Aigul Mavletova, National Research University Higher School of Economics

Mick P. Couper, Institute for Social Research, University of Michigan

Corresponding Author: Aigul Mavletova, National Research University Higher School of Economics, Department of Sociology. Kochnovskiy Proezd 3, Moscow, 125319, Russia. e-mail: amavletova@hse.ru.

Mobile Web Survey Design: Scrolling versus Paging, SMS versus E-mail Invitations

Abstract

There is some evidence that questionnaire design (scrolling or paging) and invitation mode (SMS or e-mail) have an impact on response rates in PC web surveys. This paper examines if these findings may be generalized to mobile web surveys. First, we explore the effect of scrolling and paging design on breakoff rate, item nonresponse, and completion time in mobile web surveys. Second, we investigate which type of invitation and reminder mode (SMS or e-mail) is more efficient in terms of producing higher response rate and maximizing percentage of the respondents who complete the survey via mobile device rather than PC. The paper summarizes the results of the experiment conducted among members of a volunteer online access panel in Russia. Participants were asked to fill out the questionnaire via mobile device. A total of 2,100 respondents completed the survey with an overall completion rate of 53%. We find that the scrolling design leads to significantly faster completion times, lower (though not statistically significant) breakoff rates, fewer technical problems, and higher subjective ratings of the questionnaire. We also find that SMS invitations are more effective than e-mail invitations in mobile web surveys. We discuss some practical implications of type of invitation and reminder to be used in mobile web surveys, depending on the survey goals and researcher constraints.

Keywords

mobile Web surveys, mobile devices, completion rates, survey design, scrolling, paging, invitation, reminder, SMS, nonresponse, item nonresponse

Introduction

The last few years has seen a rapid rise in research on mobile web surveys, in part because of the increasing percentage of participants who start (but not always finish) completing web surveys on mobile devices. This has led to a discussion of the design of mobile friendly questionnaires to reduce nonresponse and measurement error in web surveys (Callegaro, 2012; Couper, 2013; Peterson et al., 2013). Most of the experiments focused their attention primarily on measurement error, comparing data quality between PC and mobile web survey modes (see Baker-Prewitt, 2013; Buskirk & Andrus, 2012; De Bruijne & Wijnant, 2013; Lattery, Park Bartolone, & Saunders, 2013; Mavletova, 2013; Mavletova & Couper, 2013; Stapleton, 2011; Zahariev, Ferneyhough, & Ryan, 2009; Wells, Bailey, & Link, 2012). Many of these studies report higher breakoff rates and lower completion rates for mobile compared to PC web surveys (Baker-Prewitt, 2013; Buskirk & Andrus, 2012; De Bruijne & Wijnant, 2013; Mavletova, 2013, Mavletova & Couper, 2013). However, we know of few studies that have explicitly addressed ways to improve completion of web surveys completed on mobile devices. In this paper, we explore two factors that may affect nonresponse in mobile web surveys: the type of questionnaire design (scrolling or paging) and the invitation and reminder modes (SMS or e-mail).

With the introduction of web surveys over a decade ago, there was initial interest in whether scrolling design (where all survey questions are presented on a single page) and paging design (where the questionnaire is broken into several pages, at the extreme one for each question). Early research (e.g., Vehovar, Manfreda, & Batagelj, 2000) found that scrolling designs take less time for surveys with simple navigational logic (all respondents answer all questions), while paging designs were an advantage in surveys with many skips or complex logic (e.g., Peytchev et al., 2006). While few other differences were found between the two design approaches (see,

e.g., Couper, 2008, chapter 1), paging designs are generally used for more complex instruments and scrolling designs are still preferred for short satisfaction surveys. One of the early arguments in favor of the scrolling approach was that it required less interaction with the server, which was advantageous with slow or intermittent Internet connections. Given the evidence that mobile web surveys appear to be significantly slower than PC web surveys (De Bruijne & Wijnant, 2013; Guidry, 2012; Peterson, 2012), the issue of scrolling versus paging designs is worth revisiting for mobile web surveys. This may be particularly true in countries such as Russia where mobile Internet speeds are 16 times slower than in the USA (see Cisco Report, 2013), and the average completion time on mobile devices is about twice as long as for PC web surveys (Mavletova, 2013; Mavletova & Couper, 2013). Given this, we explore these two design approaches in a mobile web surveys, focusing on completion times, breakoff rates, and item missing data.

Another key issue in mobile web surveys that has received little or no research attention is that of the mode of invitation. E-mail is typically used to invite online panelists to web surveys. But SMS (short message service, or text messaging) may be more likely to be read on mobile devices, encouraging completion in that mode. Our paper also investigates which invitation mode is more efficient in improving response rates and increasing the proportion of respondents completing the survey on a mobile device rather than on a PC.

To test the effects of questionnaire design and invitation mode, we conducted an experiment using a volunteer online access panel in Russia. Members of a mobile web subpanel were invited to complete the survey via mobile phone, with random assignment to experimental conditions. A total of 2,110 respondents completed the survey. Below we describe the specific hypotheses and review relevant literature on each of these two topics, then describe the design of the study, before reporting on the results of this experiment.

Hypotheses and Literature Review

Scrolling vs paging

Experiments comparing scrolling and paging designs in PC web surveys found no differences in response rates and breakoff rates between the two versions (e.g., Peytchev et al., 2006; Vehovar, Manfreda, & Batagelj, 2000). In a large experiment which combined both PC and mobile web respondents with more than 35, 000 interviews McGeeney and Marlar (2013) found that the scrolling version of 13 items (presented in three screens) produced slightly higher response rate and lower breakoff rate compared to the paging version. We suggest that there might be a higher breakoff rate on the first page in the scrolling design compared to the paging version because of the longer time required to download the survey. At the same time, later breakoffs will be higher in the paging design because of the additional server interactions required for this type of design.

A recent survey was conducted among panelists who were nonrespondents or broke off in a large mobile web survey in a volunteer online access panel in Russia (Aboev et al., 2013). A total of 660 panelists filled out the follow-up questionnaire with the completion rate of 53.6%: 504 break offs (completion rate=64.3%) and 156 nonrespondents (completion rate=38.1%). Among 504 participants who dropped out in this mobile web survey the main reason reported was technical difficulties of selecting responses (not clickable response – 47%, see Table 1). Some other difficulties were related to long download times (24%) and problems with Internet speed (16%). Together, the three major breakoff reasons (accounting for 86% of responses) were related to technical limitations of the mobile Internet connection or survey (which was optimized for mobile web). In our previous mobile web experiment which used a paging design (Mavletova & Couper, 2013) almost half of the breakoffs occurred on the first question. Given that a scrolling design contains more information and may thus take longer to download on a mobile device, we can expect higher breakoff rates for the scrolling design. A competing hypothesis is that

completing a scrolling survey requires fewer pages and may be more convenient for respondents. Given the smaller number of interactions with the server in a scrolling design, the risk of breakoff for technical reasons (i.e., dropped connections) may be lower. This suggests that earlier breakoffs may be more frequent in the scrolling design, but later breakoffs more so in the paging design.

Table 1: Breakoff Reasons in Mobile Web Surveys

Breakoff reason	%
Could not select the answer (not clickable response)	46.6% (235)
Questions were not completely downloaded/ were downloaded very slowly	23.6% (119)
Not convenient to complete the survey via mobile phone	19.6% (99)
Problems with Internet speed	15.9% (80)
Not clickable URL in SMS invitation	13.9% (70)
TOTAL	504

Previous research has shown that one advantage of a scrolling design is in reduced completion time; however, this depends on the extent of skip logic implemented in the questionnaire (Peytchev et al., 2006). In surveys with no or simple skip logic, the scrolling version should take less time, as there is almost no need to follow complex instructions to navigate from one question to another (see Vehovar, Manfreda, & Batagelj, 2000; Tourangeau et al., 2004). McGeeney and Marlar (2013) found that among both mobile and PC respondents it took significantly less time to complete the questionnaire in the scrolling rather than paging version. In contrast, in surveys with more complex navigational logic, a paging design with automatic navigation takes less time to complete (Peytchev et al., 2006). Since we do not have any skip logic in the experimental questionnaire, we expect that the scrolling version will take significantly less time to complete than the paging version.

There is some evidence that a scrolling design results in higher rates of item missing data in PC web surveys (Vehovar, Manfreda, & Batagelj, 2000; Peytchev et al., 2006). The reason offered that that the need to scrolling increases the likelihood of inadvertently missing an item. In line with this finding, we expect the same to be true for mobile web surveys, that is, for the scrolling version to have higher rates of item missing data than for the paging version.

Hypothesis 1.1: A higher breakoff rate is expected on the first page in the scrolling rather than paging design because of the longer time required to download the survey. At the same time, breakoffs will be higher on subsequent pages in the paging version because of the additional server interactions required for the paging design.

Hypothesis 1.2: Given that no skip logic is used for navigation, completion time in the scrolling design is expected to be shorter compared to the paging design.

Hypothesis 1.3: A higher rate of item nonresponse is expected in the scrolling than in the paging design.

Invitation and reminder mode: SMS vs e-mail

While a number of studies have explored the mode of invitation and reminder for web surveys, comparatively little has been done for mobile web surveys. If researchers have contact e-mails and mobile phone numbers for sample members, two electronic methods of invitation/reminder

are possible: e-mail and SMS. De Bruijne and Wijnant (2013) used e-mail to invite both PC and mobile panel members in their experiment comparing data quality between PC and mobile survey modes. The response rate was significantly lower for the mobile than the PC web mode (44% vs 62%, respectively). Further, about 10% of those assigned to use the mobile mode used a PC instead of a smartphone or tablet to complete the survey. We used SMS to invite respondents to complete the survey via mobile web in our previous experiments (Mavletova, 2013; Mavletova & Couper, 2013). The completion rate in the mobile web mode was also significantly lower compared to the PC mode: 30% vs 72% (Mavletova & Couper, 2013). About 9% of the respondents used a PC instead of a mobile device to participate in the survey. Bosnjak et al. (2008) found that SMS prenotification was more efficient compared to e-mail prenotification in PC web surveys. However, an e-mail invitation produced higher response rate than an SMS invitation because the respondents did not have to type the URL manually to participate in the survey.

There are some limitations of SMS as an invitation and reminder mode in mobile web surveys. First, it leads either to immediate completion of the survey or to nonresponse (Maxl et al., 2010). SMS surveys show that almost 70% of the responses are received within 10 minutes (Cooke, Nielsen, & Strong, 2003). The results of the survey of breakoff and nonresponse reasons in a large mobile web survey in a volunteer online access panel in Russia also support this finding. The main reason given for not responding was a lack of mobile Internet access at the moment of receiving the SMS (26%, see Table 2). Second, the URL can be displayed as text and not as a hyperlink in an SMS invitation, which means that participants have to type the link manually in mobile browser. About 17% of nonrespondents and 14% of breakoffs reported such a problem (see Table 1 and Table 2). Maxl et al. (2010) found that a WAP push invitation improved start rates compared to SMS in mobile web surveys; however, it did not increase completion rate. Third, SMS has a rather limited opportunity to convince respondents to participate in the survey due to the length limitation. A single message using the Latin alphabet should not exceed 160 characters, and a message which uses non-Latin alphabet (e.g., Cyrillic) should not exceed 70 characters. Sending longer invitations result in increased costs compared to sending e-mail which does not require any expenses. Fourth, the nature of SMS is seen as more intrusive compared to e-mail (Cooke, Nielsen, & Strong, 2003). Moreover, some individuals block receiving SMS on their mobile devices. Finally, the absorption rate (percentage of the invitations delivered) is significantly lower in SMS compared to e-mail invitation. Mavletova and Couper (2013) found that the absorption rate of the e-mail invitation in Russia was almost 100%, compared to 89% for SMS. However, as noted earlier, using e-mail for invitations may encourage participants to complete the survey on a PC rather than on a mobile device.

Table 2: Nonresponse Reasons in Mobile Web Surveys

Nonresponse reason	%
No Internet access at the moment of receiving SMS invitation	25.6% (40)
Not convenient to complete the survey via mobile phone	21.8% (33)
I had to pay for mobile Internet	20.5% (32)
No time to complete the survey	18.6% (28)
Not clickable URL in SMS invitation	16.7% (26)
Problems with Internet speed	16.0% (25)
An error while opening URL	16.0% (25)
TOTAL	156

To test the effect of the invitation and reminder modes in mobile web surveys, we randomly assigned respondents to one of five experimental conditions, varying the mode of invitation/reminder (e-mail vs SMS) and whether the URL was included in the e-mail reminder (yes/no). This design keeps the number of contacts constant (at 2), but varies the mode and content of the contacts. We expect that changing the mode of the reminder improves completion rate in mobile web surveys compared to sending a reminder in the same mode as the invitation. We expect that using both SMS and e-mail for contact with panel members will maximize the absorption rate and increase the response rate, relative to using only one mode.

Given the relative transience of SMS, we expect that the SMS invitation will result in the immediate completion of the survey (i.e., within several hours of receipt) compared to the e-mail invitation which will result in later responses. Individuals usually receive and check SMS right away. At the same time, it is easier to forget SMS messages that have been read. While e-mail gives the user an opportunity to flag messages for later attention or not read them until one has time to attend to them, SMS has more limited possibilities in this regard.

Taking into consideration the limitations of the SMS mode presented above we hypothesize that an e-mail invitation will have a higher completion rate compared to SMS. However, e-mail invitations or reminders are expected to result in a significant increase in the proportion of respondents who complete the survey on a PC. We further expect that the probability of completing the survey via a mobile device if invited by e-mail depends on the frequency of mobile web usage. Those respondents who tend to make more frequent use of mobile web are expected to have a higher propensity of completing the survey in the mobile web mode compared to those who rarely use their mobile device to access the Internet.

Given that the use of e-mail reminders may increase the proportion switching mode (i.e., completing the survey on a PC rather than a mobile device), we also varied whether the e-mail reminder included the URL for the survey. We expect that including the URL in the e-mail reminder will increase overall response rates, but also increase the proportion switching modes.

Hypothesis 2.1: SMS invitations will result in the immediate completion of the survey (within several hours) compared to e-mail invitations which will result in later responses.

Hypothesis 2.2: Changing the mode of the reminder (from e-mail to SMS or from SMS to e-mail) will improve completion rates compared to the conditions which have the invitation and reminder in the same mode (SMS invitation – SMS reminder or e-mail invitation – e-mail reminder).

Hypothesis 2.3: E-mail invitations will result in higher completion rates compared to SMS invitations. At the same time, e-mail invitations are expected to increase the percentage of those respondents who fill out the questionnaire via PC rather than mobile device.

Hypothesis 2.4: Those respondents who use mobile web more frequently will have a higher probability of completing the survey via a mobile device than those who use it rarely.

Hypothesis 2.5: An e-mail reminder without a URL will result in a completion rate and percentage of PC participants comparable to the SMS reminder, but a lower completion rate compared to e-mail reminder with a URL.

Experimental Design

As described above, the experiment has two factors with two and five levels respectively:

1. Questionnaire design: scrolling vs paging. Sample persons were randomly assigned in equal proportions to the two groups. In the paging design all questions were displayed one by one on separate pages across a total of 17 pages or screens. In the scrolling version all questions were presented on two pages, with 9 questions on the first page and 8 questions on the second page. We tested a single-page scrolling version with all items displayed on a single web page and found that downloading and presenting all questions on one page varied greatly depending on the type of mobile device and Internet connection used while completing the survey. After several tests made on different feature phones and smartphones, mobile browsers and types of Internet connections, we divided the scrolling version into two pages.

2. Invitation and reminder modes: SMS vs e-mail. Almost one third of the sample persons were randomly assigned to receive an e-mail invitation, while the remaining two-thirds were assigned to receive an SMS invitation. In two days about half of the nonrespondents received e-mail, the other half – SMS reminder. If respondents received SMS invitation they were assigned either to the condition of e-mail reminder with a URL for the survey or without a URL. In total, participants were assigned to one of the five conditions:

(1) SMS invitation – SMS reminder (30%),
(2) SMS invitation – e-mail reminder with a URL (25%),
(3) SMS invitation – e-mail reminder without a URL (15%),
(4) e-mail invitation – SMS reminder (15%),
(5) e-mail invitation – e-mail reminder with a URL (15%).

Data Collection and Questionnaire

The experiment was conducted using a volunteer online access panel managed by Online Market Intelligence (see http://www.omirussia.ru/en) from April 9 to April 29, 2013, in Russia. Members of the mobile web subpanel, that is, panelists who agreed to complete surveys via mobile devices and provided their mobile phone numbers, were randomly selected and invited to the participate in the experiment. The length of the SMS invitation was considerably shorter than the e-mail invitation: 128 vs 1041 characters, respectively. In both contact modes respondents were invited using the regular individual URL which was not shortened and had 43 characters. SMS invitation was short: “Fill out the questionnaire via mobile phone! Time: 7 min. Incentive: 30. URL: www.unipark.de/uc/...”. E-mail invitation had longer sentences but did not include any additional information about the survey. Both modes encouraged respondents to complete the survey via a mobile phone. The “Mobile survey” subject line and a note that participants would be incentivized only if they completed the survey via mobile phone in the e-mail invitation were expected to increase the proportion of mobile respondents. Two days after the initial invitation, nonrespondents and breakoffs were sent reminders either in the same or in a different mode (and in the e-mail mode, with or without a URL) depending on the condition they were assigned.

The Unipark online research software (see http://www.unipark.com) was used to program the questionnaire for mobile browsers. Respondents were not expected to use a mobile application to participate in the survey. Both paging and scrolling versions had the same uniform layout. Since feature phone owners were also invited to the survey, only radio button and check box questions were used without any complex design (e.g., no sliders and drop-down menus).

In spite of encouraging participants to use mobile devices to fill out the questionnaire we expected that some of them would use a PC instead. To identify the survey mode we asked respondents to indicate the device they used to complete the survey, and verified it by analyzing

the user agent string information – a paradata variable which is captured when the respondent clicks on the survey URL and which contains information about the browser and device used by the respondent (see Callegaro, 2010).

Questionnaire

The survey used in the experiment contained 17 questions about volunteer activities. It included questions about volunteer activities respondents were involved in (e.g., helping non-profit organizations for free, organizing charity or leisure social events), practices of helping other people for free (e.g., donating blood, providing aged-care services, helping with transport), basic demographics, mobile web usage patterns, and questions about evaluation of the survey itself (whether respondents liked completing the survey via a mobile device, whether it was difficult for them, how many minutes it took to compete the survey, etc.). There were no screening questions, quotas, or skip logic in the survey. None of the questions were obligatory, and respondents could skip any question they did not want to answer. In both the paging and scrolling versions, the announced length of the survey was 7 minutes.

Results

Scrolling vs paging

A total of 4,000 invitations were sent to selected sample persons. The experiment resulted in 2,110 completed interviews: 1075 in the scrolling and 1035 in the paging version. The total completion rate was 52.8% with no difference by the survey design (see Table 3).

Table 3: Response Rates: Scrolling vs Paging

	Scrolling	Paging	Total	Chi-square (*df*=1)
Number of invitations	2,000	2,000	4,000	
Completion rate	53.8% (1075)	51.8% (1035)	52.8% (2110)	1.605 (n.s.)
Breakoff rate	8.0% (94)	10.2% (118)	9.1% (212)	3.365 (n.s.)
Breakoff rate on the first page	6.0% (70)	3.3% (38)	4.7% (108)	9.487**
Breakoff rate on the subsequent pages	2.1% (24)	6.9% (80)	4.5% (104)	32.382***
Mobile devices only (PC excluded)				
Completion rate	49.9% (916)	48.6% (902)	49.3% (1818)	.642 (n.s.)
Breakoff rate	8.8% (88)	10.6% (107)	9.7% (195)	1.947 (n.s.)

***p<0.001, **p<0.01

All chi-square tests are two-sided.

The breakoff rate was higher for the paging than for the scrolling design (10.2% and 8.0%, respectively); however, the difference did not reach statistical significance (p = 0.067). As expected, the breakoff rate on the first page was significantly higher in the scrolling version (6.0% vs 3.3%) and significantly higher on the subsequent screens in the paging version (6.9% vs 2.1%). About 83% of the respondents completed the survey via a mobile phone, 14% via PC, and 3% via tablets, with no significant difference between two versions (see Table 4). Exclusion of PC respondents resulted in an overall completion rate of 49.3%.

Table 4: Sample Composition by Devices: Scrolling vs Paging

	Scrolling	Paging	TOTAL
Feature phones	8.7% (93)	9.7% (100)	9.1% (193)
Smartphones	73.0% (785)	74.5% (771)	73.7% (1556)
Tablets	3.5% (38)	3.0% (31)	3.3% (69)
PC	14.8% (159)	12.9% (133)	13.8% (292)
TOTAL	1075	1035	2110

Chi-square=2.648 (*df*=3), p=0.449

The breakoff rate was significantly associated with the device used by the respondent (see Table 5). The highest breakoff rate was among feature phone users (30.3%), and the lowest among tablet users (2.8%), with smartphone and PC respondents about the same (6.5% and 5.5%, respectively). Among smartphone and tablet users, there were also significant differences in breakoff rates by operating system (chi-square=21.352, *df*=4, p<0.001), with the highest rate being for Symbian-based devices (12.8%), and the lowest for users of Apple iOS (2.2%).

Table 5: Breakoff Rate by Devices

Devices	Breakoff Rate	Chi-square
Feature phones	30.3% (84)	171.694*** (*df*=3)
Smartphones	6.5% (109)	
Tablets	2.8% (2)	
PC	5.5% (17)	
TOTAL	212	

***p<0.001

As expected, the mean completion time in the scrolling version was significantly lower compared to the paging version (the values were cut on the 95-th percentile for each design separately to remove outliers). It took twice more time to fill out the questionnaire in the paging than in the scrolling design: 4.5 min. and 9.1 min., respectively (see Table 6). The same difference was found after excluding PC respondents from the analysis. The scrolling design appeared to facilitate the process of completing the survey among feature phone users. It took almost three times as much time to complete the survey via feature phone in the paging than in the scrolling version (6.7 min. and 20.0 min., respectively). The smallest differences by survey design were among tablet and PC users. Subjective evaluation of the completion time reported by the respondents was close to the objective average time and was also significantly lower in the scrolling version (see Table 6). Moreover, in line with the results of Peytchev et al. (2006), participants reported greater satisfaction completing the scrolling version: 68% of mobile respondents completing the scrolling design gave the highest rating to the survey, compared to 60% for the paging version (chi-square=14.916, *df*=2, p<0.001).

Table 6: Mean Completion Time (Objective and Subjective): Scrolling vs Paging

	Scrolling	Paging	t
Objective mean completion time			
N	1020	981	
Mobile devices and PC	4.52 min. (SD=2.48 min.)	9.09 min. (SD=12.86 min.)	-11.158*** (*df*=1,999)
N	865	850	
Mobile devices	4.69 min. (SD=2.49 min.)	9.86 min. (SD=13.60 min.)	-10.995*** (*df*=1,713)
N	85	84	
Feature phones	6.65 min. (SD=3.38 min.)	19.99 min. (SD=19.23 min.)	-6.301*** (*df*=167)
N	745	735	
Smartphones	4.53 min. (SD=2.31 min.)	8.93 min. (SD=12.58 min.)	-9.394*** (*df*=1,478)
N	35	31	
Tablets	3.16 min. (SD=0.92 min.)	4.25 min. (SD=1.42 min.)	-3.754*** (*df*=64)
N	155	131	
PC	3.58 min. (SD=2.19 min.)	4.17 min. (SD=3.28 min.)	-1.809 (*df*=284)
Subjective evaluation of completion time			
N	897	894	
Mobile devices	4.82 min. (SD=2.88 min.)	6.88 min. (SD=5.88 min.)	-9.442***

***p<0.001, standard deviation in parenthesis

Significantly fewer respondents reported technical problems while completing the survey in the scrolling design (19.4%) than in the paging version (27.5%). The main problem reported by participants was the technical difficulty of selecting responses (not clickable answers – 9%) with no difference by version. Significantly more participants in the paging design reported problems with Internet speed (7% in the paging and 5% in the scrolling design, chi-square=5.637, *df*=1, p<0.05) and experiencing some errors (e.g., system and connection) while completing the survey (6% in the paging and 2% in the scrolling design, chi-square=20.109, *df*=1, p<0.001).

The paging design had a slightly higher percentage of mobile respondents who missed at least one question (10.3% vs 8.7%) but the difference was not statistically significant (see Table 7). Contrary to expectation, overall item nonresponse did not differ by survey design. In both versions, a significantly higher overall item nonresponse rate was found among feature phone users (4.5%), followed by smartphone users (1. 6%), and then tablet (0.3%) and PC users (0.5%) (F=10.600, *df*=3, p<.001).

Table 7: Item Nonresponse (Mobile Devices): Scrolling vs Paging

	Scrolling	Paging	TOTAL	Statistics
N	916	902	1818	
At least one item nonresponse (nonrespondents)	8.7% (80)	10.3% (93)	9.5% (173)	Chi-square =1.312 (*df*=1)
N	916	902	1818	
Overall item nonresponse	2.09% (SD=9.3%)	1.58% (SD=8.3%)	1.84% (SD=8.8%)	t=1.248 (*df*=1,816)

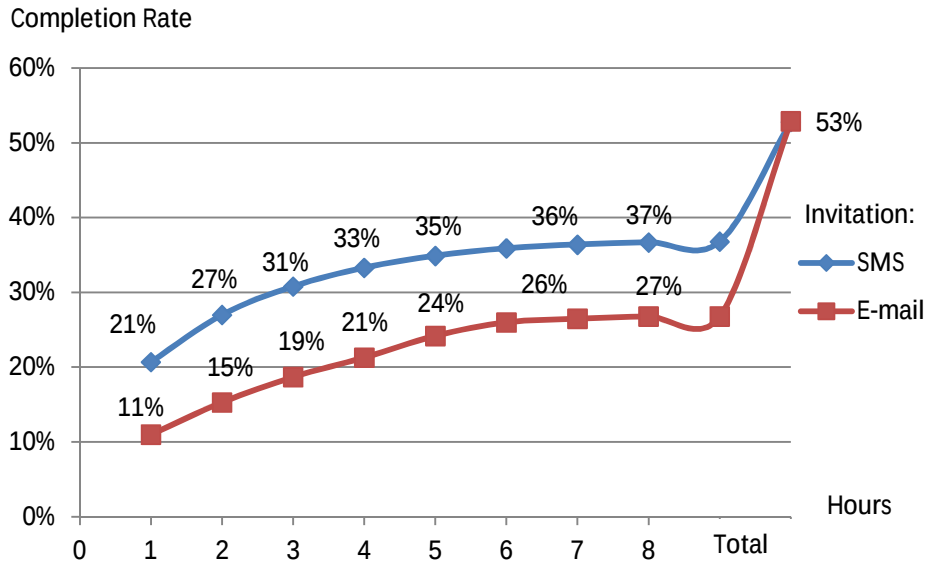
**p<0.01

Invitation and reminder mode: SMS vs e-mail

Contrary to expectation, we found no difference in completion rates between SMS and e-mail invitations, either before (40.9% and 38.7%, respectively) or after sending reminders (52.8%) if both mobile and PC respondents are included. However, SMS is more effective in terms of completion rates on mobile devices. The SMS invitation produced a mobile completion rate of 51.3%, compared to 43.7% for the e-mail invitation (chi-square=16.312, *df*=1, p<.001).

We found support for the hypothesis that SMS works immediately as the invitation mode. Within an hour after sending the SMS invitation, the completion rate was 21%, while it was only 11% for the e-mail condition (chi-square=54.176, *df*=1, p<0.001). Within three hours of sending the invitation, the completion rate was 31% in the SMS condition and 19% in the e-mail condition (chi-square=60.828, *df*=1, p<0.001, see Figure 1).

Figure 1: Progress of Completion Rate by Invitation Mode and Time of Completing the Survey: SMS vs E-mail



As expected, the five levels of the invitation/reminder factor led to significantly different final completion rates (see Table 8). The highest completion rate was in the "e-mail invitation – SMS reminder" condition (60.9%), while the lowest was in the "e-mail invitation – e-mail reminder" (44.1%). The three other conditions had comparable completion rates, though sending an e-mail reminder without a URL was slightly but not significantly less efficient than an SMS or e-mail reminder with a URL (chi-square=5.460, *df*=2, p=0.065). While excluding PC participants from the analysis, the completion rate was significantly lower only among those who received e-mail as both invitation and reminder. The other four conditions produced comparable completion rate ranging from 47.7% to 53.5%.

Table 8: Response Rates by Invitation and Reminder Modes: SMS vs E-mail

	SMS-SMS	SMS-E-mail	SMS-E-mail without URL	E-mail-SMS	E-mail-E-mail	TOTAL	Chi-square
Number of invitations	1198	1002	600	626	574	4000	
Completion rate before reminder	40.7% (487)	40.8% (409)	41.7% (250)	41.4% (259)	35.7% (205)	40.3% (1610)	5.954 (*df*=4) (n.s.)
Completion rate after reminder	53.2% (637)	54.6% (547)	48.7% (292)	60.9% (381)	44.1% (253)	52.8% (2110)	39.316*** (*df*=4)
Breakoff rate	11.2% (80)	10.3% (63)	9.6% (31)	4.8% (19)	7.0% (19)	9.1% (212)	15.451** (*df*=4)
Completion rate (mobile devices only)	52.4% (617)	52.1% (491)	47.7% (281)	53.5% (278)	32.8% (151)	49.3% (1818)	62.039*** (*df*=4)

***p<0.001, **p<0.01

In line with our expectations, an e-mail invitation resulted in a significant increase in respondents who completed the survey via PC rather than mobile device (see Table 9). About 32% of the respondents who were initially invited by e-mail completed the survey via PC and 6% via tablets. An SMS invitation with an e-mail reminder including a URL resulted in fewer PC (10%) or tablet (3%) respondents. As expected, the lowest rates of PC participants were found among those who were invited by SMS and reminded either by SMS (3.1%) or e-mail without a URL (3.8%).

Table 9: Sample Composition by Device: SMS vs E-mail

	SMS-SMS	SMS-E-mail	SMS-E-mail without URL	E-mail-SMS	E-mail-E-mail	TOTAL
Feature phone	11.1% (71)	11.5% (63)	8.6% (25)	5.8% (22)	4.7% (12)	9.1% (193)
Smartphone	83.8% (534)	75.7% (414)	85.3% (249)	63.0% (240)	47.0% (119)	73.7% (1556)
Tablet	1.9% (12)	2.6% (14)	2.4% (7)	4.2% (16)	7.9% (20)	3.3% (69)
PC	3.1% (20)	10.2% (56)	3.8% (11)	27.0% (103)	40.3% (102)	13.8% (292)
TOTAL	637	547	292	381	253	2110

Chi-square=339.350 (*df*=12), p<0.001

As hypothesized, the probability of completing the survey via a mobile device is significantly associated with the frequency of mobile web usage (Table 10). Those respondents who use it on a daily basis have higher probability of completing the survey via mobile device compared to those who use it less frequently.

Table 10: Type of Device by the Frequency of Mobile Web Usage

Mobile web usage frequency	Mobile phone	Tablet	PC	TOTAL
Every day	86.2% (1365)	3.5% (55)	10.3% (163)	1583
Less than every day	71.5% (357)	2.8% (14)	25.7% (128)	499
TOTAL	82.7% (1722)	3.3% (69)	14.0% (291)	2082

Chi-square=74.401 (*df*=2), p<0.001

Discussion and Conclusion

There are two major findings from our experiment. First, a scrolling design makes the process of completing the survey easier and more engaging for mobile web respondents. Specifically, it significantly decreases the completion time, produces fewer reports of technical problems, and increases the reported level of satisfaction among respondents.

Second, taking into consideration both completion rate and the percentage of PC respondents, an SMS invitation is more efficient compared to e-mail in encouraging respondents to complete the survey via a mobile device.

In further detail, we had eight specific hypotheses in the experiment. As expected in H 1.1, a scrolling design produced a higher breakoff rate on the first page of the survey as it requests more time to download the questions, while paging design resulted in higher rate of later breakoffs as it requests more server interactions compared to scrolling design. In total, the scrolling version had a lower, but not statistically significant (p=.067) breakoff rate. Though we found the scrolling version more efficient compared to the paging version, researchers should focus attention on identifying the optimal number of questions displayed on each page.

As hypothesized in H 1.2, in our short survey with no skip logic it took significantly longer to complete the survey in the paging rather than in the scrolling design. Respondents also rated the scrolling version significantly higher compared to the paging version. Moreover, fewer respondents reported technical problems while completing the scrolling survey.

Contrary to H 1.3, overall item nonresponse was not significantly higher in the scrolling than the paging design. A slightly higher percentage of respondents missed at least one item in the paging design. This suggest there is a higher probability of unintentionally skipping a question by clicking the ‘‘Next page’’ button in 17 rather than 2 screens. At the same time, we found comparable overall item missing data rates between the two designs.

As expected in H 2.1, an SMS invitation leads to more immediate completion of the questionnaire compared to an e-mail invitation. This supports the limitation of SMS mode which is likely to produce either an immediate response or no response. This suggests that those who don’t have mobile Internet access at the time of receiving the SMS may be more likely to be nonrespondents.

We did not find support for H 2.3 that e-mail invitations would result in higher response rates compared to SMS. No differences in completion rates by invitation mode were found. An e-mail invitation with an SMS reminder produced the highest overall completion rate, and an e-mail invitation with an e-mail reminder the lowest. Excluding those who responded via PC from the analysis shows that an SMS invitation is significantly more efficient compared to an e-mail invitation.

We also did not find support for H 2.2 that changing the mode of the reminder would improve completion rates in mobile web surveys. Though using only e-mail does not seem to be very effective, using only SMS for both invitation and reminder produced a relatively high completion rate and the lowest percentage of PC participants. If there are some financial constraints to sending SMS reminders or there is some strategy to avoid being intrusive, an e-mail reminder can be also efficient, though it significantly increases the share of PC respondents. An e-mail reminder without a URL may be a possible solution if aimed at reducing both costs and the percentage of PC respondents. In our experiment, it produced lower completion rate compared to SMS reminder, but this difference did not reach statistical significance (p=0.065).

As expected in H 2.4, the probability of completing the survey via a mobile device depends on the frequency of mobile web usage. Frequent mobile web users have a higher probability of completing the survey via a mobile device compared to those who use it less frequently.

Overall, our experiment illustrates possible ways to improve response rates and enhance the respondent experience in mobile web surveys. Though most of the studies on mobile web discuss measurement differences between PC and mobile web surveys, we focus more on nonresponse and demonstrate that improving instrument design and selecting optimal invitation and reminder modes can improve response rates and help to understand the process of completing a mobile web survey. Given the high overall rates of nonresponse and breakoff to mobile web surveys, further research on understanding the nonresponse process, and on finding ways to increase completion rates, is needed.

The generalizability of our results is limited. First, the sample was restricted to members of a volunteer online access panel who participate in web surveys on a regular basis. Second, the experiment was conducted in Russia which has rather low mobile Internet connection speed compared to European countries and the USA. Thus, the results in these countries may differ from those presented in our paper. Third, the survey was rather short and did not have any skip logic. While a scrolling version may be more efficient in short surveys with no navigational logic, and among those with limited Internet connectivity, the results could be different in longer and more complex questionnaires with skip logic. Fourth, we suggest that the number of items presented on the one page or screen in a scrolling version is also an important factor affecting breakoff rate. Hence, variations in the number of pages and the number of items per page may produce different results. Finally, rapid changes and improvements in mobile technologies may diminish the differences we found. Despite these limitations, our experiment shows that what is known about designing web surveys for PC users may not always apply to mobile web users, and that the optimal invitation mode may not be the same across devices. Given the rising number of mobile web users and the interest in using this mode of data collection, finding ways to improve response among such users is of critical importance. Our paper represents a first step on this path.

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