Switching Away: Exploring on-Device Media Multitasking in Web Surveys

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Abstract

The use of web surveys is a common and popular data collection method in behavioral and social research. Compared to other established survey modes, web surveys are frequently cheaper and less time consuming, because they are commonly self-administered. They also allow respondents to take part with few time and location restrictions. However, research has shown that web surveys are frequently associated with multitasking, which may negatively affect response behavior and response quality. In this study, we use paradata detecting switching away from the web survey to explore on-device media multitasking. We conducted a web survey in an opt-in access panel in Germany and randomly assigned respondents to a PC or smartphone condition. The results reveal that on-device media multitasking is more common on PCs than on smartphones. We also find evidence that engaging in on-device media multitasking affects response quality. Respondents who switch away are more likely to select the middle response category. In addition, the results show that the question presentation format, the device type, and respondents' age and education are associated with the occurrence of on-device media multitasking. These findings point to the importance of controlling for on-device media multitasking in web surveys.

Keywords: JavaScript, mixed-device survey, multitasking, OnBlur functions, paradata, response quality

1. Introduction

Web surveys are increasingly being used for data collection in behavioral and social research because they offer substantial benefits from a researcher's perspective, including timeliness and cost-effectiveness (Callegaro, Lozar Manfreda, & Vehovar, 2015). An additional benefit of web surveys is the collection of paradata, which are automated data that provide information about

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the data collection process and that can be used to describe and evaluate this process (see Callegaro, 2013; Couper, 2000; McClain et al., 2019). Many major national and international social surveys have started to employ web-based modules (see, for instance, the American National Election Study, the European Social Survey, and the Health and Retirement Study). Web surveys are also widely used in a variety of other settings, such as web mapping and food delivery services. There are also several benefits from a respondent's perspective. Since web surveys are self-administered, respondents can take part with almost no time and location restrictions (Mavletova, 2013). In addition, they can decide which device type (e.g., PC or smartphone) to use for survey completion.

The benefits of web surveys for researchers and respondents come at a price. More specifically, the self-administration mode associated with web surveys, which implies a spatial distance between respondent and researcher, makes it difficult to monitor survey completion and the environment in which it takes place (Ansolabehere & Schaffner, 2015; Couper, 2000; Höhne & Schlosser, 2018, Wenz, 2019). Researchers have found that web survey respondents often get distracted or engage in multitasking (Ansolabehere & Schaffner, 2015; Antoun, Couper, & Conrad, 2017; Höhne & Schlosser, 2018; Schober et al., 2015; Revilla & Couper, 2018; Sendelbah, Vehovar, Slavec, & Petrovčič, 2016; Toninelli & Revilla, 2016; Zwarun & Hall, 2014). For instance, Ansolabehere and Schaffner (2015) found that about 50% of respondents reported distractions. In addition, Revilla and Toninelli (2016) found that more than 70% of respondents reported multitasking while completing a web survey.

One methodological drawback associated with the majority of the studies on distractions and multitasking during web survey completion is that they rely on self-reports that are prone to social desirability and recall errors (see Sendelbah et al., 2016; Wenz, 2019; Zwarun & Hall, 2014). In this study, we instead use JavaScript "OnBlur" functions, as a special type of paradata eliciting information about window and browser tab switching, to detect on-device media multitasking. We also investigate the association between on-device media multitasking and survey response quality. For this purpose, we randomly assign respondents to a device type (i.e., PC and smartphone) and investigate different question presentation formats (i.e., single and multiple questions). In addition to paradata, we employ self-reports, asking respondents about on-device media multitasking. This enables us to compare both measurement techniques and to shed light on respondents' actual on-device media multitasking.

In the following, we discuss the background of multitasking in general and on-device media multitasking in particular. We then outline our research hypotheses and describe the experimental design, survey questions, study procedure, sample, and analytical strategies. Finally, we present the results and provide a summary and perspectives for future research.

2. Background

The problem associated with distractions and multitasking is that they potentially affect the four stages of the cognitive response process; i.e., comprehension, retrieval, judgment, and response (Tourangeau, Rips, & Rasinski, 2000). Although research indicates that people are generally able to conduct several tasks at the same time, the quality of their performance depends on the combination of the tasks (see Adler & Benbunan-Fich, 2012; Carrier, Cheever, Rosen, Benitez, & Chang, 2009; Foehr, 2006; Jeong & Fishbein, 2007; Salvucci & Taatgen, 2011; Spink, Cole, & Waller, 2008). Research suggests that it may be more demanding to carry out two tasks that

draw on similar mental resources than it is to carry out two tasks that draw on different mental resources (Salvucci & Taatgen, 2011). For instance, it may be more challenging to exchange text messages on a PC or smartphone during web survey completion (a combination of tasks that draw on similar mental resources) than to listen to music during web survey completion (a combination of tasks that draw on different mental resources). There are two studies providing evidence for this notion. While Höhne and Schlosser (2018) show that multitasking in the form of checking emails or social media notifications negatively affects respondents' attentiveness, Wenz (2019) shows that distractions in the form of music playing in the background have no impact on respondents' attentiveness.

These findings suggest that competing tasks may constrain respondents' mental resources for fully attending to the process of responding to survey questions. According to Kennedy (2010, pp. 73–74), distractions and multitasking can temporarily interrupt or suspend the four stages of the cognitive response process, which, in turn, can increase the overall response effort (Sendelbah et al., 2016). Consequently, respondents may only superficially comprehend the literal meaning of a question because they do not process it fully. They also may not retrieve all relevant information from memory because they may use a less burdensome estimation strategy instead of a taxing recall-and-count strategy. In addition, respondents may fail to integrate all the information retrieved from memory because they may draw on judgmental heuristics. Finally, they may not map their response accurately onto the response scale but simply select the middle category.

To classify the different kinds of distractions and multitasking during web survey completion and to evaluate their consequences for web survey responding, Zwarun and Hall (2014) suggested the following typological categories: environmental distractions (e.g., background noise or music), non-media multitasking (e.g., having a conversation), and media multitasking, which can be further divided into on-device media multitasking (e.g., checking incoming emails) and off-device media multitasking (e.g., watching TV or zapping through the TV channels). Following the theory of threaded cognition (Salvucci & Taatgen, 2011), environmental distractions represent a form of concurrent multitasking (i.e., conducting tasks at the same time) and non-media and media multitasking represent forms of sequential multitasking (i.e., alternating between tasks).[1] In their study, Zwarun and Hall (2014) show that between 9% and 17% of the respondents report environmental distractions, between 6% and 16% report non-media multitasking, and between 8% and 29% report media multitasking (without distinguishing between on-device and off-device media multitasking). In a subsequent study, Sendelbah et al. (2016) used JavaScript OnBlur functions, which are a type of paradata, instead of self-reports, to detect window and browser tab switching that provides information about on-device media multitasking. These functions allow researchers to gather how often (called "off-count") and for how long (called "off-time") respondents leave a web survey.[2] The authors show that about 40% of the respondents left the web survey at least once to, for instance, check emails or social media notifications. On average, these respondents left the web survey for about 86 seconds in total. In addition, Höhne and Schlosser (2018) report that switching

[1] For a comprehensive discussion of concurrent and sequential multitasking and threaded cognition theory, we refer interested readers to Salvucci and Taatgen (2011).

[2] The OnBlur property is a JavaScript EventHandler for processing OnBlur events. It is triggered when an element, document, window, or browser tab loses focus. Its opposite is the EventHandler "OnFocus".

away is more common for web survey pages with multiple questions than for those with a single question.

In 2010, The New York Times published an article entitled “Growing Up Digital, Wired for Distraction”. In the article, Matt Richtel indicated that young people are particularly affected by multitasking and its associated effects on mental processes. In line with these conclusions, Carrier et al. (2009) and Zwarun and Hall (2014) show that younger people indeed report more and a wider range of multitasking than older people. Carrier et al. (2009) additionally show that younger people rate multitasking as being less difficult than older people. These findings indicate that individual differences may affect the degree of engagement in multitasking (Sendelbah et al., 2016).

The web survey literature also includes some studies investigating the link between distractions and multitasking and response quality. In general, these studies differ with respect to their measurement techniques. Some studies use self-reports placed at the end of the web survey to measure distractions and multitasking on a survey-level (Ansolabehere & Schaffner, 2015; Antoun et al., 2017; Schober et al., 2015; Toninelli & Revilla, 2016). These studies find almost no effects on response quality, a finding that applies to both PC and smartphone surveys. One reason for the null findings may be that self-reports at the end of the survey are imprecise measures, because they are affected by social desirability and recall errors (see Sendelbah et al., 2016; Wenz, 2019; Zwarun & Hall, 2014). Other studies use paradata to detect window and browser tab switching, as forms of on-device media multitasking, on a page- or question-level (Höhne & Schlosser, 2018; Revilla & Couper, 2018; Sendelbah et al., 2016). The studies by Höhne and Schlosser (2018) and Sendelbah et al. (2016) investigate response quality and find significantly higher item-nonresponse rates for respondents engaging in on-device media multitasking. This corresponds to findings from Human-Computer Interaction (HCI) studies showing that multitasking has a negative effect on task performance (Adler & Benbunan-Fich, 2012). However, the studies by Höhne and Schlosser (2018) and Sendelbah et al. (2016) focused only on PC respondents and did not consider smartphone respondents. This difference may be crucial, because the occurrence of on-device media multitasking may depend on device properties, such as screen size and input capabilities (Budiu, 2015; Nagata, 2003; Spink et al., 2008).

Research on distractions and multitasking and their impact on response quality in surveys is scarce. The existing studies mostly rely on self-reports that usually measure distractions and multitasking on a survey-level instead of a page- or question-level (Ansolabehere & Schaffner, 2015; Antoun et al., 2017; Schober et al., 2015; Toninelli & Revilla, 2016). In addition, such self-reports are potentially prone to social desirability and recall errors (Sendelbah et al., 2016; Wenz, 2019; Zwarun & Hall, 2014). A smaller number of studies employs paradata that provide information on window and browser tab switching (Höhne & Schlosser, 2018; Revilla & Couper, 2018; Sendelbah et al., 2016). These studies use a precise and reliable measure of on-device media multitasking, but they do not provide information on respondents’ activities (i.e., the non-survey task in which respondents engage) and are mostly based on PC surveys. One exception is the study by Revilla and Couper (2018), which compares the on-device media multitasking behavior of PC and smartphone respondents. In that study, the authors found no differences between device types. They also do not directly compare response quality between respondents who multitask and those who do not.

2. Research Hypotheses

Even though PCs and smartphones share many device properties (e.g., they are both electronically powered and web-enabled, and they support similar communication channels), they differ in some key aspects that may play a substantial role in on-device media multitasking (see Budiu, 2015; Nagata, 2003; Spink et al., 2008). First, the screens of PCs are larger than those of smartphones, which changes the general operation of the device. For instance, in contrast to PCs, smartphones are subject to a single-window constraint, which means that smartphones usually do not allow one to view more than one window or browser tab at the same time (Budiu, 2015; Gupta, Anwar, & Balakrishnan, 2016). Second, the two device types differ with respect to their input capabilities (Lugtig & Toepoel, 2016). While PCs are most frequently operated via a mouse (or touch pad) and a keyboard that supports short cuts to, for instance, switch windows and browser tabs, smartphones are operated via screen tabs and a virtual on-screen keyboard that shrinks the viewing space available for substantive content on the screen. While the portable nature of smartphones makes them generally amenable for engaging in media multitasking (Salvucci & Taatgen, 2011; Google, 2012), their smaller screen sizes and more limited input capabilities might mean that it would be more difficult to engage in on-device media multitasking on smartphones than on PCs. That is because PCs permit multiple windows and browser tabs to be open simultaneously (see Gupta et al., 2016).

The literature on on-device media multitasking in web surveys is characterized by a small number of empirical studies and substantial gaps of knowledge. For instance, it remains unclear how frequently respondents engage in on-device media multitasking and whether the device type (e.g., PC and smartphone) plays a role. Considering the different device properties, it is plausible to presume that smartphones are more likely than PCs to impede on-device media multitasking. Therefore, we hypothesize that PCs are associated with higher levels of on-device media multitasking than smartphones (*hypothesis 1*).

Several studies argue that self-reports – on multitasking in general and on on-device media multitasking in particular – that are usually placed at the end of the web survey are associated with social desirability and recall errors (Sendelbah et al., 2016; Wenz, 2019; Zwarun & Hall, 2014). First, some questions may appear sensitive to respondents because they elicit answers that are socially undesirable (Tourangeau et al., 2000). This line of thinking presumes that there are explicit or implicit social norms with respect to behaviors, with deviations from these norms seen as socially undesirable (Tourangeau & Yan, 2007, p. 860). As shown by previous research, respondents frequently underreport socially undesirable behaviors (Preisendörfer & Wolter, 2014; Stocké & Hunkler, 2007; Tourangeau et al., 2000; Tourangeau & Yan, 2007; Tracy & Fox, 1981; van der Heijden, van Gils, Bouts, & Hox, 2000). In the case of web surveys, respondents may feel obliged to pay constant attention and to complete the survey without any interruptions. Based on this notion, admitting that one has engaged in on-device media multitasking represents a socially undesirable answer. In addition, when respondents receive modest compensation for their participation, they may also have concerns about possible consequences of disclosure, such as not getting their incentive (see Tourangeau et al., 2000 for a comprehensive discussion of the threat of disclosure). The sensitive character of self-reports, coupled with the imagined threat of disclosure, may lead respondents to underreport on-device media multitasking.

Second, self-reports are a special type of retrospective question requiring respondents to recall past behavior. One methodological drawback associated with retrospective questions is that they are prone to recall errors (Tourangeau et al., 2000). Previous research shows that respondents sometimes have trouble recalling even recent behaviors and events. For instance, Lee et al. (1999) asked parents about the vaccination of their children. The authors found that recall accuracy immediately after the vaccination was only slightly better than chance. This finding points to the possibility that respondents may not accurately recall the additional tasks that they engaged in during the course of a web survey, which would then result in an underreporting of multitasking.

In addition to feeling uncomfortable admitting that they multitasked while completing a web survey, respondents may also not recall all the potential on-device media multitasking behaviors in which they engaged. Both cases can result in an underestimation of on-device media multitasking. In contrast, paradata represent a precise and reliable measure of on-device media multitasking. Thus, we hypothesize that self-reports yield lower levels of on-device media multitasking than paradata, irrespective of the device type (*hypothesis 2*).

Switching away from the web survey to engage in on-device media multitasking may affect response quality (Höhne & Schlosser, 2018; Revilla & Couper, 2018; Sendelbah et al., 2016). Engaging in such multitasking constitutes a temporary interruption or suspension of the cognitive response process, because respondents divert their mental resources from the survey to the additional task (Sendelbah, et al., 2016; Zwarun & Hall, 2014). Since respondents need to reorient themselves and restart the response process when returning to the survey, it is presumed that this increases the overall response effort and decreases respondent motivation. This circumstance may result in a superficial, as opposed to a thoughtful response process, thereby reducing response quality (or task performance; see Adler & Benbunan-Fich, 2012). Consequently, we hypothesize that engaging in on-device media multitasking (detected by paradata) is associated with lower levels of response quality, irrespective of the device type (*hypothesis 3*).

Finally, the survey literature lacks empirical evidence on what drives respondents to switch away to engage in on-device media multitasking during web survey completion. There is some evidence suggesting that the question presentation format (i.e., single and multiple questions) is associated with the occurrence of on-device media multitasking (Höhne & Schlosser, 2018). Compared to single-question presentation, multiple-question presentation constitutes a more demanding survey navigation and operation process (see Couper, Tourangeau, Conrad, & Zhang, 2013; Dillman, Smyth, & Christian, 2014). In a multiple-question presentation, respondents must locate several question stems and response categories accompanied by scrolling and selecting a response category, which might foster on-device media multitasking due to the higher response burden and lower respondent motivation. We therefore hypothesize that multiple-question presentation is associated with higher levels of on-device media multitasking, irrespective of the device type (*hypothesis 4*).

3. Methods

3.1 Experimental Design

Before the start of the web survey, respondents were randomly assigned to a device type to use for survey completion. The survey invitation requested respondents to use either a PC or a smartphone. The goal was to obtain about 1,500 respondents per device type.

The web survey invitation was restricted to panel members who use both a PC and a smartphone, based on profile information provided by the survey company. The device type was detected at the start of the survey and respondents who attempted to access the survey using a device type other than the one we requested were prevented from continuing the survey and asked to use the correct one. We also collected user-agent-strings throughout the survey that identify device properties, such as device type and model (see Callegaro, 2013).

3.2 Questions Used in this Study

In this study, we used 47 questions: 9 questions were presented on separate survey pages (single-question presentation) and 38 questions were presented on six survey pages (multiple-question presentation). The questions were adopted from several social surveys and dealt with a variety of topics, including political efficacy, achievement and job motivation, and personality traits.

We also asked respondents about their engagement in on-device media multitasking during web survey completion. We used two "check-all-that-apply" (CATA) items listing tasks that are related to on-device media multitasking. In addition, we used one "other task" item with an open answer field for respondents to self-report on-device media multitasking. These items were presented on one page.

All questions were developed in German, which was the mother tongue of 95.8% of the respondents (see Appendix A for English translations). To improve comparability between PCs and smartphones, we employed an optimized survey layout that avoided horizontal scrolling. In addition, respondents were informed that they can skip questions without providing a response. Figure 1 illustrates the design of the single and multiple questions for PCs and smartphones, respectively.

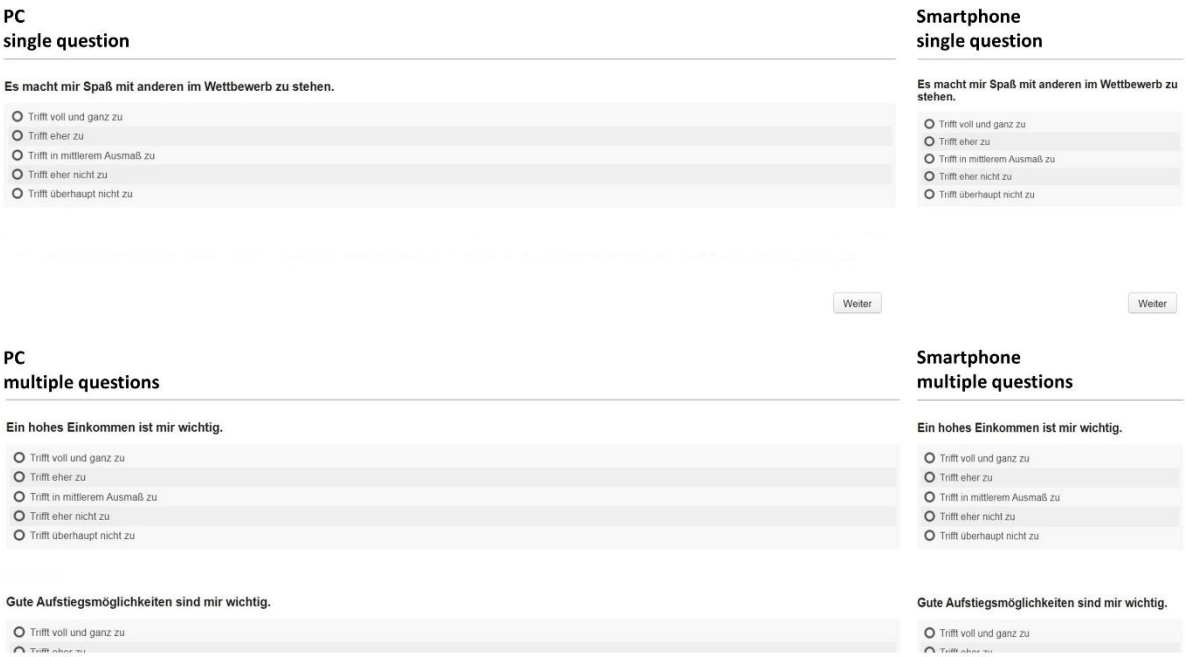

Figure 1. Screenshots illustrating the design of single and multiple questions for PCs and smartphones

3.3 Study Procedure

Data collection was conducted by the survey company Respondi and took place in Germany from 15th July to 8th August 2019. Respondi drew a quota sample from their opt-in panel that is based on age and gender, resulting in a 3×2 quota plan designed to match the German population on these two demographic characteristics. The quotas were calculated based on the German Microcensus, which served as an official population benchmark. In total, Respondi invited 24,246 opt-in panelists to participate in the survey, of which 4,581 panelists were screened out because the quotas were already achieved or because they tried to access the survey with the wrong device type. A total of 3,407 respondents started the survey. Among these, 115 dropped because they only visited the title page or had deactivated JavaScript, which prevented the collection of paradata. This leaves us with 3,292 respondents available for statistical analyses.

The email invitation to the web survey included information on the estimated duration of the survey (about 20 minutes), the respective device type to use for survey completion, and a link to the survey. The first page of the survey outlined the general topic and procedure of the survey and included a statement of confidentiality. Respondents received modest financial compensation from Respondi, which was proportional to the length of the survey and credited to their study account after finishing the entire survey.

We collected several types of paradata, such as window and browser tab switching and user-agent-strings, using the open-source tool “Embedded Client Side Paradata (ECSP)” developed by Schlosser and Höhne (2020). Prior informed consent for the collection of paradata was obtained by Respondi as part of the panelists’ registration process.

3.4 Sample

In total, 3,292 respondents participated in the study: 1,627 participated on a PC and 1,665 on a smartphone. This corresponds to a participation rate of 13.6% among all invitees. These

respondents were aged between 18 and 70 years, with a mean age of 46.6 (SD = 15.4), and 50.5% of them were female. In terms of education, 12.5% had completed lower secondary school (low education level), 34.6% intermediate secondary school (medium education level), and 52.9% college preparatory secondary school or university-level education (high education level).

3.5 Analytical Strategies

General considerations: In this study, we use JavaScript OnBlur functions to detect whether respondents switch away from the web survey to engage in on-device media multitasking. These functions are implemented in web-survey pages and, thus, switching events are measured on a page- or question-level. If respondents switch away to an element, document, window, or browser tab outside of the window or browser tab that hosts the web-survey page, it triggers an OnBlur event denoting a loss of focus. If respondents return to the window or browser tab that hosts the web-survey page, it triggers an OnFocus event denoting a regain of focus. Since OnBlur and OnFocus events are accompanied by time stamps[3], it is possible to determine how often (off-count) respondents leave a web-survey page and how long (off-time) they do so. However, JavaScript OnBlur functions do not provide any information on what respondents do during their absence. It remains unclear whether they, for instance, take a (phone) call, surf the Internet, write an email, or check social media notifications.

Hypothesis 1: In order to investigate the engagement in on-device media multitasking detected by paradata across PC and smartphone respondents we compare the percentages of respondents with switching events across the 15 web-survey pages, which contain the 47 questions. We conduct a chi-square test to test the significance of differences between device types. In addition, we report the off-count and off-time for PC and smartphone respondents, respectively.

Hypothesis 2: Similar to the investigation of on-device media multitasking by means of paradata we compare respondents' self-reports of on-device media multitasking across PCs and smartphones. We also conduct a chi-square test to test for significant differences between these two device types.[4]

In order to additionally investigate agreement between the two measures of on-device media multitasking (i.e., paradata and self-reports), we calculate r_φ (phi coefficient) to measure the association between two binary variables.

Hypothesis 3: To investigate the association between on-device media multitasking and low response quality, we use two response style indicators (van Vaerenbergh & Thomas, 2013): middle response style (i.e., selecting the middle category of a rating scale) and extreme response style (i.e., selecting the first or last category of a rating scale). In addition, we use item-nonresponse (i.e., item missing data) as a response quality indicator. To generate these three indicators of low response quality, we examined each question and determined whether

[3] The time stamps are measured in milliseconds (ms).

[4] We additionally conducted logistic regression models for switching (hypothesis 1) and self-reports (hypothesis 2), respectively, and simultaneously controlled for age, education, and gender. The main conclusions did not change.

respondents selected the middle category (middle response style), the first or last category (extreme response style), or no category at all (item-nonresponse).[5]

We conduct three separate generalized mixed effects logit regressions using binary variables for middle response style (1 = yes), extreme response style (1 = yes), and item-nonresponse (1 = yes) as dependent variables (with questions nested within respondents). In line with our hypothesis, we use switching (1 = yes) as the independent variable. In addition, we control for several variables in the regression models that were suggested by previous research to be associated with response quality (see, for instance, Ansolabehere & Schaffner, 2015; Antoun et al., 2017; Couper et al., 2013; Dillman et al., 2014; Gummer & Kunz, 2019; Höhne & Schlosser, 2018; Revilla & Couper, 2018; Toepoel & Dillman, 2011;van Vaerenbergh & Thomas, 2013): multiple questions (1 = yes), PC (1 = yes), age (in years), education with high as reference: low (1 = yes) and medium (1 = yes), and female (1 = yes).

Hypothesis 4: To investigate what drives respondents to engage in on-device media multitasking we now use switching (1 = yes) as the dependent variable. Again, we conduct a generalized mixed effects logit regression (with survey pages nested within respondents). Corresponding with our hypothesis we use multiple questions (1 = yes) as the independent variable. We control for the same variables as in the regression models on response quality, but additionally include self-reported multitasking ability (1 = low to 7 = high).[6] Some research indicates that the ability to multitask is associated with the engagement in multitasking (Carrier et al., 2009; Zwarun & Hall, 2014). To put it differently, people with a higher multitasking ability engage more frequently in multitasking.

5. Results

5.1 Detecting On-Device Media Multitasking

In line with our *hypothesis 1*, we analyzed how many respondents switched away from the web survey at least once to engage in on-device media multitasking. For this purpose, we looked at the 15 web-survey pages (9 survey pages containing single questions and 6 survey pages containing 38 multiple questions). The upper part of Table 1 displays the results. The overall percentage of respondents that switched away is 12.1%. Comparing respondents with switching events between PCs and smartphones reveals device-related differences. More specifically, PC respondents (14.8%) leave the web survey to engage in on-device media multitasking significantly more often than smartphone respondents (9.3%). Cohen's h indicates a small effect size (h = 0.17). Interestingly, these findings differ substantially from the findings reported by Sendelbah et al. (2016), who found that about 40% (PC only) of the respondents switched away from the web survey at least once.

[5] In total, 24.0% of the respondents showed a middle response style, 22.4% of the respondents showed an extreme response style, and 2.8% of the respondents showed item-nonresponse.

[6] On average, respondents report a multitasking ability of 4.9 (SD = 1.4).

Table 1. Percentages and effect sizes (in parentheses) of respondents switching away to engage in on-device media multitasking measured by paradata and self-reports

Overall	PC	Smartphone	Difference (Effect size)
Paradata			
12.1	14.8	9.3	5.5*** (h = 0.17)
Self-reports			
5.0	4.9	5.1	–0.2 (h = 0.00)

Note. ***p < 0.001. N = 3,292 and N = 3,232, respectively. Difference: PC minus smartphone. Cohen's h indicates the effect size.

In the next step, we used paradata to analyze how often (off-count) and for how long (off-time) respondents switched away from the web survey to engage in on-device media multitasking. The overall results for off-count reveal that respondents with switching events left the web survey 2.1 times on average. There is a significant difference between PC (2.5 times) and smartphone respondents (1.5 times). Cohen's d indicates a medium effect size (d = 0.44). The results for off-time show that respondents left the survey for an average of 139.2 seconds. In contrast to off-count, PC (161.3 seconds) and smartphone respondents (105.4 seconds) do not significantly differ in terms of off-time.[7] Cohen's d indicates a small effect size (d = 0.21).

In order to investigate our *hypothesis 2*, we first analyzed the self-report questions on on-device media multitasking. The lower part of Table 1 displays the results. Overall, only 5% of the respondents reported that they left the web survey to engage in on-device media multitasking. There are almost no differences between PC (4.9%) and smartphone respondents (5.1%). This result is supported by the Cohen's h indicating a negligibly small effect size (h < 0.00). All in all, these findings support our expectation indicating that respondents indeed tend to underreport on-device media multitasking during web survey completion.

We also calculated the association between paradata and self-reports across PCs and smartphones [$r_\varphi = 0.198$, $\chi^2(1) = 124.18$, $p < 0.001$]. The coefficient reveals that the two measures of on-device media multitasking are significantly associated with each other. However, the association is comparatively low and indicates that the measures do not perfectly line up.

Taking a closer look at self-reports, we identified the reasons for respondents' engagement in on-device media multitasking during web survey completion. The results show that 12.9% of the respondents reported that they were talking to other people (e.g., phone call or Skype call) via the same device, 62.6% of the respondents reported that they were using the Internet (e.g., surfing or emailing) via the same device, and 24.5% reported both talking to other people and using the Internet.

5.2 Response Quality

Corresponding to our *hypothesis 3*, we investigated whether switching away from the web survey to engage in on-device media multitasking decreases response quality. For this purpose, we ran three separate generalized mixed effects logit regressions and used the following three

[7] We truncated the lower and upper five percentile to account for an unusually short and long off-time. The skewness of the truncated off-time is 3.26.

dependent variables: middle response style (1 = yes), extreme response style (1 = yes), and item-nonresponse (1 = yes). Table 2 displays the results and reports estimated coefficients and standard errors (see Appendix B for average marginal effects).

Table 2. Generalized mixed effects logit regressions (estimated coefficients and standard errors) for middle response style, extreme response style, and item-nonresponse

	Middle response style (1 = yes)	Extreme response style (1 = yes)	Item-nonresponse (1 = yes)
Independent variables	Coefficients (S.E.)	Coefficients (S.E.)	Coefficients (S.E.)
Page level			
Switching (1 = yes)	0.128*	–0.065	0.009
	(0.05)	(0.06)	(0.17)
Multiple questions (1 = yes)	1.335***	0.978*	–3.836***
	(0.37)	(0.48)	(0.51)
Respondent level			
PC (1 = yes)	–0.014	0.077	0.279***
	(0.02)	(0.04)	(0.07)
Age (in years)	–0.001	0.001	–0.001
	(0.00)	(0.00)	(0.00)
Education with high as reference			
Low (1 = yes)	0.095**	–0.089	–0.656***
	(0.04)	(0.06)	(0.106)
Medium (1 = yes)	0.038	–0.084	–0.448***
	(0.02)	(0.04)	(0.07)
Female (1 = yes)	–0.099***	0.038	–0.624***
	(0.02)	(0.04)	(0.07)
Intercept	–0.917**	–1.702***	–6.366***
	(0.30)	(0.39)	(0.41)
Observations	154,207	154,207	154,207
Marginal R^2	0.124	0.047	0.392
Conditional R^2	0.556	0.670	0.843

Note. *p < 0.05, **p < 0.01, ***p < 0.001. Questions nested within respondents. Standard errors in parentheses.

As Table 2 reveals, the results for our third hypothesis vary and partially depend on the response quality indicator under investigation. We found supporting evidence that switching away to engage in on-device media multitasking is significantly associated with middle response style. This is suggested by the positive coefficient. The corresponding average marginal effect indicates that the probability of middle response style increases by about 2% points when switching. There is no supporting evidence that switching away is associated with extreme response style and item-nonresponse. Remember that both Höhne and Schlosser (2018) and Sendelbah et al. (2016) reported higher item-nonresponse for respondents who engaged in on-device media multitasking measured by paradata. Thus, we cannot replicate their findings.

The indicator of multiple questions is significant in all three regressions indicating that the question presentation format matters when it comes to response quality. While middle response style and extreme response style are significantly higher for multiple-question presentation (indicated by the positive coefficients), item-nonresponse is significantly higher

for single-question presentation (indicated by the negative coefficient). Although one could expect that device type (i.e., PC or smartphone) is significantly associated with response quality, this is not supported by the results, except in the case of item-nonresponse. As indicated by the positive coefficient, PC respondents are significantly more likely to produce item-nonresponse than smartphone respondents.

We also controlled for several respondent characteristics in the three regressions. Even though the results revealed that the variables education and female are significantly associated with response quality, no systematic pattern can be observed.

5.3 Variables Associated with On-Device Media Multitasking

Regarding our *hypothesis 4* on on-device media multitasking we again conducted a generalized mixed effects logit regression using switching (1 = yes) as dependent variable. Table 3 displays the results and reports estimated coefficients and standard errors (see Appendix B for average marginal effects).

Table 3. Generalized mixed effects logit regression (estimated coefficients and standard errors) for switching

	Switching (1 = yes)
Independent variables	Coefficients (S.E.)
Page level	
Multiple questions (1 = yes)	0.823***
	(0.16)
Respondent level	
PC (1 = yes)	1.379***
	(0.24)
Age (in years)	–0.033***
	(0.01)
Education with high as reference	
Low (1 = yes)	–1.677***
	(0.49)
Medium (1 = yes)	–0.235
	(0.23)
Female (1 = yes)	–0.209
	(0.22)
Self-reported multitasking ability (1 = low to 7 = high)	–0.057
	(0.08)
Intercept	–5.457***
	(0.59)
Observations	48,315
Marginal R^2	0.052
Conditional R^2	0.954

Note. *p < 0.05, **p < 0.01, ***p < 0.001. Survey pages nested within respondents. Standard errors in parentheses.

The results in Table 3 reveal four variables that are significantly associated with switching. In line with our fourth hypothesis, the coefficient for multiple questions is positive. The corresponding average marginal effect indicates that the probability of switching increases by about 1% point when answering multiple questions. This result is in line with findings reported by Höhne and Schlosser (2018). PC is also positively associated with switching,

pointing to device-related differences. This finding also supports the descriptive results in Table 1. Finally, we found that age and low education are negatively associated with switching, which indicates that on-device media multitasking is more common among younger and highly educated respondents.

6. Summary

The aim of this study was to provide evidence on on-device media multitasking by using JavaScript OnBlur functions to detect window and browser tab switching. We randomly assigned respondents to a device type (i.e., PC and smartphone), used different question presentation formats (i.e., single and multiple questions), and employed self-reports. The results reveal that a substantial minority of respondents engages in on-device media multitasking during web survey completion. They also show that paradata and self-reports come to different conclusions and that respondents engaging in on-device media multitasking have lower response quality in terms of middle response style but not in terms of extreme response style and item-nonresponse. In addition, we identified variables that are associated with the engagement in on-device media multitasking. Table 4 provides a summary of our findings in relation to the research hypotheses.

Table 4. Summary of the findings

Hypotheses	Findings
1: Device type	Supporting evidence
2: Underreporting in self-reports	Supporting evidence
3: Response quality	Partial supporting evidence
4: Question presentation format	Supporting evidence

With respect to *hypothesis 1*, we found that about 12% of respondents switch away from the web survey. The results also show that this behavior is significantly more common among PC than smartphone respondents. One explanation is that switching away on PCs, which permits multiple windows and browser tabs to be open simultaneously, is more convenient than on smartphones, where switching requires more effort, as smartphones do not permit multiple windows and browser tabs to be open simultaneously. Another potential explanation lies in the limited screen size and input capabilities of smartphones. Finally, it is important to mention that the differences between PCs and smartphones do not manifest themselves in the self-reports, which, in turn, points to measurement-specific differences.

Regarding *hypothesis 2*, we found evidence that, compared to paradata, self-reports on on-device media multitasking result in underreporting. This underreporting is somewhat more pronounced for PC than for smartphone respondents, pointing at device-related differences when it comes to measuring on-device media multitasking by means of paradata and self-reports. However, the reasons for this underreporting remain unclear. It could be due to social desirability, recall errors, or both. Future research is needed to explore the reasons behind the underreporting.

Even though self-reports are associated with underreporting, they are still useful in shedding light on the activities that respondents engage in when switching away. The self-reports revealed that most respondents reported using the Internet (e.g., surfing or emailing)

and substantially fewer respondents reported talking to other people (e.g., phone call or Skype call).

The results reveal that respondents who switch away produce lower response quality in terms of middle response style. We found no evidence that switching is associated with extreme response style and item-nonresponse. The finding on item-nonresponse is somewhat surprising and contradicts findings reported by Höhne and Schlosser (2018) and Sendelbah et al. (2016). One reason might be that the overall item-nonresponse rate in this study was very low (about 3%). In the study by Höhne and Schlosser (2018), for instance, item-nonresponse varied between 3% and 10% depending on the question presentation format. Although respondents were able to skip questions without providing a response in our study, this is frequently not the standard procedure in opt-in access panels so that respondents may tend to select a response category in the middle (about 24%) or at the end (about 22%) of the scale instead. It would be worthwhile for future studies to employ more complex study designs that allow investigating stronger response quality indicators, such test-retest reliability and criterion validity.

With respect to *hypothesis 4*, we found that multiple-question presentation is positively associated with switching away to engage in on-device media multitasking. One possible explanation for the effect is that the presentation of multiple questions per page impedes responding because it represents a more complex and demanding processing task (Couper et al., 2013; Dillman et al., 2014). Such a presentation format may increase response burden and decrease respondent motivation, which, in turn, results in on-device media multitasking. It would be worthwhile for future research to investigate the relation between question presentation format and on-device media multitasking.

7. Limitations and Future Research Perspectives

We used respondents from a non-probability opt-in access panel. This does not decrease the internal validity of our study, but it limits the generalizability of our findings. For instance, the percentage of PC respondents engaging in on-device media multitasking is substantially smaller than in the study by Sendelbah et al. (2016). The authors report a rate that is 2.6 times higher than ours. Given the fact that their web survey with 13 web-survey pages and 28 questions is similar to our web survey the differences might be related to the samples. While the authors used a university student sample, we used a quota sample drawn from an opt-in access panel. This suggests that on-device media multitasking may depend on samples drawn from different (target) populations. Therefore, future research could explore on-device media multitasking and its consequences for web survey research across different samples and respondent groups.

The analyses on response quality reveal that the question presentation format (i.e., single and multiple questions) is associated with all three response quality indicators. Interestingly, the results show that multiple-question presentation increases the occurrence of middle and extreme response style. For item-nonresponse, the opposite trend is observed, which corroborates the findings reported by Höhne and Schlosser (2018). As in our study, the findings in Höhne and Schlosser (2018) indicate higher item-nonresponse for single-question than multiple-question presentation. The authors explained their findings by stating that it might be easier for respondents to skip a single question than it is to skip multiple questions that are grouped on a web survey page. Even though we find this explanation plausible, this is only an attempted explanation that requires further research. It is important to note that the finding on

item-nonresponse should be interpreted with caution because of the low item-nonresponse rate. Thus, we recommend that future studies focus on the connection between item-nonresponse and question presentation.

The field setting of our experimental study did not allow us an isolated investigation of on-device media multitasking and its effects on response quality. More specifically, there is a chance that other forms of multitasking, such as off-device media multitasking, played an additional role, thereby confounding our results. We therefore advocate for more refined research on on-device media multitasking in web surveys that limits potential confounding effects. Furthermore, it would be worthwhile to use paradata to determine respondents' inactivity time (i.e., the period without any actions, such as clicking and scrolling), which might be a good predictor of other forms of multitasking.

We only employed two "check-all-that-apply" (CATA) items and one "other task" item with an open answer field for respondents to self-report on-device media multitasking. Even though this method generally allows us to be exhaustive in capturing the different forms of on-device media multitasking, we encourage future researchers to use a more diverse and refined set of measures.

Switching away from a web survey to engage in on-device media multitasking is not uncommon. In order to minimize the occurrence of on-device media multitasking (opt-in access and probability-based) online panels could use JavaScript OnBlur functions not only to detect this kind of multitasking but also to provide respondents with immediate (real time) feedback. For instance, if respondents trigger an OnBlur event by switching away from the web survey, they could be asked to complete the web survey continuously without any interruptions (see Conrad, Tourangeau, Couper, & Zhang, 2017 for a discussion of immediate feedback in web surveys and its consequences).

Finally, our study shows that different measurement techniques of on-device media multitasking come to different conclusions and have different merits and limits. Paradata represent a precise and reliable measure, but they only inform us about on-device media multitasking without providing any information about respondents' activities. We therefore recommend a combination of paradata and self-reports in web surveys. A reliable method of detecting on-device media multitasking is an important endeavor, because it is a potential threat to survey response quality.

References

Adler, R. F., & Benbunan-Fich, R. (2012). Juggling on a wire: Multitasking effects on performance. *International Journal of Human-Computer Science, 70*, 156–168. DOI:10.1016/j.ijhcs.2011.10.003

Ansolabehere, S., & Schaffner, B. F. (2015). Distractions: The incidence and consequences of interruptions for survey respondents. *Journal of Survey Statistics and Methodology, 3*, 216–239. DOI: 10.1093/jssam/smv003

Antoun, C., Couper, M. P., & Conrad, F. G. (2017). Effects of mobile versus PC web on survey response quality: A crossover experiment in a probability web panel. *Public Opinion Quarterly, 81*, 280–306. DOI: 10.1093/poq/nfw088

Budiu, R. (2015). Multitasking on mobile devices. Retrieved February 14, 2020, from https://www.nngroup.com/articles/multitasking-mobile/

Callegaro, M. (2013). Paradata in web surveys. In F. Kreuter (Ed.), *Improving surveys with paradata. Analytic uses of process information* (pp. 261–280). Hoboken, NJ: John Wiley & Sons. ISBN: 9780470905418

Callegaro, M., Lozar Manfreda, K., & Vehovar, V. (2015). *Web survey methodology*. London, UK: Sage. ISBN: 9781473927308

Carrier, L. M., Cheever, N. A., Rosen, L. D., Benitez S., & Chang, J. (2009). Multitasking across generations: Multitasking choices and difficulty ratings in three generations of Americans. *Computers in Human Behavior, 25*, 483–489. DOI: 10.1016/j.chb.2008.10.012

Conrad, F. G., Tourangeau, R., Couper, M. P., & Zhang, C. (2017). Reducing speeding in web surveys by providing immediate feedback. *Survey Research Methods, 11*, 45–61. DOI: 10.18148/srm/2017.v11i1.6304

Couper, M. P. (2000). Usability evaluation of computer-assisted survey instruments. *Social Science Computer Review, 18*, 384–396. DOI: 10.1177/089443930001800402

Couper, M. P., Tourangeau, R., Conrad, F. G., & Zhang, C. (2013). The design of grids in web surveys. *Social Science Computer Review, 31*, 322–345. DOI: 10.1177/0894439312469865

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, mail, and mixed-mode surveys: The tailored design method*. New York, NY: John Wiley. ISBN: 9781118456149

Foehr, U. (2006). *Media multitasking among youth: Prevalence, pairings, and predictors*. Retrieved September 13, 2019, from https://www.kff.org/wp-content/uploads/2013/01/7592.pdf

Google (2012). The new multi-screen world: Understanding cross-platform consumer behavior. Retrieved February 14, 2020, from https://ssl.gstatic.com/think/docs/the-new-multi-screen-world-study_research-studies.pdf

Gummer, T., & Kunz, T. (2019). Relying on external information sources when answering knowledge questions in web surveys. *Sociological Methods and Research*. DOI: 10.1177/0049124119882470

Gupta, A., Anwar, M., & Balakrishnan, R. (2016). Porous interfaces for small screen multitasking using finger identification. Proceedings of the 29th Annual Symposium on User Interface Software and Technology, 145–156. DOI: 10.1145/2984511.2984557

Jeong, S.-H., & Fishbein, M. (2007). Predictors of multitasking with media: Media factors and audience factors. *Media Psychology, 10*, 364–384. DOI: 10.1080/15213260701532948

Höhne, J. K., & Schlosser, S. (2018). Investigating the adequacy of response time outlier definitions in computer-based web surveys using paradata SurveyFocus. *Social Science Computer Review, 36*, 369–378. DOI: 10.1177/0894439317710450

Kennedy, C. K. (2010). *Nonresponse and measurement error in mobile phone surveys*. Retrieved September 13, 2019, from https://deepblue.lib.umich.edu/bitstream/handle/2027.42/75977/ckkenned_1.pdf?sequence=1&isAllowed=y

Lee, L., Brittingham, A., Tourangeau, R., Willis, G., Ching, P., Jobe, J., and Black, S. (1999). Are reporting errors due to encoding limitations or retrieval failure? Surveys of child vaccination as a case study. *Applied Cognitive Psychology, 13*, 43–63. DOI: 10.1002/(SICI)1099-0720(199902)13:1<43::AID-ACP543>3.0.CO;2-A

Lugtig, P., & Toepoel, V. (2016). The use of PCs, smartphones, and tablets in a probability-based panel survey. Effects on survey measurement error. *Social Science Computer Review, 34*, 78–94. DOI: 10.1177/0894439315574248

Mavletova, A. (2013). Data quality in PC and mobile web surveys. *Social Science Computer Review, 31*, 725–743. DOI: 10.1177/0894439313485201

McClain, C. A., Couper, M. P., Hupp, A. L., Keusch, F., Peterson, G. J., Piskorowski, A. D., & West, B. (2019). A typology of web survey paradata for assessing total survey error. *Social Science Computer Review, 37*, 196–213. DOI: 10.1177/0894439318759670

Nagata, S. F. (2003). Multitasking and interruptions during mobile web tasks. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 47*, 1341–1345. DOI: 10.1177/154193120304701105

Preisendörfer, P., & Wolter, F. (2014). Who is telling the truth? A validation study on determinants of response behavior in surveys. *Public Opinion Quarterly, 78*, 126–146. DOI: 10.1093/poq/nft079

Revilla, M., & Couper, M. P. (2018). Comparing grids with vertical and horizontal item-by-item formats for PCs and smartphones. *Social Science Computer Review, 36*, 349–368. DOI: 10.1177/0894439317715626

Richtel, M. (2010). *Growing up digital, wired for distraction*. The New York Times. Retrieved September 13, 2019, from https://www.nytimes.com/2010/11/21/technology/21brain.html

Salvucci, D. D., & Taatgen, N. A. (2011). *The Multitasking Mind*. New York, NY: Oxford University Press. ISBN: 9780199733569

Schlosser, S., & Höhne, J. K. (2020). Embedded Client Side Paradata (ECSP). *Zenodo*. DOI: 10.5281/zenodo.3782592

Schober, M. F., Conrad, F. G., Antoun, C., Ehlen, P., Fail, S., Hupp, A. L., Johnston, M., Vickers, L., Yan, H. Y, & Zhang, C. (2015). Precision and disclosure in text and voice interviews on smartphones. *PLoS One, 10*, 1–20. DOI: 10.1371/journal.pone.0128337

Sendelbah, A., Vehovar, V., Slavec, A., & Petrovčič, A. (2016). Investigating respondent multitasking in web surveys using paradata. *Computers in Human Behavior, 55*, 777–787. DOI: 10.1016/j.chb.2015.10.028

Spink, A., Cole, C., & Waller, M. (2008). Multitasking Behavior. *Annual Review of Information Science and Technology, 42*, 93–118. DOI: 10.1002/aris.2008.1440420110

Stocké, V., & Hunkler, C. (2007). Measures of desirability beliefs and their validity as indicators for socially desirable responding. *Field Methods, 19*, 313–36. DOI: 10.1177/1525822X07302102

Toepoel, V., & Dillman, D. A. (2011). Words, numbers, and visual heuristics in web surveys: Is there a hierarchy of importance? *Social Science Computer Review, 29*, 193–207. DOI: 10.1177/0894439310370070

Toninelli, D., & Revilla, M. (2016). Is the smartphone participation affecting the web survey experience? *Proceedings of the 48th scientific meeting of the Italian statistical society*, Salerno. ISBN: 9788861970618

Tourangeau, R., Rips, L. J., & Rasinski, K. (2000). *The Psychology of Survey Response*. Cambridge: Cambridge University Press. ISBN: 9780521576291

Tourangeau, R., & Yan, T. (2007). Sensitive questions in surveys. *Psychological Bulletin, 133,* 859–883. DOI: 10.1037/0033-2909.133.5.859

Tracy, P. E., & Fox, J. A. (1981). The validity of randomized response for sensitive measurements. American Sociological Review, 46, 187–200. DOI: 10.2307/2094978

van der Heijden, P. G. M., van Gils, G., Bouts, J., & Hox, J. J. (2000). A comparison of randomized response, computer-assisted self-interview, and face-to-face direct questioning: Eliciting sensitive information in the context of welfare and unemployment benefit. *Sociological Methods and Research, 28,* 505–537. DOI: 10.1177/0049124100028004005

van Vaerenbergh, Y., & Thomas, T. D. (2013). Response styles in survey research: a literature review of antecedents, consequences, and remedies. *International Journal of Public Opinion Research, 25*, 195–217. DOI: 10.1093/ijpor/eds021

Wenz, A. (2019). Do distractions during web survey completion affect data quality? Findings from a laboratory experiment. *Social Science Computer Review*. DOI: 10.1177/0894439319851503

Zwarun, L., & Hall, A. (2014). What's going on? Age, distraction, and multitasking during online survey taking. *Computers in Human Behavior, 41*, 236–244. DOI: 10.1016/j.chb.2014.09.041

Appendix A

English translations of all single and multiple questions including the self-report questions on on-device media multitasking.

Single questions on political efficacy:

I am good at understanding and assessing important political issues.
Politicians strive to keep in close touch with the people.
I have the confidence to take active part in a discussion about political issues.
Politicians care about what ordinary people think.
Response categories: agree strongly, agree, it depends, disagree, disagree strongly

Multiple questions on personality traits (big five inventory):

I see myself as someone who is reserved.
I see myself as someone who is generally trusting.
I see myself as someone who tends to be lazy.
I see myself as someone who is relaxed, handles stress well.
I see myself as someone who has few artistic interests.
I see myself as someone who is outgoing, sociable.
I see myself as someone who tends to find fault with others.
I see myself as someone who does a thorough job.
I see myself as someone who gets nervous easily.
I see myself as someone who has an active imagination.
Response categories: agree strongly, agree, neither agree nor disagree, disagree, disagree strongly

Multiple questions on life and health satisfaction:
How satisfied are you with your life as a whole?
How satisfied are you with your overall state of physical health?
How satisfied are you with your overall state of mental health?
Response categories: very, fairly, somewhat, hardly, not at all

Multiple questions on trust in people:
Do you believe that most people can be trusted?
Do you believe that most people try to be fair?
Do you think that most people try to be helpful?
Response categories: very, fairly, somewhat, hardly, not at all

Multiple questions on society and values:
Society should be tough on outsiders and blighters.
It should be clear to troublemakers that they are undesirable in society.
Social rules should be enforced without pity.
Traditions should be cultivated and maintained at all costs.
Good practices should not be called into question.
It is always best to do things the usual way.
Response categories: agree strongly, agree, neither agree nor disagree, disagree, disagree strongly

Single questions on achievement motivation:
I like being in competition with other people.
It is satisfying when I achieve better results than other people.
I am always trying to perform better than other people.
I try harder when I am in competition with other people.
It is important for me to be the best at a task.
Response categories: agree strongly, agree, neither agree nor disagree, disagree, disagree strongly

Multiple questions on job motivation 1:
A job with a high income is important for me.
A job with good promotion prospects is important for me.
A job with clear career perspectives is important for me.
A job that I can work autonomously on is important for me.
A job that allows to make use of my skills and talents is important for me.
A job where I have responsibilities for specific tasks is important for me.
A job that allows me to implement my own ideas is important for me.
A job with regular working hours is important for me.
Response categories: agree strongly, agree, neither agree nor disagree, disagree, disagree strongly

Multiple questions on job motivation 2:

A job where I am guided by a supervisor is important for me.
A job where I receive credit by other people is important for me.
A job where I can help other people is important for me.
A job with a safe professional future is important for me.
A job that contributes to the society is important for me.
A job with flexible working hours is important for me.
A job with a good working atmosphere is important for me.
A job with a short distance to work is important for me.

Response categories: agree strongly, agree, neither agree nor disagree, disagree, disagree strongly

Self-report questions on on-device media multitasking:

Did you engage in the following tasks while completing this web survey?

Talking to other people via this device (e.g., making a phone call).

Surfing the Internet, writing emails or messages, or visiting social networks via this device.

Response categories: yes, no

Other tasks: please specify

Note. The order of the questions corresponds to the presentation order in Appendix A. Some of the questions were subject of questionnaire design experiments that, for instance, systematically varied the scale direction. The original German wordings of the questions are available from the first author on request.

Appendix B

Table B1. Average marginal effects of the generalized mixed effects logit regressions for response quality (middle response style, extreme response style, and item-nonresponse) and switching

Independent variables	Middle response style (1 = yes)	Extreme response style (1 = yes)	Item-nonresponse (1 = yes)	Switching (1 = yes)
Page Level				
Switching (1 = yes)	0.022*	–0.009	0.001	---
Multiple questions (1 = yes)	0.226***	0.142*	–0.076***	0.008***
Respondent level				
PC (1 = yes)	–0.002	0.011	0.006***	0.012***
Age (in years)	–0.000	0.000	–0.000	–0.001***
Education with high as reference				
Low (1 = yes)	0.016**	–0.013	–0.013***	–0.015***
Medium (1 = yes)	0.007	–0.012	–0.009***	–0.002
Female (1 = yes)	–0.017***	0.006	–0.012***	–0.002
Self-reported multitasking ability (1 = low to 7 = high)	---	---	---	–0.001

Note. *p < 0.05, **p < 0.01, ***p < 0.001.