub sind gelegentliche, einmahlige Ausgaben
- Optional oder unwesentlich?**  
Unwesentliche sind Daten zur Deckung des physischen Bedarfs, nicht-erforderliche- und kostenintensive Ausgaben bzw. unwesentlich  
\*Wichtige Strichen Sie in der Anleitung\*

**Speziellere eben rechts**

### 4. Wiederholen



Klicken Sie auf jedes der angezeigten Events an und wählen Sie **Details** oder **Ändern**

Kurze Events brauchen keine Validierung (1 bis 5 Minuten)

Das blaue Häkchen bedeutet, dass das Event erfolgreich validiert ist

**Weitere Informationen finden Sie in unserer Anleitung**

### Gut zu wissen

Ohne Ihre **Validierung** sind die gesammelten Daten für unsere Forschung nicht nutzbar. Wir empfehlen Ihnen, Ihre Daten **Jeden Tag zu validieren** damit diese so vollständig wie möglich sind.

Besuchen Sie [timeuse.ethz.ch](http://timeuse.ethz.ch)



# List of materials

Material	Medium	Wo/Wann/etc
Einladungsbrief	Physical letter sent by mail	Erste Kontaktaufnahme; enthält persönlichen ID-Code
Einleitende Umfrage	Web-Umfrage	Qualtrics
TimeUse+ app	App in zwei Stores verfügbar	Registrierung nur mit ID-Code
Umfrage Langfristige Ausgaben	Web-Umfrage	Qualtrics
Automatisierte E-Mails	Email	Wiederkehrend: Skript auf dem Server läuft zweimal täglich
<a href="mailto:timeuse@ethz.ch">timeuse@ethz.ch</a>	E-Mail für persönliche Kommunikation; in <i>Freshdesk</i> erstellte Tickets	Das TU+ Team kontrolliert und antwortet kontinuierlich in diesem Kanal
Anleitungen (EN/DE)	PDF	Timeuse.ethz.ch
FAQs	In-App und auf der TU+ Website	App/ timeuse.ethz.ch
Flyers: Quickstart & Validierung	PDF auf der TU+-Website und Versand per automatisierter E-Mail als Anhang	
Berichte	Email	Lead UI, wöchentlich am Montag
Video	Youtube and shared link	E-mail communication

# Automated email communication

Email number	Content	Trigger
1	App not activated, please download the app	1 day after filling out first survey
2	Thank you for in-app registration/activation, twin code and invite (+Flyer Quick Start)	Participants registered in the app. Day of registration
2.1	Tips and tricks for using the app: change event location, mode of transport, expenses over 200 Swiss Francs, and meaning of validation (+website link)	Sent once one day after email 2
3	Tracking not started	App registered but no events tracked after 3-4 days of no tracks
4	Tracking stopped	Tracking started but no events for 3 days no new tracks
5	End of the study - Successful	30 days tracking with validation >70% Includes personalized link to final survey
6	Validation reminder 1 - Friendly	20% < current validation < 70% (once a week, one day before reports) every 6th day- until next step happens
7	Validation reminder 2 - Serious	current validation < 20% (once a week, one day before reports)
8	End of study - more validation required (blind reminder)	30 days tracking with validation <70%
9	Kick out	Validation reminder 3, validation < 70% sent 2 days after mail 8

\*6 and 7 are ORs. You get one or the other.