Discussion paper

A smart Travel Survey Results of a push-to-smart field experiment in the Netherlands

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Content

Summary

Travel Surveys are considered promising candidates to go 'smart'. Respondents need to be both motivated and competent to correctly report all details of their travels for a specified time period. Location tracking offers options to remove burden and to improve quality of measurement. Adding contextual information, the collected location data may also be input to predictions of travel mode and travel purpose. However, location tracking may be perceived as privacy-sensitive by respondents. Furthermore, location data are subject to various types of error that (in part) can only be adjusted for with the help of respondents. It is, therefore, not evident that the promise of smart features will hold in practice. For this reason, Statistics Netherlands conducted a first field test in 2018 using a proof-of-concept travel app. Response rates clearly showed variation across relevant subgroups in the population, but were sufficiently high to justify further development and experimentation.
In 2022, Statistics Netherlands again fielded a travel-app assisted experiment, but this time including the regular online Travel Survey as a concurrent option. A population sample was offered the online option at different time points. These time points were randomized across the sample. Simultaneously, also the requested tracking period, one full day or one full week, was randomized.
In this paper, we discuss the design and outcomes of the field experiment. We focus on response and representation. Measurement data quality and the in-app behaviour of respondents are studied and reported in separate papers. Our main conclusion is that the concurrent option had a backfiring impact on response and needs to be introduced differently. Response was much lower than the 2018 field test and the regular 2022 Travel Survey using only the online questionnaire.

Keywords

Smart surveys, Location tracking, Mobility, Push-to-smart data collection strategy

1. Introduction

Smart surveys employ the features of smart devices in collecting and/or processing of data. These devices are particularly promising for surveys that are (cognitively) burdensome, demand for detailed knowledge or recall, or include topics for which questions provide weak proxies such as health or living conditions. Travel surveys are typical examples of surveys that satisfy these criteria. This has been recognized early on in travel survey research. Over the last decade a wide range of studies into sensor-assisted travel surveys have been conducted (e.g. McCool, Lugtig and Schouten 2021, Faghih Imani et al 2020, Gillis, Lopez and Gautama 2023 and Lawson et al 2023). Studies into the use of an app-assisted approach including location tracking started in 2017 at Statistics Netherlands. The aim is to supplement data collection options in general population travel and time use surveys. This paper reports the findings of a second large-scale field test employing an app-assisted approach for general population samples.

While promising from a measurement perspective, the potential of increased survey participation rates by a reduced burden has yet to be demonstrated. The reasons are clear, in part. Survey response is not just about burden; it is also about making contact, respondents feeling sufficiently competent and respondents being sufficiently motivated. Offering a smart option does not necessarily remove these reasons. An app-assisted location tracking approach demands some minimal digital skills. Also location tracking data are subject to error (e.g. Harding et al 2021, McCool, Lugtig and Schouten 2022, Klingwort et al 2024) that cannot (fully) be adjusted for without the help of respondents. Finally, location tracking leads to microdata that have a surplus of information relative to survey output needs. As a consequence, respondents may perceive the detailed data as too privacy sensitive. Evidence for these hesitations and perceptions can be found in Assemi et al (2018), Struminskaya et al (2020), Klingwort and Schnell (2020), and Lunardelli et al (2024). All in all, willingness to go smart may be the Achilles heel of smart travel surveys. Therefore, effective, nudge-to-smart recruitment and motivation strategies are paramount. These considerations have been major drivers behind the follow-up field test.

Various experimental studies have evaluated the design features of potentially effective recruitment and motivation strategies. We refer to Maruyama et al (2015), Safi et al (2017), Faghih Imani et al (2020), McCool, Lugtig & Schouten (2021) and Winkler et al (2023). The 2018 Statistics Netherlands first, proof-of-concept study, based on a general population random sample and a cross-platform app, attained registration rates of around 25% and seven-day completion rates of around 20%. The study randomized different incentive strategies. The registration rates were only slightly lower than the traditional one-day web diary used in the regular Travel Survey. Consequently, the rates were deemed sufficiently high to justify further research into effective data collection strategies and into trade-offs in active-passive involvement of respondents.

Between November 2022 and February 2023 a second large-scale field test was conducted by Statistics Netherlands. The cross-platform app had been completely redesigned. The new app ('CBS Onderweg in Nederland') included several options for respondents to edit automated stop-track segmentations that were shown to them during the diary reporting period. In the experiment, three design features were randomly varied: the length of the reporting period (one day or seven days), the amount of respondent editing (full editing or limited editing) and the offering of the web diary as an alternative (direct at invitation, at first reminder or at second reminder). In particular, the last experimental condition was considered very promising in learning how to optimize or tailor the recruitment strategy.

In this paper, we describe the outcomes of the 2022-2023 experiment in terms of height of response rates and variation of response rates across population subgroups relevant to travel statistics. Our goal is to come to an effective recruitment and motivation strategy. We, therefore, study three research questions:

1. How does length of reporting period affect participation?
2. How does mixing modes affect participation?
3. How to converge to an effective data collection strategy?

In the analysis and discussion, we make a distinction between registration and completion. The definition of completion is, however, not trivial as respondents had to perform several tasks during the diary period and they were able to skip some of those. We make relatively pragmatic decisions about what we perceive as completion that need to be refined for actual implementation. We study representation by linking a range of administrative variables to the field test sample.

We need to note in advance that the 2022 travel survey app did suffer from some technical issues for specific brands/models of smartphones. As a consequence, drop-out of the study was in part caused by low data quality. Again, we will make pragmatic choices when studying completion versus registration.
In parallel to this paper, other papers were produced based on the 2022-2023 study. These papers investigate data quality/validity (Klingwort, Gootzen, Remmerswaal and Schouten 2024), location data handling (Gootzen, Klingwort and Schouten 2024) and respondent editing actions (Remmerswaal, Lugtig, Schouten and Struminskaya 2024 and Remmerswaal et al 2024).

This is the outline of the paper: We describe the design of the 2022-2023 field test in Section 2. In Section 3, we discuss the technical issues and decisions that we made in the analyses. We then move to discussion of the research questions in Section 4. We end with discussion and next steps in Section 5.

2. Design of the 2022-2023 app-assisted field test

The field test consisted of two main parts, the app-assisted main mixed-mode travel survey (MMTS) and a follow-up online evaluation survey (ES). We describe the main design features of the two surveys in the following subsections.

2.1 Design of the MMTS

We start with the MMTS design. Random samples from two different target populations were drawn:

– Follow-up sample: A sample of former participants in the regular 2022 Travel Survey (sample size n=667) was drawn. Higher inclusion probabilities were assigned to participants who reported multi-modal trips and/or many trips in sequence in the regular online diary. Respondents were asked to use the travel app for a week and, in addition, to fill out the regular online web questionnaire once more for one specified day in this week.
– New sample: A simple random sample of the Dutch population of 16 years and older (sample size n=2544) was drawn.

The follow-up sample was included to study location data quality and stop-track segmentation validity. This sample will not be studied here, but is evaluated in Klingwort et al (2024). Here we will focus on the new sample.

Three experimental conditions were randomized across the sample:

1. Reporting period: An experiment with the number of participation days was conducted: Half of the respondents were invited to participate in the app for one day, the other half were invited to participate for one week. The one-day group was, however, told that they did not have to stop after the first full day and could continue up to a full week.
2. Concurrent online questionnaire: An experiment with the timing of offering the online questionnaire was conducted. Respondents were offered the option to fill out the online questionnaire instead of using the app a) directly in the invitation letter, b) in the first reminder letter, or c) in the second reminder letter. The invitation letter for the first reminder condition and the invitation letter and first reminder letter for the second reminder conditions did not mention the concurrent online questionnaire option. They were thus much shorter.
3. Editing options: An experiment was added concerning the amount of editing respondents were invited to do (and were able to do). One half of the sample had full editing options and one half had limited editing options. Full editing included: adding stops or tracks, deleting stops or tracks, changing start and end times of stops and tracks, labeling travel modes and labeling travel purposes. Limited editing restricted options to deleting stops and tracks and labeling.

The three conditions were crossed, leaving us with 12 different subsamples. Table 2.1 presents all new samples (columns 5 and 6) and the follow-up sample (column 4). The follow-up sample had a seven-day reporting period and full editing.
A practical motivation for aiming at a seven-day reporting period is the choice of reference day. In a one-day (or few days) setting, the reference day typically is randomized. This is done to prevent that all respondents prefer certain days of the week or choose days on which they travel only. The communicated reference day may, however, not be noticed by respondents or they may have forgotten it when starting the survey. In the MMTS, each day of the week was randomly set for the one-day group and for the online questionnaire, i.e. each day had a subsample of size 363. The assigned reference day was communicated in invitation letters and reminder letters. The seven-day group could start any day of the week. For the concurrent option in the seven-day group, consequently, the letters were relatively complex and long; they had to give different instructions dependent on the mode. In addition, when opening the app and registering, the user interface (UI) would always show the upcoming seven days for reporting. The one-day sample was instructed that participants can ignore days beyond the first full day but were welcomed to continue for a full week. The highlighted week in the app UI did not start at the specified reference day for the one-day group. This flaw in the design may have caused extra confusion. Very few respondents, however, contacted Statistics Netherlands about this discrepancy. For these reasons, we ignore the starting day in the analyses.

Table 2.1: Overview of samples and experimental conditions in MMTS.

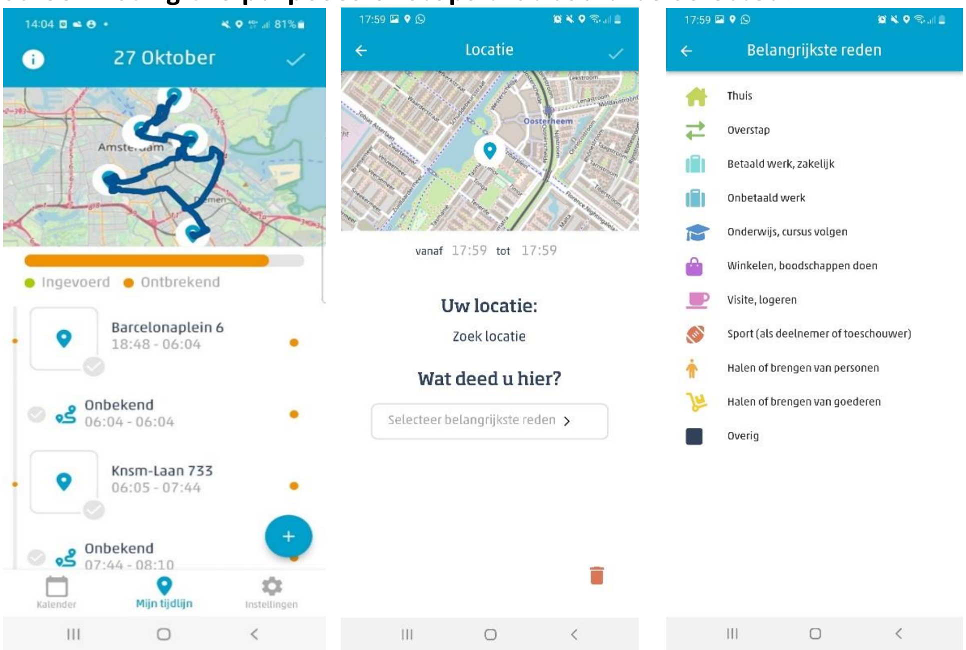
App & questionnaire	Location tracking	Timing of questionnaire	Full editing		Limited editing
			FOLLOW-UP SAMPLE	NEW SAMPLE	NEW SAMPLE
YES	Seven days	Invitation	667		
NO	One day	Invitation		212	212
NO	Seven days	Invitation		212	212
NO	One day	1st reminder		212	212
NO	Seven days	1st reminder		212	212
NO	One day	2nd reminder		212	212
NO	Seven days	2nd reminder		212	212

The MMTS employed incentives. Conditional incentives of 10 Euro gift vouchers were given to those respondents that used the app, regardless of the assigned reporting period length. Respondents that opted for the online questionnaire participated in a lottery of an iPad. They were informed when submitting the questionnaire whether they had won.

The regular travel survey (TS) consists of a relatively small number of introductory before moving to the one-day diary and and a series of background questions asked after the diary is completed. The online questionnaire in MMTS was exactly the same as for the TS. However, the in-app introduction questionnaire in MMTS was only a condensed version. Like in the TS respondents were asked per reporting day whether travel was as normal (trajectory, times, transport modes) or not. If not, respondents were invited to indicate what was different from normal days.

Figure 2.1 shows a number of screenshots of the MMTS app. Underlying to the app was an automated stop-track segmentation algorithm. Location points were clustered within stops based on radius and duration parameters. Missing location data time slots were displayed in shaded colours. Details on stop-track decision rules can be found in Klingwort et al (2024).

Figure 2.1: Screenshots of the MMTS app: First screen with daily stop-track segmentation, second screen for adding a label to a stop location and third screen listing the purposes of stops that could be selected.



2.2 Design of the ES

Following the MMTS, the ES was conducted to learn about respondent experiences in terms of technical performance, usability and validity of automated in-app stop-track decision rules. In particular, prior to fieldwork it was uncertain how respondents would react to the different editing options (i.e. full versus limited). There was also interest in respondent perceptions about the seven-day tracking versus the one-day tracking from the legal office. This was because of data minimization principles that form the core of European Union GDPR legislation. The content of the questionnaire was almost the same as for the 2018 field test and is listed in Appendix A.

Invitation letters including a login to an online questionnaire for ES and the conditional incentive for completing MMTS were sent to all sampled persons that registered the app and that performed a minimal amount of location tracking. Respondents not completing the intro questionnaire or dropping out before location tracking started were not invited. No additional incentive was promised for completing the ES itself. The ES was fielded in two batches, one for thefollow-up sample and the full editing group and one for the limited editing group. It implies varying time lags between response to MMTS and invitation.

Ultimately, a total of 445 respondents were invited of which 159 responded. Given the relatively low response rate, of around 36%, the ES is foremost considered as additional context.

3. Technical performance of the app frontend

An important requirement for successful respondent completion of an app-assisted travel survey employing location tracking is adequate technical performance. When studying completion of the study relative to registration, technical performance is a confounding factor.

In this section, we consider performance and its impact on completion. We start by discussing the potential causes of weaker performance. Next, we run by available data sources that shed some light on actual performance: In-app paradata on navigation behavior, platform error logging, helpdesk emails by respondents and the answers given in the ES.

3.1 Sources of weaker technical performance

Technical performance may be evaluated along three dimensions: device battery management, location data accuracy and stop-track segmentation accuracy.

Location tracking is done primarily through GPS, but Wi-Fi or GSM may be used when there is no (strong) GPS signal. Tracking frequency is usually split into low frequency mode when the device is in rest and high frequency mode while in motion. In motion, careful management is crucial in order not to drain a battery and risk missing data. Respondents may also drop out when the app is too heavy on their device battery. The MMTS app applied a battery management tailored to the platform, iOS and Android, and within Android further adapted to the operating system version (more precisely the Software Development Kit or SDK). In Android devices, operating systems continuously evaluate the battery usage of applications. Without additional measures, an application may be stopped and will not restart without the help of the respondent. In the MMTS app, respondents were pointed to the app battery settings, asking them to exempt the app from battery saving options. In addition, the general battery saving mode had to be switched off. Nonetheless, even with these measures, the app could be stopped leading to missing data.

The location data accuracy is a mix of missing data and imprecise measurements. As argued, missing data may occur due to operating systems shutting down the MMTS app or a battery being depleted. Missing data may also occur as a result of lack of signal, occurring for example underground or around tall buildings. A more general account of the causes and impact of missing data sources is given by McCool, Lugtig & Schouten (2022). Location data may, however, also be inaccurate, resulting in a noisy trajectory.

Under fully passive location tracking (i.e. without involving respondents) missing and imprecise location data would only complicate analyses and estimation in the post-survey stage by the statistics department. However, when actively engaging respondents, lower data quality will also affect respondent motivation. Regardless of the decision to let respondents check and adjust location data, it is imperative that respondents label the transport modes of tracks and the purposes of stops. The location tracking data must, therefore, be translated to a series of stops and tracks near real-time and must be presented to respondents. Obviously, when data quality is lower, such segmentation is subject to more and more missed events. Thus, inadequate battery management and app performance, risks more respondent drop-out and more missing items of tracks and stops.

Even for perfect location data, however, stop-track segmentation is far from trivial. There is a vast literature on stop-track decision rules that employ various types of additional data sources, e.g. Zhou et al 2022. A stop at a location must have a purpose other than awaiting further travel. Without context, all stop-track decision rules are subject both to spurious stops and tracks and to missed stops and tracks. In case the presented stops and tracks are too far away from the perception of a respondent, there again may be a risk of drop-out and missing items. Given that deleting events is easier than adding them, stop-track rules were made relatively sensitive to being in a stop.

The 2022 MMTS app had embedded three so-called sensor configurations. The sensor configurations varied in how sensors were employed, in particular whether routines offered by Google/Apple were used or not. The motivation for including the three options was to gain insight into the best balance between data quality and tracking frequency. An in-depth evaluation of the consequences for data quality is included in the paper by Gootzen, Klingwort and Schouten (2024). Given that three streams of data were collected simultaneously the app was more heavy on battery usage.

3.2 Evaluation of app paradata and platform error logging

A detailed account of technical performance investigating in-app paradata and error logging is provided by Schijvenaars (2023). Covariates in the evaluation are operating system (OS), brand/model and Software Development Kit (SDK). SDK essentially corresponds to a mix of device age and OS age. In developing apps at CBS, it is claimed by Statistics Netherlands that devices of less than five years old are supported. The lower boundary for the 2022-2023 field test was SDK 28 introduced in 2018. Hence, for SDK's 27 (introduced in 2017) and lower the app was not guaranteed to work properly. Indicators of weaker technical performance were taken from error logs (user, data flow, Google Maps), battery usage and density of location data. The relatively small number of respondents warranted against strong conclusions on detailed device characteristics.

In Schijvenaars (2023) in-depth descriptives and explorations are presented of device covariates and respondent indicators. Around 45% of devices was iOS and 40% was Android – Samsung. Around 5% of respondents switched devices during the course of the survey. Percentages conform to market shares in the Netherlands.

The following conclusions were drawn on differential technical performance:
- Small numbers of error logs of all types were found with no strong relation to device characteristics. The two errors that appeared the most (no access to the GeolocatorPlatform (i.e. location requests are not handled) and user ran into trouble within the LocationSearch-page) are mostly harmless since the user will not necessarily experience any negative app-behaviors.
- No clear relation was found between device characteristics and completing the intro and survey. The median survey time was around two minutes and the mean total intro time (including the survey) was around three minutes.
- Significant hardware-related correlations or patterns of error were found for iPad, Redmi and HUAWEI devices. Missing data and crashes during the introduction were related to known bugs/issues within the user onboarding. Several cases of missing logs were found, but not frequently enough to find any sources of the error. Chinese brands' native location routines were banned by the EU so that location tracking effectively did not work without ad hoc technical measures.
- Similarly, lower data quality was found for lower SDK levels (28 and down)[1].
- No clear relation was found between battery charging and device characteristics. It was concluded though that motivated users not only validate all their days, but are also willing to charge their phones more often.

The findings led to a number of recommendations:
- Some brands and models have weak technical performance. While Statistics Netherlands does not claim to support older devices, it must reconsider the performance of some brands.
- Although battery usage has not been singled out to be a cause of users quitting, battery performance should be further optimized. Users who validated all of their days for the most part had on average over three battery charging moments per day.
- To improve long-term analysis of user data, iPhone device product names should be saved as well, to be able to differentiate between device age of Apple devices.

[1] SDK version 28 is not supported as of January 2022 and SDK version 29 is not supported as of February 2023.

– The possibility of adding comments for each study day could be made a configurable option that can be turned on and off. It is insightful but adds workload to respondents.

All in all, evaluation of technical performance showed that certain smartphone brands and older models had low data quality and that the app was still quite heavy on the battery. There was an evident risk that those respondents would drop out sooner than others. Let us first consider whether other data sources also revealed respondents that expressed having issues.

3.3 Evaluation of helpdesk consultation

A dedicated app helpdesk was set up, answering technical and user-experience questions via email. Questions around logins were captured by the general Statistics Netherlands Contact Center.

The helpdesk received a total of 44 emails, from 37 different respondents (out of the 3211 invited persons). Hence, relatively few respondents called the helpdesk. Table 3.1 summarizes the reasons for contact. Most questions resulted from an error in iOS login credentials. These were quickly resolved. Alongside this, the most common report was that the app was no longer loading or some other technical problem. In addition, there was a relatively high demand about when the conditional incentive would be sent.

Table 3.1: Contacts with helpdesk over the course of the study.

Reason for helpdesk contact	Number of respondents
Problems with logging in	30
Technical problem	18
App does not load	14
Incentives	11
Feedback about the app	7
Irrelevant question about another questionnaire	7
UX question	7
Problem with the MMTS online questionnaire	5
Substantive question	5

We conclude that the helpdesk contacts did not display a high prevalence of technical issues. If respondents were experiencing issues, then they either tried to handle these themselves or stopped without an attempt to resolve them through technical assistance.

3.4 Evaluation of self-reported technical performance in ES

The ES allows for an evaluation of technical performance but only for those MMTS respondents that also participated in the ES questionnaire. We, therefore, likely get an overly optimistic view on app performance. Findings must, thus, be considered with care.

We first consider overall satisfaction with the MMTS app. While this also includes usability, technical performance obviously is a strong determinant of respondent perceptions. Table 3.2 displays the proportions per phase and per location tracking group. It must be noted that the ES respondent size (r = 159) warranted very strong conclusions. Standard errors are around 7% for each experimental condition, around 5% for each reporting period and around 4% for the total response. In Table 3.2 also the scores are included for the 2018 ES. Overall, the scores have improved in 2022 relative to the field test in 2018.

Table 3.2: User friendliness of the app as rated by respondents participating in the evaluation survey

	(Very) user friendly	Neutral	(Wholly) not user friendly
Full editing	56%	31%	13%
Limited editing	66%	21%	13%
1 day	74%	18%	8%
7 days	45%	32%	23%
Total ES 2022	52%	29%	19%
Total ES 2018	40%	34%	26%

In the ES survey respondents were asked about the technical problems they encountered. Of them 30% experienced a malfunctioning of the app, and 5% indicated that the MMTS app affected other apps in a negative way.

All respondents who reported malfunctions (n = 47), were also asked to specify the specific problem they encountered. Some respondents reported several problems, five respondents did not give a substantive answer to this question, ten respondents reported that the app did not load or crashed at least once, 14 respondents reported that the app did not register all trips or stops, 16 respondents reported that they had a problem with manually entering, adjusting or saving data, and six respondents reported another small/specific problem.
ES respondents were asked about their experiences with battery depletion. 43% indicated that their phone battery emptied faster than normal, and 6% indicated that their phone died/fell out because of the app. In 2018, the reported proportions in ES were 24% and 10%, respectively. So the 2022 MMTS app was reported to be more battery heavy. This finding did not come as a surprise as the 2022 app performed location tracking through three sensors simultaneously. During the data collection period, 23% charged their phone several times a day, 64% charged once a day, 9% charged once every two days, and 4% charged less than once every two days. So, around a quarter of the respondents had to be or were more cautious about battery depletion during the day.

To round off, we look at preferences ES respondents had for the type of travel survey. Respondents were asked which method they would prefer if they were asked again to track their movements over a number of days. Respondents of phase 1 were asked if they would use the app, fill out the questionnaire, or something else. 66% preferred the app, 8% preferred the questionnaire, 10% preferred something else, and 16% didn't know. Respondents of phase 2 and 3 were asked if they would use the app or something else. 42% would use the app, 19% something else, and 38% answered they did not know.

4. Recruitment, registration and response

In this section, we consider our three research questions:
1. How does length of the reporting period affect participation?
2. How does mixing modes affect participation?
3. How to converge to an effective data collection strategy?

The third research question is not an empirical question and marks the start of follow-up explorations.

Before answering the research questions, we address the confounding of diary completion and technical performance of the app.

4.1 Registration, completion and technical issues of the MMTS app

Before we move to the research questions, we discuss the definitions of response to the MMTS and the impact of technical issues on participation.

We define *registration* as installing the MMTS app, entering login credentials and answering the short introduction questionnaire. The introduction questionnaire is a condensed version of the formal Travel Survey introduction questionnaire which by itself is relatively short. The questionnaire could not be skipped and was launched before moving to the diary. The app attempted to start tracking once the questionnaire was completed.

We define *active participation* as:
- sending at least some location tracking data after registration, and/or;
- sending at least some in-app paradata after registration;

In-app paradata refers to audit trails that log in-app navigation behaviour by a respondent. Typically, these are records that indicate a change of screen and include a time stamp. The second condition, thus, implies that there is a sign of life of the respondent. See also Klingwort et al (2024) for a detailed account of data quality.

We define *completion* as actively participating up to the end of the reporting period, i.e. either one day or seven days. For the one-day group, this meant that at least one full calendar day is completed. For the seven-days group, we distinguish

two options. A respondent was active on seven consecutive full calendar days. Alternatively, a respondent could be active on eight days where he/she started during the first day and stopped during the eight day. Under the second option, a respondent could have less than 7 x 24 = 168 hours of data. Instructions were, however, ambiguous on the starting time. We do not define completion as fulfilling all in-app (smart) tasks. Respondents were asked to label tracks and stops and to flag each day as complete. The full-editing group was also asked to impute missing time periods. If they did not, then only a soft warning appeared. Respondents were also invited to check the correct derivation of stops and tracks. The limited editing group could only delete events and not add or mutate. If no editing was performed, the respondent could proceed. Hence, respondents could only allow for location tracking and not do any form of imputing or editing, but still be considered as complete. The reason we chose this definition is that the study served as input to determine the level of respondent engagement. At the start, we were uncertain about the type and amount of tasks that can be requested from an average respondent. Evaluation of respondent edits is part of a separate paper (Remmerswaal et al 2024).
Now, if the MMTS app would have perfect location tracking, then considering in-app paradata would essentially be unnecessary. This was not the case. The MMTS app did have deficiencies for some brands and types of devices. For a detailed account, we refer to Klingwort et al (2024) and to Schijvenaars (2023). Since we believe that technical performance can (and will) be improved in the future and since we are interested in the respondent’s perspective, we omit respondents with devices that showed very low data quality. These are:

- Respondents with a HUAWEI, REDMI, OPPO or iPad;
- Respondents with an Android phone using SDK of 28 and lower;
- Respondents with less than 250 location data points on the first reporting day.

Table 4.1 shows the numbers of sampled persons entering the MMTS app split between the one-day and the seven-days groups and with or without technical issues. Persons who logged in are followed up to completion. It is clear that persons with technical issues drop-out much faster than those without. The drop-out for those without technical issues is very modest for the one-day group, around 3%. The drop-out for the seven-days group is around 8% after the first day and increases to around 30% for the full week.

Table 4.1: Numbers of respondents in the MMTS app for the one-day and seven-days groups. Respondents are split between those without and those with technical issues and against one, three, five and seven days in-study.

Study duration	Logged in	Completed questionnaire	Days in-study			
			1	3	5	7
One-day issues	28	16	2			
One-day no issues	105	104	98			
Seven-days issues	43	26	12	11	7	5
Seven-days no issues	116	114	107	95	88	77

In the following, we consider only the registered respondents that had no technical issues. We must add that this group may still have gaps in location data or sometimes a relatively low frequency of location tracking. The drop-out in the 2022-2023 study is larger than in the 2018 study. The 2018 study only had a seven-days group.

In the following, we will not make a distinction between respondents that had full editing options and those that had limited editing options.

4.2 How does the length of the reporting period affect participation?

We consider the first of two experimental conditions: the length of the reporting period.

The sample consisted of 2544 units, of which 51 units turned out to be administrative nonresponse. This number is relatively high, because there was a longer time lag between sampling and fielding the study than usual. Of the 2493 remaining units, another 51 persons called Statistics Netherlands to report they did not want to participate, i.e. around 2%. Table 4.2 shows the numbers of units that registered split between the one-day and seven-days samples. In total, 459 persons either registered the MMTS app and/or started the online questionnaire. Out of those, 11 persons switched between app and questionnaire during their reporting period. The diary and questionnaire were not synchronized in any way.

From Table 4.2, we can conclude that the overall registration rate for the seven-days sample was larger than the one-day sample. The biggest difference came from the app registration, but also the questionnaire completion rate was larger. The difference in registration rate for the app and overall registration is significant at 5% level.

Table 4.2. Registration numbers and rates in MMTS split against reporting period. Standard errors are given within brackets.

	One-day		Seven-days	
	Number	Rate (SE)	Number	Rate (SE)
App	133	10.6% (0.8%)	159	12.8% (0.9%)
Questionnaire	83	6.6% (0.7%)	95	7.6% (0.8%)
Total registration	210	16.8% (1.1%)	249	20.0% (1.1%)

Figure 4.1 displays the survival curves for the two samples as function of time in-study. It must be noted that location data may be missing on intermediate study days, i.e. the number of respondents with stop-tracks on a given study day may also vary even when not dropping out entirely. As expected the one-day group has smaller numbers after the first two days and steadily decreases. The seven-days group also experiences a drop after the first two days, but then numbers decrease at a much smaller rate. We conclude that the seven-days group had a higher

registration rate and that this persists. The drop-out for respondents without technical issues is, however, still sizeable and larger than in the 2018 field study. So far, we have looked at overall rates only. We now differentiate to different subpopulations based on auxiliary variables that were linked from administrative data.

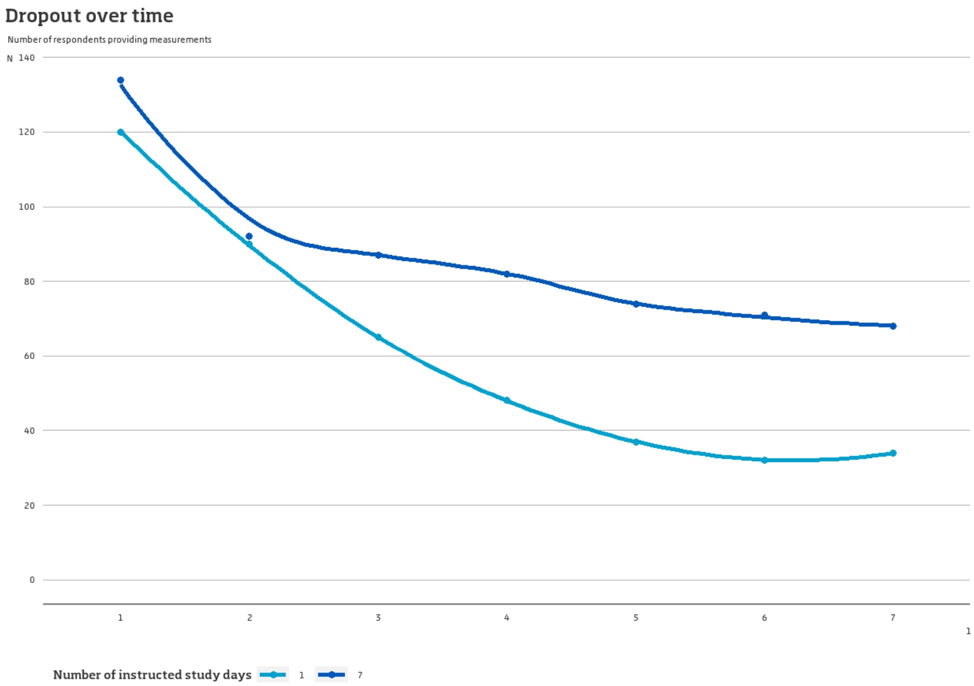


Figure 4.1. In-app passive participation as function of reporting/study day for registered respondents without technical issues.

Table 4.3. Distributions for auxiliary variables for respondents after registration, one day of reporting and a week of reporting for one-day and seven-days group combined.

	Registered	Participates for at least 1 day	Participates for at least 7 days
Age			
15 – 24	17%	17%	15%
25 – 44	33%	34%	35%
45 - 64	33%	33%	31%
65+	17%	17%	19%
Gender			
Male	50%	51%	56%
Female	50%	49%	44%
Migration background			
The Netherlands	85%	86%	85%
Child of migrant(s)	7%	7%	9%
Migrant	8%	7%	6%
Degree of urbanization			
Extremely	21%	20%	20%

Strongly	25%	25%	21%
Moderately	10%	20%	22%
Hardly	17%	16%	17%
Not	18%	18%	20%
Standardized household income (quintiles)			
1 - 20	5%	4%	5%
21 – 40	10%	8%	6%
41 – 60	16%	17%	17%
61 – 80	31%	31%	28%
81 - 100	37%	39%	42%
No registered income	1%	2%	2%

Table 4.3 presents the distributions of age, gender, migration background, degree of urbanization of the residence area and household income at registration, after one day and after a full week. The one-day and seven-days sample are combined. Given the relatively small number of respondents, the distributions are subject to sampling variance and should be interpreted with some care. We only make the general observation that changes in the demographics of the response are small.

Next, we focus the analysis on the seven-days sample and estimated conditional drop-out rates for a small set of subpopulations. Table 4.4 presents the resulting drop-out rates. Numbers are small and must be evaluated with some caution. Only for household income relatively large differences are observed.

Summarizing, the length of the reporting period shows a mixed picture. Uptake of the app is higher for the full week than for a single day. The app and online questionnaire are complementary in response. However, drop-out during the week is severe and outweighs the higher registration at the start. The field test sample is too small for strong conclusions about further differentiation to relevant subpopulations.

Table 4.4: Drop-out rates for the seven-days sample for a subpopulations based on age, gender, migration background, urbanization degree and household income.

	Drop-out after first day	Drop-out before end of 7 days
Age		
15 – 24	5%	26%
25 – 64	14%	28%
65+	6%	29%
Gender		
Male	10%	30%
Female	13%	25%
Migration background		
The Netherlands	11%	28%
Other	11%	28%
Degree of urbanization		

Extremely/strongly	14%	32%
Other	9%	25%
Std HH income (quintiles)		
21 - 60	19%	37%
61 – 100	18%	26%
No or 0 - 20	0%	14%

4.3 How does mixing modes affect participation?

The second experimental condition is the timing of the concurrent regular online questionnaire: direct at invitation, at first reminder after two weeks or at second reminder after four weeks.

Table 4.5 shows the registration for the three scenarios. Overall registration rates drop when the alternative online questionnaire is offered later during fieldwork. While perhaps conform expectations, this decrease is not significant. However, what is clear, and significant, is that the proportion choosing the alternative is decreasing once offered. While this finding by itself is not surprising, the important conclusion is that app registration remains stable. In other words, app respondents and online questionnaire respondents seem to be different groups. The modes are not competing but complementary.

Table 4.5: Registration numbers and rates in MMTS split against timing of the online alternative. Standard errors are given within brackets

	Direct		Reminder 1		Reminder 2	
	Number	Rate (SE)	Number	Rate (SE)	Number	Rate (SE)
App	90	10.8% (1.1%)	103	12.3% (1.2%)	99	12.0% (1.1%)
Questionnaire	83	10.0% (1.0%)	60	7.2% (0.7%)	35	4.2% (0.7%)
Combined	168	20.1% (1.4%)	157	18.8% (1.9%)	134	16.2% (1.3%)

The interaction between timing and length of the reporting period, obviously, is relevant as well. At the onset of the study the field test budget was not sufficient, however, to get high statistical power in detecting minimal observable differences for interactions. Nonetheless, we do report the registration descriptives in Table 4.6. The most effective combination seems to be a seven-days reporting period and offering the two modes right from the start. The least effective is a one-day reporting period with the questionnaire offered at second reminder. The difference between the two is just about significant, even when accounting for multiple testing.

We return to the timing of the online questionnaire and its impact on representation. We start by a univariate analysis of the demographical and socioeconomical composition of the sample and the total, app and online questionnaire registration. In Table 4.7, we give the distributions.

Table 4.6: Registration rates for the two experimental conditions crossed. Standard errors between brackets.

	Direct		Reminder 1		Reminder 2	
	One-day	7-days	One-day	7-days	One-day	7-days
App	10% (1.5%)	12% (1.5%)	12% (1.6%)	13% (1.6%)	10% (1.5%)	14% (1.7%)
Questionnaire	9% (1.4%)	11% (1.6%)	7% (1.3%)	7% (1.3%)	4% (1.0%)	4% (1.0%)
Total	18% (1.9%)	22% (2.0%)	18% (1.9%)	20% (2.0%)	14% (1.7%)	18% (1.9%)

Table 4.7. Distributions for different background characteristics for the MMTS app, MMTS online questionnaire, MMTS app and questionnaire combined, the 2018 app-assisted field study and the 2022 TS.

	MMTS 2022-2023				2018	TS 2022	
	Sample (n=2544)	Combined (r = 459)	App only (r=292)	Online only (r = 178)	response (r= 946)	Sample (n=172248)	Response (r=43945)
Age							
15 – 24	14.4%	13.7%	16.1%	9.6%	14.2%	14.9%	13.2%
25 – 44	29.0%	27.2%	30.8%	21.3%	29.1%:	33.3%	27.8%
45 – 64	31.0%	31.4%	32.9%	28.1%	35.7%	28.0%	30.5%
65+	25.5%	27.7%	20.2%	41.0%	21.0%:	23.8%	28.5%
Gender							
Male	49.3%	49.2%	49.0%	49.4%	47.4%	48.8%	50.7%
Female	50.2%	50.8%	51.0%	50.6%	52.6%	51.2%	49.3%
Migration background							
Native	74.4%	82.3%	84.6%	79.2%	NA	66.4%	78.0%
Non-western	13.6%	6.3%	6.5%	6.2%	NA	20.7%	11.2%
Western	12.0%	11.1%	8.9%	14.6%	NA	12.9%	10.8%
Degree of urbanization							
Extremely	24.1%	23.7%	21.9%	25.3%	21.9%	29.4%	25.6%
Strongly	26.1%	22.4%	23.6%	20.8%	25.3%	29.6%	29.7%
Moderately	18.6%	19.0%	19.9%	18.0%	19.8%	15.0%	16.2%
Hardly	14.5%	18.1%	17.1%	20.8%	17.7%	19.7%	21.5%
Not	16.1%	16.8%	17.5%	15.2%	16.1%	6.3%	7.1%
Standardized household income (quintiles)							
1 – 20	8.9%	6.8%	4.8%	9.6%	12.4%	19.6%	12.3%

21 – 40	17.4%	12.9%	11.6%	15.2%	17.1%	20.8%	17.6%
41 – 60	21.2%	17.9%	18.5%	16.3%	19.9%	17.9%	18.8%
61 – 80	23.4%	27.7%	29.8%	25.3%	23.3%	18.8%	22.6%
81 – 100	26.0%	33.3%	33.9%	32.0%	24.8%	20.1%	26.8%
Not registered	3.1%	1.5%	1.3%	1.6%	2.5%	2.8%	2.0%

A first question is whether the MMTS online questionnaire and the MTMM app complement each other in registration, i.e. when the app has an underrepresentation is this in part compensated for (or moderated by) an overrepresentation in the questionnaire? In general, this is true: We see that the app and online questionnaire complement each other and attract slightly different respondents. The composition of the total response is more comparable to the sample than the response solely based on the app or online questionnaire. The online questionnaire attracts older respondents (mean age = 54.7 years, SD = 19.6), whereas the app attracts somewhat younger respondents (mean age = 46.6 years, SD = 18.4). The impact of differential response is less easy to pinpoint for degree of urbanization and household income, but in this case the same holds as well: the composition of the total response is closer to the sample of solely the app or online questionnaire response.

The exception to this phenomenon is migration background. We observe that respondents with a migration background are underrepresented in both the app and the questionnaire. Combining the two modes only averages the underrepresentation.

Table 4.8. Logistics regression results of total, app and online questionnaire registration.

	Total		App		Questionnaire	
	Estimate	s.e.	Estimate	s.e.	Estimate	s.e.
Intercept	-1.69***	0.23	-2.62***	0.29	-2.89***	0.37
Age: (ref = 15 – 24 years)						
25 – 44					0.06	0.30
45 – 65					0.24	0.29
65+					1.05***	0.28
Income (ref = 1 – 20)						
21 – 40	-0.11	0.24	0.14	0.33	-0.28	0.32
41 – 60	0.01	0.23	0.41	0.31	-0.29	0.32
61 – 80	0.44*	0.22	0.84**	0.30	0.18	0.30
81 - 100	0.55*	0.22	0.88**	0.30	0.38	0.30
No income	-0.18	0.45	0.23	0.60	-0.37	0.65
Migration background: (ref = country of origin: NL)						
Child of migrant(s)	-0.29	0.19	-0.28	0.23		
Migrant	-0.58**	0.18	-0.76***	0.22		
Urbanization: (ref = extremely)						
Strongly	-0.27	0.15			-0.43	0.23
Moderately	-0.12	0.16			-0.27	0.25
Hardly	0.11	0.17			0.22	0.24

Not	-0.19	0.17			-0.30	0.26
Number of days: (ref = 1 day)						
7 days	0.22*	0.10	0.21	0.13		
NagelkerkeR	0.040		0.037		0.045	

Note: * $p < .05$, ** $p < .01$, *** $p < .001$. Logistic regression models explain registration, 1 = yes. The order from highest to lowest show how strong the predictors are according to stepAIC

A second question is how the MMTS distributions compare to the TS distributions. Table 4.7 also displays the sample and response distributions for the TS. The distributions are based on the full year, i.e. they deviate from the MMTS that was fielded only from November to January. We must first note that the sample distributions for the regular survey and MMTS differ because of different sampling designs. The TS stratifies on a number of variables, one of which is household income, whereas the MMTS was a simple random sample. This difference in design is particularly apparent for household income. It is, thus, the relative difference to the sample distribution that matter. The 2018 field study also used a simple random sample. The subgroup response rates in the MMTS and the TS display the same tendencies for all variables except gender. There is some indication that the TS has a stronger selective response than the mix of modes in the MMTS. However, standard errors for the MMTS do not allow for strong conclusions.

As a final step, we turn to multivariate analysis of who registers for the app or the online questionnaire, and who participates or drops out. To do this we apply logistic regression models. We use the same background variables that were linked: age (continuous), gender, migration background, degree of urbanization and household income. Due to the small sample sizes we decided not to do separate analyses for one-day versus seven-days or the timing of the questionnaire. So regressions combine all response from all conditions.
We performed logistic regression models to predict app registration, online questionnaire registration/participation and total registration. Table 4.8 shows the fitted logistic regression models. For the combined registration of app and questionnaire, four variables are selected: study duration, standardized household income in quintiles, urbanization and migration background. A longer study duration led to a higher app response, but was not significant when combining with questionnaire response. Higher income quintiles register more, persons with a migration background less and more urbanized areas are underrepresented. The main question is whether app and questionnaire supplement each other or sharpen underrepresentation. Interestingly, the impact of age is present for questionnaire response (older people participate more), but moderated by the app response. The net effect is not significant. For income it seems that the two modes do not supplement each other, but rather lead to more people with high incomes. For ethnicity, the underrepresentation comes mostly from the app, is to some extent moderated by the questionnaire, but remains relatively strong. For urbanization, it is the other way around; here the questionnaire led to stronger underrepresentation, which is not fully moderated. Finally, we note that the fitted models have Nagelkerke's pseudo-R2 all below 0.05. Hence, the variance in predicted propensities is relatively small for the available auxiliary variables.

All in all, we can conclude that combining the modes is moderating rather than sharpening contrasts between response and nonresponse.

4.4 How to converge to an effective data collection strategy?

So how to translate the results to a recruitment and motivation strategy? Let us return to the main findings:

- The combined app and online concurrent recruitment strategy backfired; it was less effective than the single online questionnaire.
- A seven-day reporting period seems more natural and appealing to respondents; the registration rate is higher than for a single day.
- There is a severe drop-out during the week, larger than in 2018, which is likely caused by a mix of lower location measurement quality and inaccurate stop-track segmentation (not discussed here, but see Klingwort et al 2024 and Gootzen et al 2024).
- App and online questionnaire registration are hardly related; timing the online questionnaire earlier during field work does not alter the app registration rate.
- App and online questionnaire complement each other in the types of respondents that are recruited.

These results give reason to both optimism and pessimism. The optimism comes from the complementary nature of the app and questionnaire. So offering both options seems advantageous from a representation point of view. The pessimism comes from the fact that the concurrent design with two modes does not work as it was implemented now. There are several potential reasons. The most likely reasons are that recruitment materials were confusing and demotivating. The experimental condition that has been least affected by a ‘double’ explanation and instruction is the introduction of the online questionnaire at the second reminder. At that point, the sample was around four weeks in-field and had received two letters pointing only at the app. Given that also this subsample had a considerably smaller registration rate than the 2018 study, we must conclude that overall willingness to participate in an app-assisted location tracking study must have weakened. So, as a stand-alone mode, an app-assisted smart travel survey may be too weak; at least, for the general population. Offering two modes, thus, ultimately should also be advantageous for response rates.

We conclude that in order to converge to an effective data collection strategy the two modes should both be offered but without making them explicitly distinct. The most obvious way to do this is to make location tracking a known but optional feature not necessarily connected to a different application. Another option, given the complementary nature, is to apply a form of adaptive survey design where different relevant strata get assigned different strategies. The MMTS study was too small to design such adaptation, but did give some clues as to how to go about.

5. Follow-up steps

The question that remains is how to combine the two modes in an overarching data collection strategy without confusing or overloading persons that are invited. This is a stepping stone to future research and development.

A first imperative recommendation was (and is) an extensive review of all invitation and reminder materials including instructions. At the time of writing this review was already initiated. The aim of the review is a simplification of the instructions. A new field study should be preceded by a user test of the revised materials.

A second recommendation is harmonization of the online questionnaire and app design parameters. The two modes differ in IT applications. They also in principle aim at a difference in reporting period length and starting/reference day. The online questionnaire is a single day with a specified reference day that is randomized. Although the number of days can be varied, the app in first instance assumes a longer period without an explicit starting day of the week. Without harmonization, the instructions will be inherently complicated and confusing, unless the modes are offered in an adaptive way. Harmonization could be achieved by structuring all options within a cross-platform, multi-device application that allows for location tracking on demand.

The 2022-2023 MMTS study had a number of limitations that likely have affected the outcomes and that need to be resolved in future studies.
One limitation was that no user test was performed before the field test. The app UI-UX more or less went into field based purely on experiences in prior smart survey experiments. This holds for the entire workflow and respondent journey. A future field test must be preceded by a user test of the full UI-UX starting from recruitment materials.
Another limitation was the measurement quality of the location data. Also when omitting some problematic brands and models, the drop-out was sizeable and larger than in 2018. One cause may be that the MMTS app employed three parallel sensor measurements simultaneously and was, consequently, relatively heavy on the battery. The battery load likely has led to more missing data. A future test must have a smaller battery load.

In this respect, we point at other (discussion) papers linked to the MMTS study. These evaluate location tracking data quality, stop-track decision rules and respondent involvement, and further optimization of the corresponding methodology.

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Appendix A - ES questionnaire

BLOCK EVALUATION
Intro
We willen u hartelijk danken voor uw deelname aan de verplaatsingen app. Graag willen we u nog enkele evaluatievragen voorleggen.
In het vervolg van de vragenlijst hebben we het over de app en bedoelen daarmee de app die u heeft gebruikt voor het meten van verplaatsingen.

Instruct_tbl
In hoeverre vond u de volgende instructies duidelijk?
Heel duidelijk
Duidelijk
Niet duidelijk, niet onduidelijk
Onduidelijk
Heel onduidelijk
DK

Instruct_a
De instructie over het installeren van de app
Instruct_b
De instructie over het activeren/inloggen in de app
Instruct_c
De instructie over het gebruik van de app

Install, Install_anders
Liep u bij het installeren tegen problemen/onduidelijkheden aan?
Ja, namelijk STRING[250][Ja]
Nee [Nee]

{NewPage}

GebrVriend
In hoeverre vond u over het algemeen de app gebruiksvriendelijk?
Zeer gebruiksvriendelijk [ZWel]
Gebruiksvriendelijk [Wel]
Neutraal [Neutraal]
Niet gebruiksvriendelijk [Niet]
Helemaal niet gebruiksvriendelijk [ZNiet]
DK

TydApp
Wat vond u over het algemeen van de tijd die de app u kostte?
De app kostte me meer tijd dan gedacht [Meer]
De app kostte me evenveel tijd als gedacht [Gelyk]
De app kostte me minder tijd dan gedacht [Minder]

DK

{NewPage}
Storing
Gaf de app storingen (vastlopen, foutmeldingen, uitvallen)?
Ja [Ja]
Nee [Nee]

StoringWelk
Kunt u een omschrijving geven van de storing(en) die u kreeg?
STRING [250]

AnderApps
Werkten andere apps of functies van uw telefoon anders dan u gewend bent?
Ja [Ja]
Nee [Nee]

WelkProb
Kunt u een omschrijving geven van wat er gebeurde?
STRING [250]

{NewPage}

Opladen
Hoe vaak heeft u tijdens de meetperiode de batterij van uw smartphone opgeladen?
1. Meerdere keren per dag [DagM1]
2. Eén keer per dag [Dag1]
3. Een keer per twee dagen [Dag2]
4. Minder vaak dan een keer per twee dagen [DagMind]

Battery
Liep de batterij van uw smartphone tijdens de meetperiode sneller leeg dan u gewend bent?
1. Ja [Ja]
2. Nee [Nee]

TelLeeg
Is uw telefoon tijdens de meetperiode uitgevallen omdat de batterij leeg was?
1. Ja [Ja]
2. Nee [Nee]

{NewPage}

AantVerpl
Hoe goed kwamen de metingen van de app overeen met de verplaatsingen die u gemaakt heeft?
1. De app heeft meer verplaatsingen geregistreerd dan ik heb gemaakt [Meer]

2. De app heeft evenveel verplaatsingen geregistreerd als ik heb gemaakt
[Gelyk]
3. De app heeft minder verplaatsingen geregistreerd dan ik heb gemaakt
[Minder]
4. De ene keer registreerde de app meer verplaatsingen, de andere keer te weinig
[Wisselt]
DK

TelBij
Had u tijdens de meetperiode van de app uw telefoon altijd bij u?
[TJaNee]
DK

{NewPage}

StopTwee
De volgende vragen gaan over het automatisch aanmaken van locaties in de app.

Is het weleens voorgekomen dat er een nieuwe locatie werd aangemaakt terwijl er daar een bestaande locatie gebruikt had kunnen worden?
[JaNee]
DK

{NewPage}

StopGem
Heeft de app weleens een locatie aangemaakt, terwijl dit volgens u niet had gemoeten?
[TJaNee]
DK

AantSG
Om hoeveel locaties ging het ongeveer?
1 locatie [Loc1]
2 locaties [Loc2]
3 locaties of meer [Loc3]
DK

{NewPage}

StopEen
Is het weleens voorgekomen dat er ergens geen nieuwe locatie werd aangemaakt, terwijl dat volgens u wel had gemoeten?
[JaNee]
DK

AantStopEenOms
Kun u aangeven wat er volgens u is fout gegaan?
STRING[250]

DK

{NewPage}

RechtLyn
Nu volgt een aantal vragen over de routes die de app heeft aangemaakt.

Zijn er routes geweest waarbij er een rechte lijn tussen 2 locaties is getrokken in plaats van de door u afgelegde route?
[TJaNee]
DK

AantRL
Hoe vaak kwam dit voor?
[TFreq]
DK

{NewPage}

SpookVerpl
Heeft de app weleens geregistreerd dat u onderweg was terwijl dit helemaal niet zo was?
[TJaNee]
DK

AantSpookVerpl
Hoe vaak kwam dit voor?
[TFreq]
DK

{NewPage}

GatVerpl
Heeft de app weleens delen van een door u afgelegde route niet geregistreerd?
[TJaNee]
DK

AantGatVerpl
Hoe vaak kwam dit voor?
[TFreq]
DK

{NewPage}

AndOpm
Heeft u andere opmerkingen over het functioneren van de app?
STRING [250]
1. Geen opmerkingen [Geen]
NODK

{NewPage}

Wyze, Wyze_anders
Als u gevraagd wordt uw verplaatsingen bij te houden gedurende een aantal dagen, zou u dan deze app gebruiken of iets anders?
1. Deze app [App]
2. Iets anders, namelijk [Anders]
DK

ODINVoork, ODINVoork_anders
U heeft deze week ook meegedaan via een vragenlijst (Onderweg in Nederland) om uw reizen van 1 dag door te geven.
Zou u uw reizen liever doorgeven via deze app, via de vragenlijst 'Onderweg in Nederland' of op een andere manier?
1. Via deze app [App]
2. Via de vragenlijst 'Onderweg in Nederland' [VLijst]
3. Op een andere manier, namelijk STRING [250] [Anders]
DK

{NewPage}

HoeAanp, HoeAanp_anders
Hoe heeft u het invullen van de vragenlijst aangepakt?
Ik heb mijn verplaatsingen en locaties uit het hoofd ingevuld [Hoofd]
Ik heb de CBS-app gebruikt als hulpmiddel [CBSApp]
Ik heb (andere) hulpmiddelen gebruikt, zoals een agenda, een notitieblaadje of Google Maps [AnderWyze]
Anders, namelijk STRING [250] [Anders]
DK

{NewPage}

BLOCK MOBILE DEVICE USE

GebrDag
Tot slot een aantal vragen over uw smartphone gebruik in het algemeen.

Gebruikt u uw smartphone normaalgesproken dagelijks?
1. Ja [Ja]
2. Nee [Nee]

FreqGebr
Hoe vaak gebruikt u uw smartphone normaalgesproken voor andere dingen dan bellen?
1. Een aantal keer per dag of vaker [DagM1]
2. Ongeveer 1 keer per dag [Dag1]
3. Een paar keer per week [WeekM1]
4. Een paar keer per maand [MaandM1]

5. Ongeveer 1 keer per maand, of minder vaak [Maand1]

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Grp_Gebruik
Gebruikt u uw smartphone normaalgesproken weleens voor de volgende activiteiten:
[TJaNee]

Gebruik_a
Het bezoeken van websites
Gebruik_b
Het lezen of schrijven van e-mails
Gebruik_c
Het maken van foto's
Gebruik_d
Het maken van video's
Gebruik_e
Het gebruik van social media, bijvoorbeeld voor het plaatsen of lezen van berichtjes, foto's of video's op Facebook, Twitter, Instagram
Gebruik_f
Het installeren van nieuwe apps, bijvoorbeeld via de App Store van Apple of de Google Play Store
Gebruik_g
Het gebruiken van GPS/locatie-apps, bijvoorbeeld Google Maps, Foursquare, Yelp
Gebruik_h
Het afspelen van van muziek of video via internet
Gebruik_i
Iets anders dan hierboven genoemd

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GPS
Hoe vaak gebruikt u GPS/locatie-apps op uw smartphone?
1. Een aantal keer per dag of vaker [DagM1]
2. Ongeveer 1 keer per dag [Dag1]
3. Een paar keer per week [WeekM1]
4. Een paar keer per maand [MaandM1]
5. Ongeveer 1 keer per maand, of minder vaak [Minder]

Vaardig
Hoe zou u uw vaardigheden als smartphone gebruiker omschrijven op een schaal van 1 t/m 5, waarbij 1 = beginner en 5 = gevorderd?
1. 1 (Beginner) [Een]
2. 2 [Twee]
3. 3 [Drie]
4. 4 [Vier]
5. 5 (Gevorderd) [Vijf]

Privacy
Hoe bezorgd bent u in het algemeen over uw privacy?
1. Heel erg bezorgd [HeelErg]
2. Bezorgd [Beetje]
3. Niet bezorgd [NietErg]
4. Helemaal niet bezorgd [HeelNiet]

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Bedankt
Dit waren alle vragen. Bedankt voor het gebruik van de app en het invullen van de vragenlijst!
Als u nog opmerkingen over de app of deze vragenlijst heeft, kunt u die hier invullen.
STRING[250], EMPTY

Colophon

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