Switching away: what can we learn from JavaScript "OnBlur" functions about response behavior in web surveys?

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Setting the Scene

- Who is this guy talking to you today?
 - Postdoc researcher at the German Internet Panel.
 - Research fellow at the Research and Expertise Centre for Survey Methodology.
 - Former research fellow at the University of Michigan.
 - Former Fulbright fellow at Stanford University.
- What is his research about?
 - Combining methodology, psychology, computer science, and data science.
- What is his presentation about?
 - Applicability of JavaScript "OnBlur" functions in web surveys.



Web Surveys and OnBlur Functions I

- Web surveys allow passive collection of paradata.
 - Response times, mouse activities, scrolling, window/tab switching, ...
- Paradata can be collected via ...
 - apps installed on the device.
 - browsers hosting web surveys.
- Browser-based paradata are collected via JavaScript.
 - Application Programming Interface (API).
- Window/tab switching is detected by OnBlur functions.
 - How often (off-count) and for how long (off-time).
 - Page-level detection.



Web Surveys and OnBlur Functions II

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Interpret/www3.uniperk.de/uc/Studium_Erfolg_H/ Es befriedigt mich, alles was ich tue, so gut wie möglich zu machen. O Trifft voll zu O O O O O O O O O O O O O O	Es befriedigt mich, alles was ich tue, so gut wie möglich zu machen. OTrifft voll zu O O Trifft gar nicht zu	https://ww3.amipark.de/uc Es befriedigt mich, a O Trifft voll zu O O O O O O O	Erstelle ein neues Konto Es geht schnell und einfach. Vorname Nachname Handynummer oder E-Mail-Adresse Neues Passwort Geburstag Geschlecht	Handynummer oder E-Mail-Adresse Passwort Anmelden oder Neues Konto erstellen Passwort vergessen?- Impressum/AG8/NetzDG
Weiter Deutsch English (US) Tärkge Potoli Italano Français (France) Románá Pyccová 19,4 Español Potogode (Brast) +	Weiter	Deutori English (US) Tange	Webbild Mannich M	Destsch Erglich (JS) Takop Polski Italian Espatiol Portuguls (Brasil Facebook Inc.

No switching away

Switching away



Web Surveys and OnBlur Functions III

```
var FocusTArray=new Array();
var FocusArray=new Array();
var state='';
var visibilityChange=(function(window) {
     var inView=true;
     return function(fn) {
window.onfocus=window.onblur=window.onpageshow=window.onpagehide=function(s
) {
     if({focus:1, pageshow:1}[s.type]){
         if(inView) return;
         fn("1"); //visible
         inView = true;
         else if(inView){
             fn("0"); //hidden
             inView=false;
         };
     };
}(this));
visibilityChange(function(state) {
     FocusArray[FocusArray.length]=state;
     FocusTArray[FocusTArray.length]=Math.round(now()-start);
});
```



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Web Surveys and OnBlur Functions IV

Raw data from OnBlur functions are stored as strings.

100431,230838	0,1
1011,125193	0,1
1020,17153	0,1
1027,3094	0,1
NA	NA
10646,29095	0,1
10750,28158	0,1
NA	NA
109472,133384,139913,159686	0,1,0,1
1096,41394,42668,52469	0,1,0,1
11,12207	0,1
111734,645909,770886,838399	0,1,0,1
1129,11930	0,1
1156,83178	0,1
11665,311456	0,1

Time stamps (ms)	Blur events
1027,3094	0,1
	No Blur event
10646,29095	0,1
10750,28158	0,1
	No Blur event
109472,133384,	0,1,0,1
1096,41394,42668,	0,1,0,1
11,12207	0,1



Web Surveys and OnBlur Functions V

ZECCOO Search Q Upload Communities		€ Log in Cor Sign up
May 2, 2020 Journal article Open Access	110	70
ECSP – Embedded Client Side Paradata		/9 • deurslande
Stephan Schlosser; Jan Karem Höhne	See mor	e details
Embedded Client Side Paradata (ECSP) is a tool that is licensed under the Creative Commons Attribution 4.0 International License (see http://creativecommons.org/licenses/by/4.0/). It is based on different program languages, such as JavaScript and HTML. In general, ECSP can be implemented in web-based survey software solutions that provide access to the source		
code. It enables researchers to passively collect different kinds of client-side paradata, such as response times and scrolling events, and data from built-in sensors, such as Global Positioning System (GPS) and acceleration data. This is	Indexed in	
irrespective of the Internet browser and operating system used and allows researchers to investigate respondents' completion behavior with respect to web surveys. Paradata and sensor data are collected at the page-level and are stored together with the actual survey data (i.e., respondents' answers) in the same dataset.	Oper	AIRE
Preview 🗸	•	
□ P ★ ↓ Seite: 2 of 27 - + Automatischer Zoom ÷ ∴ Automatischer Zoom ÷		
In this contribution we introduce and outline the program codes of the following five	Publication date: May 2, 2020	
new data types: 1) acceleration data (SurveyMotion with and without gravity; see Höhne,	DOI:	
Revilla, & Schlosser, 2020; Höhne & Schlosser, 2019), 2) compass data, 3) Global Positioning	DOI 10.5281/zenodo.37	782592
System (GPS) data, 4) gyroscope data, and 5) swiping. The codes can be customized to suit individual needs. In other words, only data types that	ECSP HTML JavaScript	paradata
are deemed necessary can be collected. ECSP users can drop the codes that they do not need	passive data collection we	b survey sensor data
without affecting the collection of the remaining data types. However, the collection of response	License (for files):	Attribution 4.0 International
and start times is always necessary for collecting time stamps for the other data types.		
ECSP extension		
Acceleration data (SurveyMotion with and without gravity)	Versions	
ECSP can register the acceleration of (mobile) devices, including time stamps (in milliseconds).	Version 1	May 0.0000
Acceleration is defined as the rate of change of velocity of an object over time, the lower/higher the rate of change of velocity of an object in a specific time period is, the lower/higher its	10.5281/zenodo.3782592	May 2, 2020

Source: https://zenodo.org/record/1218941#.XYp-jmbgq70



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 "Embedded Client Side Paradata" by Schlosser and Höhne (2020).

- Just recently released.
- Gathers switching events plus 18 further data types.
- Based on JavaScript and HTML.
- Data collection across browsers, devices, and operating systems.
- Synchronous data transfer.
- Data are stored with survey responses.

Höhne & Schlosser (2018). Investigating the adequacy of response time outlier definitions in computer-based web surveys using paradata SurveyFocus. Social Science Computer Review, 36, 369–378.



Introduction I

- Measuring response times has a long tradition in survey research.
 - Informs about cognitive question processing.
 - Allows to draw conclusions about response behavior.
- In web surveys response times are passively collected via JavaScript.
 - Almost no additional burden for researchers and no additional burden for respondents.
- Self-administration mode of web surveys impedes response time handling and interpretation.
 - Spatial distance between researchers and respondents.
 - Difficult to monitor web survey completion.
 - For instance, switching away to check emails inflates response times.



Introduction II

- Some respondents have very short/long response times.
 - So-called outliers vary from other respondents.
- The literature proposes different strategies to define outliers.
- Commonly, researchers calculate arbitrary "thresholds" based on response time distributions.
 - Response times below/above thresholds are defined as outliers.
- One key problem is the determination of appropriate thresholds.
 - Different strategies result in different amounts of outliers.
 - There is a lack of objectivity in defining outliers.



Introduction III

- JavaScript OnBlur functions may allow to overcome the flaws of common outlier definitions.
- Distinguishing dis-/continuously responding respondents.
 - Discontinuous responding because of on-device media multitasking (e.g., checking emails) inflates response times.
- Subtracting respondents' off-time from their response time.
 - Allows a more precise and objective response time analysis.
- Investigating the adequacy of outlier definitions based on response time distributions using JavaScript OnBlur functions.



Hypotheses

Common outlier definitions do not detect all discontinuously responding respondents. (H1)

Discontinuously responding respondents need longer to respond – after off-time correction – than continuously ones. (H2)

Discontinuously responding respondents produce lower data quality in terms of item non-response than continuously ones. (H3)



Outlier Definition Methods





Methods: Research Design

- Cross-sectional study at two German universities in May 2015.
- Students were invited to a self-administered web survey via email.
 - The email included an introduction to the study and a link directing respondents to the web survey.
 - PC only survey.
- We used 24 survey questions:
 - 8 single questions dealing with achievement motivation.
 - 16 multiple (matrix) questions dealing with job motivation.
 - Non-optimized survey layout.



Methods: Sample Characteristics

Final sample size:	N = 1,751 (participation rate: 3.0%)
Age (in years):	Mean = 24.9
Gender:	55.0% female
Education:	At least college preparatory secondary school
Survey experience:	93% had previously participated in a web survey



Methods: Analytical Strategy

- H1: Prevalence of outliers.
 - Comparing proportions (descriptive only).
 - Single and multiple questions, respectively.
- H2: Comparing time differences.
 - Comparing means and conducting t-tests.
 - Single and multiple questions, respectively.
- H3: Comparing data quality (item non-response).
 - Comparing proportions and conducting chi-square tests.
 - Single and multiple questions, respectively.



Results: Prevalence of Outliers (H1)





Results: Comparing Time Differences (H2)





Results: Comparing Data Quality (H3)





Discussion and Conclusion

- Common outlier definitions do not capture all discontinuously responding respondents.
 - Depends on the respective strategy.
 - Consequences for remaining sample size.
- Discontinuously responding respondents inflate response times.
 - Weakens conclusions drawn from response times (e.g., on question processing).
- Discontinuously responding respondents show lower data quality.
 - Higher item non-response.
- JavaScript OnBlur functions are an easy way to improve response time analyses.



Höhne, Schlosser, Couper, & Blom (2020). Switching away: exploring on-device media multitasking in web surveys. Computers in Human Behavior. DOI: 10.1016/j.chb.2020.106417



Introduction I

- Increase in self-administered web surveys.
 - Major social surveys employ web-based modules (e.g., ANES, ESS, and HRS).
- Web surveys have several benefits.
 - Researchers: timeliness and cost-effectiveness.
 - Respondents: few time and location restrictions.
- Benefits come at a price.
 - Few information about survey environment.
 - Limited ways to monitor survey completion.
- Research shows that respondents multitask.
 - Threat to data quality.



Introduction II

- Different forms of multitasking.
 - Non-media.
 - On-device media.
 - Off-device media.
- These forms are usually measured with self-reports.
 - Measured on survey-level.
 - Prone to social desirability and recall errors.
- OnBlur functions detect on-device media multitasking.
 - Precise and reliable measure.
 - Measured on page- or question-level.



Introduction III

- Almost no studies on detecting on-device media multitasking with OnBlur functions.
 - Effects on data quality remain unclear.
- We build on the scarce literature focusing on data quality.
 - Response styles (middle and extreme).
- Randomizing respondents to a device type.
 - PC and smartphone.
- Comparing results of OnBlur functions with self-reports.



Hypotheses

PCs are associated with higher levels of on-device media multitasking than smartphones. (H1)

Self-reports yield lower levels of on-device media multitasking than OnBlur functions. (H2)

Engaging in on-device media multitasking – detected by OnBlur functions – is associated with lower levels of data quality. (H3)



Methods: Research Design



- Self-administered web survey in Germany in July/August 2019.
- Cross-quota sample based on age and gender (3×2).
 - Designed to represent the German population.
 - Census served as population benchmark.
- Respondents were randomly assigned to a device type.
- We used 9 single and 37 multiple questions.
 - Various question topics.
 - Optimized survey layout.



Methods: Sample Characteristics

Final sample size:	N = 3,292 (participation rate: 13.6%)
Age (in years):	Mean = 46.6
Gender:	50.5% female
Education:	12.5% lower secondary school (low)
	34.6% intermediate secondary school (middle)
	52.9% at least college preparatory secondary school (high)
Daily usage:	PC: 69.8%, smartphone: 87.4%, and internet: 93.9%

Note. We conducted chi-square tests to evaluate the effectiveness of random assignment. No differences between experimental groups were found.



Methods: Analytical Strategy

- H1: Prevalence of on-device media multitasking.
 - Comparing proportions and conducting chi-square tests.
 - Reporting off-count and off-time.
- H2: Agreement between OnBlur functions and self-reports.
 - Comparing proportions and conducting chi-square tests.
 - Calculating phi coefficient.
- H3: Data quality.
 - Two separate multilevel logistic regressions.
 - Middle and extreme response style as DVs.
 - Switching, question presentation, and device type as IVs.



Results: Prevalence of On-Device Media Multitasking (H1)



Note. ***p < 0.001. Result of a chisquare test. Base: All respondents.



Note. Result of a U-test. Base: All switching respondents. Off-time (sec)



Note. Result of a U-test. Base: All switching respondents.



Results: Agreement Between OnBlur Functions and Self-reports (H2)



Self-report (%)

- Associations between switching away and self-reports (phi coefficients):
 - PC: phi = 0.22***
 - Smartphone: phi = 0.17***

Note. ***p < 0.001.



Note. Result of a chi-square test.

Base: All respondents.

Results: Data Quality (H3)

Independent variables	Regression coefficients	Robust standard errors	Middle response style:
Switching (1 = yes)	0.13***	0.05	Observations: 154,207
Multiple questions (1 = yes)	1.34***	0.37	Pseudo R ⁻ : 0.12
PC (1 = yes)	non-sig.		

Note. ***p < 0.001. Dependent variable: Middle response style (1 = yes). Intercept is significant. Controls: age, education, and gender.

Independent variables	Regression coefficients	Robust standard errors	Extreme response style:
Switching (1 = yes)	non-sig.		Observations: 154,207
Multiple questions (1 = yes)	0.98*	0.48	Pseudo k ⁻ : 0.05
PC (1 = yes)	non-sig.		

Note. *p < 0.05. Dependent variable: Extreme response style (1 = yes). Intercept is significant. Controls: age, education, and gender.



Discussion and Conclusion

- On-device media multitasking is more common on PCs.
 - Reasons might be device-related: screen size and input capabilities.
- Precise and reliable gathering of on-device media multitasking by OnBlur functions.
 - Merit: page- or question-level gathering.
 - Limit: no information about outside activities.
- OnBlur functions and self-reports yield different conclusions.
 - Self-reports result in underreporting.
- On-device media multitasking reduces data quality.
- A combination of paradata and self-reports seems superior.



Höhne, Cornesse, Schlosser, Couper, & Blom (in press). Looking up answers to political knowledge questions in web surveys. Public Opinion Quarterly. DOI: 10.1093/poq/nfaa049



Introduction I

- Political knowledge is a key aspect in public opinion research.
- Many surveys employ political knowledge questions.
 - American National Election Study (ANES).
 - Eurobarometer.
- In interviewer-based surveys, respondents who do not know the answer have two options.
 - Confessing their lack of knowledge.
 - Guessing the answer.



Introduction II

- In self-administered web surveys there is a further option.
 - Switching away and looking up answers.
- Looking up answers causes measurement error.
 - Drawing on "procedural" instead of "declarative" memory.
- Unlike errors committed by satisficing, errors caused by looking up answers are optimizing errors.
- Few studies provide insights into the prevalence and factors of looking up answers.



Introduction III

- The knowledge gap is usually closed by using self-reports.
 - No strong evidence for looking up answers.
- We strike a new methodological path using OnBlur functions.
 - Prevalence and factors of looking up answers.
 - Factors of correct answers.
- Randomizing respondents to ...
 - device type (PC and smartphone).
 - response format (open and closed).
- Comparing results of OnBlur functions with self-reports.



Hypotheses

Self-reports result in lower proportions of looking up answers than "OnBlur" functions. (H1)

Looking up answers is more common for open than closed response formats. (H2)

Open response formats yield more correct answers than closed response formats. (H3)



Methods: Research Design



- Self-administered web survey in Germany in September/October 2018.
- Cross-quota sample based on age, education, and gender (3×3×2).
 - Designed to represent the German population.
 - Census served as population benchmark.
- Respondents were randomly assigned to a device type and response format.
- We used 3 political knowledge questions on the European Union.
 - Optimized survey layout.



Methods: Sample Characteristics

Final sample size:	<i>N = 3,332 (participation rate: 9.1%)</i>
Age (in years):	Mean = 47.1
Gender:	50.2% female
Education:	37.0% lower secondary school (low)
	30.4% intermediate secondary school (middle)
	32.6% at least college preparatory secondary school (high)
Daily usage:	PC: 63.2%, smartphone: 87.8%, and internet: 94.5%

Note. We conducted chi-square tests to evaluate the effectiveness of random assignment. No differences between experimental groups were found.



Methods: Analytical Strategy

- H1: Prevalence of looking up answers.
 - Comparing proportions and conducting directed Z-tests (OnBlur functions > self-reports).
- H2: Factors of looking up answers.
 - Multilevel logistic regression with switching as DV.
 - Response format, device type, and self-report as IVs.
- H3: Factors of correct answers.
 - Multilevel logistic regression with correct answer as DV.
 - Response format, device type, self-report, and switching as IVs.



Results: Prevalence of Looking Up Answers (H1)



Note. Result of a directed Z-test (OnBlur functions > self-report). Base: All respondents. Questions 1 to 3 (%)



Note. ***p < 0.001. Results of directed Z-tests (OnBlur functions > self-report). Base: All respondents.



Results: Factors of Looking Up Answers (H2)

Independent variables	Regression coefficients	Robust standard errors	Observations:	9,783
Open (1 = yes)	0.61***	0.14	Pseudo R ² :	0.28
PC (1 = yes)	1.51***	0.13		
Self-report (1 = yes)	2.50***	0.09		

Note. ***p < 0.001. Dependent variable: Switching (1 = yes). Intercept is significant. Controls: age, education, gender, the political knowledge questions with the first as reference, and Open×PC.



Results: Factors of Correct Answers (H3)

Independent variables	Regression coefficients	Robust standard errors	Obs
Open (1 = yes)	- 1.02***	0.08	Pseu
PC (1 = yes)	non-sig.		
Self-reports (1 = yes)	1.48***	0.07	
Switching (1 =yes)	1.76***	0.08	

Observations: 9,783 Pseudo R²: 0.28

Note. ***p < 0.001. Dependent variable: Correct answer (1 = yes). Intercept is significant. Controls: age, education, gender, the political knowledge questions with the first as reference, and Open×PC.



Discussion and Conclusion

- A substantial minority is looking up answers.
- OnBlur functions and self-reports come to different conclusions.
 - There are device-related differences.
- Looking up answers is more common for open response formats.
 - Higher task difficulty: no response options to draw on.
- Correct answers are more common for closed response formats.
 - Response options allow (informed) guessing.
- Controlling for looking up answers with OnBlur functions.
 - Improving measurement of political knowledge.



Future Research Perspectives

- Connection between switching and data quality.
 - Reliability and validity.
- Providing immediate (real-time) feedback.
 - Responsive survey designs.
 - Asynchronous paradata transfer.



Many thanks for your attention!

Contact: hoehne@uni-mannheim.de



Appendix: Single and Multiple Questions

PC single question	Smartphone single question
Es macht mir Spaß mit anderen im Wettbewerb zu stehen.	Es macht mir Spaß mit anderen im Wettbewerb zu stehen.
O Trifft voli und ganz zu O Trifft eher zu	Trifft voll und ganz zu
O Trifft in mittlerem Ausmaß zu	O Trifft in mittlerem Ausmaß zu
O Trifft eher nicht zu	O Trifft eher nicht zu
O Trifft überhaupt nicht zu	O Trifft überhaupt nicht zu
PC	Weiter Weiter Smartphone
multiple guestions	multiple guestions
Ein hohes Einkommen ist mir wichtig.	Ein hohes Einkommen ist mir wichtig.
Ein hohes Einkommen ist mir wichtig.	Ein hohes Einkommen ist mir wichtig.
multiple questions Ein hohes Einkommen ist mir wichtig. O Trifft voll und ganz zu O Trifft voll und ganz zu	Ein hohes Einkommen ist mir wichtig.
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multiple questions Ein hohes Einkommen ist mir wichtig. O Trift voll und ganz zu O Trift onl und ganz zu O Trift in mitterem Ausmaß zu O Trift in mitterem Ausmaß zu O Trift in mitterem Ausmaß zu	Ein hohes Einkommen ist mir wichtig. O Trifft voll und ganz zu O Trifft ner zu O Trifft ner führt mitterem Ausmaß zu O Trifft her nicht zu
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multiple questions Ein hohes Einkommen ist mir wichtig. O Trifft voll und ganz zu Trifft oher zu Trifft oher nicht zu Trifft oherhaupt nicht zu Trifft uberhaupt nicht zu	multiple questions Ein hohes Einkommen ist mir wichtig. Trifft voll und ganz zu Trifft oher zu Trifft oher nicht zu Trifft oher nicht zu Gute Aufstiegsmöglichkeiten sind mir wichtig. Trifft voll und ganz zu

- We used 46 questions on a variety of topics.
 - 9 single questions.
 - 37 multiple questions on 6 survey pages.
- We used an optimized survey layout.



Appendix: Political Knowledge Questions

	Wer ist der derzeitige Präsident der Europäischen Kommission? Bitte beantworten Sie die Frage so korrekt wie möglich.
Weiter	Weiter Smartphone
	Wer ist der derzeitige Präsident der Europäischen Kommission? Bitte beantworten Sie die Frage so korrekt wie möglich.
	O Donald Tusk
	O Mario Draghi
	O Antonio Tajani
	O Jean-Claude Juncker
Weiter	O José Manuel Barroso
	Welter

- We developed 3 questions dealing with the EU.
 - Including an instruction asking to answer as accurately as possible.
- We also employed a selfreport question.
- We used an optimized survey layout.

