

Log-data and paradata - the introduction

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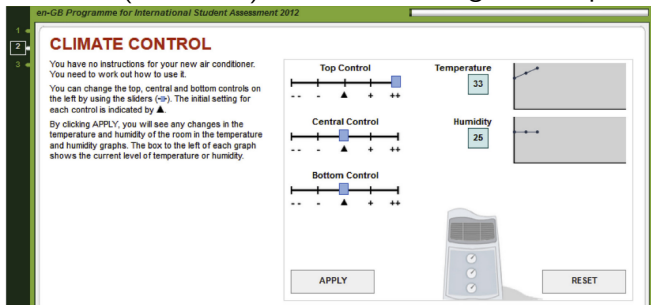
- Log-data is everywhere. . .
 - Server and web administration (and security)
 - Engineering and industrial processes
 - . . .
- But here we will speak about in the context of **web surveys**
 - Log-data as a specific kind of *paradata*, i.e. information that describes how the data was collected

Paradata then and now

- Historically:
 - Number of attempts made by the interviewer to contact the respondent
 - Interviewer's report on whether respondent was *cooperative*
 - Notes on possible deviations from the testing procedure during a given test session
- Nowadays:
 - Response times
 - Information on hardware and software configuration
 - Typing speed
 - Sequences of actions
 - Cursor moves (*mouse moves*)
 - Geolocation from sensors in mobile devices
 - ...

Typical use of paradata in research (1)

- In International Large Scale Assessments (ILSAs):
 - Sequences of actions in constructed response items
 - Variables (indicators) constructed using such sequences



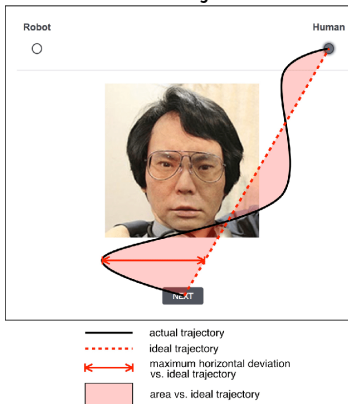
Interactive item "Climate control" from PISA

Source: <https://loganpackage.shinyapps.io/shiny/>

- Dedicated R packages: ProcData, LOGAN
- FLIP+ / IEA / DIPF Working Group on Process Data

Typical use of paradata in research (2)

- *Category competition* psychological experiments
 - Mouse move trajectories



Source: Mathur & Reichling (2019)

Typical use of paradata in research (3)

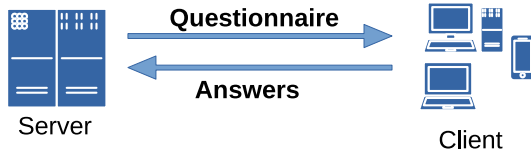
- In CAPI/CAMI, CASI and CAWI surveys:
 - Mostly page/screen time
 - Typically collected on the server side
 - Indexes describing cursor moves as indicators of careless/insufficient effort responding, f.g.:
 - Pokropek, A., Żółtak, T., & Muszyński, M. (2023). Mouse Chase: Detecting Careless and Unmotivated Responders Using Cursor Movements in Web-Based Surveys. *European Journal of Psychological Assessment* 39(4), 299-306.
<https://doi.org/10.1027/1015-5759/a000758>.
 - Pokropek, A., Żółtak, T., & Muszyński, M. (2024). Identifying careless responding in web-based surveys: Exploiting sequence data from cursor trajectories and approximate areas of interest. *Zeitschrift für Psychologie*, 232(2), 95–108.
<https://doi.org/10.1027/2151-2604/a000555>.

Paradata typology

Kroehne & Goldhamer (2018):

- *access*:
 - *contact* - contact history
 - *setting* - location, time & time zone, test/survey setting
 - *device* - hardware and software configuration
- *response*:
 - *answer* - answer selections and edits, keystrokes (in open-format items)
 - *input* - mouse and touch events, scrolling, zooming, etc.
- *process*:
 - *micro* - order of answers, navigation within entities, prompts and messages, etc., time measures at the entity level
 - *macro* - last entity and drop-off, navigation between entities, item or question review

Modes of paradata collection



- Which pages (screens) were shown
- Time of generating screens
- Time of receiving answers
- Hardware and software configuration:
 - Operating system, web browser, language, screen and browser window size
- Marking answers:
 - Order and timing of marking and changing answers
- Other interactions with the interface:
 - Showing tips or warnings
 - Scrolling the page
 - Leaving the browser window
- Cursor moves and clicks

Log-data

```
4393;mousemove;LABEL;answer745195X1852X8388SQ001-3;ls-label-xs-visibility;0;false;1234;343;
4601.5;mousemove;LABEL;answer745195X1852X8388SQ001-3;ls-label-xs-visibility;0;false;1232;343;
4624.3;mousedown;LABEL;answer745195X1852X8388SQ001-3;ls-label-xs-visibility;1;false;1232;343;
4680.5;mouseup;LABEL;answer745195X1852X8388SQ001-3;ls-label-xs-visibility;1;false;1232;343;
4680.5;click;LABEL;answer745195X1852X8388SQ001-3;ls-label-xs-visibility;1;false;1232;343;
4680.5;click;INPUT;answer745195X1852X8388SQ001-3;;1;false;1232;343;
4691.8;change;INPUT;answer745195X1852X8388SQ001-3;;undefined;undefined;undefined;undefined;
```

- A specific form of storing client-side *paradata* describing respondent's interactions with the survey/test
 - Every (relevant) *event* (caused by respondent himself or by the system) stored as a separate entity
 - Not necessarily in a rectangular form
- Originating from the IT field:
 - Application development - for debugging
 - UX research - exploring sequences of actions and *what catches the eye*
 - Server administration - anomalies detection (security), load-balancing

From log-data to process indicators

- *Log-data* is typically not directly useful for analysis!
 - Incompatible data format
 - Single *events* are of little interest
- *Log-data* needs to be transformed to analytically useful *process indicators*
 - Describing something analytically relevant and interpretable
 - F.g., the number of actions taken to solve the item, some measure of cursor trajectory complexity
- Deriving *process indicators* is hard
 - A complex process involving many decisions whose consequences are difficult to predict
 - No easy way to perform exploratory data analysis

Opportunities and problems

In principle, collecting *paradata* is very easy

- Possible by developing rather simple add-ons to existing, widely-used test or survey data collection systems
- *Paradata* sometimes described as *data that come “for free”* (Olson, 2013)

But

- One needs additional IT solutions to transform it to analytically useful indicators
 - Which sometimes need to be developed first
- The data is often big
- It is easy to run into technical problems
- There will be always some missing data
 - Generally, the more data one wants to collect, the more missings there will be

Uncontrolled environments

- Usually, *paradata* was collected in *controlled environments*
 - Psychological experiments performed in laboratories
 - ILSAs: hardware with standardized parameters and exactly the same software configuration as part of a highly-standardized test procedure
- But there are no technical problems preventing *paradata* collection in **online tests or surveys**
 - Different hardware and software configurations
 - Different types of devices (nowadays: mostly mobile ones)
 - Survey layouts are different on mobile devices
 - No cursor (moves) on mobile devices
 - More probable distractions or even multitasking
 - Same data format, but **can the data be interpreted the same way?**

Cited literature

Couper, M. P. (1998). Measuring survey quality in a CASIC environment. In: *Proceedings of the section on survey research methods of the American Statistical Association*, 41–49.

Kroehne, U., & Goldhammer, F. (2018). How to conceptualize, represent, and analyze log data from technology-based assessments? A generic framework and an application to questionnaire items. *Behaviormetrika*, 45(2), 527–563.
<https://doi.org/10.1007/s41237-018-0063-y>

Mathur, M. B., & Reichling, D. B. (2019). Open-source software for mouse-tracking in Qualtrics to measure category competition. *Behavior research methods*, 51(5), 1987–1997. <https://doi.org/10.3758/s13428-019-01258-6>

Olson, K. (2013). Paradata for Nonresponse Adjustment. *The ANNALS of the American Academy of Political and Social Science*, 645(1), 142–170.
<https://doi.org/10.1177/0002716212459475>

Olson, K., & Parkhurst, B. (2013). Collecting Paradata for Measurement Error Evaluation. In: F. Kreuter (Ed.), *Improving surveys with paradata: Analytic use of process information* (pp. 43–72). John Wiley & Sons, Inc.

Thank you for your attention!

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Understanding response styles in self-report data: consequences, remedies and sources [NCN/Opus/17/HS6/00937]



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