Cluster and Set Analysis Survey

Goal of This Study

The goal of this study is to gather data about how various visualization styles impact the performance of cluster and set relation tasks.

Who Can Participate?

We invite participants who are at least 18 years old, are not diagnosed with dyslexia and have normal or corrected-to-normal vision. Further, participation requires an **appropriate screen size and input device**. Appropriate screen sizes are desktop PCs, laptops and tablets in landscape mode. Additionally, we require an external input device (e.g., mouse, trackpad, or stylus/pen). Please do not participate in the study if you do not use the required hardware. Participation is voluntary and you may decide not to continue at any point in the survey.

Procedures

- Screening: Answer questions to determine your eligibility
- Tutorial: Complete a few tasks to get familiar with the visualization styles and question structure
- Experiment: Complete tasks on different visualizations
- Post-experiment survey: Tell us, e.g., how confident you were in the experiment
- Demographics: Provide basic info we can use to describe our participants

Completing the whole survey should take no longer than **30–45 minutes**. Please do not resize your browser window during the survey. Please answer questions honestly. **In the experiment, try to find a compromise between accuracy and speed.** That is, try to answer correctly without spending too much time on each question.

Potential Benefits of Participation

Most likely you will not benefit from this research personally, but your participation will ultimately lead to better data visualizations.

Potential Risks and Discomforts of Participation

We do not expect considerable risks to your physical or mental health. You may feel fatigued after the survey, as processing new information and keeping focus for a long time is usually tiring. If you need a break in between, please only do so at the indicated points in the survey.

Data Collection and Management

We will collect your answers to experiment questions and how long it took you to answer. No personally identifiable information will be stored alongside. We will ask you to provide data that is typically used in academic papers to describe a participant population, e.g., age, visual ability, etc. You may choose not to answer questions that we do not need for the experiment or to exclude participants. All data will be stored on the researcher's work computers for analysis, which have disk encryption enabled, and in TU Wien's private storage systems for backup. Data will be accessible to members of the research team.

GDPR Regulations

You have a legal right to appeal. In connection with the processing of your personal data, you are entitled to information, rectification, erasure, restriction of processing, data portability, and withdrawal (GDPR, Chapter 3, Articles 12–23). However, there may be limitations to your rights of information, rectification, and restriction of processing if these rights render impossible or seriously impair the achievement of the purposes according to GPDR Article 89 Sec 2. If you believe the processing of your data violates data protection law, you can contact the Austrian Data Protection Authority (DSB).

Responsible Researchers & Contact Information

- Nikolaus Piccolotto, TU Wien, Email (mailto:nikolaus.piccolotto@tuwien.ac.at)
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Data Protection Contacts

- Christina Thirsfeld, TU Wien Data Protection Officer, Email (mailto:christina.thirsfeld@tuwien.ac.at)
- Datenschutzbehörde, Email (mailto:dsb@dsb.gv.at)

There are 57 questions in this survey.

Screening

I consent to participate in this study. I have read and understood the text shown on the previous screen. *

Please choose **only one** of the following:

◯ Yes
◯ No

You must give consent to participate in order to continue. *

Only answer this question if the following conditions are met:
Answer was 'No' at question ' [consent]' (I consent to participate in this study. I have read and understood the text shown on the previous screen.)

Before you continue, please ensure the following:

- Temporarily disable browser extensions that could interfere with how a page is displayed (e.g., custom CSS rules, image blockers...). A simple way to achieve this is to open the survey in a tab with private browsing enabled. Manual: Chrome (https://support.google.com/chrome/answer/95464?hl=en&co=GENIE.Platform%3DDesktop) Firefox (https://support.mozilla.org/en-US/kb/private-browsing-use-firefox-without-history) Edge (https://support.microsoft.com/en-us/microsoft-edge/browse-inprivate-in-microsoft-edge-cd2c9a48-0bc4-b98e-5e46-ac40c84e27e2).
- Ensure that JavaScript is enabled.
- Ensure that your screen and browser are in landscape mode.
- Increase the height of your browser's viewport as much as possible, e.g., by making the window full screen, hiding bookmarks and other toolbars, or entering full screen mode.

This question automatically saves your screen size. *

Please write your answer here:

We will ask some questions to ensure you are eligible to participate in the survey.

Please specify your current age in years. *

❶ Only numbers may be entered in this field.

Please write your answer here:

Do you have normal or corrected-to-normal vision? *

Please choose **only one** of the following:

○ Yes

○ No

Have you received a medical diagnosis for dyslexia? *

❶ Choose one of the following answers

Please choose **only one** of the following:

○ Yes, I have been medically diagnosed with dyslexia

○ No, but I am in the process of being diagnosed

○ No, but I strongly suspect I have undiagnosed dyslexia

○ No

○ Prefer not to say

Have you received a medical diagnosis for color vision deficiency, such as red-green (deuteranopia or protanopia) or blue-yellow color blindness (tritanopia)? *

❶ Choose one of the following answers

Please choose **only one** of the following:

○ Yes

○ No, but I suspect having a color vision deficiency

○ No

Tutorial

In the visualization, you will see small images that look like this:

These images we call "glyphs" and they show numbers visually. The straight grey lines divide the image into 6 slices. The gray concentric circles divide each slice further into 3 sectors.


Each slice corresponds to one variable and each sector to a number from 1–3. In the example above, the variable represented by the slice would have the value 2.

A glyph can thus show a number 1–3 for 6 variables. An example could be restaurant ratings, where each variable is a characteristic such as tastiness, price, service, etc. The numbers could represent ratings into bad (1), okay (2) and excellent (3).

However, for the purpose of this survey, the variables are anonymous and do not represent any real-world dataset.
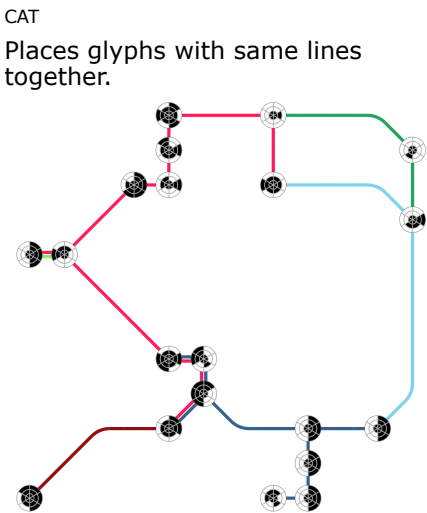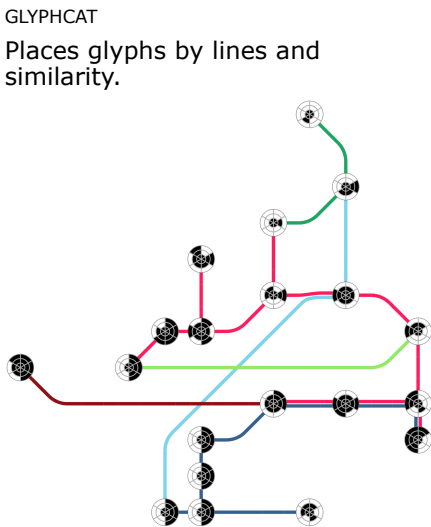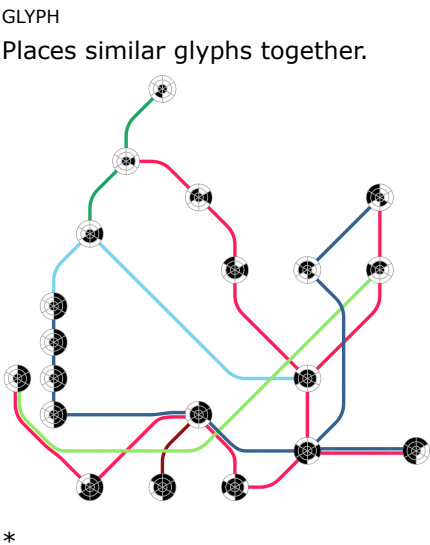
*

The visualizations will look roughly like this:
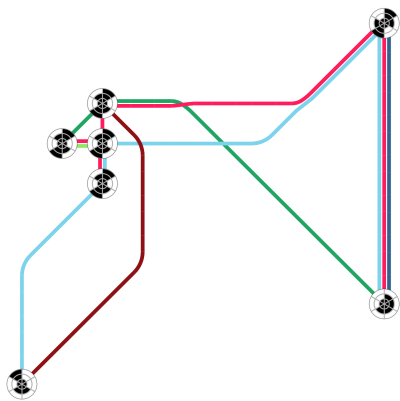
There will be multiple glyphs. In addition, they will be connected by lines.

Each colored line represents a category and connects glyphs that are in said category. Picking up the restaurant example from before, the category could be the type of cuisine, e.g., chinese, italian, japanese.

Again, for the purpose of this survey, the lines do not represent any category in particular and we will refer to them by their color.

The particular arrangement of glyphs will follow one of three layout strategies, which are GLYPH, CAT, and GLYPHCAT. We will explain each in a bit more detail.

GLYPH

Places similar glyphs together.

GLYPHCAT

Places glyphs by lines and similarity.

CAT

Places glyphs with same lines together.

*

Let's start with the GLYPH layout. Here, glyphs are arranged by their similarity. Consequently, identical glyphs will be placed nearby or next each other.

Consider the image below where identical glyphs are colocated on the left (marked by arrow):
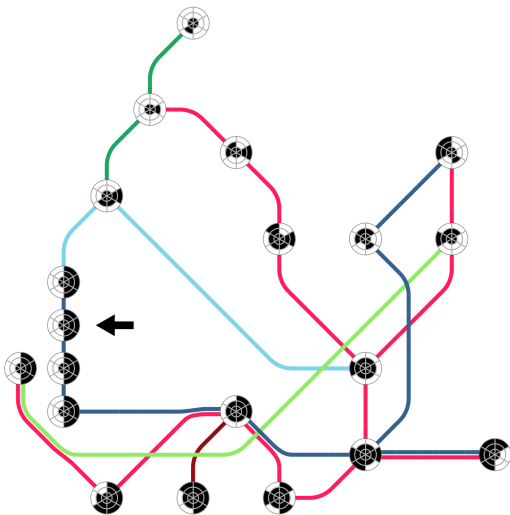
In the CAT layout, glyphs are arranged by their categories or, equivalently, their incident lines. Glyphs with the same categories will be grouped together, although not necessarily in a single cluster.

Consider how the same glyphs are now redistributed according to their lines (marked by black arrows):


*
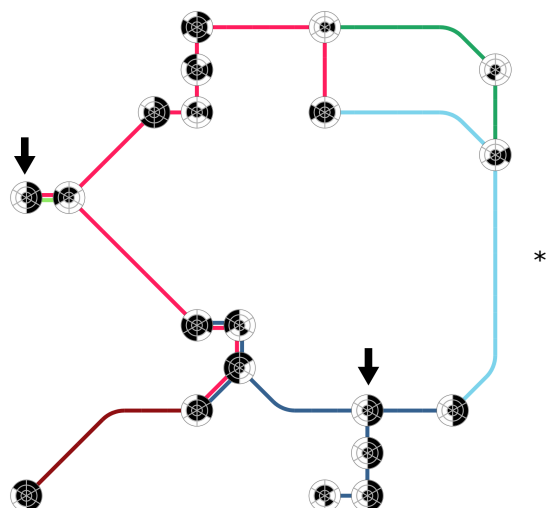
There is also the GLYPHCAT layout. It is a mixture of GLYPH and CAT and tries to find a compromise between the two. You can think of it as grouping first by categories, then arranging by similarity within each group.

Consider the image below where the same glyphs are still separated but closer together than before (marked by black arrows).
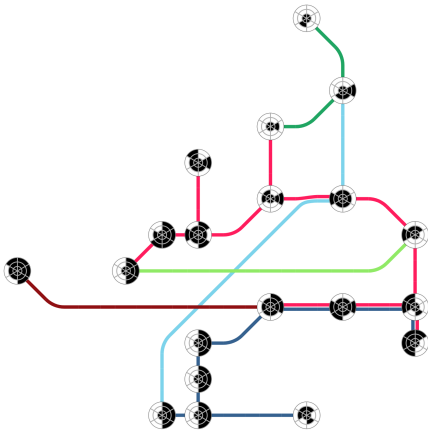

*
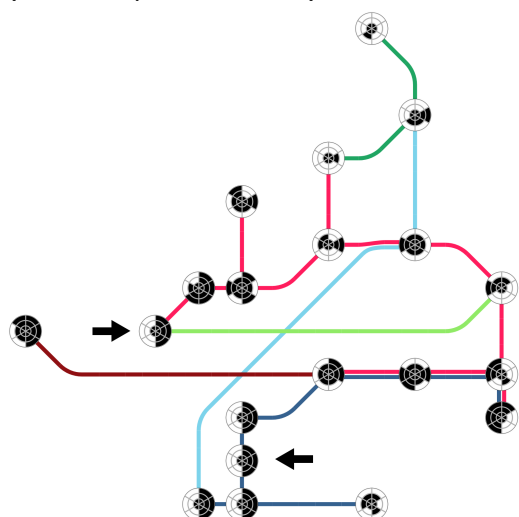
Here is again an overview of the layouts.

GLYPH
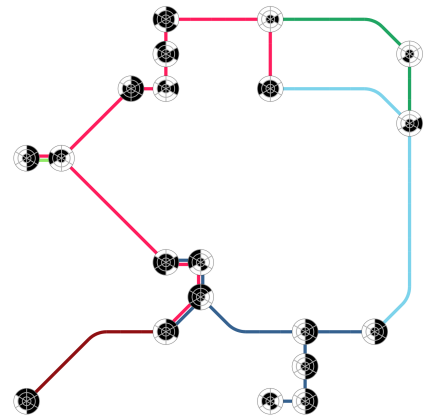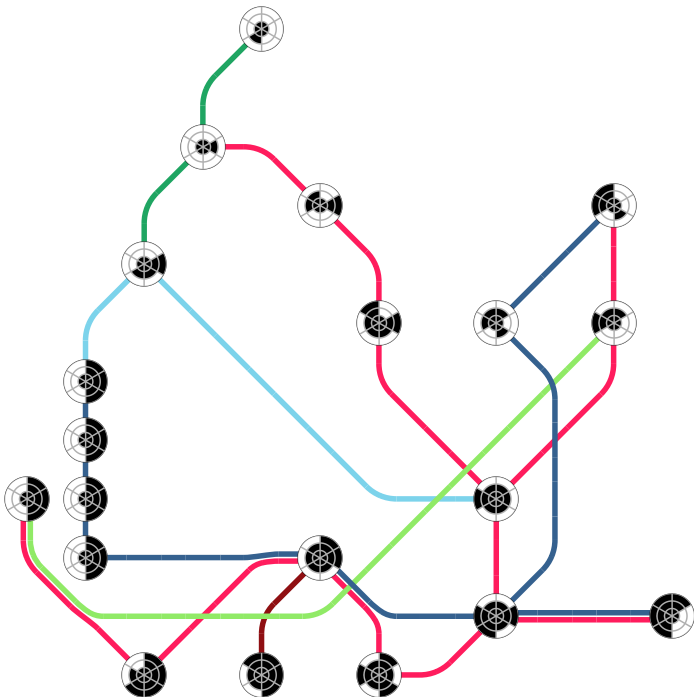Places similar glyphs together.
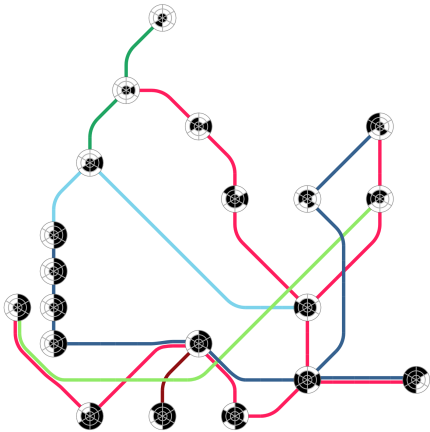
GLYPHCAT
Places glyphs by lines and similarity.

CAT
Places glyphs with same lines together.

*

The only way to respond to a question is by selecting glyphs in the visualization. You do that by clicking on them. When a glyph is selected, you will see a yellow outline around it. Click the glyph again to unselect.

Select a glyph to continue.

*

Please write your answer here:

[   ]

We will measure the time it takes you to complete a question. To do so accurately, we show the visualization only after you press the "Start" button. Once you are finished, please press the "End" button, located underneath the image.

If you want to take a break between questions, please do so before pressing "Start"!

Try it out:

*

Please write your answer here:

There are four questions in the survey, numbered 1–4. Questions are prefixed by the used glyph layout in brackets.

The first question in our survey is to select glyphs that look <u>exactly</u> like a given reference. The reference glyph will be highlighted with an orange outline in the visualization. You do not need to select the reference itself. For example:

1. [GLYPH] Select all glyphs that look exactly like the **reference glyph** highlighted in orange. The layout places similar glyphs nearby each other.

*

Please write your answer here:

The second question relates to lines. You will be asked to select glyphs that a particular line connects. For example:

2. [GLYPHCAT] Select all glyphs in the category indicated by the **dark green** line. The layout groups by lines, then arranges glyphs by their similarity.

*

Please write your answer here:

The third question also relates to lines. You will be asked to select glyphs that are connected by two lines, i.e., not either one but <u>both</u>. For example:

3. [CAT] Select all glyphs in both categories indicated by the **bright red** and **dark blue** lines. The layout places glyphs with identical lines nearby each other.

*

Please write your answer here:

Finally, the fourth question relates to both glyphs and lines. We will ask you to select glyphs that look like the given reference and also share at least one of the lines connected to it. E.g.:

4. [GLYPHCAT] Select all glyphs that look exactly like the **reference glyph** highlighted in orange, but only if they share **at least one category** with the reference. The layout groups by lines, then arranges glyphs by their similarity.

*

Please write your answer here:

You completed the survey tutorial. The experiment is about to start.

Please follow these rules:

- You may take breaks as you wish, but please do so before pressing the "Start" button in a question.
- You only have one shot at each question. Please do not try to return to a previous question, e.g., by using the browser's backward navigation.
- Try to strike a compromise between speed and accuracy when answering a question. That is, try to answer correctly without spending too much time on each question. You do not have to get all of them 100% right.

Click "Next" to start the experiment.

*

Experiment

conD1PhW0
*

Please write your answer here:

[   ]

expD3PoW0
*

Please write your answer here:

[   ]

expD3PhW1
*

Please write your answer here:

[   ]

expD3PhW5
*

Please write your answer here:

[   ]

expD4PhW0
*

Please write your answer here:

[   ]

expD4PhW1
*

Please write your answer here:

[   ]

expD4PoW5
*

Please write your answer here:

[   ]

expD1PoW0
*

Please write your answer here:

[   ]

expD1PoW1
*

Please write your answer here:

[   ]

expD1PhW5
*

Please write your answer here:

expD2PoW5
*

Please write your answer here:

expD2PoW0
*

Please write your answer here:

expD2PhW1
*

Please write your answer here:

conD1PhW0
*

Please write your answer here:

expD3PhW0
*

Please write your answer here:

expD3PoW5
*

Please write your answer here:

expD3PoW1
*

Please write your answer here:

expD4PoW1
*

Please write your answer here:

expD4PhW5

*

Please write your answer here:

expD4PoW0

*

Please write your answer here:

expD1PhW0

*

Please write your answer here:

expD1PhW1

*

Please write your answer here:

expD1PoW5

*

Please write your answer here:

expD2PhW0

*

Please write your answer here:

expD2PhW5

*

Please write your answer here:

expD2PoW1

*

Please write your answer here:

conD1PhW0

*

Please write your answer here:

You completed the experiment! We will continue with questions about your demographics and visualization-related preferences. *

Post-Experiment Questions

Please rate on a scale from 1 (least) to 5 (most) how much you **preferred** each layout when answering different question types.
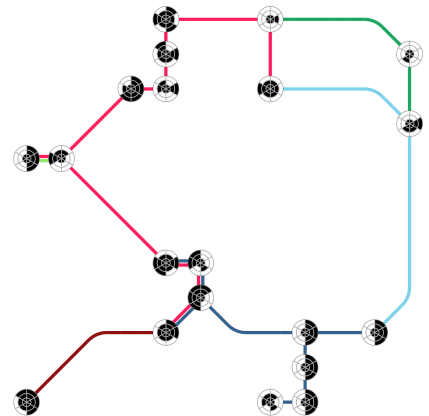
GLYPH
Places similar glyphs together.
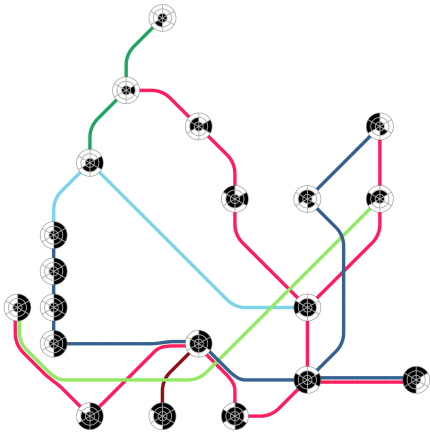
GLYPHCAT
Places glyphs by lines and similarity.
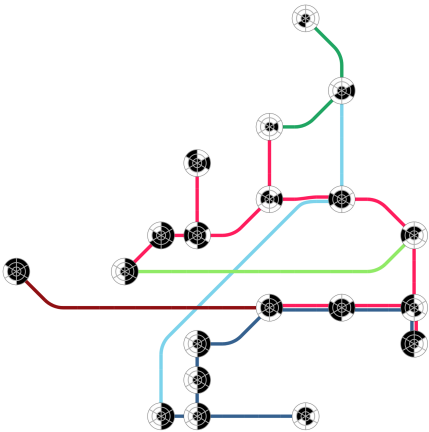
CAT
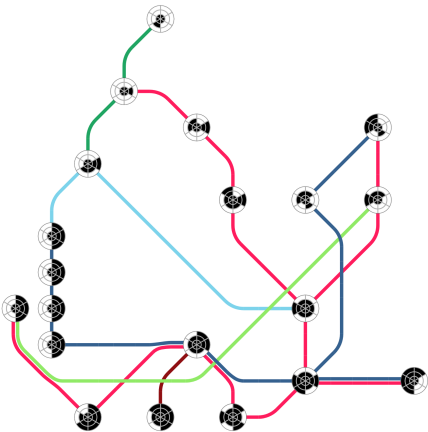Places glyphs with same lines together.

*

	GLYPH	GLYPHCAT	CAT
1. Find glyphs that look exactly like a reference.			
2. Find glyphs in a category.			
3. Find glyphs in two categories.			
4. Find glyphs that look exactly like a reference and share at least one category.			

Please rate on a scale from 1 (least) to 5 (most) how **confident** you were that your answer to a given question using a given layout was **correct**?
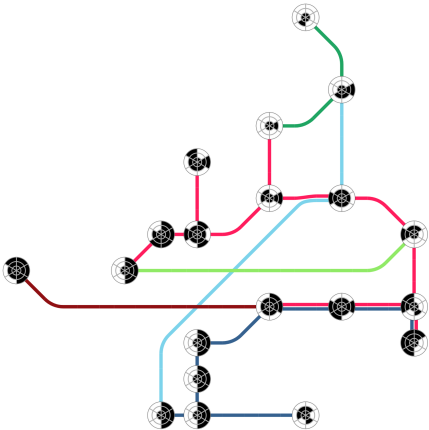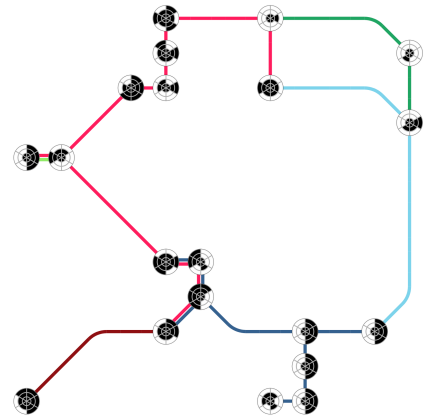
GLYPH

Places similar glyphs together.

GLYPHCAT

Places glyphs by lines and similarity.

CAT

Places glyphs with same lines together.

*

	Glyphs	Glyphs + Categories	Categories
1. Find glyphs that look exactly like a reference.			
2. Find glyphs in a category.			
3. Find glyphs in two categories.			
4. Find glyphs that look exactly like a reference and share at least one category.			

Is there anything else you want to tell us about the visualizations you saw? E.g., anything in particular that you liked or disliked? Or something you found easy or hard to do?

Please write your answer here:

Demographics and General Questions

What is your gender, as recorded on legal/official documents? *

Please choose **only one** of the following:

○ Male
○ Female
○ Other
○ Rather not say

Which of these is the highest level of education you have completed? *

Please choose **only one** of the following:

○ No formal education
○ High school (A-levels / Matura)
○ Undergraduate degree (BSc / BA / other)
○ Graduate degree (MSc / MA / other)
○ Doctorate degree (PhD / other)
○ Rather not say

Which input device did you use? *

Please choose **only one** of the following:

- ◯ Mouse
- ◯ Trackpad
- ◯ Stylus or pen
- ◯ Touch
- ◯ Other

Thank you for participating in our survey! Your contribution will be used to further scientific knowledge.

04-19-2024 – 08:00
Submit your survey.
Thank you for completing this survey.