



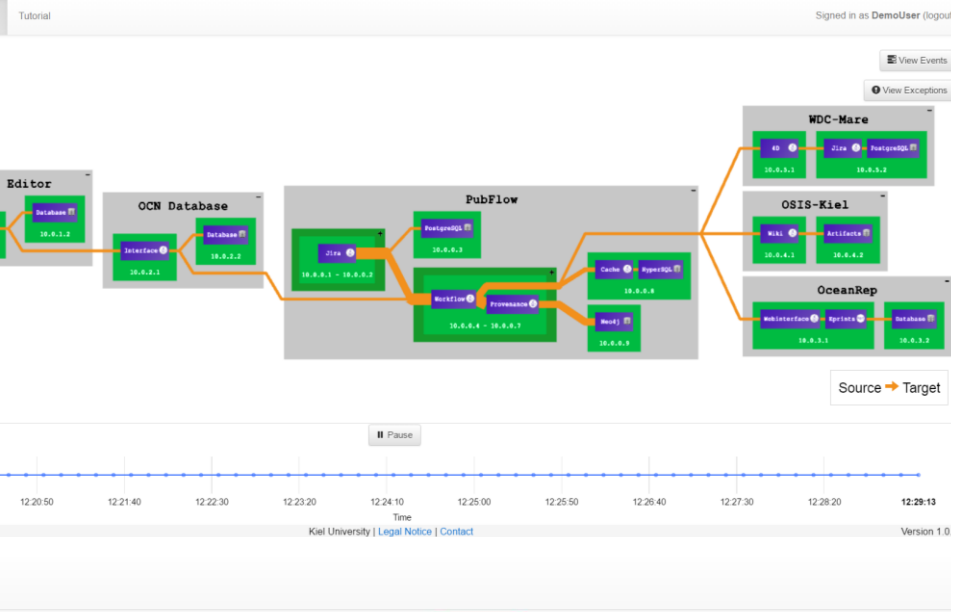
EYE TRACKING BASED EXPERIMENTS WITH EXPLORVIZ

MASTERTHESIS PRESENTATION OF MARIA-ANNA KANDSORRA

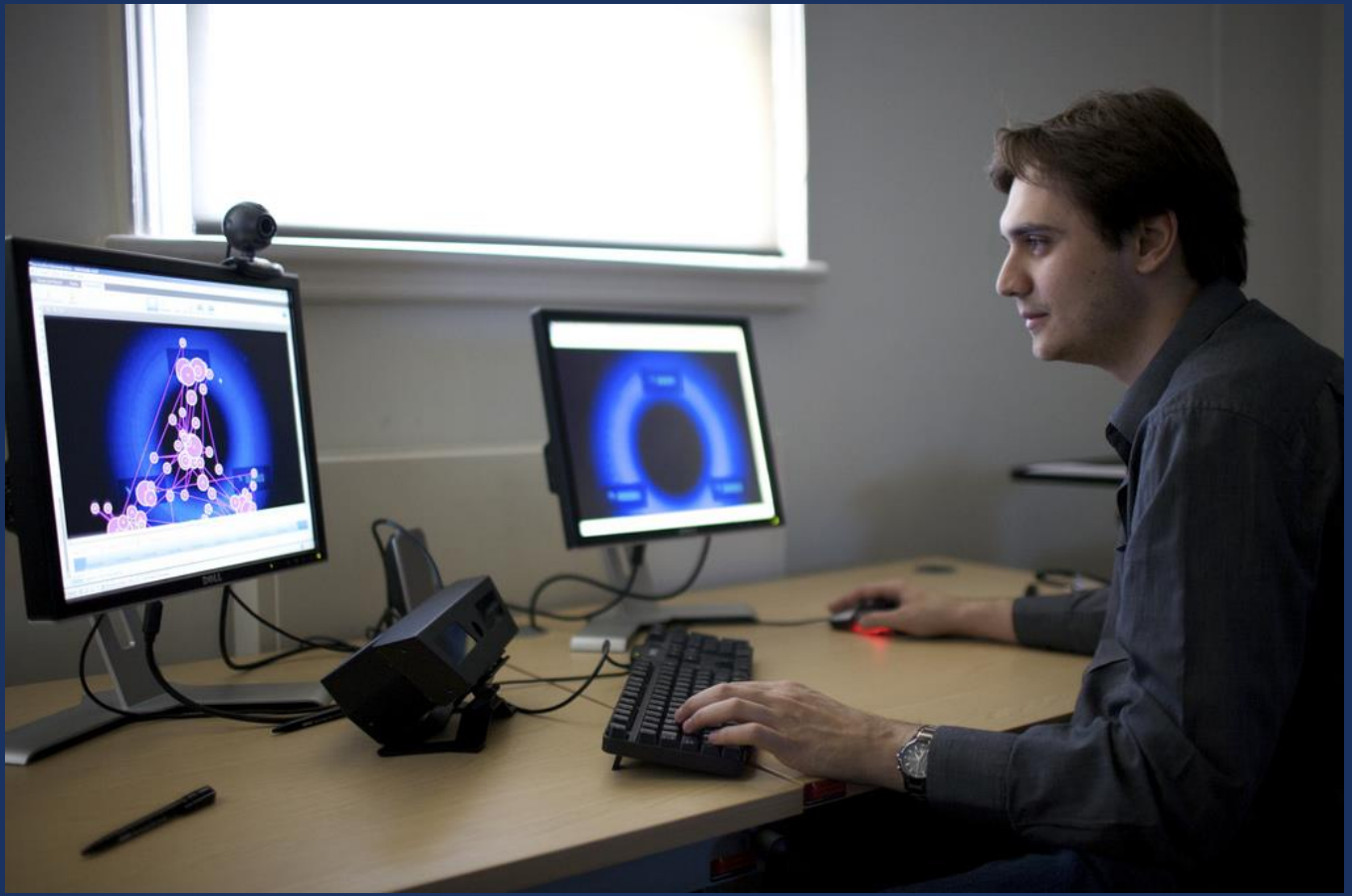
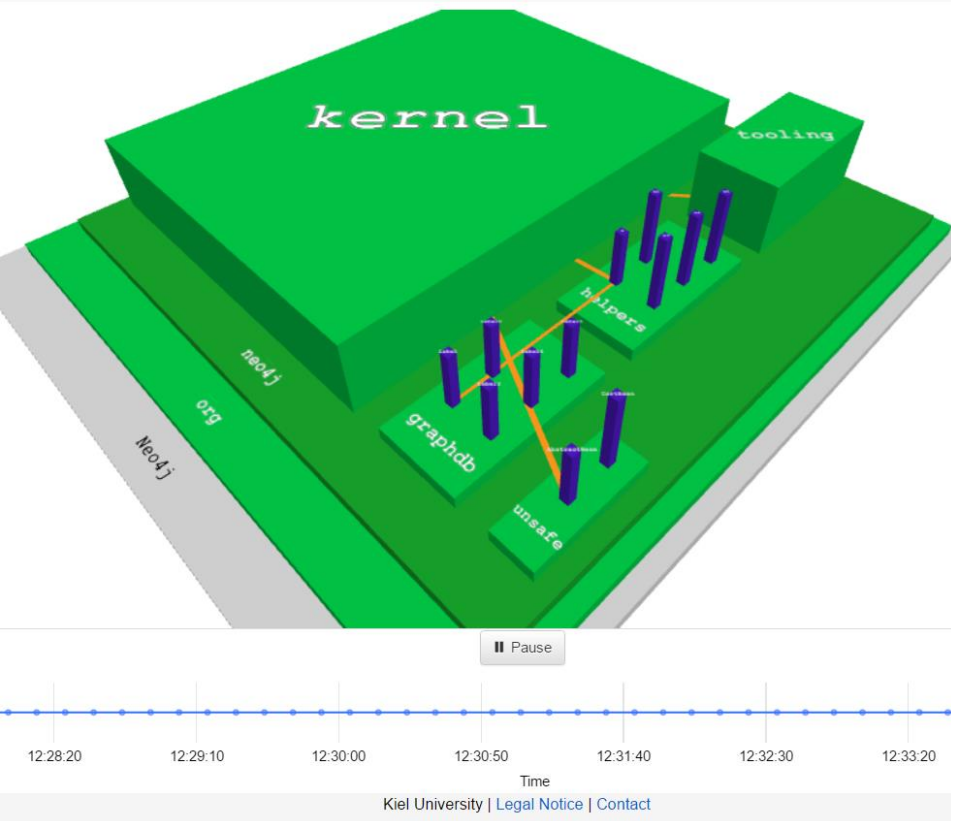
15.06.2017

OVERVIEW

- Introduction
- Foundations & Technologies
- Approach
- Implementation
- Evaluation
 - Experiment Design
 - Experiment Results
- Conclusion
- Future Work



INTRODUCTION



INTRODUCTION

GOALS

- G1: Determine Experiment Management Systems Requirements
- G2: Concept and Implementation of Experiment Mode with Eye Tracking
- G3: Evaluation of the Experiment Mode with Eye Tracking

GWT

- ↔ Overview
- Get started
-
- ↔ Tutorials
- ↔ Docs
- ↔ Resources
- ↔ Make GWT Better
- ↔ Terms

Download

JD Java Doc



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Productivity for developers, performance for users

GWT is used by many products at Google, including Google AdWords and Google Wallet. It's open source, completely free, and used by thousands of enthusiastic developers around the world.

FOUNDATIONS & TECHNOLOGIES

GOOGLE WEBTOOL KIT (GWT)

WebRTC Experiments & Demos

- It is a repository of uniquely experimented WebRTC demos; written by [Muaz Khan!](#)
- No special requirement! Just WebRTC compatible web-browser (e.g. chrome/firefox/opera on desktop/android)
- These demos/experiments are mostly client-side; i.e. no server installation needed!
- You can use all these demos in PHP/Python/Ruby/ASP.NET/etc. since they are only relying on JavaScript and 3rd party services!

How to use?

Each demo has a unique directory. Simply download that directory, upload in your webserver and use it; and it'll work!

You don't need to modify any single line to use it. No single installation or modification is needed :)

DetectRTC | Is WebRTC Supported On Your Browser?

A tiny JavaScript library that can be used to detect WebRTC features e.g. system having speakers, microphone or webcam, screen capturing is supported, number of audio/video devices etc.

Live Demo: <https://www.webrtc-experiment.com/DetectRTC/>

npm **v1.3.5** downloads **11k/month** build **passing**

FOUNDATIONS & TECHNOLOGIES EXPERIMENT WEBRTC

Fish

Saltwater, Freshwater

Dogs

Various Breeds

Cats

Various Breeds, Exotic Varieties

Reptiles

Lizards, Turtles, Snakes

Birds

Exotic Varieties



[View all pet images](#) [Check client time](#)

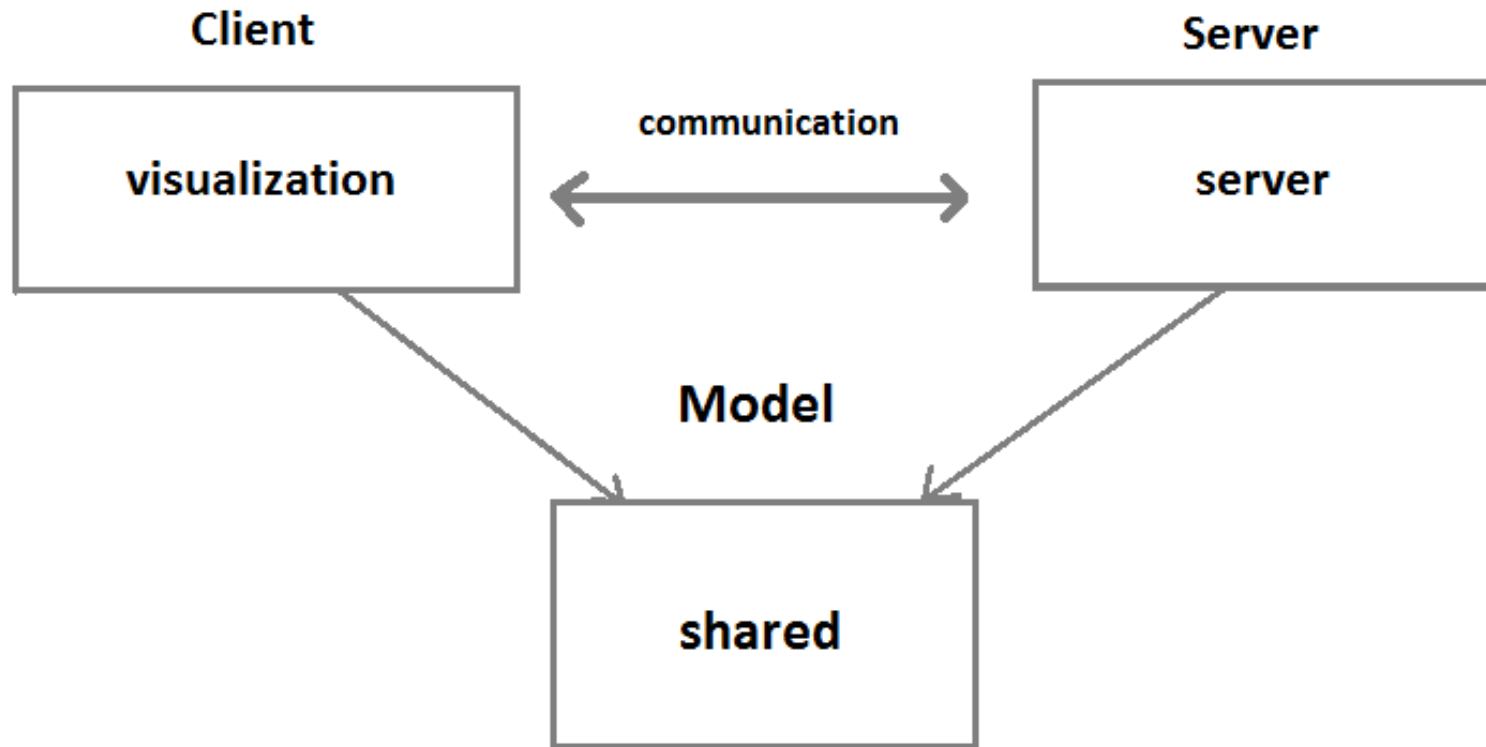


FOUNDATIONS & TECHNOLOGIES

JPETSTORE

APPROACH

EXPLORVIZ CONCEPT



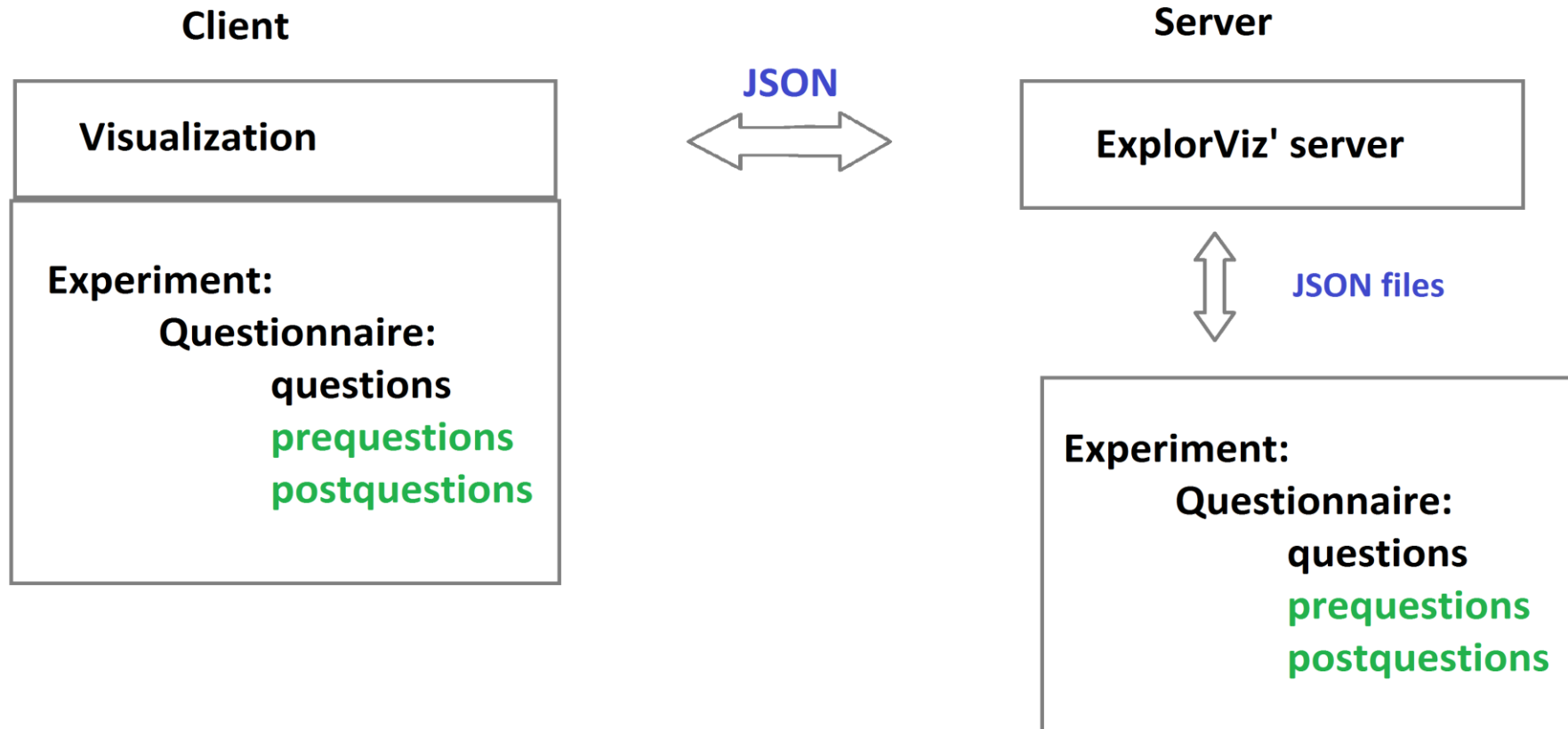
APPROACH

REQUIREMENTS FOR EXPERIMENT MANAGEMENT SYSTEMS [JAKOBOVITS ET AL. 2000]

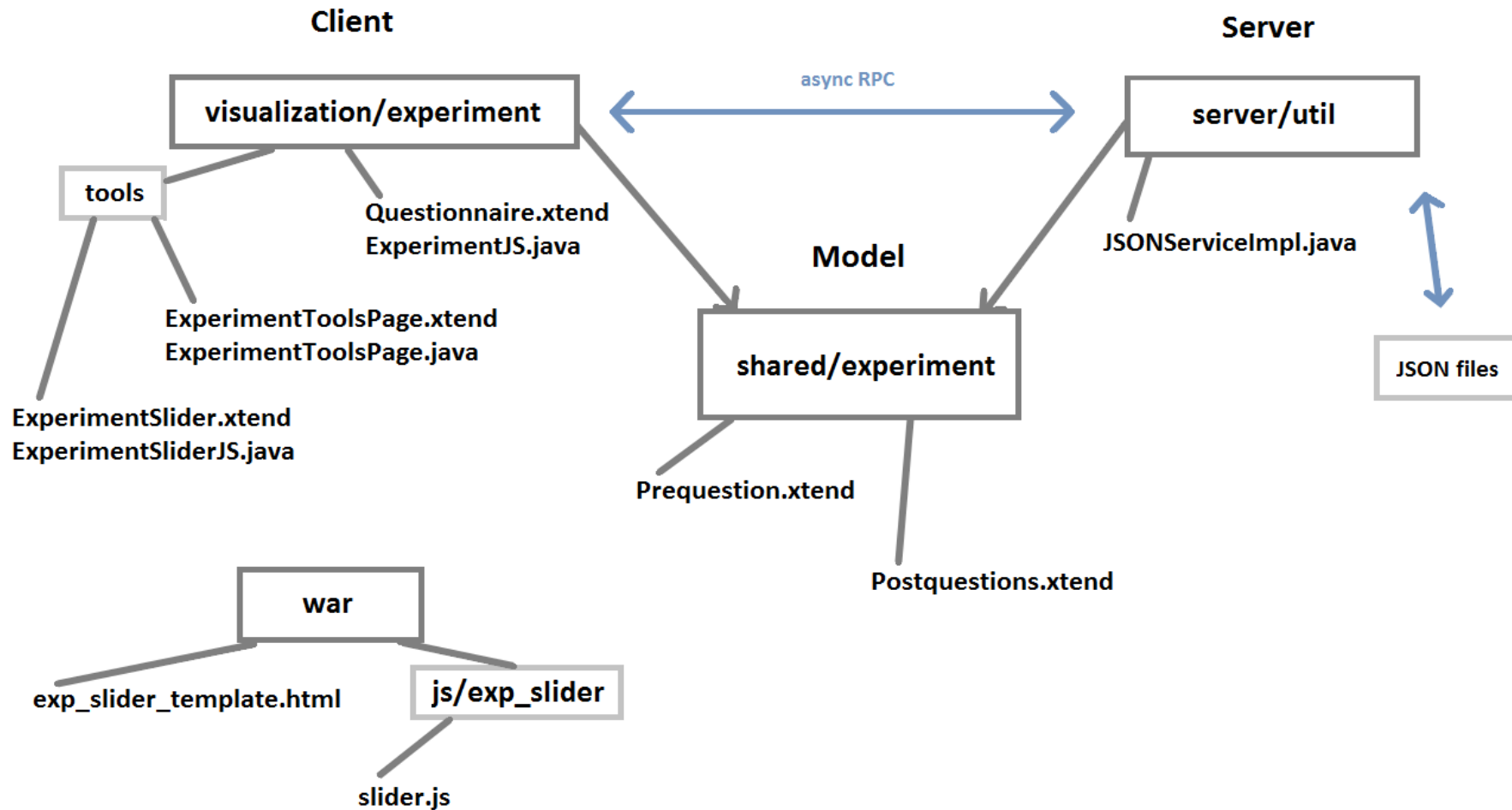
- System Integration
- Data Integration
- Workflow Support
- Remote Collaboration Facilities
- Advanced Data Type Management
- Intelligent Navigation
- Adaptive User Interface

APPROACH

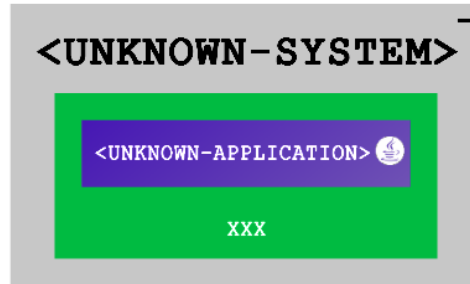
COMMUNICATION IN EXPLORVIZ



IMPLEMENTATION QUESTIONNAIRE



Show tour



Question Interface

Question 1

Type:

Free text

Landscape:

1467188123864-6247035

Question Text:

Question One

Working time in minutes (min. 1 / max. 10):

5

Correct answers:

Answer One

Answer Two

Delete ✕

Pre-

Questions

Post-

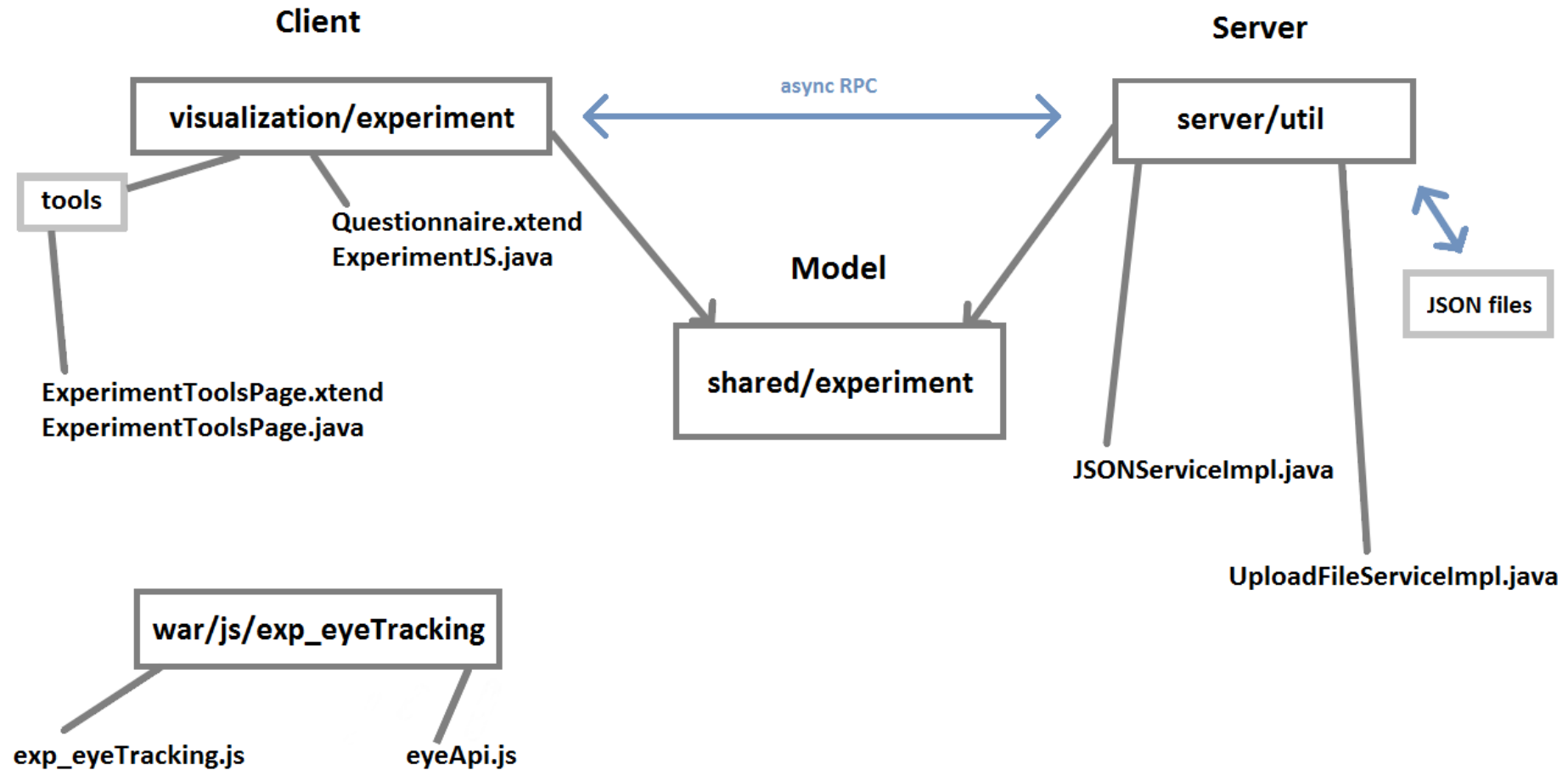
Back ◀

Save & Forward ▶▶

Exit ▲

IMPLEMENTATION



























EYE TRACKING & SCREEN RECORDING

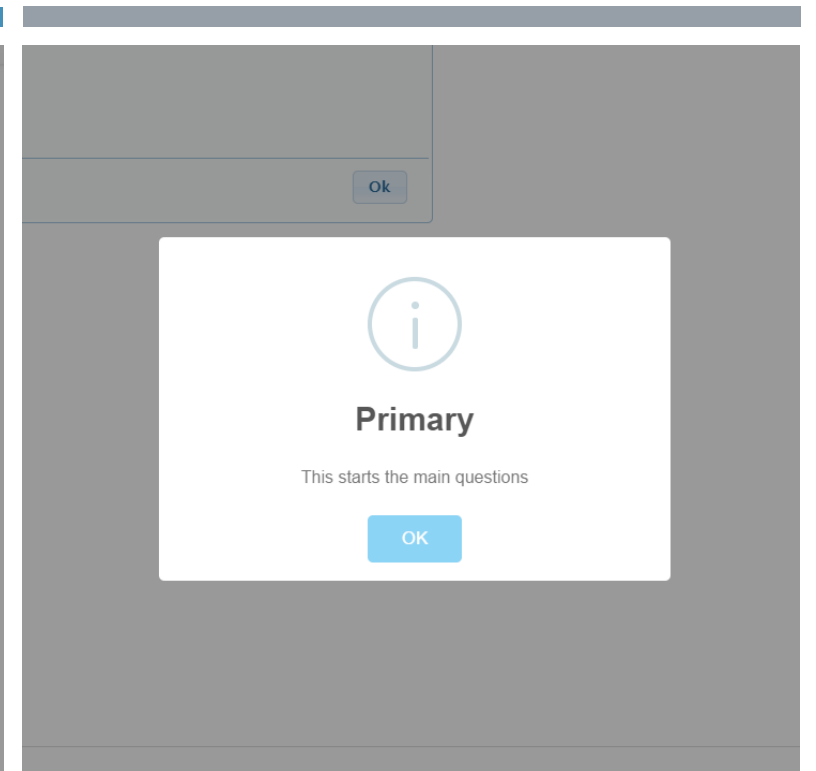
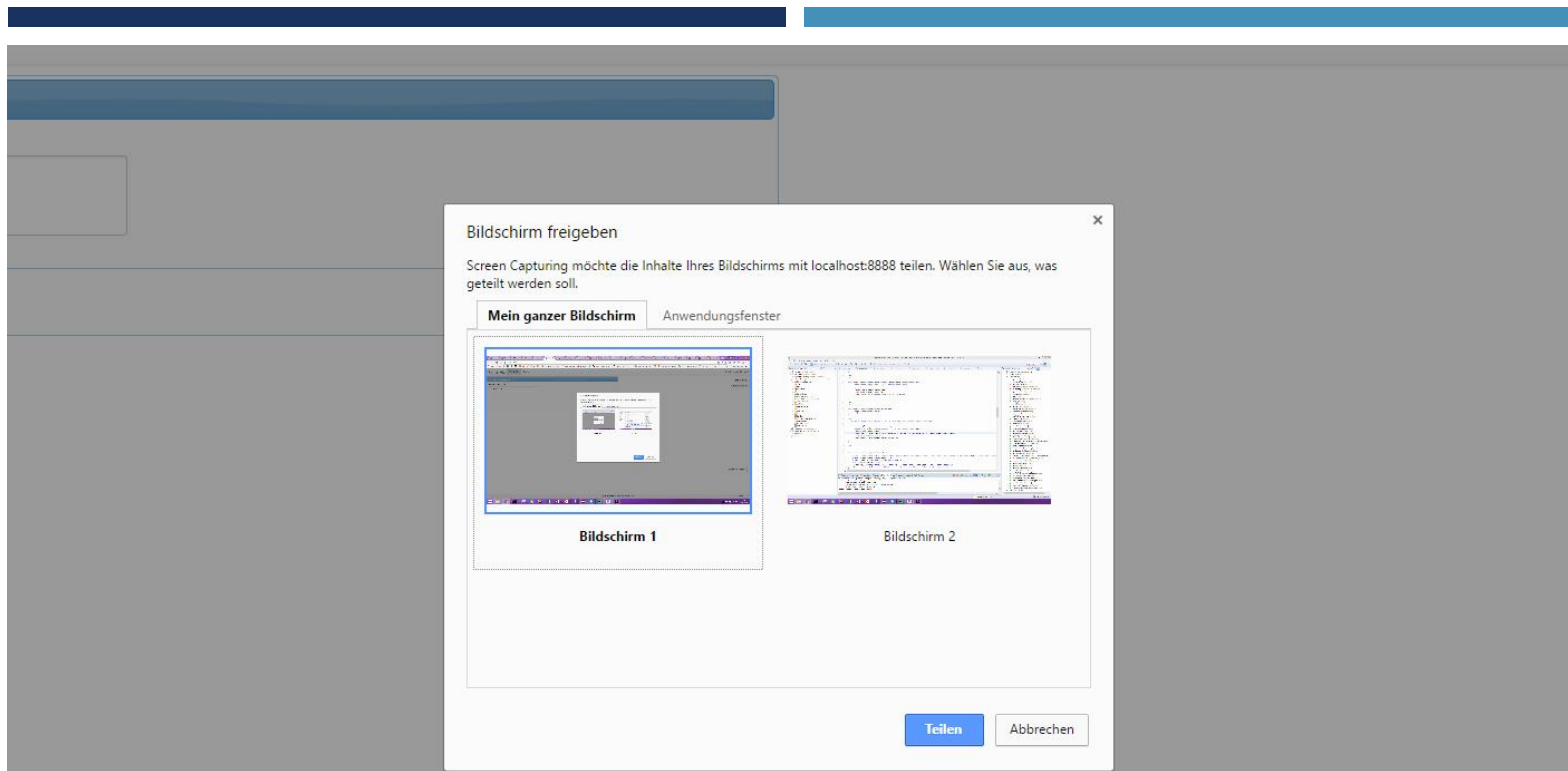


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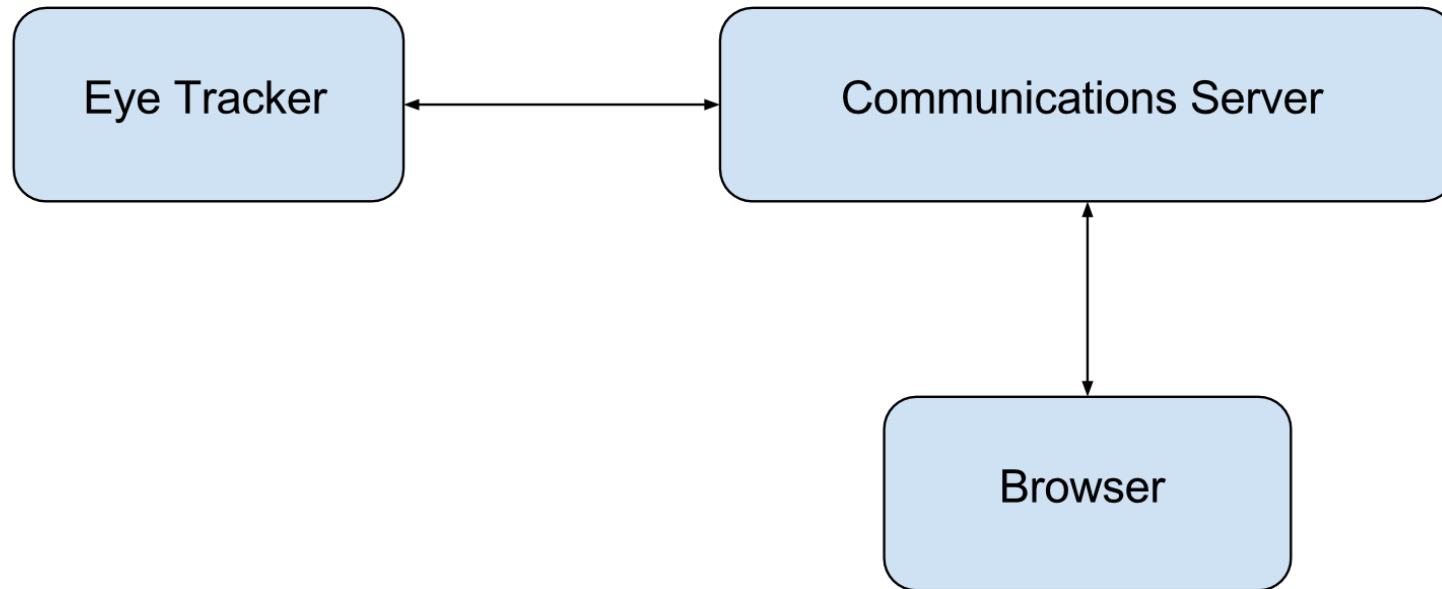
IMPLEMENTATION FIRST RESULT MODAL

Select for Screen Record Replay

Name	Done	Eye Tracking	Screen Recording	Download
user105	✓	✓		
user106	✓	✓		
user107	✓	✓		
user108	✓	✓		
user109	✓	✓		
user110	✓	✓		
user111	✓	✓		
user112	✓	✓		
user113	✓	✓		
user114	✓	✓		
user115	✓	✓		
user116	✓	✓		
user117	✓	✓		



IMPLEMENTATION MODALS DURING EXPERIMENT PARTICIPATION



IMPLEMENTATION EXTERNAL COMMUNICATIONS SERVER WITH EYE TRACKER

EVALUATION

- Experiment Design
- Experiment Results

EVALUATION EXPERIMENT DESIGN

- Research Questions:
 - What is the ratio between participants gazing not at the display, gazing at the question modal, and the ExplorViz interactive interface?
 - Is there a correlation between correctness of answers and amount of gaze time on the question modal versus on the interactive interface?
 - What does a participant mostly do (gaze and interaction with interface) when answering a question incorrect?
- Hypotheses:
 - The ratio of gazing at the question modal, interface and not at the display differs between participants.
 - The correctness of answers differs between participants that gaze more at the question modal than the interface and vice versa.

EVALUATION EXPERIMENT DESIGN

- Empirical Methods
- Tasks
 - Dependent and Independent Variables
 - Treatment
 - Personal Information
 - Population

EVALUATION

EXPERIMENT OPERATION

- Experimental Set-Up
- Create Input
- Tutorial
- Questionnaire
- Pilot Study
- Procedure
- Data Collection:
 - Timing and Tracking Information
 - Correctness Information

EVALUATION EXPERIMENT RESULTS

- Prequestions:
 - Experience with JPetStore: 1,2667
 - Experience with ExplorViz: 1,8667
- Correctness Information:

ID	Mean	SD	Score
T1.1	0,8	0,4332	1
T1.2	1,2667	0,9501	2
T1.3	0,5333	0,5001	1
T2	1,6	0,8664	3
T3	1,8667	0,662	2
T4	1,0667	0,9356	2

EVALUATION EXPERIMENT RESULTS

- Eye Data Results (in %):

Category	Mean	SD
Question Modal	17,0679	8,0997
Interface	78,0356	20,0754
Non-Display	4,8965	4,137

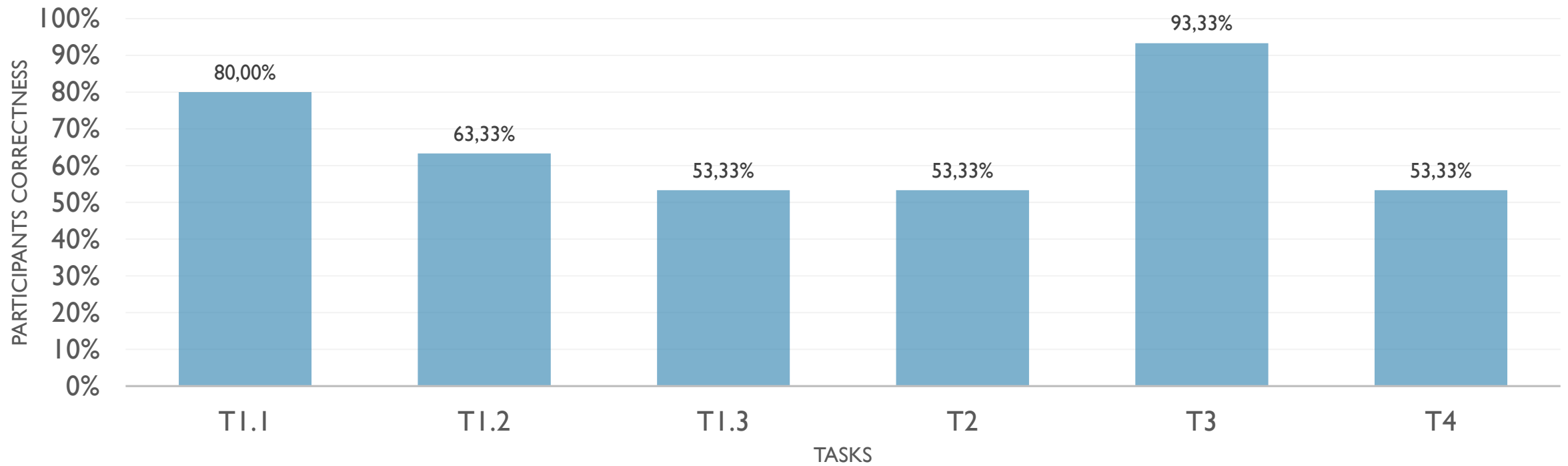
EVALUATION EXPERIMENT RESULTS

- Postquestions:

Category	Mean	SD
Pressure Time	1,733	0,7988
Pressure Eye Tracking	1,2	0,6399
Pressure Screen Recording	1,467	0,7988
Difficulty T1.1	1,933	0,4577
Difficulty T1.2	1,933	0,4577
Difficulty T1.3	2,333	0,8997
Difficulty T2	2,929	0,8287
Difficulty T3	2,429	0,9376
Difficulty T4	2,857	0,663

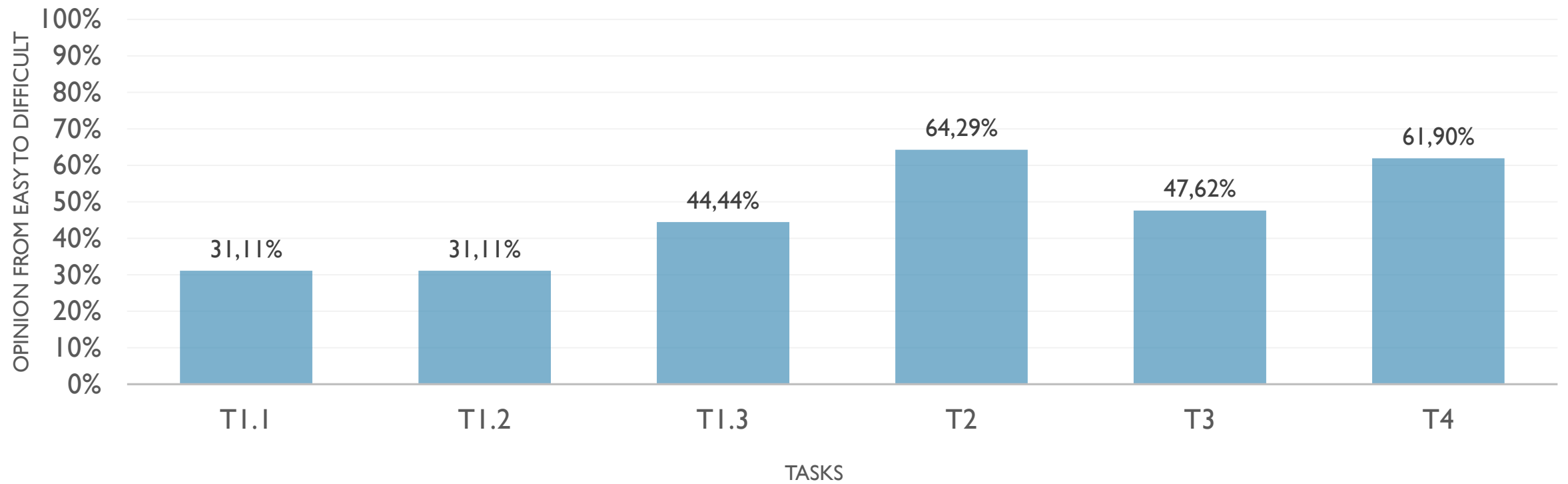
EVALUATION EXPERIMENT RESULTS

CORRECTNESS OF TASKS:



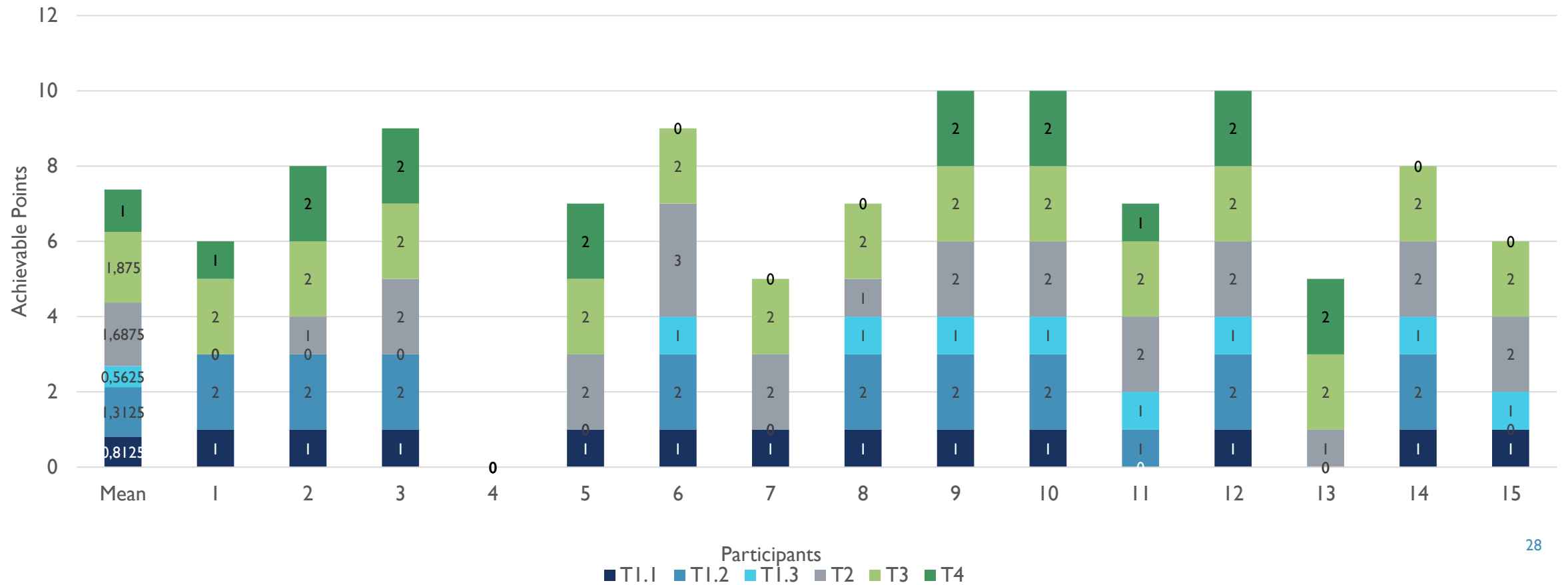
EVALUATION EXPERIMENT RESULTS

AVERAGE OPINION OF TASKS:



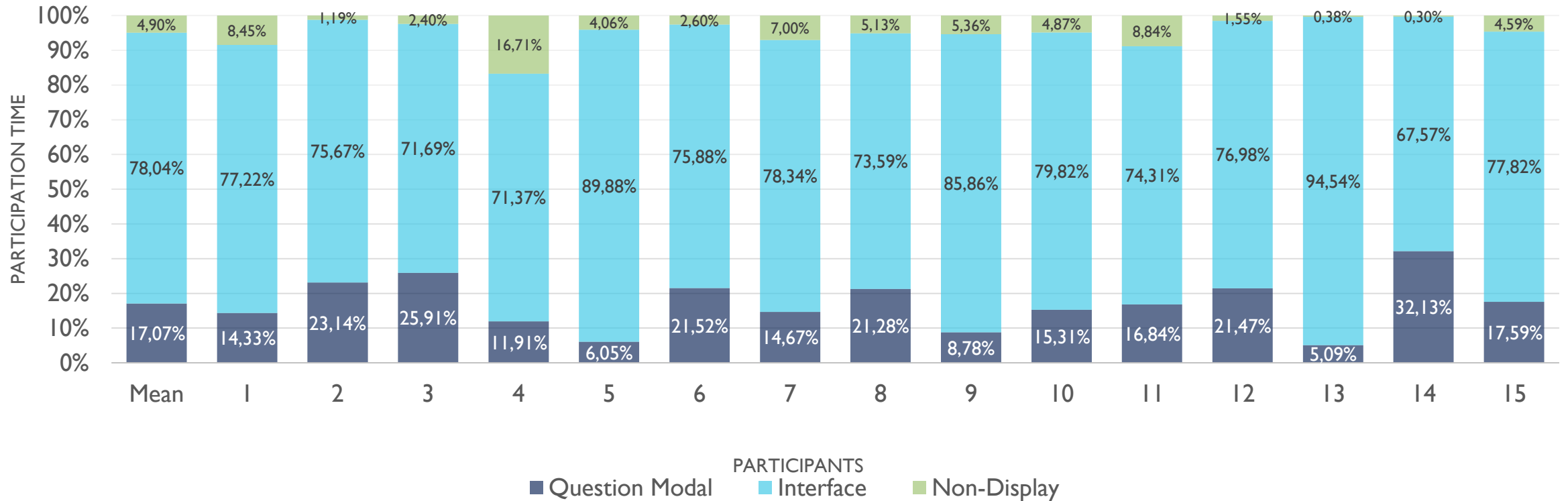
EVALUATION EXPERIMENT RESULTS

PARTICIPANTS RESULTS:



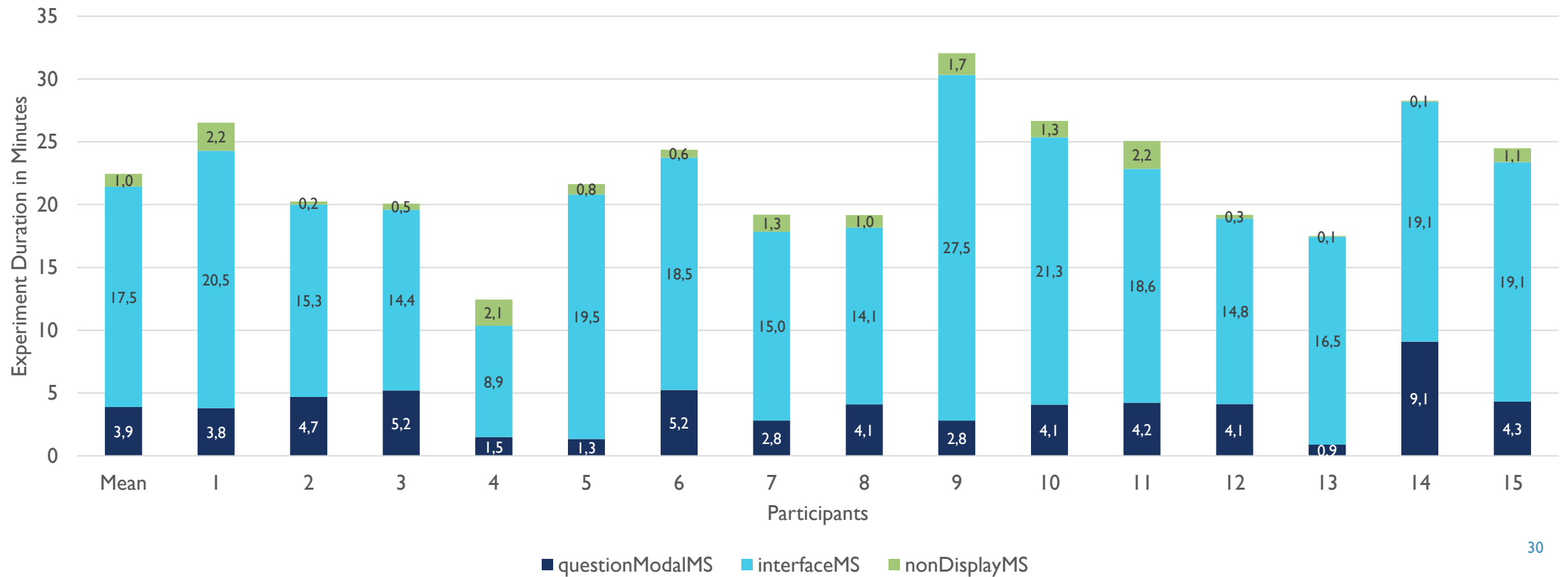
EVALUATION EXPERIMENT RESULTS

PARTICIPANTS GAZE-RATIOS:



EVALUATION EXPERIMENT RESULTS

DURATION OF EXPERIMENT PARTICIPATION:



SUMMARY & CONCLUSION

- Improvement of Usability of Experiment Mode
- Enhancement of Experiment Mode with Eye Tracking and Screen Recording
- Execution of an Experiment
- Experiment Results in Comparison to Research Questions
- Conclusion

FUTURE WORK

- Improve ExplorViz' Interactive Tutorial Save Process
- Automated Merging of the Screen Recording Media Files
- Import of existing Experiment Data
- Automated Analysis of Eye Tracking Data

BIBLIOGRAPHY

- www.explorviz.net
- <http://samoa.informatik.uni-kiel.de:8181/>
- <http://www.gwtproject.org/>
- <https://github.com/muaz-khan/WebRTC-Experiment>
- <http://www.jpetsstore3.appspot.com/shop/index.shtml>
- <https://canjs.com/index.html>
- <https://eclipse.org/artwork/>
- <http://brand.qt.io/downloads/>
- [Jakobovits et al]: Jakobovits, R., Soderland, S. G., Taira, R. K., & Brinkley, J. F. (2000). Requirements of a Web-based experiment management system. In *Proceedings of the AMIA Symposium* (p. 374). American Medical Informatics Association.
- [Basili et al.]: Basili, V. R., Selby, R. W., & Hutchens, D. H. (1986). Experimentation in software engineering. *IEEE Transactions on software engineering*, (7), 733-743.