

Group 05: Presentation of Results

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Agenda

- Introduction
- Goals and hypotheses
- Experimental procedures
- Conducting the experiment
- Data analysis
- Qualitative Research
- Threats to validity
- Conclusion

Introduction

- **UML (Unified Modeling Language)**
 - The specification used in most object-oriented systems.
 - Defines 13 standardized diagrams and one of his goals is to visualize systems.
 - Evaluate usability of tools is know whether they have components associated with:
 1. Be easy to learn.
 2. Be efficient in the use.
 3. Be subjectively pleasant.

Introduction

- And among the various tools available in market was selected **StarUML** and **Lucidchart**.
- **StarUML** is an open source tool with goal to build projects modeling software.
- **Lucidchart** is an modeling tool used in the web there's no download or installation and can modeling UML diagram, business process, data flow diagram.



Goals and Hypotheses

- **Goal**

- The main goal is to compare the usability (effort spent) of two UML design tools: StarUML and Lucidchart

- **Hypotheses**

1. We spend more time and effort to use web-based tools than pre-installed software
2. Independently of the tools, the second diagram will be done faster

Experimental procedures

After selecting goals and hypotheses, we had to:

- (a) Find the UML tools to use
- (b) Find the class diagrams
- (c) Write the experiment (instructions)
- (d) Run simulations
- (e) Run the experiment and collect data
- (f) Analyze the data
- (g) Present the results

Conducting the experiment

- 19 students participated. They all had some prior knowledge of UML and OO development
- The students were divided into two groups, each group with two tasks
- Group A (9 students)
 - Task 1: Diagram 'Pedidos' using StarUML
 - Task 2: Diagram 'Eleicoes' using Lucid Chart
- Group B (10 students)
 - Task 1: Diagram 'Pedidos' using Lucid Chart
 - Task 2: Diagram 'Eleicoes' using StarUML

Conducting the experiment

- Metrics collected
 - Start and end time for tasks
 - Number of mouse clicks: left, right and wheel
 - Distance in pixels (mouse movement)
- Questionnaire. Students had to state:
 - Their prior knowledge in UML
 - Their opinion about the tools
 - If they had used the tools before
 - If they use the help provided by the tools
 - If they were you able to finish the diagrams

Conducting the experiment

- Problems
 - Two computers froze up and the two students had to restart tasks
 - One student (group B) did not annotate the end time for the second task
 - One student (group A) did the second task first
 - One student (group B) was not able to finish the diagrams
- Data affected by these problems were **not** considered in the final analyses

Data analysis (visualization)

- Prior knowledge in UML

Group A: Excellent(0) Good(6) Average(2) Poor(0)

Group B: Excellent(0) Good(6) Average(2) Poor(0)

- Have used the tool before (Yes)

Group A: StarUML (1) Lucid Chart (0)

Group B: StarUML (2) Lucid Chart (2)

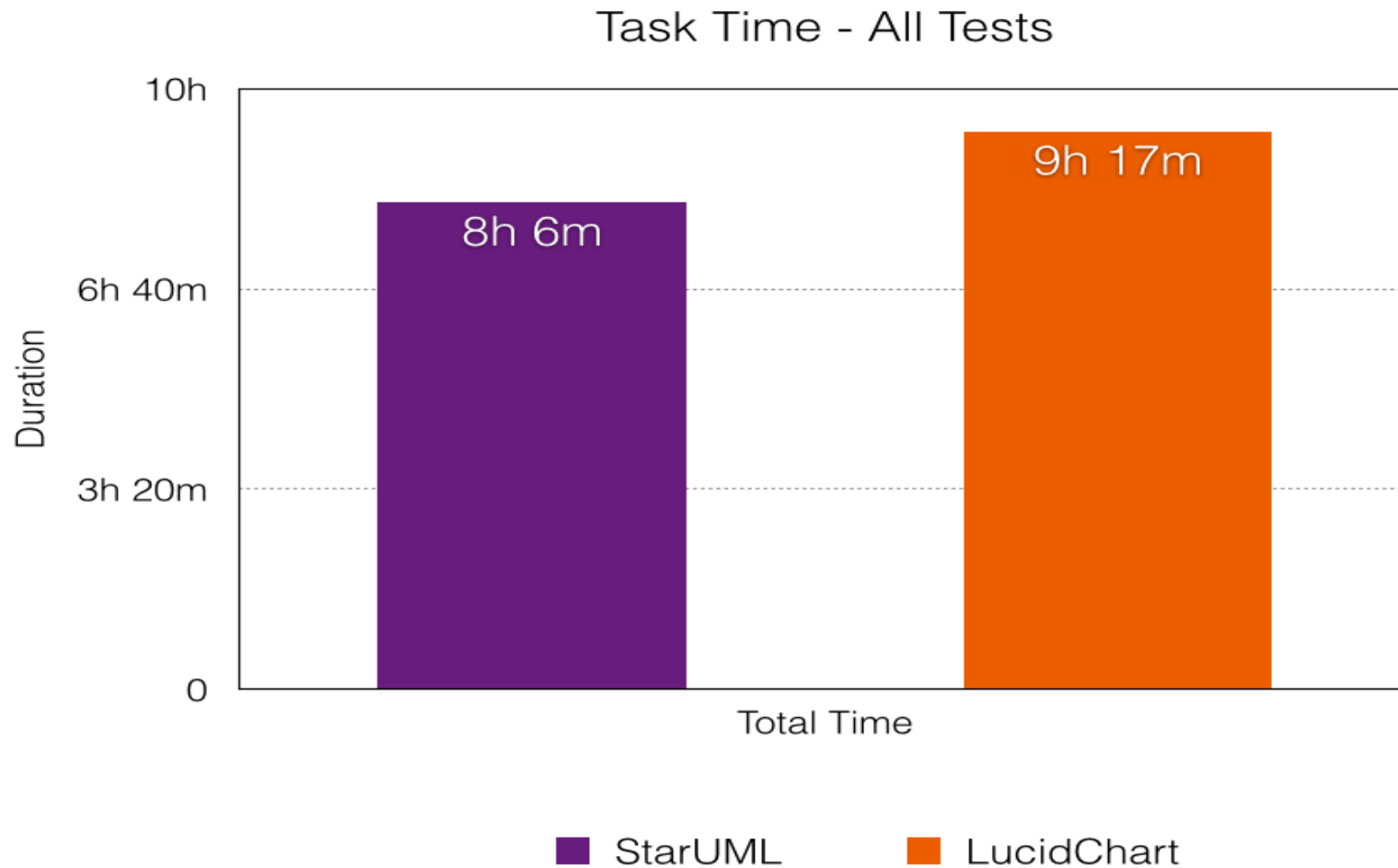
Data analysis (visualization)

	Original Dataset	Cuts	Final Dataset
Diagrams	38	2 - Lost Files 2 - Incomplete 2 - Discarded	32
StarUML - TestA	10		8
StarUML - TestB	9		8
LucidChart - TestA	10		8
LucidChart - TestB	9		8

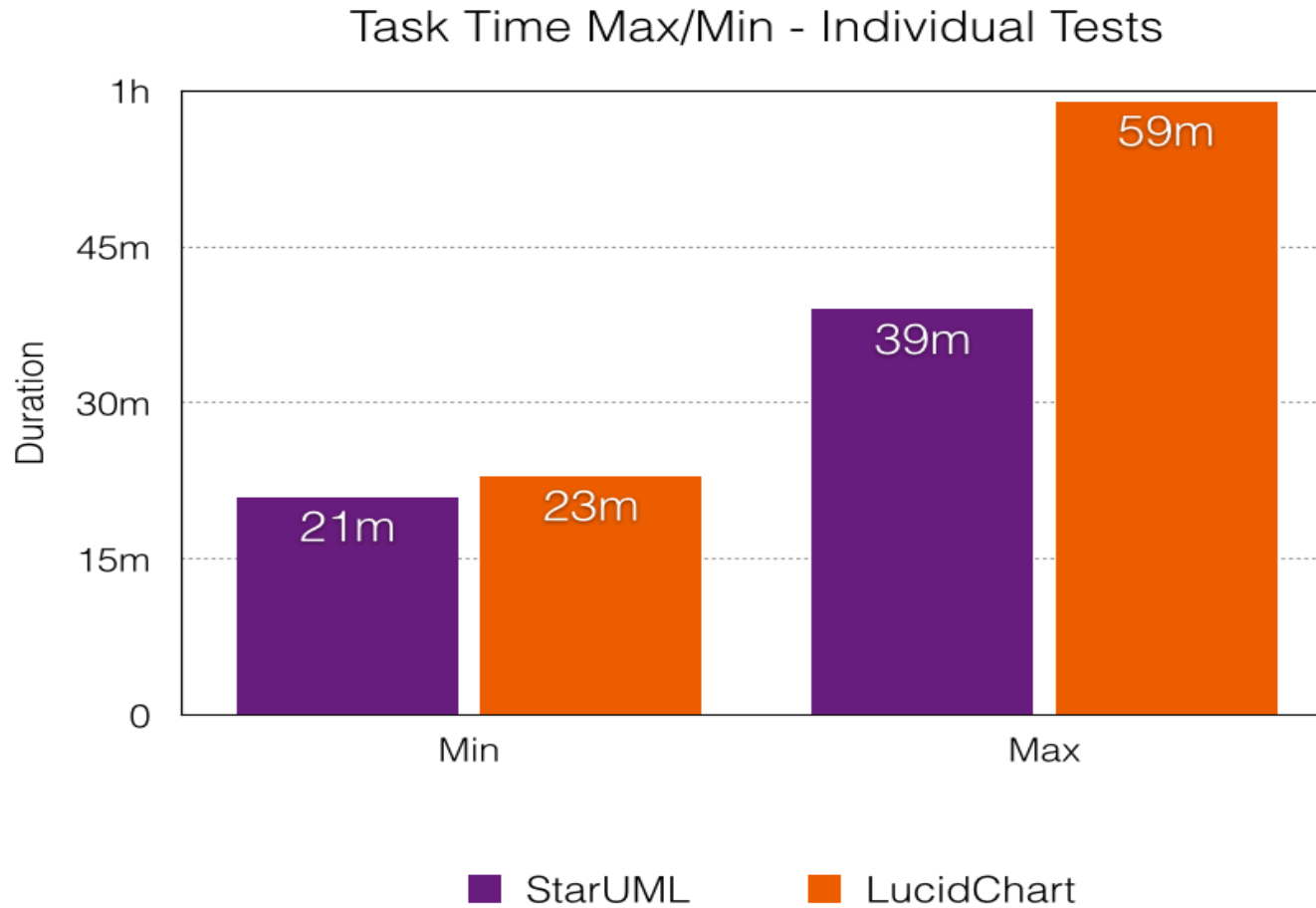
Data analysis (visualization)

			TIME					EFFORT				
			TASK	COUNT	SUM	AVERAGE	MIN	MAX	STDEV	SUM	AVERAGE	MIN
StarUML	T1	8	3:55:00	0:29:23	0:21:00	0:39:00	0:06:01	5,168.89	646.11	371.64	972.29	198.39
	T2	8	4:11:00	0:31:23	0:24:00	0:36:00	0:04:08	6,378.20	797.28	524.45	1,085.82	198.50
	TOTAL	16	8:06:00	0:30:23	0:21:00	0:39:00	0:05:06	11,547.10	721.69	371.64	1,085.82	207.00
LucidChart	T1	8	4:13:00	0:31:38	0:26:00	0:39:00	0:04:47	5,608.50	701.06	494.43	1,118.05	205.09
	T2	8	5:04:00	0:38:00	0:23:00	0:59:00	0:10:53	8,360.20	1,045.02	610.90	1,293.86	211.90
	TOTAL	16	9:17:00	0:34:49	0:23:00	0:59:00	0:08:45	13,968.70	873.04	494.43	1,293.86	268.57
TOTAL		32	17:23:00	0:32:36	0:21:00	0:59:00	0:07:24	25,515.80	797.37	371.64	1,293.86	248.09

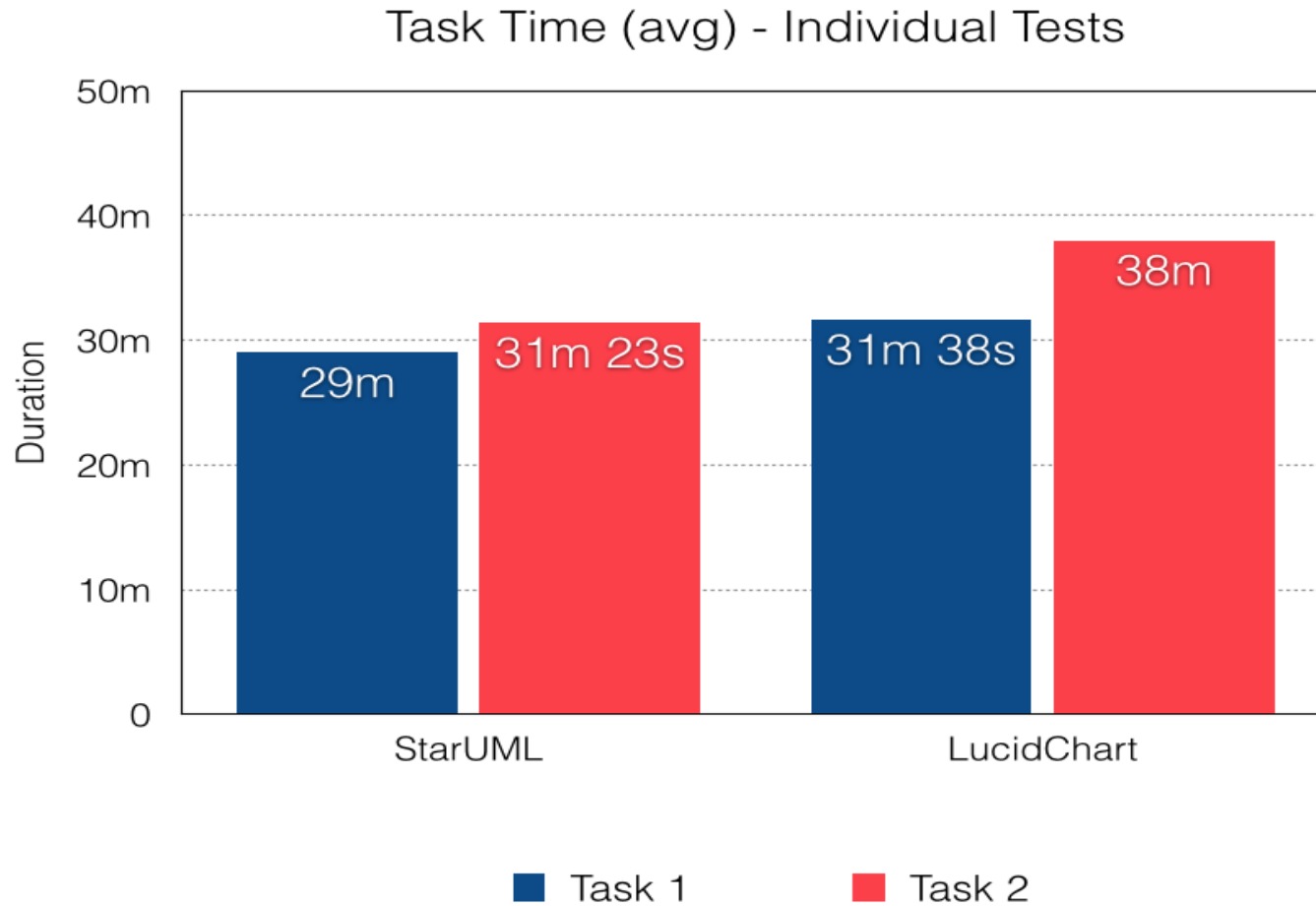
Data analysis (visualization)



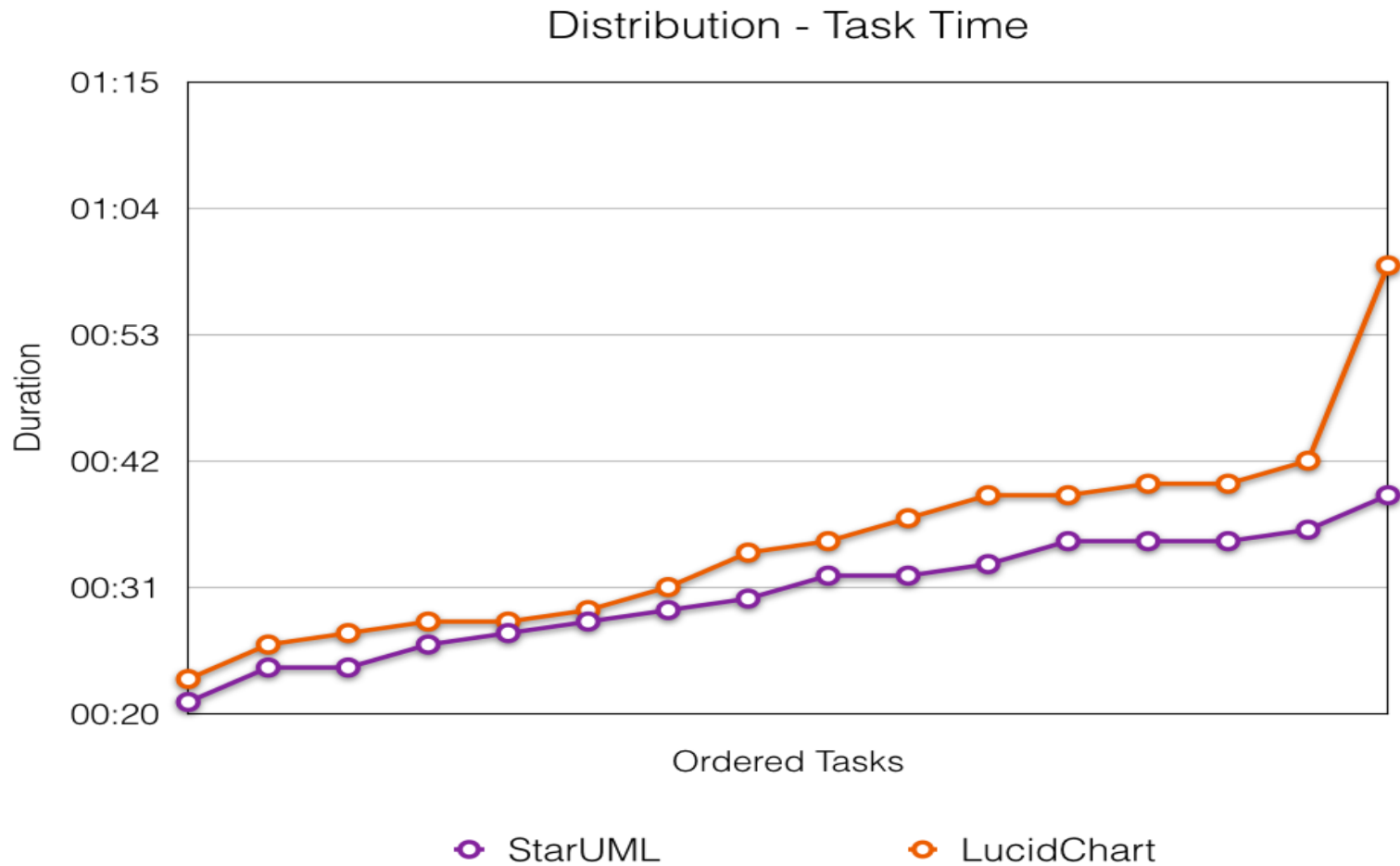
Data analysis (visualization)



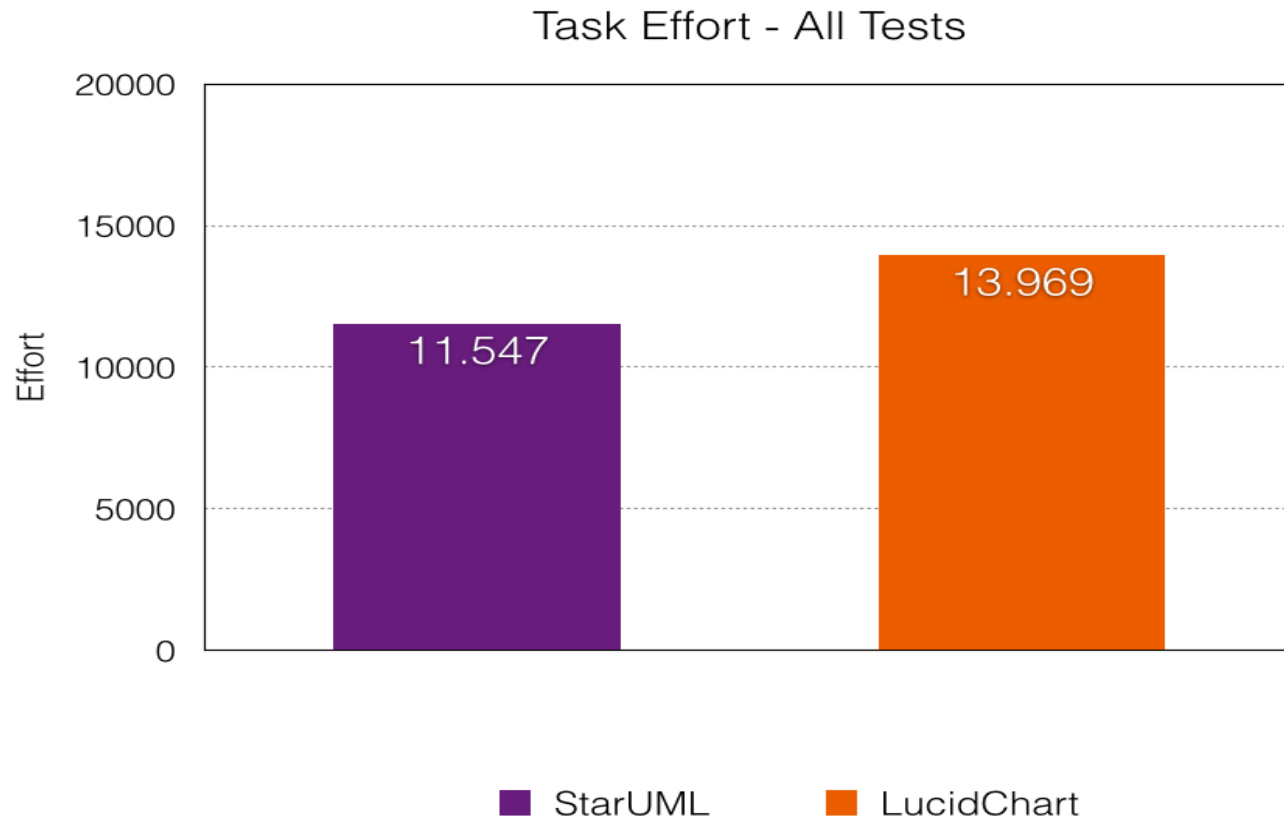
Data analysis (visualization)



Data analysis (visualization)

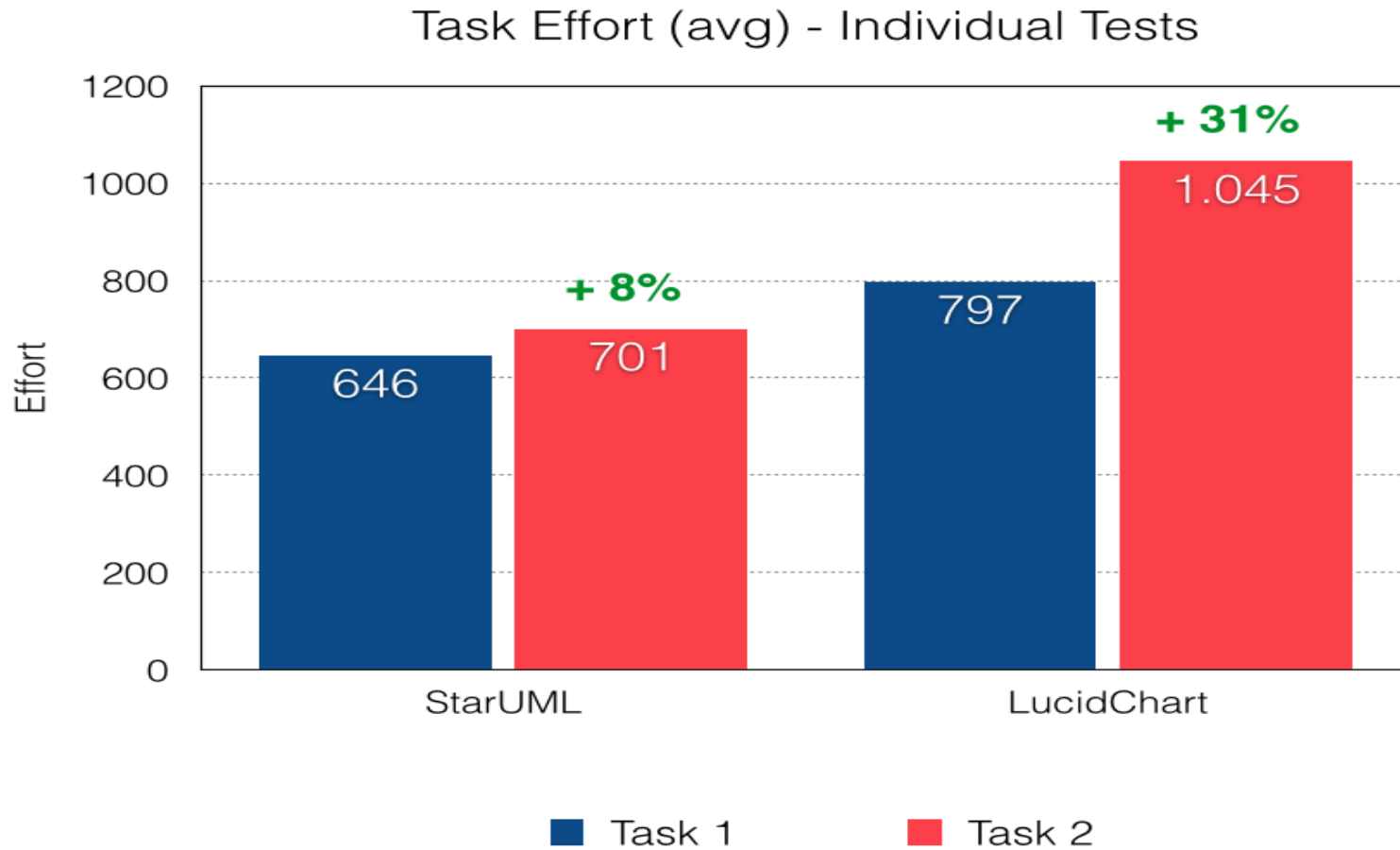


Data analysis (visualization)

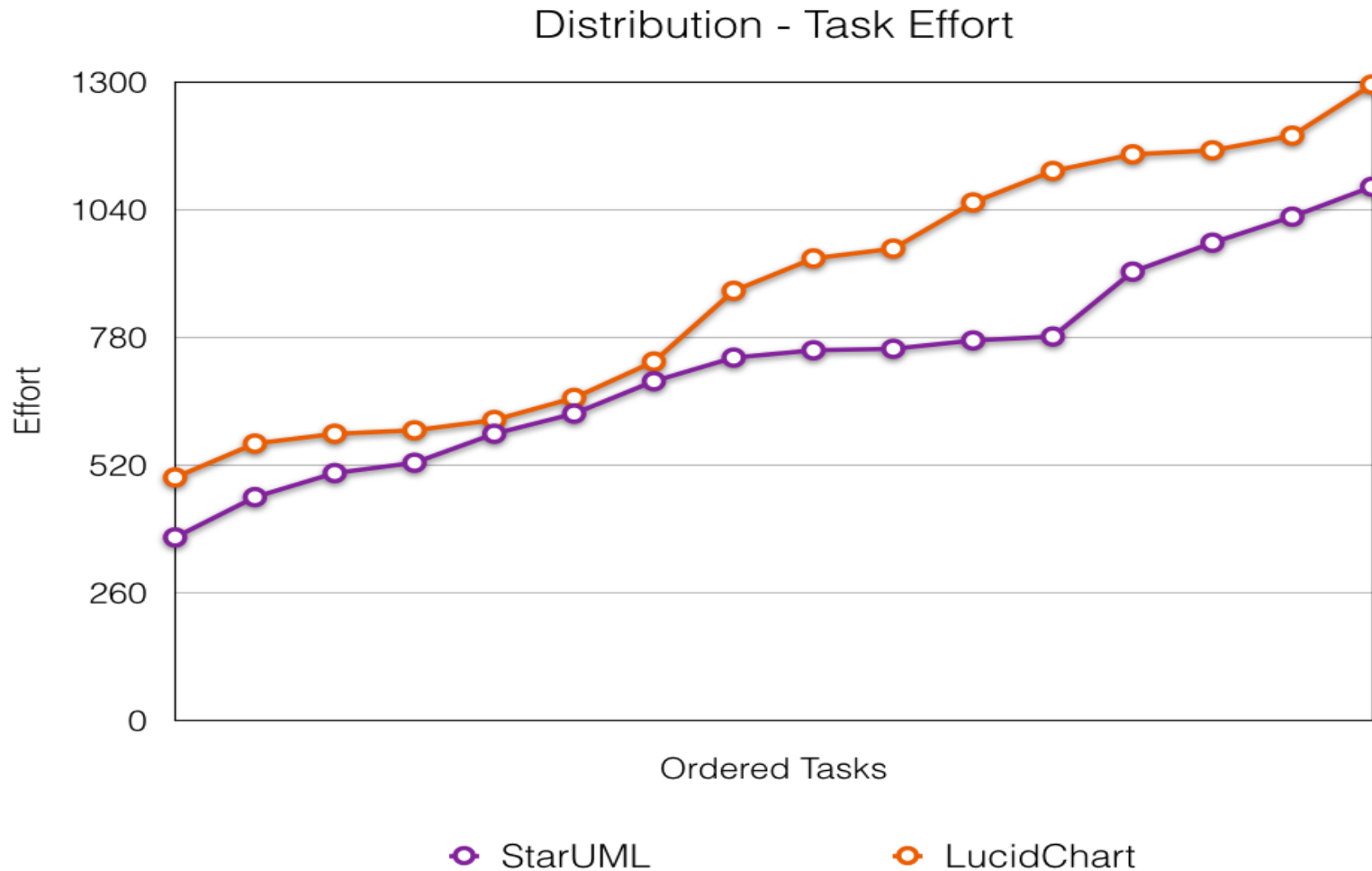


Task Effort = Distance (k pixels) + LClicks + RClicks + Wheel Ticks

Data analysis (visualization)

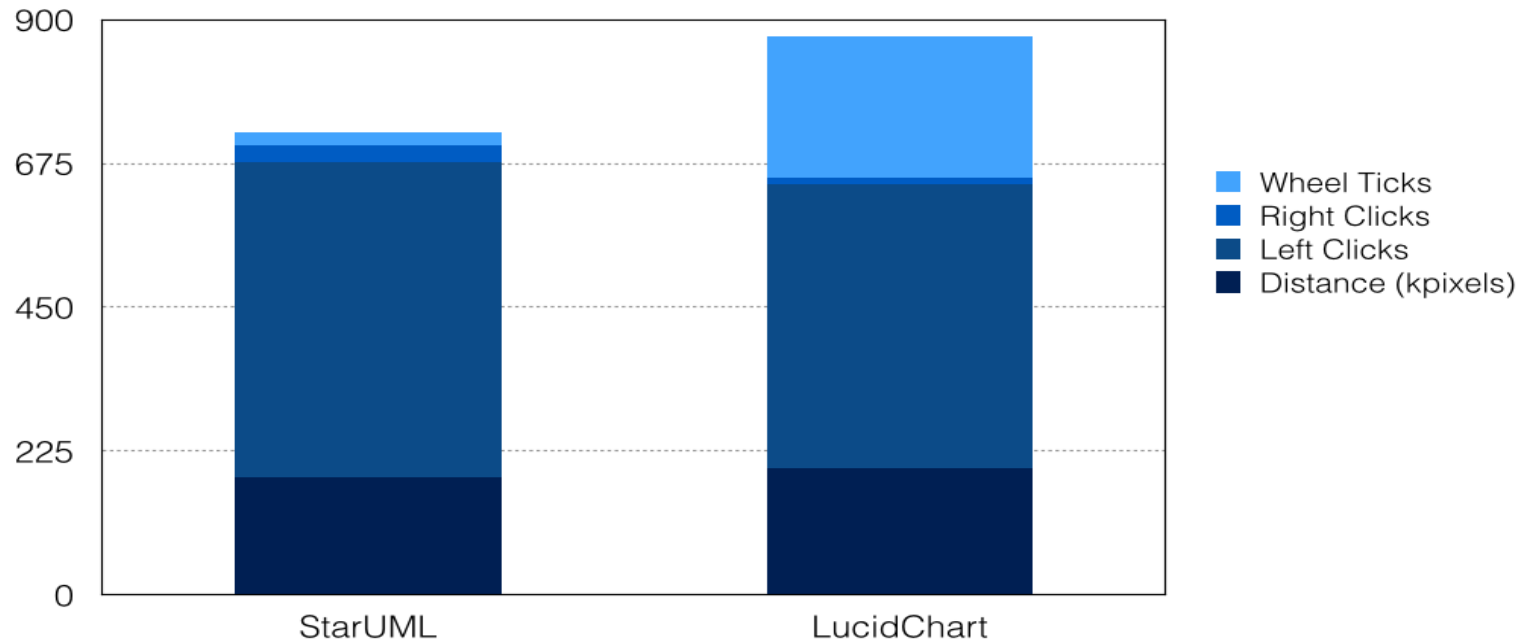


Data analysis (visualization)



Data analysis (visualization)

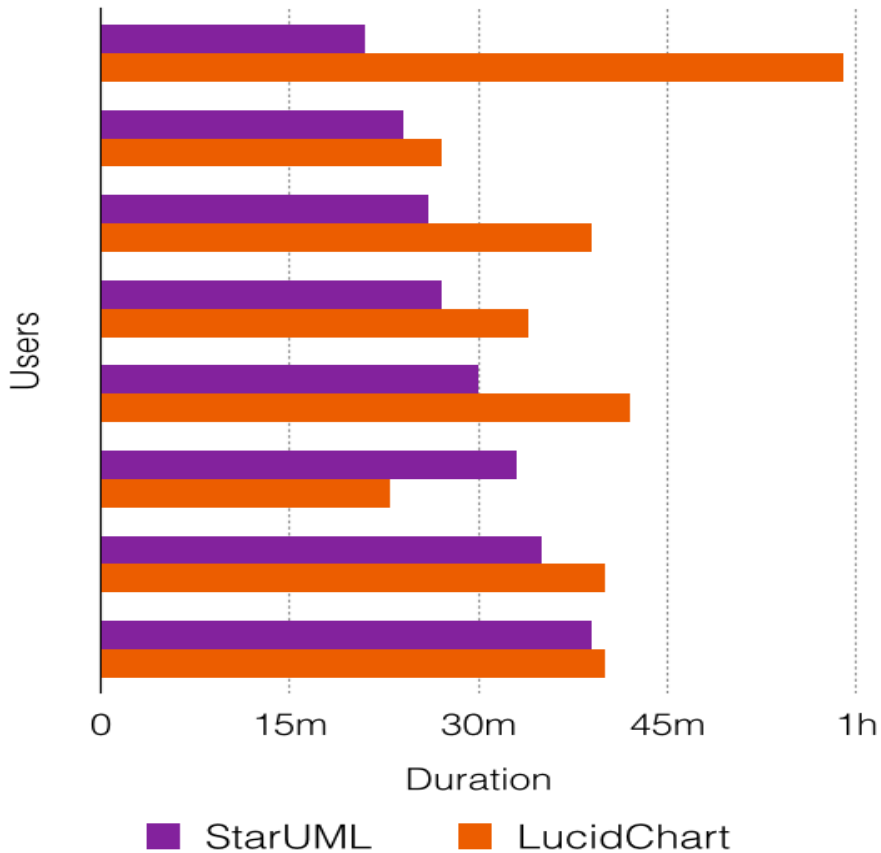
Task Effort (avg) - Individual Metrics



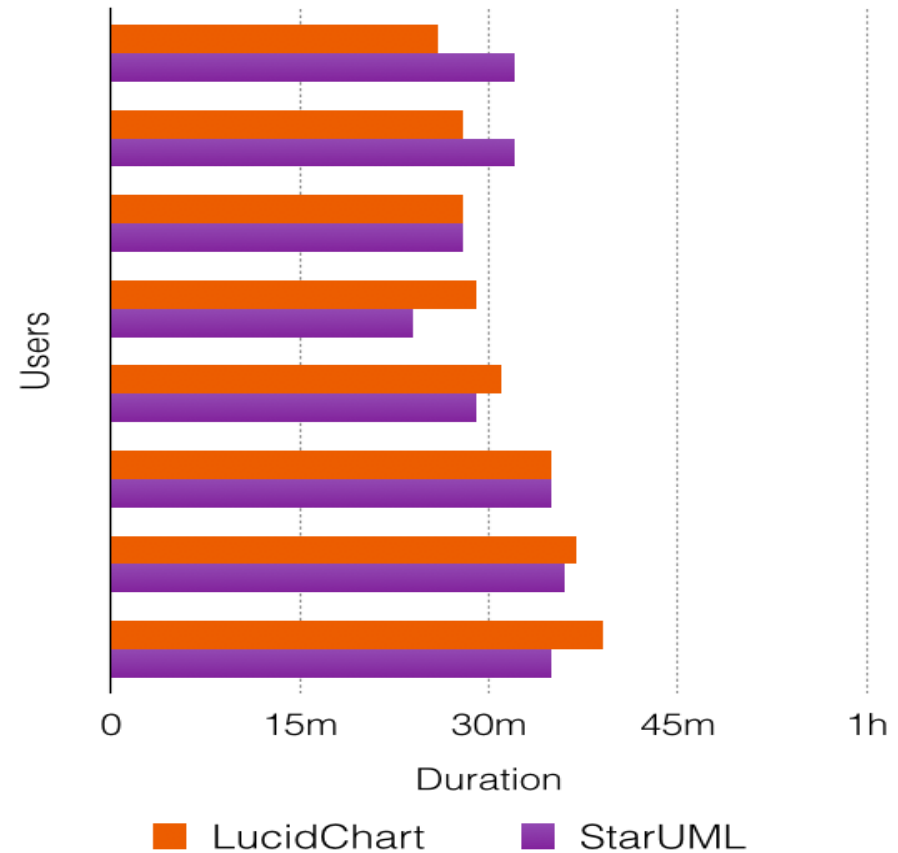
	StarUML	LucidChart
Distance (kpixels)	183,82	199,17
Left Clicks	493	444
Right Clicks	26	8,81
Wheel Ticks	20,5	221,06

Data analysis (visualization)

Task Time Diference - Test A
(StarUML to LucidChart)

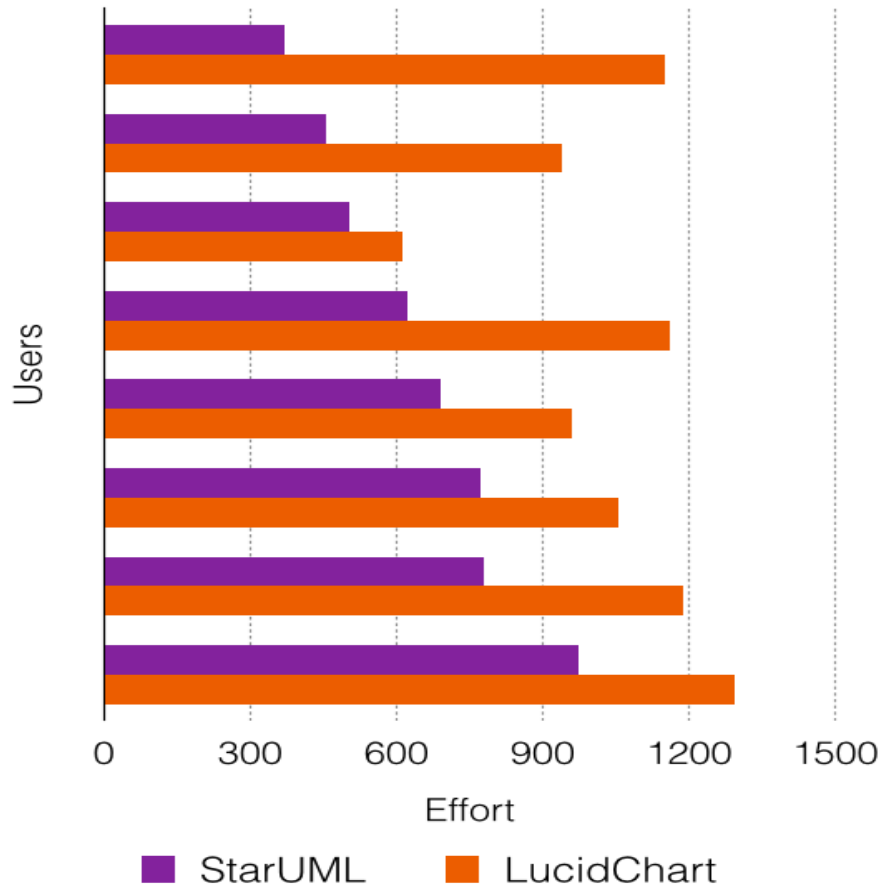


Task Time Diference - Test B
(LucidChart to StarUML)

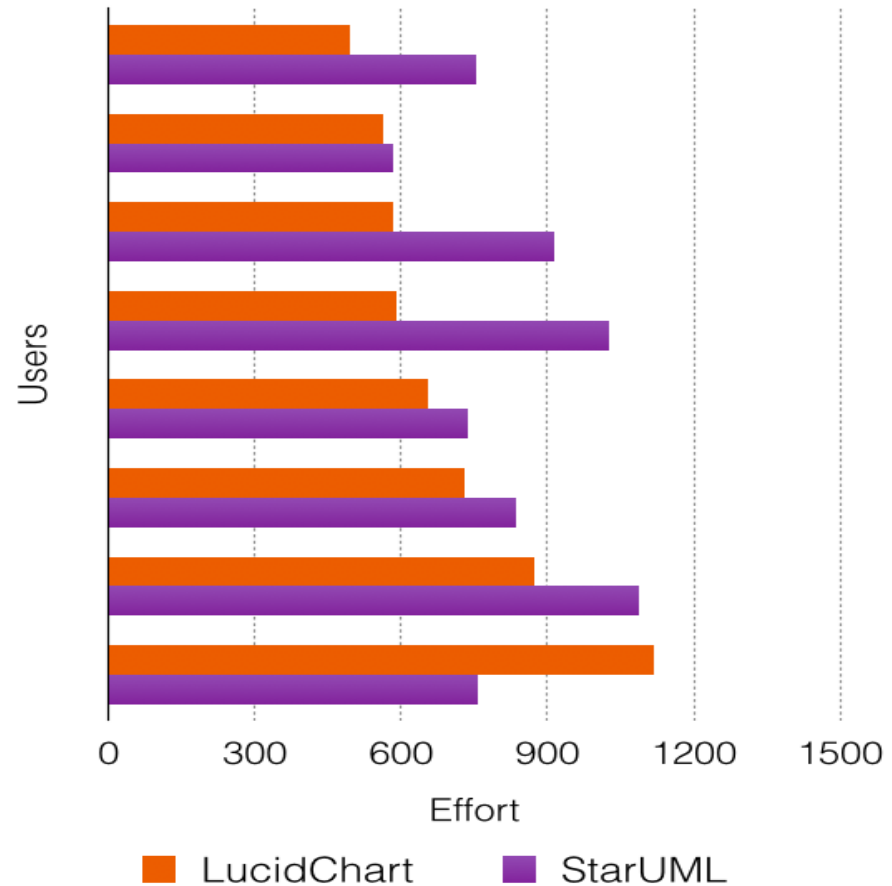


Data analysis (visualization)

Task Effort Difference - Test A
(StarUML to LucidChart)



Task Effort Difference - Test B
(LucidChart to StarUML)



Qualitative Research

- Our research have the exploratory into know what the participants found of the tools through of the following questions:

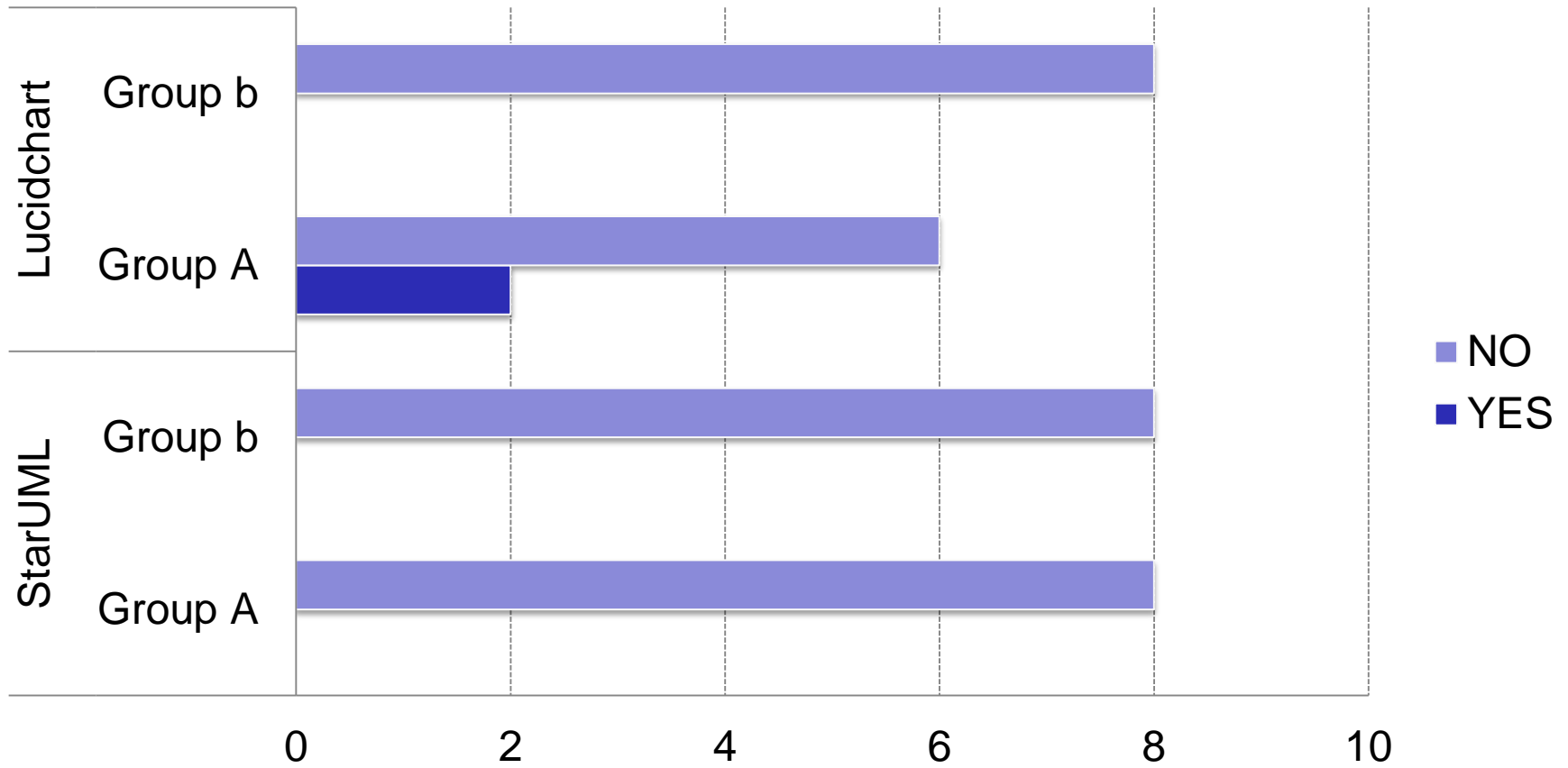
Did you use the help by the tool?

Highlight one positive aspect (if any) of the tool

Highlight one negative aspect (if any) of the tool

Qualitative Research

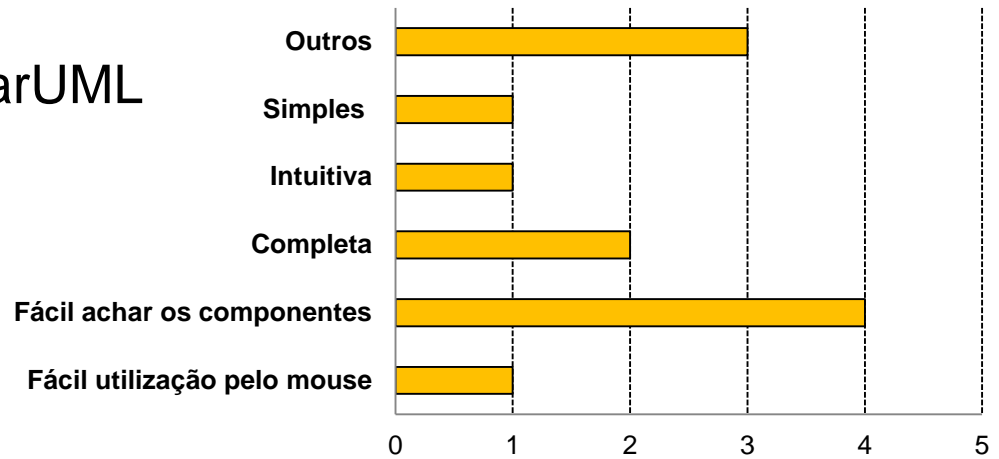
Did you use the help provided by the tool?



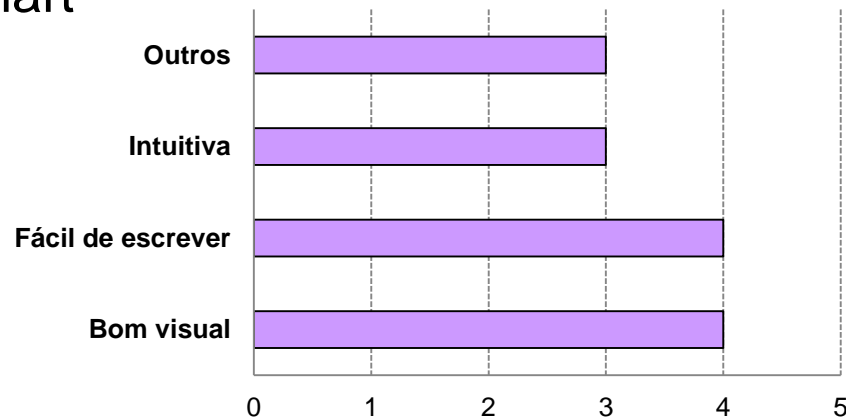
Qualitative Research

Highlight one positive aspect (if any) of the tool

- **StarUML**



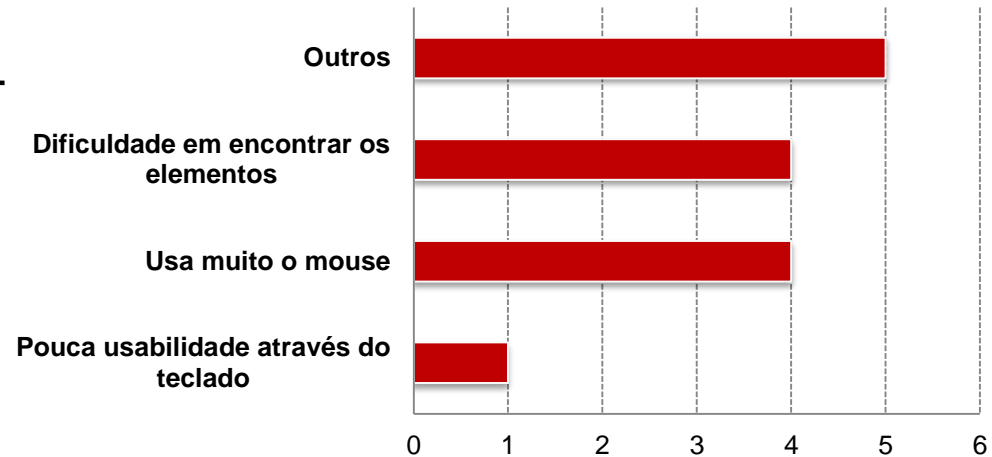
- **Lucidchart**



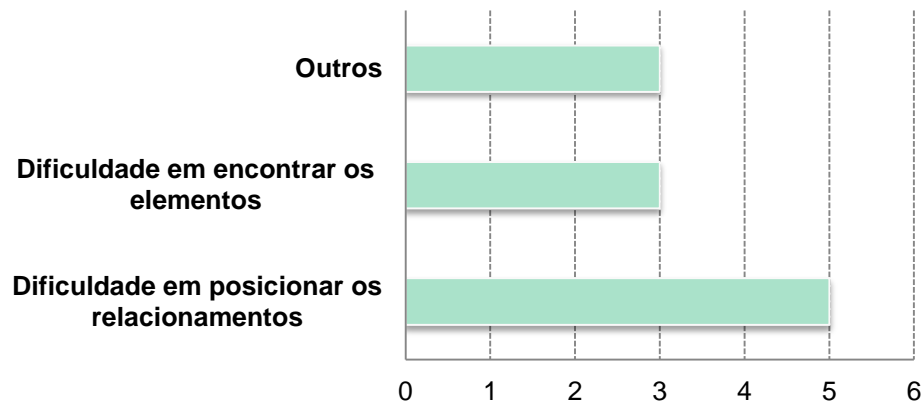
Qualitative Research

Highlight one negative aspect (if any) of the tool

- **StarUML**



- **Lucidchart**



Threats To Validity

- Internal validity
 - If I spend more effort to do a task in a tool, does it mean the tool is more difficult to use?
- Construct Validity
 - Is it possible to determine that both diagrams used in tasks 1 and 2 require the same effort and time to be done?
- External Validity
 - Can we generalize the results for other design tools? And for other participants?

Conclusions

- Hypothesis 1 could be confirmed by data analysis but hypothesis 2 could not
- We can't generalize the results for other tools, but it is a good indication that web-based tools require more effort and time
- Second task took more time and effort in both tools

Thank You!