

Mouse moves and clicks (in an uncontrolled environment)

It was supposed to be easy!

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Problem statement

- One wants to collect data on *mouse moves* in an online survey
 - JavaScript event listener will be used for this purpose
- There will be **no respondents using mobile devices**
- Surveying system has a *responsive* layout that adapts to the size of the user's browser window
- It is possible that some survey screens won't fit respondent's browser window (they will be *longer* and there will be scrolling needed to read the whole survey screen content)

Preliminary remarks

- *Mouse moves* are actually **cursor** moves
 - Users can use different pointing devices: mouse, touchpad, touchscreen... and others
- Cursor moves over the **page**, not over the screen
 - Nevertheless, the distance of the movement is measured in pixels
 - The same distances in pixels can be different *physical* (measured in inches) distances on the screen and different distances traveled by/on the pointing device, depending on user's hardware and software configuration
- Cursor movement may be due to causes other than pointing device movement
 - E.g. scrolling the page using the arrow keys on the keyboard, or TAB to cycle through the form input fields
 - Cursor can move over the page even if it's not moving over the screen

The curse of a responsive layout (1)

Szczepienia

*W jakim stopniu zgadza się Pan(i) lub nie zgadza z następującymi stwierdzeniami?

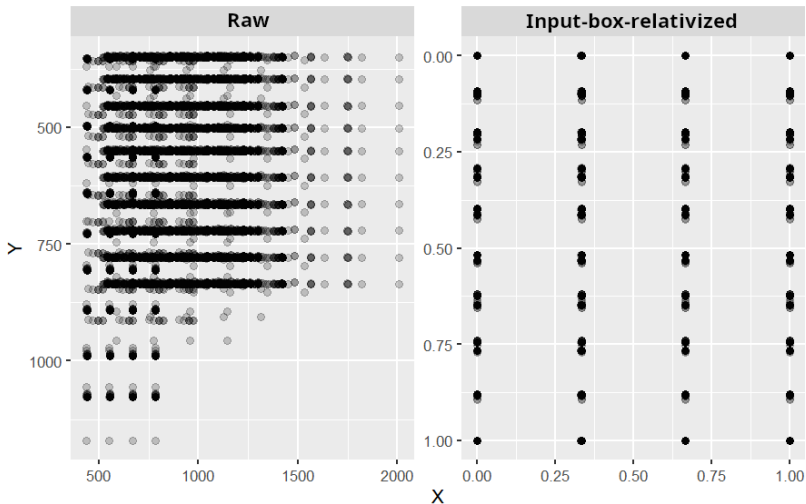
🗳️ (Zaznacz tylko jedną odpowiedź w wierszu)

	Zdecydowanie się NIE zgadzam	NIE zgadzam się	Zgadzam się	Zdecydowanie się zga- dzam
Ważne jest, aby każdy miał podstawowe szczepienia.	☐	☐	☐	☐
Szczepienia są ważne, ponieważ chronią nie tylko Pana/Panią, ale także inne osoby.	☐	☐	☐	☐
Niewykonanie szczepień może prowadzić do poważnych problemów zdrowotnych.	☐	☐	☐	☐
Szczepienia są ważne tylko dla dzieci.	☐	☐	☐	☐
Szczepionki są poddawane rygorystycznym badaniom, zanim zostaną dopuszczone do stosowania.	☐	☐	☐	☐
Szczepionki mogą wywoływać poważne choroby (np. bezpłodność, autyzm itp.).	☐	☐	☐	☐
Wszyscy pełnoletni, zdrowi Polacy powinni zaszczepić się przeciwko SARS-COV-2.	☐	☐	☐	☐
Dzięki szczepieniom ochronnym dzieci wiele groźnych chorób obecnie praktycznie nie występuje.	☐	☐	☐	☐
Szczepienia są najskuteczniejszym sposobem ochrony dzieci przed poważnymi chorobami.	☐	☐	☐	☐
Szczepienia są promowane nie dlatego, że są rzeczywiście potrzebne, lecz dlatego, że leży to w interesie koncernów farmaceutycznych.	☐	☐	☐	☐

Input-box

The curse of a responsive layout (2)

Position of survey input fields for 519 respondents before and after relativization.



The curse of a responsive layout (3)

- In the online survey platform *LimeSurvey*, for questions in tabular format, INPUT elements used to mark the answers:
 - Report (to JavaScript) to be in position marked 1
 - Are visible to users in position marked 2

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Ważne jest, aby każdy miał podstawowe szczepienia.	☒ 1 ☒ 2	☐	☐	☐
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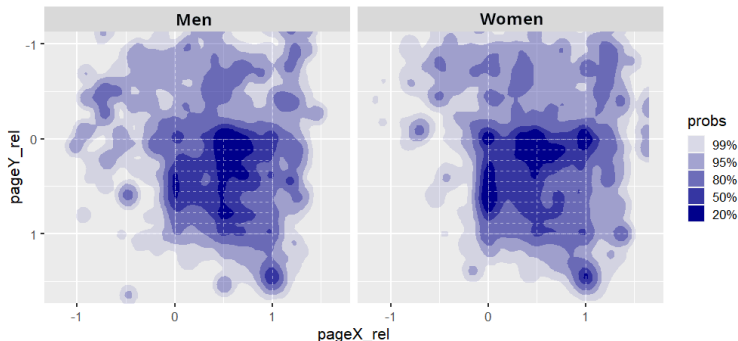
- If one knows this, they can correct it
 - But the solution that is relatively easy to implement will be only mostly right
(See the *details* section in the `preprocess_input_positions` function documentation of the R *logLime* package for details.)

The curse of a responsive layout (4)

Do these layout differences matter?

...it depends

- If you want to draw a heatmap - **definitely it matters!**



- When it comes to general characteristics of cursor moves... perhaps not so much (see next slide)

The curse of a responsive layout (5)

Minimum (across 20 survey screens) Pearson correlations between different variants of cursor moves indices and their *raw* versions (N varies from 607 to 841).

Index - X axis	Scroll-corrected	Relativized	Scroll-corrected & relativized
Total distance	1,000	0,990	0,990
Av. speed	1,000	0,979	0,979
Av. abs. acceleration	1,000	0,995	0,995
<i>Flips</i>	1,000	NA	NA

Index- Y axis	Scroll-corrected	Relativized	Scroll-corrected & relativized
Total distance	0,933	0,989	0,932
Av. speed	0,979	0,992	0,979
Av. abs. acceleration	0,988	0,999	0,987
<i>Flips</i>	0,991	NA	NA

The curse of a responsive layout (6)

But there were also layouts that we simply **had to exclude from the analyzes!**

Szczepienia

*W jakim stopniu zgadza się Pan(i) lub nie zgadza z następującymi stwierdzeniami?

(Zaznacz tylko jedną odpowiedź w wierszu)

Ważne jest, aby każdy miał podstawowe szczepienia.

☐ Zdecydowanie się NIE zgadzam

☐ NIE zgadzam się

☐ Zgadzam się

☐ Zdecydowanie się zgadzam

Szczepienia są ważne, ponieważ chronią nie tylko Pana/Panią, ale także inne osoby.

☐ Zdecydowanie się NIE zgadzam

☐ NIE zgadzam się

☐ Zgadzam się

☐ Zdecydowanie się zgadzam

Niewykonanie szczepień może prowadzić do poważnych problemów zdrowotnych.

☐ Zdecydowanie się NIE zgadzam

☐ NIE zgadzam się

The curse of *mousemove* JS event (1)

- Collecting cursor moves via JavaScript *mousemove* event listener is very easy in principle
 - The same technology that is used on any website
 - No need to install anything on the *client* side
- The *mousemove* event behaves somewhat strange
 - It reports simply cursor position on the website (a single point, while the concept of move requires a vector!)
 - It is triggered by *moving a pointing device*
 - If cursor moves on the page because of some other cause, it won't be triggered!
 - If cursor is not moving, there is no easy way to check where it is
 - If pointing device is *in move*, the frequency of triggering the event is not constant!

The curse of *mousemove* JS event (2)

Consequences:

- Cursor **moves** have to be derived from information on cursor positions
- Derived moves will cover different time spans
 - Necessity of weighing while computing average speed etc.
- There will be no zero-length moves (*stagnation* periods)
 - Unless one derives them from *suspiciously long-lasting* moves
 - But this involves using a heuristic (cutting at the arbitrarily chosen cutoff)

Not only *mousemove*s

- There are other JavaScript events that may be useful for tracking cursor position
 - *mouseover*, *mouseout*
- They report cursor entering or leaving a given survey/test interface element
 - Ability to track that the cursor was over something without the need to map cursor position to survey screen layout
 - HTML elements are rectangles! (in general)
- However, interface elements must be reasonably labelled in the HTML code for such information to be analytically useful

The curse of clicks (1)

- There are many different JavaScript event related to clicking: *click*, *dblclick*, *mousedown*, *mouseup*
 - ```
4624.3;mousedown;LABEL;answer745195X1852X8388SQ001-3;(...);
4680.5;mouseup;LABEL;answer745195X1852X8388SQ001-3;(...);
4680.5;click;LABEL;answer745195X1852X8388SQ001-3;(...);
4680.5;click;INPUT;answer745195X1852X8388SQ001-3;(...);
4691.8;change;INPUT;answer745195X1852X8388SQ001-3;(...);
```
- A user's click on one interface element may cause the interface itself to trigger a click event on some other interface element!
  - It is rather easy to say, whether any click occurred or not, but counting user clicks is usually very hard
- When determining marking/changing the answer (changing the state of an interface input field) it is better to rely on *change* events

# The curse of clicks (2)

- A user's click on one interface element may cause the interface itself to trigger a click event on some other interface element!
- In the online survey platform *LimeSurvey*:
  - Clicking on the INPUT field itself will trigger only one *click* event

|                                                    | Zdecydowanie się NIE zgadzam | NIE zgadzam się       | Zgadzam się           | Zdecydowanie się zgadzam |
|----------------------------------------------------|------------------------------|-----------------------|-----------------------|--------------------------|
| Ważne jest, aby każdy miał podstawowe szczepienia. | <input type="radio"/>        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>    |

- Clicking on a table cell (array questions) or answer label will trigger two *click* events - one on the cell/label and one on the corresponding INPUT field

|                                                    | Zdecydowanie się NIE zgadzam | NIE zgadzam się       | Zgadzam się           | Zdecydowanie się zgadzam |
|----------------------------------------------------|------------------------------|-----------------------|-----------------------|--------------------------|
| Ważne jest, aby każdy miał podstawowe szczepienia. | <input type="radio"/>        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>    |

## It can be easy!

- If someone has developed the software that will do all the crucial data processing for you
  - But one should be aware, that there are often some arbitrary choices and heuristics involved in transforming log-data to process indicators
- Some observations will often need to be excluded from the analyses
  - Which ones, depends on the type of process indicators one wants to use
  - And also on the survey/test design

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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