Discussion paper

Mobile device login and break-off in individual surveys of Statistics Netherlands

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Content

Summary

In this paper, we analyse the use of mobile devices, i.e. smartphones and tablets, in individual surveys of Statistics Netherlands in 2017.

Over the last five years, the mobile device penetration has strongly increased and mobile devices have become standard communication tools. In parallel, the proportion of online logins by mobile devices on Statistics Netherlands' individual surveys showed a gradual but steady increase as well. At Statistics Netherlands, respondents are stimulated to respond online, but, to date, most of its questionnaires are designed for desktops/laptops. As a result, completing questionnaires on mobile devices, and in particular on smartphones, is not easy to manage, due to differences in screen size and navigation. Despite these challenges and despite not being encouraged, respondents do login and attempt to complete the surveys on mobile devices.

We explore the proportion of mobile device logins, the proportion of device switches, the break-off rate and the average mobile device interview duration for a combined dataset of individual surveys. In the exploration, we include demographic and socio-economic background variables of the samples. The exploration forms the starting point for mobile device data collection and questionnaire design strategies.

Keywords

Smartphone; Tablet; Mobile device; Break-off; Non-response; Survey duration; Responsive; Push-to-web; CAWI.

1. Introduction

In this paper, we investigate the use of smartphones and tablets in individual surveys of Statistics Netherlands. Almost all individual surveys at Statistics Netherlands are web first multi-mode surveys. It is therefore important to monitor ICT changes and trends and their effect on data collection. At Statistics Netherlands, respondents are stimulated to respond online, but, to date, most of its questionnaires are designed for desktops/laptops. As a result, completing questionnaires on mobile devices, and in particular on smartphones, is not easy to manage, due to differences in screen size and navigation. Despite these challenges and despite not being encouraged, respondents do login and attempt to complete the surveys on mobile devices. Investigating the device usage can provide Statistics Netherlands with valuable insight for improvement of data collection and questionnaire design. It could help to understand:

- the importance of a responsive (mobile friendly) survey lay-out and the user friendliness of the current survey lay-out;
- the response (and non-response) per target group;
- to what extent we can reach people when using specific mobile applications to gather data (like GPS);
- the influence of survey duration on response per device.

This exploration forms the starting point for mobile device data collection and questionnaire design strategies at Statistics Netherlands. Furthermore it will fuel further research within the data collection innovation network (WIN, Waarneem-Innovatie Netwerk) of Statistics Netherlands and Utrecht University.

Device ownership and usage

Over the last five years, the mobile device penetration has strongly increased and mobile devices have become standard communication tools. For example in the United States (US), smartphone ownership rose from 35% in 2011 to 77% in 2016 and tablet ownership went from 3% in 2010 to 51% in 2016 (Smith, 2017). In the European Union, mobile phone subscriptions giving access to Internet have increased on average 16 percentage points between December 2011 and January 2014 (Special Eurobarometer 414, 2014). Furthermore, smartphone ownership increased on average 15 percentage points among 21 non-western countries between 2013 and 2015 (Poushter, 2016). In The Netherlands we see similar trends, where the proportion of people who had access to the internet via a smartphone or a tablet increased strongly between 2012 and 2017 (see Table 1). Contrarily the same does not hold for desktop possession, which shows a decreasing trend in this period (from 71% to 60%). These figures indicate that mobile devices become more important to access the internet, while desktops are becoming less important. It is therefore logical that people also use these mobile devices more often to fill in online surveys, even if they are not specifically encouraged to do so. De Bruijne and Wijnant (2014) showed that the share of mobile respondents in the LISS panel nearly quadrupled between March 2012 and September 2013 (i.e. from 3% to 10.9%). Sarraf, Brooks, Cole and Wang (2015) reported that the share of smartphone respondents in the

National Survey of Student Engagement (n>300.000) increased from just 4% in 2011 to 27% in 2015. Similarly the smartphone use in MaritzCX Web surveys increased almost 10 percentage points per year between 2012 and 2015 (from 9% to 38%) (Saunders & Kessler as cited in Couper, Antoun, & Mavletova, 2017).

Table 1: devices with internet access at home: 2012-2017 (% population 12 years or older)

	desktop	laptop or netbook	tablet	mobile or smartphone
2012	70.5%	73.4%		56.5%
2013	67.8%	74.7%	45.1%	66.8%
2014	61.2%	75.9%	57.1%	74.1%
2015	56.6%	77.2%	64.9%	78.8%
2016	58.3%	79.3%	68.3%	84.6%
2017	60.3%	82.0%	71.7%	89.0%

Source: Statistics Netherlands (2017a)
Note: 2012 tablet data is not available

User expectations

ICT trends might change people's lifestyle and their expectations and attitudes towards (online) data collection: people expect web surveys to be smartphone- and tablet-compatible. If these expectations are not met, people have three choices. They can first of all struggle-on, resulting in a high response burden, longer completion time and possible lower quality response. A longer completion time for people using smartphones compared to those using other devices is frequently seen, which is most apparent among surveys that are mobile-incompatible (Couper, Antoun, & Mavletova, 2017; Couper & Peterson, 2015; Mavletova & Couper, 2015). Secondly people can choose to switch to another device for which the survey is compatible, although it seems unlikely that people will do so (Guidry, 2012; Peterson, 2012). Finally people can break-off. Survey break-off, also known as drop-out and abandonments, is a specific kind of non-response where respondents start a survey but do not complete it. Multiple studies report break-off rates on smartphones that are more than twice that of the break-off rate on a desktop (Couper, Antoun, & Mavletova, 2017; Peterson, 2012; Mavletova & Couper, 2015). Couper, Antoun and Mavletova (2017) compared different studies with mobile-compatible and mobile-incompatible surveys. They found that optimizing surveys for mobile devices in at least some form reduces the median break-off rate from 24% in mobile-incompatible surveys to 13% in more mobile-compatible surveys. Even though the break-off rate is reduced substantially when making the survey more mobile-compatible, it is still higher than the median break-off rate for desktops (9%). If the people breaking-off or providing lower quality responses differ from respondents in terms of the constructs under investigation, the results will depict a distorted view of reality, i.e. the results will be biased.

Demographic characteristics of device ownership

Differences in demographic characteristics point towards a general digital divide where people using the internet are more often young, higher educated and have a high income. This division seems strongest for smartphone ownership. A comparison of 40 countries across the globe consistently showed that adults who use the internet

at least occasionally or report owning a smartphone are more often young, have more education and a higher income (Poushter, 2016). In the US similar patterns are seen, where smartphones are also owned more often by men, younger people, people with a high income and people living in urban areas (Pew Research Centre, 2017). In The Netherlands smartphones are owned more often by men, younger people, people with a non-western foreign background, working people and people with an above average income (see Table 2). Tablet ownership is similar to smartphone ownership, except for age and background. People with a Dutch or western background and middle aged people more often own tablets.

Table 2: devices with internet access at home: demographic characteristics (% population 12 years or older)

	desktop	laptop or netbook	tablet	mobile or smartphone
Gender				
male	64.8%	82.9%	71.9%	90.4%
female	56.0%	81.1%	71.6%	87.7%
Age				
18-25 years	66.5%	96.6%	68.3%	97.9%
25-35 years	47.9%	90.7%	71.2%	98.5%
35-45 years	57.8%	89.6%	81.0%	98.2%
45-55 years	66.4%	87.1%	79.1%	95.7%
55-65 years	66.7%	78.5%	73.1%	89.8%
65-75 years	60.0%	65.7%	65.4%	75.7%
75 years or older	39.4%	47.7%	40.2%	42.5%
Background				
Dutch	60.7%	82.1%	72.5%	88.4%
western foreign	59.5%	80.5%	70.8%	85.9%
non-western foreign	58.9%	82.8%	67.4%	96.0%
Employment status				
working	62.4%	89.2%	77.8%	96.7%
not working	57.0%	70.3%	61.8%	76.5%
Household income				
far below average income	53.0%	77.5%	58.4%	86.2%
below average income	52.4%	70.7%	58.0%	78.3%
average income	61.5%	80.4%	72.3%	88.0%
above average income	62.7%	86.6%	77.6%	92.9%
far above average income	67.5%	89.6%	84.2%	95.3%

Source: Statistics Netherlands (2017b)

Demographic characteristics of device users in surveys

Multiple studies have been conducted, that at least mention some results about differences in demographic characteristics between smartphone, tablet and desktop respondents. In general these studies report that tablet respondents are very similar to desktop respondents, and differences were mainly found between smartphone and non-smartphone (i.e. tablet and desktop) respondents. The most common

finding is that smartphone respondents tend to be younger than tablet and desktop respondents (Buskirk & Andrus, 2014; Cook, 2014; Guidry, 2012; Lambert & Miller, 2014; Maxl, Baumgartner, 2014; Merle et al., 2015; Poggio, Bosnjak, & Weyandt, 2015; Toepoel & Lugtig, 2014; Wells, Bailey & Link, 2014). Gender differences for the type of device respondents use, are less straightforward than age differences. Only one study found slightly more male than female respondents using a smartphone (Guidry, 2012). Several studies found the opposite, where females were more likely than males to use smartphones (Lambert & Miller, 2014; Merle et al., 2015; Wells, Bailey, & Link, 2014). Furthermore Lambert and Miller (2014), Merle et al. (2015) and Cook (2014) found the same for tablet respondents. Finally Buskirk and Andrus (2014), Maxl and Baumgartner (2014), Merle et al. (2015), and Poggio, Bosnjak and Weyandt (2015) did not find gender differences.

Contrary to smartphone ownership, people who responded in a survey were more likely to have a lower income (Cook, 2014; Lambert & Miller, 2014) and less likely to be employed (Lambert & Miller, 2014). In the study of Lambert and Miller (2014), smartphone respondents were more likely to be in school and those responding on desktops and tablets were much more likely to be retired. Furthermore, smartphone respondents tended to have the lowest yearly income, desktop respondents were somewhat in the middle and tablet users had the highest yearly income. They noted that the income differences do not necessarily mean that a tablet is a luxury item and a smartphone is not. Age could also play a role, since tablets were more often used by retired people and smartphones more frequently by students.

Exclusive mobile device users (mobile only)

International data show an increase in people who only go online using a smartphone. In 2016 eMarketer reported that more and more people in the US are relying on their mobile devices for digital access. They estimated that 88.3% of US internet users go online via desktop/laptop at least monthly in 2016, a significant decrease from 97.3% in 2011. More than one in ten US internet users (11.7%) go online exclusively through a mobile device and that number will continue to rise according to the eMarketer forecast. This share of exclusive mobile device users is highest among people with a lower income (Anderson, 2017) and non-white Americans (Perrin, 2017). For the UK population eMarketer reports similar trends (eMarketer, 2017): in 2017 13.7% of UK internet users go online using only a mobile device, compared to 12.0% in 2016, which is mainly due to a shift away from desktop/laptop use among individuals aged 34 and under. This trend is expected to continue. Lugtig, Toepoel and Amin (2016) found that 12% of the respondents in the American Life Panel always use a mobile device to participate. They also found that these "mobile-only" respondents share many characteristics of typically hard-to-recruit survey respondents, for example they are more likely to be non-white, young and not have a higher education.

Limitations previous research and research questions

Studies conducted on device usage, survey length, switching behaviour and break-offs all share a common limitation concerning coverage due to either sub-optimal samples or limited sample size. Having smaller samples and sub-optimal samples makes it more difficult to pinpoint who is more prone to break-off, takes more time

to complete surveys or can be reached with what kind of device. Therefore this study will investigate the following research questions:

1. What proportion of device use in Statistics Netherlands surveys is made from smartphones and tablets?
2. To what extent do respondents break-off or switch devices when starting the questionnaire on a smartphone or tablet?
3. What is the average duration per survey to fill in on smartphones and tablets as opposed to desktops/laptops (as a measure of problems filling in the survey)?
4. How are device usage, break-off, device switch and interview duration related to the characteristics of the respondent?

Section 2 gives a brief overview of the methods used to answer the research questions, including an overview of some limitations of the analyses. In section 3 we discuss mobile device login and the relation to respondent characteristics. Section 4 explores the number of break-offs, device switching and the characteristics of break-offs per device. Section 5 shows the average survey duration and the survey duration in relation to the number of break-offs per device. Section 6 gives a brief summary of the findings, suggestions for future research and discusses the importance of designing questionnaires for mobile devices.

2. Methods

We analysed data of surveys among the general Dutch population that took place between January and May 2017 (6 surveys; over 15,000 responses in total).

All questionnaires of the selected surveys could be completed on computer, tablet and smartphone, however none were specifically designed to be filled in on smartphones or tablets. This means that the surveys were available on smartphones and tablets in the same lay-out as on computer. There were no adjustments made to fit the smaller screen size or to fill in with touch screens.

An overview of the survey specifications can be found in appendix 1. We used the results from 6 web first multi-mode surveys, with a total sample size of almost 40,000. Response rates in the Computer Assisted Web Interview (CAWI) mode varied from 31.3% to 48.6% (37% on average). Filling in the web survey took on average 22 minutes for the shortest and 34 minutes for the longest of the six surveys.

In the next sections we analyse the following respondent characteristics:

- gender;
- age;
- Dutch or foreign (western / non-western) background;
- household income (before taxes);
- household position (living with parents, single with or without children, couple with or without children);
- employment status (working, welfare, retired/not looking for work, student);
- urbanicity;
- region.

For all CAWI surveys, Statistics Netherlands registers the device type on which people open and fill in the questionnaire. Data on respondent characteristics are available from Dutch registers. Only completed questionnaires are counted as response, break-offs are not counted as response.

In the next sections if we speak of computer or pc we mean both desktops and laptops.

3. Mobile device login

In this section we explore mobile device usage to fill in online surveys in the general Dutch population. We distinguish between smartphone, tablet and computer.

3.1 Overall rates

In the general Dutch population 5.1% chose to fill in the survey on a smartphone and 16.7% on a tablet, in the first months of 2017 (see table 3a). Almost all other people fill in the survey on a computer. Other devices, like gaming devices or smart TV's, are hardly ever used. This category was therefore excluded for further analysis.

Table 3b shows the device usage per month. The χ^2 test was used to test differences between the months. Device usage did not vary significantly over the first months of 2017. However, over the years we do see some differences; the usage of smartphones and tablets has increased since 2012 and desktop usage has decreased (see Figure 1). The increase in tablet logins diminished after 2014, which is in line with the percentage of people who own a tablet with internet access over the years: from 2013 to 2014 tablet usage still increased by 12 percentage points, but from 2015 to 2016 the increase was less than 4 percentage points (see Table 1).

Table 3a: device usage (responses only)

	Response
n	15,645
Smartphone	5.1%
Tablet	16.7%
Computer	78.1%
Other	0.1%

Table 3b: logins per device per month in 2017 (including break-offs)

	January	February	March	April
n	2,793	2,658	4,468	7,772
Smartphone	6.1%	6.9%	6.6%	6.9%
Tablet	17.4%	17.9%	15.5%	16.9%
Computer	76.3%	75.1%	77.7%	76.0%
Other	0.2%	0.1%	0.2%	0.2%
			χ^2	10.6
			p	0.302

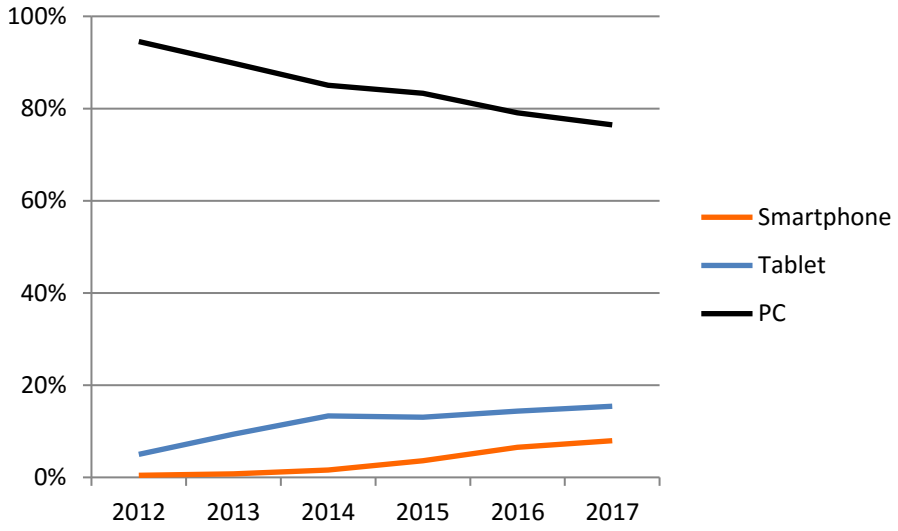

Figure 1: logins per device since 2012[1]

3.2 Relation to respondent characteristics

In this subsection we use classification trees and logistic regression to explore respondent characteristics per device type.
Advantages of classification trees are that these give a full stratification of the population and that the most influential characteristics are identified directly. However, strata may be exotic and are, therefore, harder to interpret. Also categories within a variable that do not differ significantly from each other are automatically merged in this analysis. The advantage of logistic regression is that all variables are included and interpretation and adaptation may be more intuitive. We therefore included results from both methods.
In addition we calculated an R-indicator per device type to get an idea of the selectivity of responses per device type for the combination of respondent characteristics. An overview of respondent characteristics per device type can be found in appendix B.

Figures 2 and 3 show the combined respondent characteristics per device, based on a Chi-squared automatic interaction detection (CHAID) analysis.
Especially younger people, aged 18-39, respond using their smartphone. Within this group we see a relatively high percentage of people with a foreign background: 19.5% of the people with a foreign background, aged 30-39, respond using a smartphone. People of 60 years or older hardly ever fill in the survey using a smartphone (0.6%).

1) The percentages used in Figure 1 are based on all available device data from 2012 to December 2017, not only surveys among the general population. The percentages in 2017 are therefore slightly different from the percentages described in this subsection.

Tablets are mainly used by working women with a far above average household income (24.1%). Students hardly ever fill in a survey on a tablet, especially male students (3.4%).

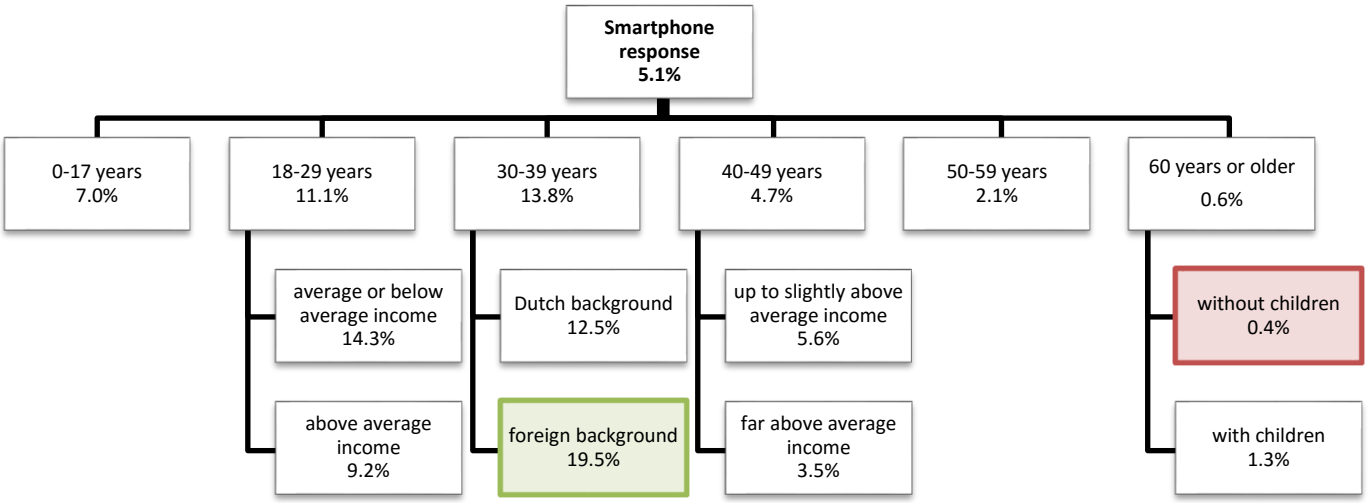

Figure 2: percentage of responses supplied via smartphone by group

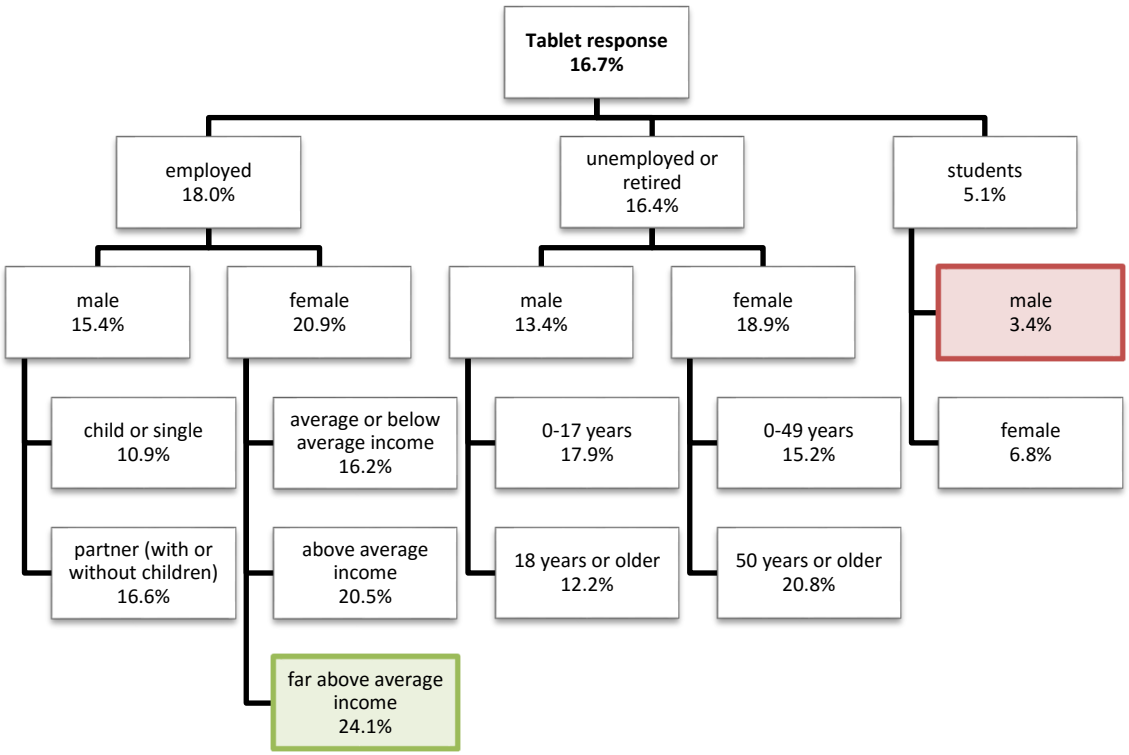

Figure 3: percentage of responses supplied via tablet by group

Next we explored the respondent characteristics per device with logistic regression analyses. Table 4 shows the results with device as the dependant variable (smartphone=1, computer=0 or tablet=1, computer=0). Initial analyses showed that region and urbanicity did not have an independent effect on smartphone and tablet response, so we decided to not include them in subsequent analyses. Variables with no significant influence are not shown in the tables. Also people of 17 years or younger were not included because often parents fill in the survey for their children.

Logistic regression shows similar results as CHAID analyses. Especially younger people fill in surveys using smartphones. Also people with a foreign background are more likely to choose a smartphone compared to Dutch people. On the other hand people with higher income, students and retired people are less likely to use a smartphone. Women and people with higher household income are more likely to fill in on a tablet. Students, children living at home and people with a foreign background are less likely to use a tablet.

The Nagelkerke R^2 is medium (smartphone) to low (tablet), which means there must be other variables explaining the device people choose, besides socio-demographic variables. The socio-demographic variables however give a good picture of the people we (can) reach, which is important information when deciding to invest in mobile friendly survey lay-out.

Table 4a: logistic regression respondent characteristics smartphone compared to computer

Nagelkerke R^2 = 0.154	**Exp(B)**	**Wald**	**p-value**
gender (ref. female)	0.724	22.084	0.724
age (ref. 70 years or older)		365.702	**0.000**
18-29 years	9.928	68.222	**0.000**
30-49 years	6.008	42.928	**0.000**
50-69 years	1.150	0.256	0.613
background (ref. Dutch)		47.424	**0.000**
non-western foreign	1.959	43.027	**0.000**
western foreign	1.405	9.005	**0.003**
economic position (ref. working)		51.385	**0.000**
welfare	1.423	8.586	**0.003**
retired/not working	0.460	22.742	**0.000**
student	0.600	14.789	**0.000**
household income (ref. minimum income)		44.101	**0.000**
below average	1.523	7.438	**0.006**
average	1.391	5.123	**0.024**
above average	1.036	0.063	0.802
far above average	0.809	2.189	0.139

Table 4b: logistic regression respondent characteristics tablet compared to computer

Nagelkerke R^2 = 0.028	Exp(B)	Wald	p-value
gender (ref. female)	0.663	95.613	**0.000**
background (ref. Dutch)		14.704	**0.001**
non-western foreign	0.771	6.786	**0.009**
western foreign	0.788	8.818	**0.003**
economic position (ref. working)		50.199	**0.000**
welfare	0.894	1.465	0.226
retired/not working	0.984	0.084	0.772
student	0.332	48.478	**0.000**
household income (ref. minimum income)		21.084	**0.000**
below average	1.315	4.775	**0.029**
average	1.353	6.197	**0.013**
above average	1.518	11.821	**0.001**
far above average	1.629	15.922	**0.000**
household position (ref. living at home)		15.460	**0.004**
single without children	1.113	1.288	0.256
partner without children	1.287	11.224	**0.001**
partner with children	1.283	9.899	**0.002**
single with children	1.170	1.273	0.259

Another way to look at the respondent characteristics per device, is calculating an R-indicator. The R-indicator gives an indication of the selectivity of the responses for a combination of characteristics (Cobben & Schouten, 2008). The R-indicator has a value from 0 to 1, where 1 means fully representative for the specified characteristics. Most surveys at Statistics Netherlands have an R-indicator between 0.80 and 0.85.

We calculated an R-indicator for the complete response, but also for computer-response, computer + tablet and computer + smartphone response. This is done by recoding response into non-response for the device that is not included. Note that this simulation is a fictional situation; when not allowing smartphone and/or tablet participation, it is likely that part of the people who would normally choose a mobile device will choose a computer to fill in the survey.

Table 5 shows the R-indicator for the various device combinations. As can be seen, the R-indicator for desktop alone and the combination desktop and smartphone is larger than for combinations with tablet responses. This suggests that the tablet responses make the response less representative. Smartphone responses make the representativeness better, although the difference falls within the error margin (note that smartphone response is a small group compared to pc response).

Table 5: R-indicator per device combination

	R-indicator	95% Confidence interval
computer	0.844	0.836 - 0.851
computer + tablet	0.798	0.790 - 0.806
computer + smartphone	0.850	0.843 - 0.858
computer + tablet + smartphone	0.803	0.796 - 0.812

4. Device switch and break-off

In this section we explore break-offs and device switching. Break-off fraction is defined as the number of non-complete responses divided by the total number of unique logins on the specific device. Switching is defined as using different devices at the first and last login.

4.1 Overall rates

Table 6 shows a χ^2 test of break-offs per device. Pairwise tests are done to distinguish specific differences between the groups. We used the Bonferroni method to correct for multiple testing. If there are significant differences between groups, the results from pairwise comparisons are shown in a second table. The first row defines a letter for every compared group. Next rows show the letters of the groups with significant lower rates than the concerning group.
People who use a smartphone to login, are more likely to break-off than people who use a tablet or computer. Also on tablets this percentage is significantly higher than on a computer (but lower than on smartphone).

Table 6: break-offs per device type

	smartphone	**tablet**	**computer**
n	1,184	2,972	13,512
% break-off	32.1%	12.1%	9.6%
		χ^2	553.7
		p	<0.001

Pairwise comparisons:	**(A)**	**(B)**	**(C)**
	BC	C	

People who login on a smartphone at their first attempt to participate, on average log in more often than people who start on a tablet or computer (see Table 7). If we look at device switching (see Table 8), we see that most people stay with their initial device. Less than 1% switches from smartphone to computer or from tablet to computer. The combined data from Tables 7 and 8 indicate that people need more attempts to complete a survey on a smartphone, but they are not willing or able to switch to another device.

Table 7: average number of logins per device (including break-offs, based on device at first attempt)

	smartphone	tablet	computer
n	1,307	3,012	13,348
average number of logins	1.14	1.08	1.07
		F-value	17.0
		p	<0.001

Pairwise comparisons	**(A)**	**(B)**	**(C)**
	BC		

Table 8: Device switching (including break-offs)

	n=17,690
No switching or only 1 attempt	98.7%
From smartphone to computer	0.6%
From tablet to computer	0.5%
From computer to tablet or smartphone	0.2%

4.2 Relation to respondent characteristics

In this subsection we use classification trees and logistic regression to explore the characteristics of break-offs per device type. The reason to include results from both methods is explained in section 3.2.

Figures 4 and 5 show the combined characteristics of the break-offs per device, based on CHAID analyses. On computer as well as on smartphone we see that break-off is more frequent among young people with a non-western foreign background. On tablets there are no significant differences per characteristic. This is possibly due to the low number of respondents/break-offs on tablet.

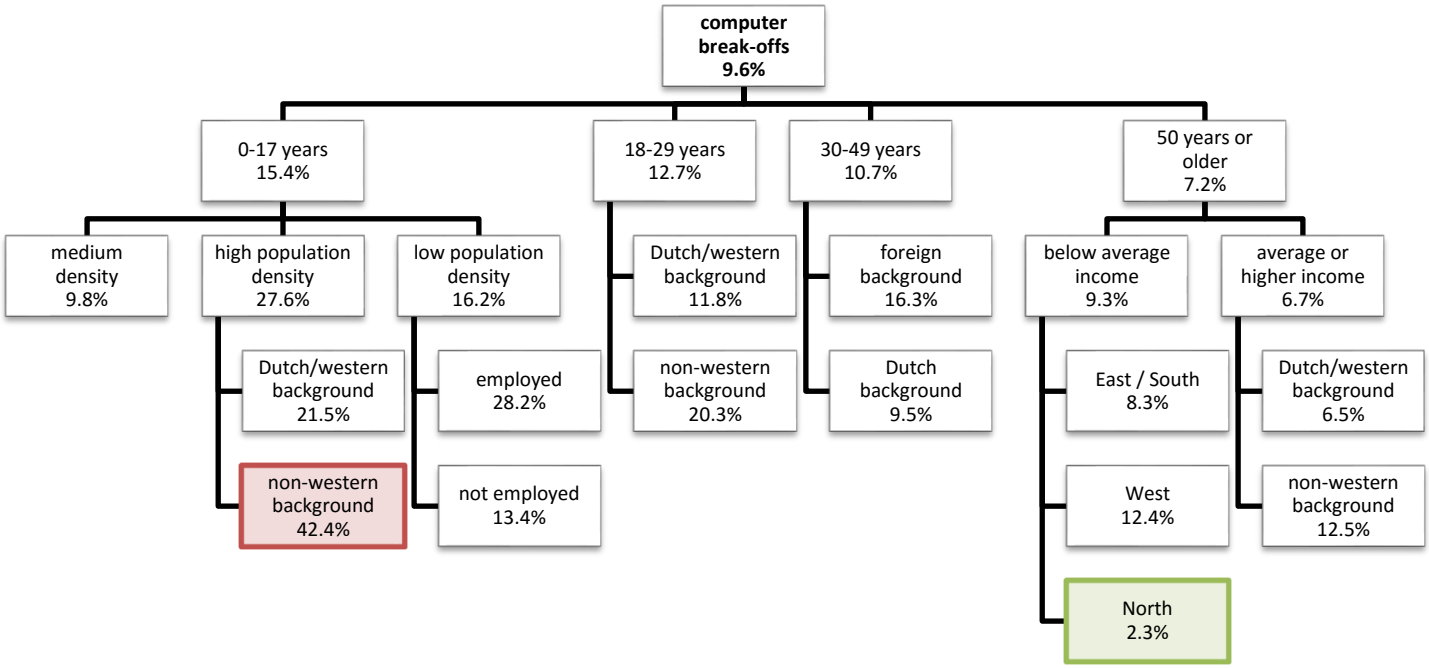

Figure 4: percentage of break-offs on computer by group

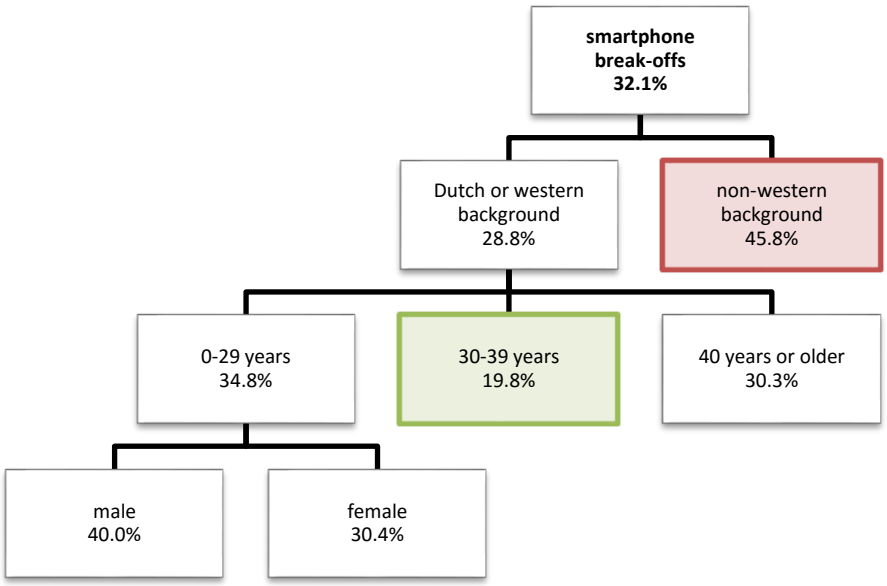

Figure 5: percentage of break-offs on smartphone by group

Next we explored the characteristics of break-offs per device with logistic regression analyses. Table 9 shows the results with break-off as the dependant variable (break-off=1, complete response=0). Initial analyses showed that region did not have an independent effect on break-off, so we decided to not include this in subsequent analyses. Variables with no significant influence are not shown in the tables. Also people of 17 years or younger were not included because often parents fill in the survey for their children.

Logistic regression shows similar results as CHAID analyses. Especially younger people and people with a non-western background are more likely to break-off. The Nagelkerke R^2 however is low for every device type.

Table 9a: logistic regression smartphone break-offs

Nagelkerke R^2 = 0.051	**Exp(B)**	**Wald**	**p-value**
background (ref. Dutch)		16.669	**0.000**
non-western foreign	2.035	15.894	**0.000**
western foreign	1.410	2.684	0.101
household position (ref. living at home)		14.909	**0.005**
single without children	0.559	7.469	**0.006**
partner without children	0.632	5.347	**0.021**
partner with children	0.565	12.390	**0.000**
single with children	0.799	0.542	0.462
urbanicity (ref. not urban)		7.875	0.096
light urban area	0.537	5.510	**0.019**
medium urban area	0.524	5.460	**0.019**
strong urban area	0.706	1.942	0.163
very strong urban area	0.606	3.581	0.058

Table 9b: logistic regression tablet break-offs

Nagelkerke R^2 = 0.007	**Exp(B)**	**Wald**	**p-value**
age (ref. 70 years or older)		11.009	**0.012**
18-29 years	1.125	0.249	0.618
30-49 years	0.636	5.825	**0.016**
50-69 years	0.733	2.989	0.084

Table 9c: logistic regression computer break-offs

Nagelkerke R^2 = 0.023	**Exp(B)**	**Wald**	**p-value**
age (ref. 70 years or older)		25.856	**0.000**
18-29 years	1.555	6.580	**0.010**
30-49 years	1.273	2.586	0.108
50-69 years	0.911	0.484	0.486
background (ref. Dutch)		28.848	**0.000**
non-western foreign	1.643	18.372	**0.000**
western foreign	1.458	13.532	**0.000**
economic position (ref. working)		7.646	0.054
welfare	1.125	0.914	0.339
retired/not working	0.991	0.007	0.933
student	0.680	6.321	**0.012**
household position (ref. living at home)		12.028	**0.017**
single without children	0.919	0.361	0.548
partner without children	0.707	6.060	**0.014**
partner with children	0.732	4.518	**0.034**
single with children	0.809	0.963	0.327

5. Average survey duration

In this section we discuss the survey duration and explore the effect of survey duration on break-offs per device. Note that the calculation of survey duration has some limitations. First it is based on date/time stamps rather than exact time spent per question. This means there is some bias when people break-off and complete the survey later. To limit bias we only calculated survey duration when start and end time were at the same day. In addition outliers were excluded by calculating the 5% trimmed mean. Second limitation is that we were not able to recover data on survey duration for the break-offs. Only completed surveys were registered with date and time stamps in the available para data. This limits the possible statistical analyses and also makes it impossible to add survey duration in the regression model for break-offs per device, while this intuitively might explain a large part of the break-offs.

5.1 Overall rates

Table 10 shows the average survey duration per device. One-way-anova / F-test was used to test differences in average survey duration per device. Pairwise comparisons are done to distinguish specific differences between the groups. We used the Bonferroni method to correct for multiple testing.
The average time to complete the survey on tablets and smartphones is respectively more than 3 and 4 minutes higher than on computer. These differences are statistically significant. Per survey we see the same picture. Interestingly this difference is not visible in our survey on consumer confidence (see Table 11), where the survey lay-out was adjusted for smartphone and tablet respondents (note that this survey is not included in all other analyses because of the specific mobile friendly design and use of QR code, which influence device usage). Although based on only one survey, this indicates that an adjusted lay-out may decrease response duration on tablets and smartphones.

Table 10: Time to complete the survey per device type

	smartphone	**tablet**	**computer**
n	804	2,611	12,215
minutes	30.2	29.4	26.1
		F-value	47.8
		p	<0.001

Pairwise comparisons	**(A)**	**(B)**	**(C)**
	C	C	

Table 11: Time to complete survey on Consumer confidence per device type

	smartphone	tablet	computer
n	476	501	1,852
minutes	8.2	9.0	8.6
		F-value	3.537
		p	0.014

Pairwise comparisons	**(A)**	**(B)**	**(C)**
		A	

In Figure 6[2] the percentage of break-offs is plotted against the average survey duration, per device per survey. Linear trend lines are added to test the relation between survey duration and break-offs. R^2 is a measure for the fit of the trend line: the closer to 1, the better the dots are explained by a straight line.
The graph indicates that the percentage of break-offs increases with the survey duration. This increase is slightly higher on tablets than on computer. The strongest increase, however, is visible on smartphones: the percentage of break-offs varies from less than 10% in the shortest survey to more than 40% in the longest surveys. In other words, the trend line indicates that for every extra minute, the break-off rate increases by 1.15 percentage points (compared to 0.46% on tablets and 0.29% on computer).

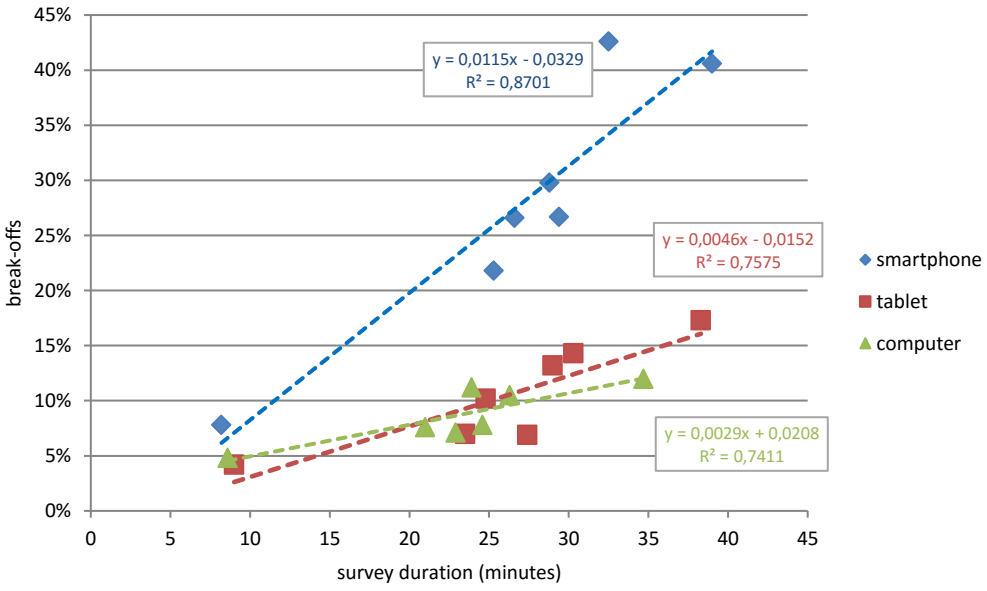

Figure 6: Break-offs plotted against the average survey duration per device per survey, including regression lines per device

2) In this graph we included the survey on Consumer Confidence (the three dots in the lower left corner), which was at the beginning of 2017 the only survey with an optimized lay-out for tablets and smartphones and also the shortest survey of al person surveys at that time.

5.2 Relation to respondent characteristics

In this section we discuss the effect of respondent characteristics on survey duration, corrected for device type. First we discuss a classification tree based on CHAID analyses, second a linear regression. The reason to include results from both methods is explained in section 3.2.

For these analyses we assume that the respondent characteristics used are not related to the amount of questions people had to answer (due to routing in the survey). For this reason we did not include household position and economic position (because having children, a job or current education likely increases the number of questions). Region was not included because initial analysis showed that region does not have an independent effect on survey duration.

Figure 7 shows segmentation of respondents to higher or lower survey duration. Survey duration differs a lot between certain groups. Especially older people use more time to fill in the survey. The highest average duration occurs for people of 70 years or older with an average or above average income, who complete the survey on a tablet (39.3 minutes). Fastest are younger people between 20 and 30 years with a minimum income, who use a computer or tablet to fill in the survey (21.0 minutes).

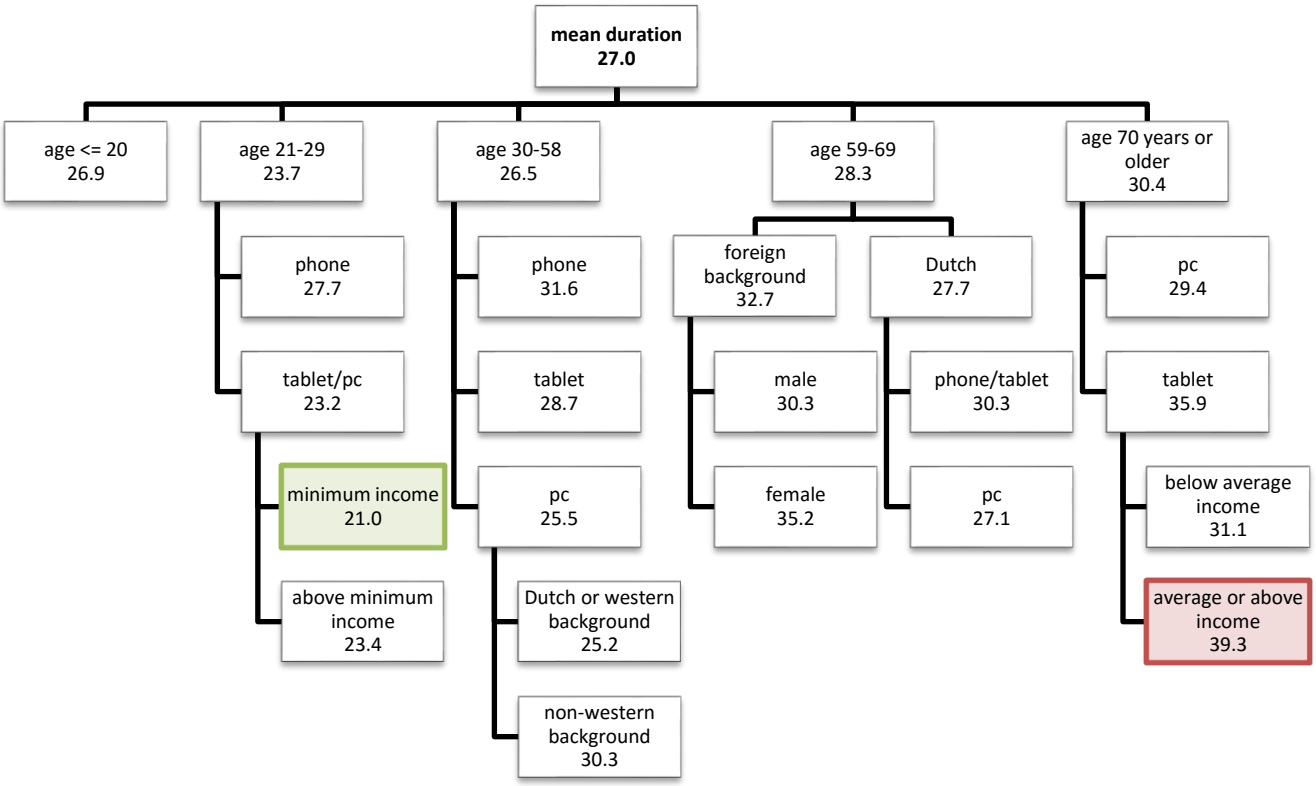

Figure 7: average survey duration in minutes by group

In addition survey duration was analysed using linear regression. To ensure normality, we not only removed outliers, but also applied a log transformation on the average survey duration.

The results are shown in Table 12. Gender has no significant effect on survey duration. Survey duration however increases with age. Also people with a foreign background use more time to complete a survey, as well as people in strong urban areas. Survey duration increases most when using a smartphone or tablet.

Table 12: linear regression survey duration

(log) survey duration R^2**= 0.033**	**B**	**Exp(B)**	**t**	**p-value**
gender (ref. female)	-0.002	0.995	-0.588	0.557
age (ref. 70 years or older)				
18-29 years	-0.064	1.159	-10.537	**0.000**
30-49 years	-0.038	1.091	-7.661	**0.000**
50-69 years	-0.014	1.033	-3.028	**0.002**
background (ref. Dutch)				
non-western background	0.044	1.107	6.274	**0.000**
western background	0.024	1.057	4.057	**0.000**
urbanicity (ref. not urban)				
light urban area	-0.007	1.016	-1.049	0.294
medium urban area	-0.006	1.014	-0.978	0.328
strong urban area	-0.015	1.035	-2.512	**0.012**
very strong urban area	-0.017	1.040	-2.691	**0.007**
household income (ref. minimum income)				
below average income	0.024	1.057	3.172	**0.002**
average income	0.024	1.057	3.406	**0.001**
above average income	0.020	1.047	2.944	**0.003**
well above average income	0.016	1.038	2.522	**0.012**
device (ref. computer)				
smartphone	0.083	1.211	11.297	**0.000**
tablet	0.057	1.140	13.130	**0.000**

These results give detailed insight in how long people need or take to complete a survey. However, we cannot draw any conclusions about the meaning of higher or lower survey duration. Higher duration maybe means that people struggle more to complete the survey or that people take it more seriously to complete (e.g. read more carefully etc.). Also it can be a combination of both reasons.

6. Discussion and conclusion

In web surveys of Statistics Netherlands among the general Dutch population, about 5% of all respondents uses a smartphone and more than 17% uses a tablet to fill in the questions. Especially people with a foreign background from 30 to 39 years old fill in the survey using their smartphone (19.5%). People of 60 years or older hardly ever choose to use a smartphone (0.6%). Females with a high household income relatively often use a tablet (24.1%), while students seldom respond on a tablet (5.1%). R-indicators show that smartphone responses can improve representativeness of the results.

Device switch and break-off

Especially on smartphones, a high percentage of the respondents do not complete the survey: 32.1% compared to 12.1% on tablet and 9.6% on computer (percentage of total number of unique logins). This is in line with higher break-offs found on smartphones by Couper, Antoun, Mavletova (2017), Peterson (2012) and Mavletova, Couper (2015). Especially younger people and people with a non-western background fail to complete the questionnaire, irrespective of the device they use. An explanation for this is given by Peytchev (2009) who concluded that break-off is mainly a result of questionnaire design, where socio-demographic variables act as a proxy for how people respond to lay-out issues. The results still give important information about which groups break-off per device, even though break-off might not be caused by respondent characteristics, but rather by design.

Device switching does not happen very often, similarly to previous research (Guidry, 2012; Peterson, 2012). Less than 1% of smartphone or tablet users switches to computer, even if they need multiple attempts to complete the survey.

In conclusion the percentage of break-offs is not only high on smartphones but this more frequently concerns younger people and people with a foreign background, who in general have lower response rates in survey research. People who choose a smartphone or tablet are unlikely to switch to a computer once started.

Survey duration

The time it takes to complete a survey on a tablet or a smartphone is on average respectively 3 and 4 minutes more than on a computer. There are several likely explanations for the time difference, like smaller screen size, time required to scroll and transmission times. Mavletova and Couper (2015) found a linear relation between screen size and completion time, where each additional 100 pixels in screen size resulted in a 12 second decrease in expected completion time. Couper and Peterson (2015) found that "scrolling has a big impact on response times", and Couper, Antoun, Mavletova (2017) further explain that this is especially the case for surveys that were not designed to be filled in on a mobile device. Our results also show that the older people are, the more time they use to complete the survey, irrespective of the device they use. Also people with a non-western background use

more time irrespective of the device. We cannot assume that more time is positive or negative: respondents might need more time because they encounter problems or because they take the survey more serious (or a combination of both).

Mobile friendly lay-out

The results of our analyses show that more than 20% of the respondents use a tablet or smartphone, while the questionnaires are not necessarily designed for mobile devices. This is a considerable part of the total response. These findings underpin the necessity to focus on mobile questionnaire design. A possibly even more important reason for this is the number of break-offs, especially on smartphones. A mobile friendly lay-out will highly likely prevent at least part of these break-offs, as has been shown in the meta-analysis of Mavletova and Couper (2015). In addition smartphone respondents and break-offs are relatively often people with a non-western background, who are generally less likely to respond. If we are able to optimize smartphone responses, we might reach more people with a non-western background in CAWI phase, which is considerably cheaper than CAPI.

Future research

As a next step it is important to gain more insight in the influence of survey duration on smartphone break-offs, especially for questionnaires with a mobile lay-out. It is often assumed that a questionnaire should be short on smartphones. There is however little to no data available on how long a questionnaire can be on a smartphone if the design is optimized for the device. In the current analyses we see that break-offs increase with survey duration, and that this increase is bigger on smartphones than on other devices. Because this is based on questionnaires that are not specifically designed for smartphones, we cannot conclude whether this is due to survey length, survey design or a combination of both.

Another future research objective is the response data quality per device: is response data quality on mobile devices comparable to computer response data quality? How about if we optimize the survey lay-out for smartphones and tablets? If response data quality is considerably lower on mobile devices, even with an optimized design, this might influence the decision between investing in mobile designs or blocking smartphone responses and redirecting people to a computer. De Bruijne and Wijnant (2013) conducted an experiment which suggests that survey completion on mobile devices does not necessarily lead to different results than on computers, after optimizing the design for the smaller screen size and touchscreen. One should however be prepared for longer survey duration and higher break-off rates according to this study. Guidry (2012) found that smartphone respondents provide responses of lower quality in 2 of the 5 data quality indicators, however they provide better quality in 1 indicator. The other 2 remain inconclusive. These results are based on a Web-based survey that was not optimized for small screens and/or touchscreens. Finally, several studies have been conducted on differences in the length of answers to open-ended text questions between devices (Peterson, 2012; Mavletova, 2013; Nichols, Hawala, Horwitz, & Bentley, 2015; Wells et al., 2014). They found that on smartphone answers to open-ended text questions were shorter but contextually similar to answers from other devices.

Conclusion

In conclusion, the results show that mobile devices give us the opportunity to reach more people in CAWI and to reach more difficult groups like people with a non-western background. The findings underpin the necessity to focus on mobile friendly questionnaire design. Further research is important to gain more insight in response quality on mobile devices and the limitations of survey length.

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Appendix A: Survey details

The table below shows some details of the surveys used for this paper. Sample sizes and response rates are based on the analysed period: January - May 2017.

Name and topic	Population	Sample size	Survey length	Modes	CAWI response	Incentive
Social cohesion Happiness, life satisfaction, contacts with family and friends, volunteer work, political and social participation, trust in institutions, environment and nuisance	15 years or older	3968	25 min.	CAWI with CATI-CAPI follow-up	1930 48.6%	unconditional incentive of €5 voucher
Life style monitor Alcohol and drugs use, sexual habits (topics vary over the years)	0 years or older	5620	27 min.	CAWI with CATI-CAPI follow-up	2634 47.0%	unconditional incentive of €5 voucher
Experiences Behaviour, attitude, experiences and opinions on society	18 years or older	6344	23 min.	CAWI with CATI-CAPI follow-up	2281 36.0%	lottery incentive iPads
ICT Use of ICT systems, communicating with government through the internet and buying services or products on the internet	12 years or older	9171	22 min.	CAWI with CATI follow-up	3165 34.5%	lottery incentive iPads
Statistics on Income and Living Conditions Income and economic situation (there are 3 follow-up surveys, only the first survey was used for this paper)	16 years or older	9327	34 min.	CAWI with CATI follow-up	2954 31.7%	50% lottery incentive iPads and 50% conditional incentive of €10 voucher
Learning Adult education, lifelong learning, access to education	25-64 years	7425	25 min.	CAWI with CATI follow-up	2326 31.3%	lottery incentive iPads

Appendix B: Respondent characteristics per device

The tables below show the percentage of responses supplied per device per group.

Gender	male	female
Smartphone	4.4%	5.9%
Tablet	14.0%	19.3%
Computer	81.6%	74.6%

Age	0-11	12-17	18-29	30-39	40-49	50-59	60-69	70 +
Smartphone	7.2%	7.9%	10.7%	13.3%	4.6%	2.1%	0.7%	0.6%
Tablet	24.4%	14.5%	9.0%	17.5%	19.4%	17.9%	17.6%	16.1%
Computer	68.4%	77.5%	80.2%	68.9%	76.0%	80.0%	81.6%	83.3%

Household position	child living at home	single	partner without children	partner with children	single with children
Smartphone	8.2%	5.3%	2.5%	6.5%	7.1%
Tablet	13.2%	13.8%	17.8%	18.4%	17.2%
Computer	78.4%	80.9%	79.7%	75.0%	75.4%

Economic position	working	welfare	retired / not working	student
Smartphone	5.8%	7.0%	2.4%	8.8%
Tablet	17.9%	14.4%	16.8%	4.9%
Computer	76.2%	78.4%	80.7%	86.1%

Household income	far below average	below average	average	above average	far above average
Smartphone	6.2%	5.8%	5.7%	5.4%	4.2%
Tablet	9.9%	15.0%	15.9%	17.0%	18.7%
Computer	83.9%	79.1%	78.3%	77.5%	77.0%

Region	North	East	West	South
Smartphone	4.8%	5.0%	5.4%	4.8%
Tablet	15.7%	17.1%	16.8%	16.4%
Computer	79.5%	77.7%	77.7%	78.7%

Urbanicity	very strong urban	strong urban	medium urban	light urban	not urban
Smartphone	6.0%	4.9%	5.2%	5.2%	3.8%
Tablet	14.9%	17.4%	16.7%	17.5%	16.2%
Computer	79.0%	77.6%	78.0%	77.2%	79.9%

Background	Dutch	Non-western foreign	Western foreign
Smartphone	4.6%	11.1%	6.1%
Tablet	17.3%	12.2%	14.2%
Computer	78.1%	76.5%	79.5%

Explanation of symbols

Empty cell	Figure not applicable
.	Figure is unknown, insufficiently reliable or confidential
*	Provisional figure
**	Revised provisional figure
2017–2018	2017 to 2018 inclusive
2017/2018	Average for 2017 to 2018 inclusive
2017/'18	Crop year, financial year, school year, etc., beginning in 2017 and ending in 2018
2015/'16–2017/'18	Crop year, financial year, etc., 2015/'16 to 2017/'18 inclusive

Due to rounding, some totals may not correspond to the sum of the separate figures.

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