



# GPS-Paradata in Computer-Assisted Personal Interviews: Additional Opportunities for Monitoring Fieldwork Interviewers

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# Background

## Separate locations analysis:

- “Geofencing” - Comparison of locations at the beginning and at the end of an interview [Seeger 2011; Wang, Biemer 2010; Mohajer, Edwards 2018; Choumert-Nkolo et al. 2019]
- “Strand length” - Comparison of interview location and that of the sampled household [Mohajer, Edwards 2018; Sikes 2009] or with interviewers own home [Hasson 2015]
- “Curbstoning” test - checking for presence of too dense groups of interviews' locations [U.S. Census 2010; Dajani, Marquette 2015]

## Route analysis (sequence of GPS measured locations):

- Linking locations of interviews into the route [Choumert-Nkolo et al. 2019]
- Analysis of interviewers' routes [Wagner, Olson, Edgar 2017; Olson, Wagner 2015]

## Research question:

How to use GPS-paradata in computer-assisted personal interviews on tablets for fieldwork monitoring?

# Data

**26<sup>th</sup> wave, RLMS HSE, CAPI, 37** interviewers, **7** regions, **491** interviews

October 2017– February 2018

Individual surveys

**GPS locations** – information regarding latitude and longitude of a tablet in the beginning and at the end of the interview (SurveySolutions application) – active measurement

**GPS routes** – information about interviewers' routes in the field (GPSLogger application) – passive measurement

## **Additional data:**

- Interviewers' socio-demographic characteristics and expectations towards the success of transition

# GPS-paradata quality

Missing data

Measurement accuracy (GPS Logger, Survey Solutions)

# Missing data

## Binary logistic regression

**Dependent variable:** Missing data of location measurements either at the beginning or at the end of the interview - 110 cases (22,4%)

	B	S.E.	Sig.	Exp(B)	B	S.E.	Sig.	Exp(B)
Age	0,87	0,40	<b>0,031</b>	2,39	4,41	2,39	0,065	82,51
Tablet availability	1,26	0,38	<b>0,001</b>	3,52	0,95	0,74	0,202	2,58
Confidence with tablet	-0,48	0,28	0,086	0,62	-2,69	1,15	<b>0,020</b>	0,07
Expectations index	-1,53	0,37	<b>0,000</b>	0,22	-3,42	1,85	0,065	0,03
Mean accuracy (GPS Logger)	-0,75	0,28	<b>0,006</b>	0,47	2,79	1,27	<b>0,028</b>	16,20
Mean battery charge level	-0,87	0,28	<b>0,002</b>	0,42	2,30	1,39	0,098	9,92
Solikams					-13,86	5,69	<b>0,015</b>	0,00
Kazan					-22,30	4893,87	0,996	0,00
Kurgan					-4,92	3,88	0,205	0,01
Volsk					6,68	5,33	0,210	797,16
Moscow region					-9,52	4,37	<b>0,030</b>	0,00
Berdsk					2,63	2,34	0,262	13,80
Constant	-2,66	0,35	0,000	0,07	-0,77	1,61	0,632	0,46
<b>-2 Log likelihood</b>								
				127,97				106,101
<b>Cox &amp; Snell R Square</b>								
				0,224				0,283
<b>Nagelkerke R Square</b>								
				0,438				0,553

# GPS-paradata accuracy

GPS Logger	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Survey solutions	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound		B	Std. Error	Beta			Lower Bound	Upper Bound
<b>(Constant)</b>	-0,66	0,09		-7,18	0,000	-0,84	-0,48	<b>(Constant)</b>	24,61	1,4		17,58	0,000	21,86	27,36
<b>Solikamsk</b>	1,48	0,15	0,48	10,09	<b>0,000</b>	1,20	1,77	<b>Solikamsk</b>	-0,24	2,24	-0,01	-0,11	0,914	-4,64	4,16
<b>Kazan</b>	1,47	0,16	0,43	9,32	<b>0,000</b>	1,16	1,79	<b>Kazan</b>	-3,21	2,39	-0,08	-1,34	0,180	-7,91	1,49
<b>Kurgan</b>	1,12	0,13	0,43	8,56	<b>0,000</b>	0,86	1,38	<b>Kurgan</b>	-1,17	1,99	-0,04	-0,59	0,558	-5,07	2,74
<b>Volsk</b>	-0,68	0,16	-0,20	-4,28	<b>0,000</b>	-1,00	-0,37	<b>Volsk</b>	-0,73	2,52	-0,02	-0,29	0,773	-5,68	4,22
<b>Berdsk</b>	0,40	0,15	0,13	2,69	<b>0,007</b>	0,11	0,69	<b>Berdsk</b>	0,50	2,31	0,01	0,22	0,828	-4,04	5,04
<b>Moscow region</b>	0,74	0,12	0,31	6,00	<b>0,000</b>	0,50	0,98	<b>Moscow region</b>	-1,16	1,81	-0,05	-0,64	0,520	-4,71	2,39

	Mean accuracy (GPSLogger)	Mean accuracy (Survey solutions)
<b>R</b>	0,654	0,084
<b>R Square</b>	0,428	0,007
<b>Adjusted R Square</b>	0,419	-0,009
<b>Std. Error of the Estimate</b>	0,763	11,457

# Identifying “suspicious” / “at risk” interviews

Comparing location at the beginning and at the end of the interview

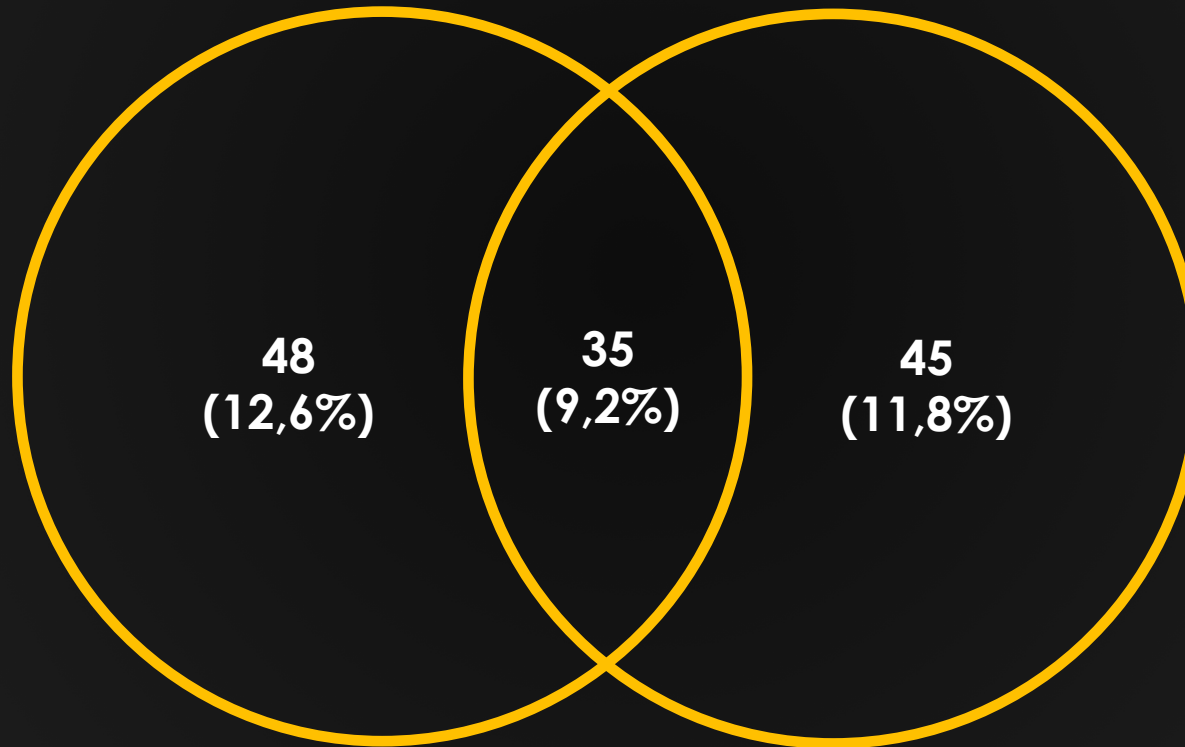
Thresholds choice

Time difference in location measurements

# Geofencing

Two ways of threshold identification:

Conventional (8-25 metres) [Keating et al. 2014] – distance is more than 50 metres



Accuracy-based (Survey Solutions) – distance is more than sum of accuracy of location measurements

Overall “suspicious” interviews (distance based) – **58 (15,2%)**



# Significant distance between two locations

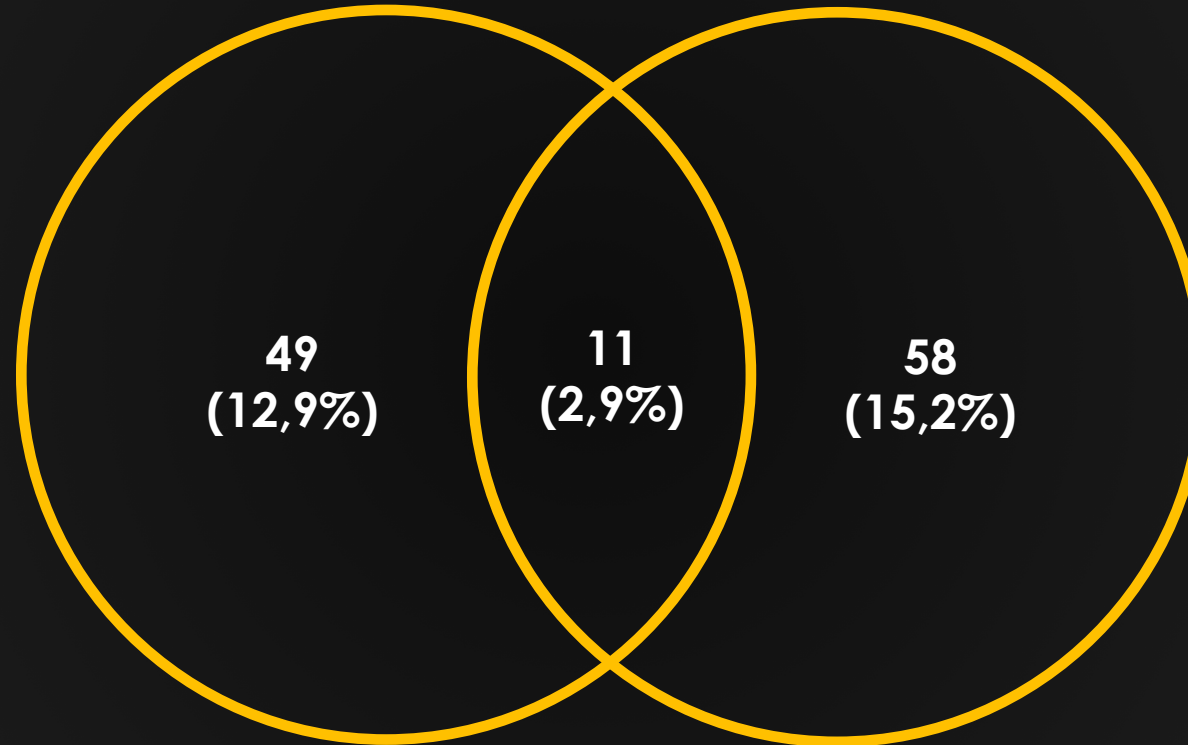
## Binary logistic regression

**Dependent variable:** Significant distance between two locations (either methods of thresholds identification)

	<b>B</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Exp(B)</b>
<b>Satisfaction with RLMS project</b>	0,63	0,37	0,086	1,88
<b>Tablet</b>	0,29	0,37	0,424	1,34
<b>Confidence with tablet</b>	-0,62	0,28	<b>0,024</b>	0,54
<b>Expectations index</b>	-0,06	0,26	0,822	0,94
<b>CAPI experience</b>	0,66	0,27	<b>0,014</b>	1,93
<b>Age</b>	-0,53	0,29	0,063	0,59
<b>Mean satellites number (GPS Logger)</b>	-0,05	0,23	0,846	0,96
<b>Mean time difference between locations (GPS Logger)</b>	-0,19	0,25	0,431	0,82
<b>Mean battery charge level</b>	0,09	0,27	0,748	1,09
<b>Constant</b>	-1,68	0,24	0,000	0,19
<b>-2 Log likelihood</b>				
		200,863		
<b>Cox &amp; Snell R Square</b>				
		0,067		
<b>Nagelkerke R Square</b>				
		0,113		

# Negative time difference between location measurements

Negative time difference between time of location measurements at the beginning and at the end of interview



Significant distance between locations (either methods of threshold identification)

Overall “suspicious” interviews – **96 (25,2%)**

# Curbstoning analysis

Distance between interviews conducted in different households:

	Frequency	Percent
Distance between interviews is less than 8*	90	18,3
Distance between interviews is less than 16*	132	26,9
Same HH interviews have distance of more than 16	25	5,1
Missing data	94	19,1
No other members from this household were interveiwed	85	17,3
* - (in more than 2 cases)		

# Outlook (1)

Four indicators of «suspicious» interviews:

- Significant distance between locations at the beginning and at the end of an interview (conventional threshold identification (48 – 12,6%) and accuracy-based (45 – 11,8%))
- Negative time difference between location measurements (49 – 12,9%)
- Interviews proximity (excluding members of the same HH) by 8 metres (90 – 18,3%) or by 16 metres (132 – 26,9%)
- Significant distance between interviews within the same HH (25 – 5,1%)

Overall «suspicious»/«at risk» interviews – (274 – 55,8%)

## Outlook (2)

GPS-paradata quality may vary in connection with **regions** (lower quality in more developed regions [Lemmens 2011; Gong et al. 2012]) and with **interviewers' characteristics** (confidence with CAPI)

Experience with CAPI is connected with higher probability of significant distance between locations at the beginning and at the end of the interview (**by 93%**), while high levels of confidentiality regarding working with tablet is connected with lower probability of existence of significant distance (**by 46%**)

# Recommendations

Focus on **interviewers education** while starting using CAPI which can be connected with further increase in GPS-paradata quality and with lower levels of «suspicious» interviews

Use **accuracy** as threshold identification for distance between two loactions (e.g. at the beginning and ant the end of the interview) – GPS-data quality may vary in different regions

GPS-paradata should be used in **conjunction with other methods** of fieldwork monitoring – no exact assumptions about fabrications or falsifications may be done based on GPS-paradata analysis only (nonintentional errors or technical difficulties)

# Limitations

GPS paradata employment differs in case of longitudinal panel and cross-sectional surveys as well as between surveys with different sampling design

We were unable to use respondents' addresses

Regarding passive GPS-data capturing we were unable to detect whether some additional software was used and when it was turned off

# Future plans

**Second wave** of experimental RLMS-HSE CAPI – additional regions, interviewers, respondents and data

Location comparison **between waves** (panel option)

**Compare applications** (GPS Logger, Survey Solutions) from the standpoint of data quality, precision



# Thank you for the attention

For cooperation, questions and comments please contact:  
[zenon-daniil@yandex.ru](mailto:zenon-daniil@yandex.ru)

**Thanks to Dr. Aigul Mavletova for considerable  
impact on this research**

# Contents

<h3>GPS-paradata in Computer-Assisted Personal Interviews: Additional Opportunities for Monitoring Fieldwork Interviewers</h3> <p>Dr. Alquist Marilewski, Heriot-Watt University</p> <p>© 2017 Alquist Marilewski</p>	<h3>Background</h3> <p><b>Separate location analysis</b>          "Displacement" - Comparison of locations at the beginning and at the end of an interview (Lewer 2011; Wang et al. 2014; Hargreaves et al. 2016; "Normal weight") - Comparison of interview location and that of the contacted household (Lewer 2011; Wang et al. 2014) or with interviewers own home (Lewer 2011; "Lightweight") - Checking for presence of too dense groups of interview locations (Lewer 2011; "Heavy")</p> <p><b>Single analysis (sequence of GPS measured locations)</b>          Grouping locations of interview into the route (Lewer 2011; Wang et al. 2014; Analysis of interview routes (Hargreaves et al. 2016; Wang et al. 2014; Wang et al. 2014)</p> <p><b>Research question</b>          How to use GPS-paradata in computer-assisted personal interviews on tablets for household matching?</p>	<h3>Data</h3> <p>GPS data, 8,040, 482, 6,491, 87 interviews, 7 regions, 497 interviewers, October 2014 - February 2016</p> <p>Individual survey</p> <p><b>GPS location</b> - Information regarding latitude and longitude of a tablet in the beginning and at the end of the interview (Coordinates, elevations) - "Home measurement"</p> <p><b>GPS route</b> - Information about interviewers' routes in the field (GPS Logger application) - "Passive measurement"</p> <p><b>Additional data</b>          - Interviewers' socio-demographic characteristics and expectations towards the location of transfer</p>	<h3>GPS-paradata quality</h3> <p>Measurement accuracy GPS Logger, Survey Solutions</p>	<h3>Mixing data</h3> <p>Binary logistic regression</p> <p>Measuring error: mixing data of location measurements either at the beginning or at the end of the interview (Lewer 2011; Wang et al. 2014)</p> <table border="1"> <thead> <tr> <th></th> <th>Yes</th> <th>No</th> <th>Total</th> <th>Yes (%)</th> <th>No (%)</th> </tr> </thead> <tbody> <tr> <td>Region</td> <td>1,116</td> <td>1,116</td> <td>2,232</td> <td>50.0</td> <td>50.0</td> </tr> <tr> <td>Interviewer</td> <td>1,116</td> <td>1,116</td> <td>2,232</td> <td>50.0</td> <td>50.0</td> </tr> <tr> <td>Interview</td> <td>1,116</td> <td>1,116</td> <td>2,232</td> <td>50.0</td> <td>50.0</td> </tr> <tr> <td>Location</td> <td>1,116</td> <td>1,116</td> <td>2,232</td> <td>50.0</td> <td>50.0</td> </tr> <tr> <td>Time</td> <td>1,116</td> <td>1,116</td> <td>2,232</td> <td>50.0</td> <td>50.0</td> </tr> <tr> <td>Distance</td> <td>1,116</td> <td>1,116</td> <td>2,232</td> <td>50.0</td> <td>50.0</td> </tr> <tr> <td>Accuracy</td> <td>1,116</td> <td>1,116</td> <td>2,232</td> <td>50.0</td> <td>50.0</td> </tr> <tr> <td>GPS Logger</td> <td>1,116</td> <td>1,116</td> <td>2,232</td> <td>50.0</td> <td>50.0</td> </tr> <tr> <td>Survey Solutions</td> <td>1,116</td> <td>1,116</td> <td>2,232</td> <td>50.0</td> <td>50.0</td> </tr> <tr> <td>Total</td> <td>1,116</td> <td>1,116</td> <td>2,232</td> <td>50.0</td> <td>50.0</td> </tr> </tbody> </table>		Yes	No	Total	Yes (%)	No (%)	Region	1,116	1,116	2,232	50.0	50.0	Interviewer	1,116	1,116	2,232	50.0	50.0	Interview	1,116	1,116	2,232	50.0	50.0	Location	1,116	1,116	2,232	50.0	50.0	Time	1,116	1,116	2,232	50.0	50.0	Distance	1,116	1,116	2,232	50.0	50.0	Accuracy	1,116	1,116	2,232	50.0	50.0	GPS Logger	1,116	1,116	2,232	50.0	50.0	Survey Solutions	1,116	1,116	2,232	50.0	50.0	Total	1,116	1,116	2,232	50.0	50.0																																																																		
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Accuracy	1,116	1,116	2,232	50.0	50.0																																																																																																																																			
GPS Logger	1,116	1,116	2,232	50.0	50.0																																																																																																																																			
Survey Solutions	1,116	1,116	2,232	50.0	50.0																																																																																																																																			
Total	1,116	1,116	2,232	50.0	50.0																																																																																																																																			
<h3>Clustering analysis</h3> <p>Distance between interviews conducted in different households</p> <table border="1"> <thead> <tr> <th></th> <th>Response</th> <th>Percent</th> </tr> </thead> <tbody> <tr> <td>Distance between interviews is less than 50 meters</td> <td>90</td> <td>38.3</td> </tr> <tr> <td>Distance between interviews is less than 100 meters</td> <td>102</td> <td>44.9</td> </tr> <tr> <td>Same 100 interviewers have distance of more than 100 meters</td> <td>20</td> <td>8.1</td> </tr> <tr> <td>Missing data</td> <td>84</td> <td>35.1</td> </tr> <tr> <td>No other members from the household were interviewed</td> <td>80</td> <td>33.9</td> </tr> <tr> <td>Of more than 100 meters</td> <td></td> <td></td> </tr> </tbody> </table>		Response	Percent	Distance between interviews is less than 50 meters	90	38.3	Distance between interviews is less than 100 meters	102	44.9	Same 100 interviewers have distance of more than 100 meters	20	8.1	Missing data	84	35.1	No other members from the household were interviewed	80	33.9	Of more than 100 meters			<h3>Outlook (1)</h3> <p>Four indicators of suspicious interviews</p> <p>Significant distance between locations at the beginning and at the end of an interview (Lewer 2011; Wang et al. 2014; Hargreaves et al. 2016) and accuracy based (Lewer 2011; Wang et al. 2014)</p> <p>Negative time difference between location measurements (Lewer 2011; Wang et al. 2014)</p> <p>Interviewers' proximity (including members of the same HH) to 8 meters (Lewer 2011; Wang et al. 2014) or 10 meters (Lewer 2011; Wang et al. 2014)</p> <p>Significant distance between interviewers within the same HH (Lewer 2011; Wang et al. 2014)</p> <p>Overall suspicious interviews = 274 = 12.2%</p>	<h3>Outlook (2)</h3> <p>GPS-paradata quality may vary in connection with regions (lower quality in more developed regions (Lewer 2011; Wang et al. 2014) and with interviewers' characteristics (connection with CAPI)</p> <p>Experience with CAPI is connected with higher probability of significant distance between locations at the beginning and at the end of the interview (Lewer 2011; Wang et al. 2014), while high levels of confidence regarding location with tablet is connected with lower probability of existence of significant distance (Lewer 2011; Wang et al. 2014)</p>	<h3>Recommendations</h3> <p>Focus on household selection while starting using CAPI which can be connected with higher increase in GPS-paradata quality and with lower level of suspicious interviews</p> <p>Use accuracy as household identification for distance between two locations (beginning and end of the interview) - GPS data specifies this only in different regions</p> <p>GPS-paradata should be used in connection with other methods of household identification - no precise conclusions about households or individuals may be drawn unless on GPS-paradata analysis and identification status is technical difficulties</p>	<h3>Limitations</h3> <p>GPS-paradata employment offers in case of longitudinal panel and cross-sectional design as well as between surveys with different sampling design</p> <p>We were unable to use respondents' addresses</p> <p>Regarding positive GPS data including we were unable to detect whether some additional address was used and when it was turned off</p>																																																																																																															
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<h3>Future plans</h3> <p>Second wave of experimental 8,040, 482, 6,491 - additional regions, interviewers, respondents and data</p> <p>Location comparison between waves (panel option)</p> <p>Compare applications: GPS Logger, Survey Solutions from the standpoint of data quality, precision</p>	<h3>Thank you for the attention</h3> <p>For cooperation, questions and comments please contact: <a href="mailto:alquist.marilewski@hw.ac.uk">alquist.marilewski@hw.ac.uk</a></p> <p>Thanks to Dr. Alquist Marilewski for considerable impact on this research</p> <p>The study was funded by Russian Scientific Fund (No. 17-19-01172)</p>	<h3>Contents</h3>																																																																																																																																						