Cartography M.Sc.

Map-based Storytelling in Spatial Augmented Reality: Projection of Interactive Layers

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Outline

- Research identification
- State of the art
- Methodology
- The Minard map
- AR exhibition
- Classical exhibition
- Evaluation
- Results
- Conclusions and outlook

Research identification

Propose and evaluate a method of Map-Based Storytelling in Mixed Reality.

Bring interactivity to a static printed map and make the map reading, understanding and exploration in a historic map exhibition more enjoyable than in a traditional, static exhibition.

Research identification

Hypothesis:

proposed Map-Based Storytelling in Mixed Reality method could enhance user experience: the way of the story exploration will become more entertaining and flexible, and as one of the results, the quality of acquired knowledge will be better than with traditional solutions.

Research identification

Research Objectives

I. Make an overview of current MR technologies for CH. Identify the most common limitations of classical exhibitions and ways to avoid them.

II. Chose the technologies that can be used for the projection of interactive layers on the map.

III. Find the ways of user interactions with maps in AR-space. Figure out what kinds of connected media and information could be integrated into the exhibition.

IV. Evaluate the proposed method concerning its impact on the user experience.

Research identification

Research Questions

I. Which MR methods are used in CH applications, especially in exhibitions, how do they guide user through story? What are the limitations of traditional exhibition methods while storytelling using maps and how to overcome them?

II. How can the projection of interactive layers on printed historical maps in a Spatial AR environment be realised?

III. How can users interact with a paper map in the Spatial AR environment?

What kinds of connected media and information can be added? Furthermore, how can it be realised for different types of media (e.g., are there differences)?

IV. Can the new method make storytelling using maps more enjoyable/entertaining, and enhance the user experience and quality and quantity of the acquired knowledge?

State of the art

-Storytelling in museums

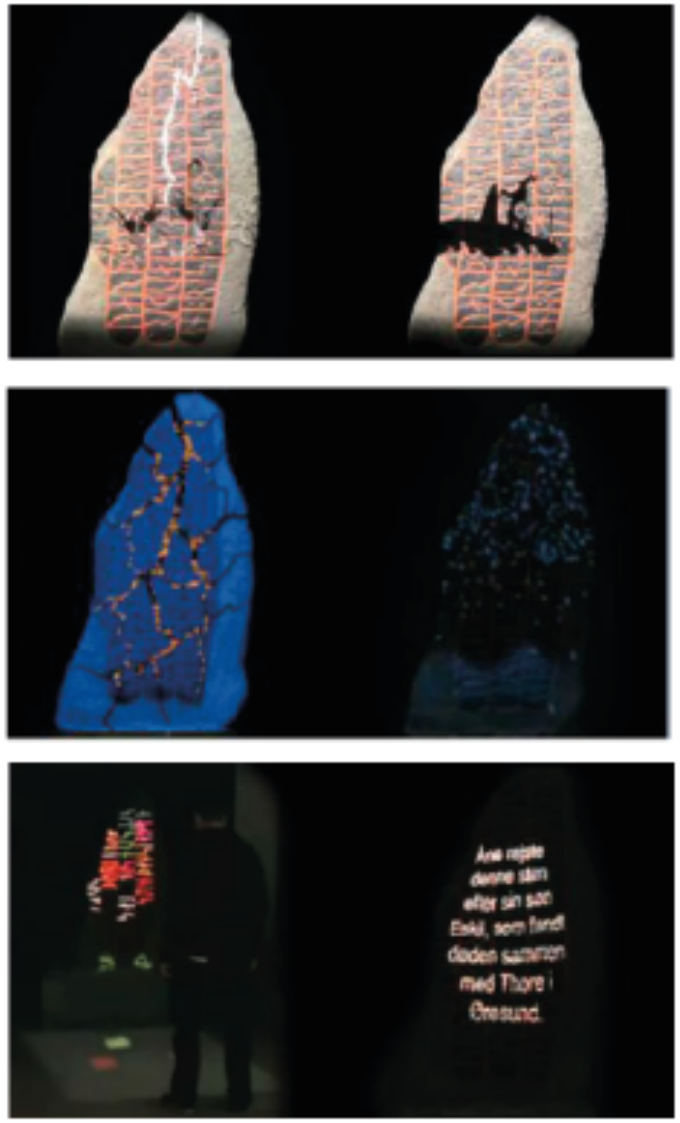
-Storytelling in and with maps

-Mixed Reality for Cultural Heritage

-Mixed Reality and maps

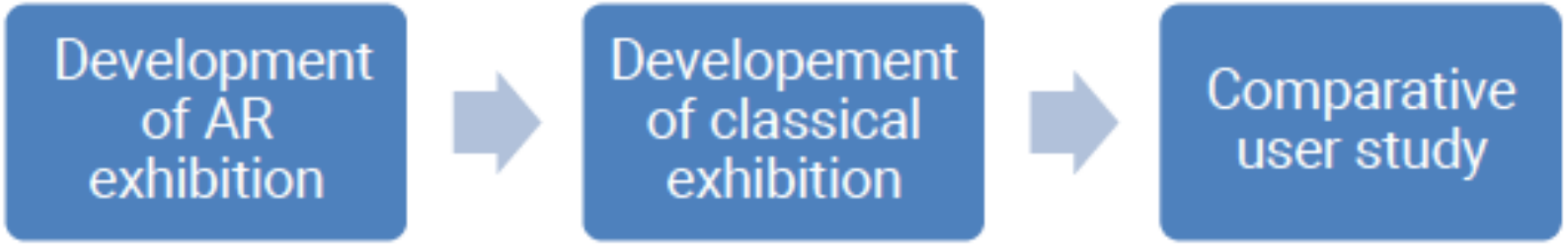
An augmented map, showing
the flooded River Cam. (Reitmayr et al., 2005)

Musqueam Belongings
(Courtesy Reese Muntean)



The Mejlby stone exhibition
(Basballe & Halskov, 2010).).

Methodology

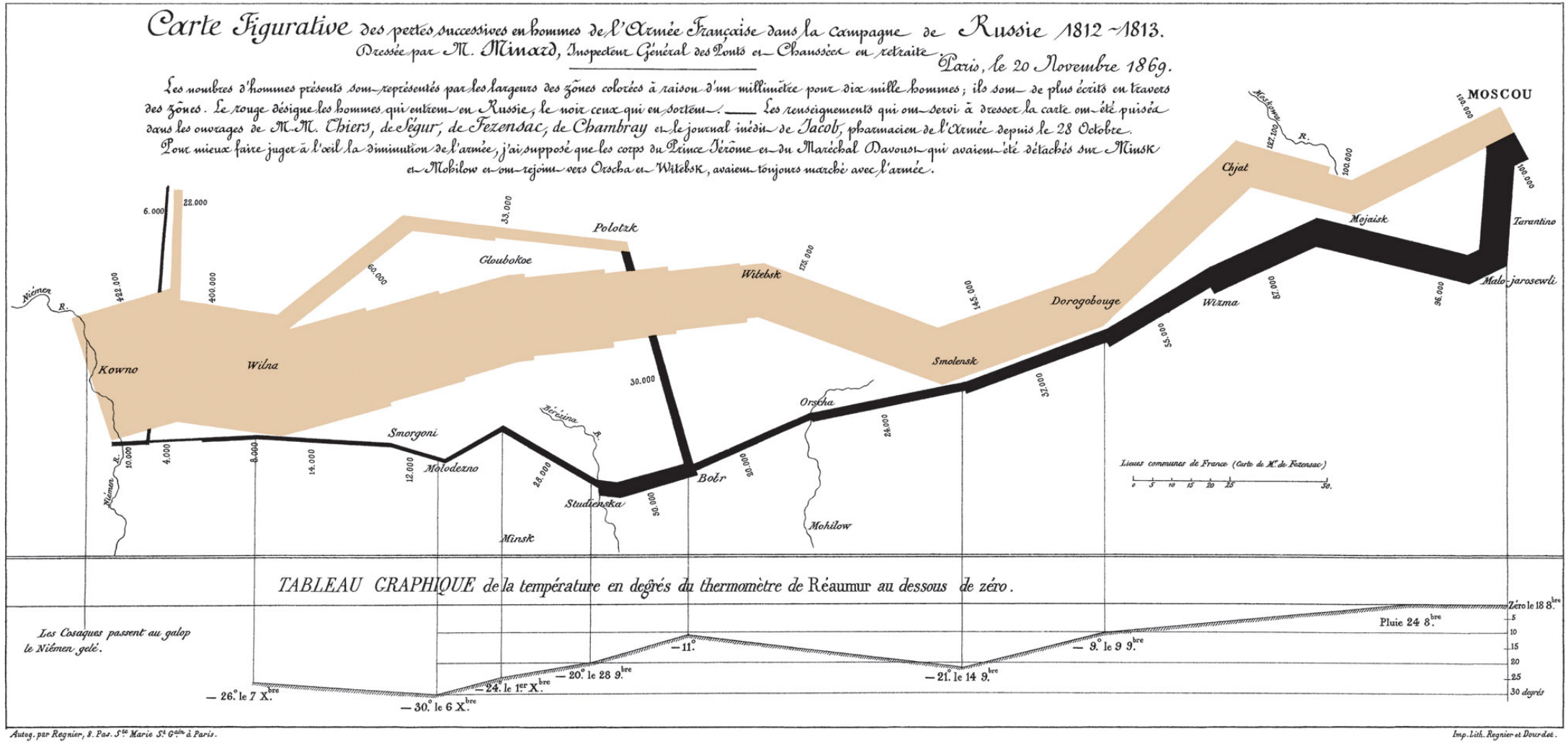


- choose the hardware and software technologies
- case study
- Spatial AR prototype

- same content and design style
- non-digital solutions

- museum experience simulation
- two independent groups ”Classical” and “AR”
- task-based questionnaire and interaction observation

Case study

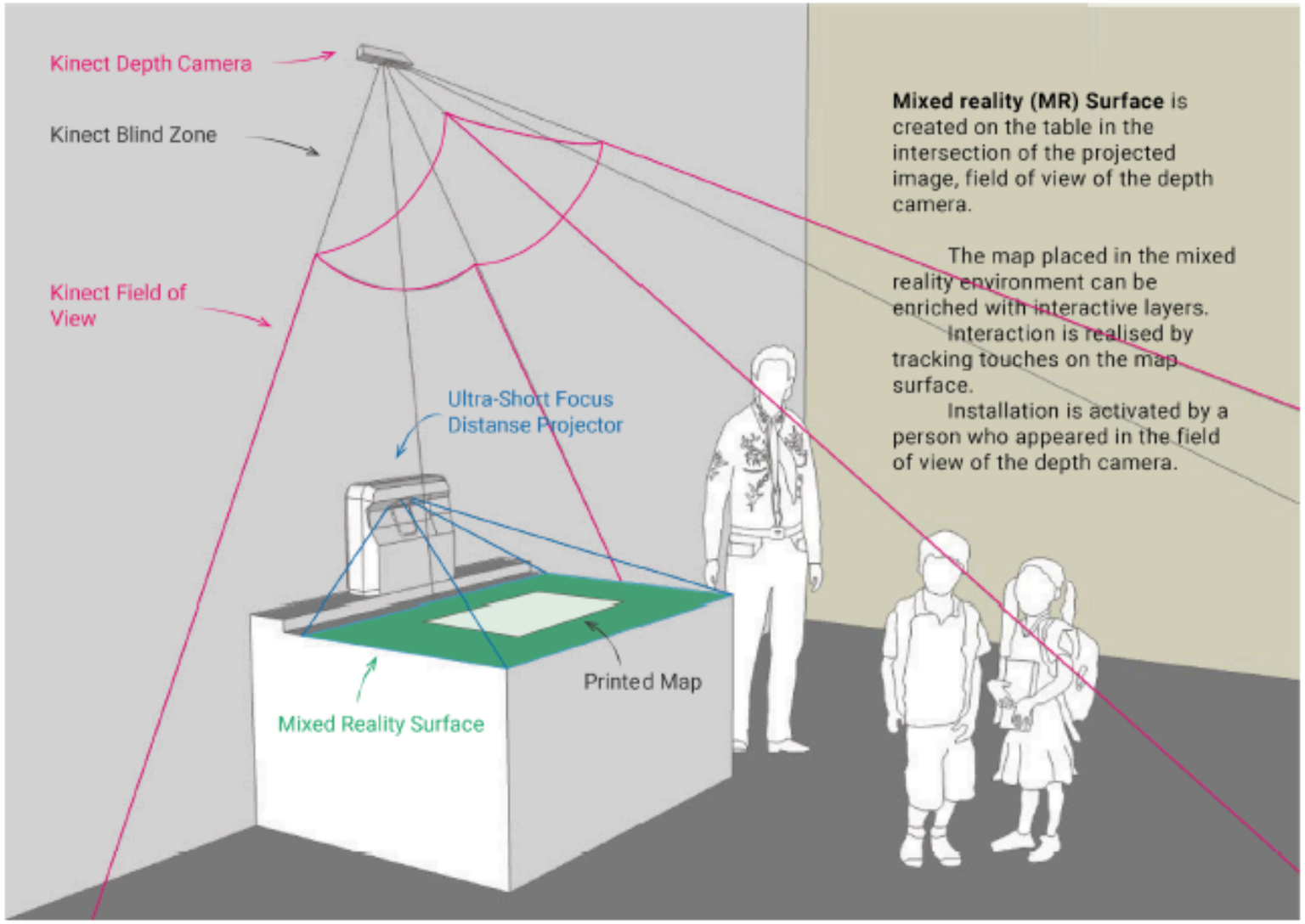

Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.
Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite.
Paris, le 20 Novembre 1869.
Les nombres d'hommes présents sont représentés par les largeurs des zônes colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zônes. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M.M. Thiers, de Ségur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.
Pour mieux faire juger à l'oeil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davoust qui avaient été détachés sur Minsk et Mobilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.
Kowno
Wilna
Niémen R.
Smorgoni
Molodexno
Minsk
Studienska
Bobr
Berézina R.
Polotzk
Gloubokoe
Witebsk
Orscha
Mohilow
Smolensk
Dorogobouge
Wixma
Chjat
Mojaisk
MOSCOU
Tarantino
Malo-jarosewli
Lieues communes de France (Carte de M.r de Fezensac)
TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.
Les Cosaques passent au galop le Niémen gelé.
— 26.° le 7 X.bre
— 30.° le 6 X.bre
— 24. le 1.er X.bre
— 20.° le 28 9.bre
— 11.°
— 21. le 14 9.bre
— 9.° le 9 9.bre
Pluie 24 8.bre
Zéro le 18 8.bre
30 degrés
Autog. par Regnier, 8. Pas. S.te Marie S.t Gain à Paris.
Imp. Lith. Regnier et Dourdet.

Case study

1812.tass.ru

AR exhibition

Concept



AR exhibition

Realization

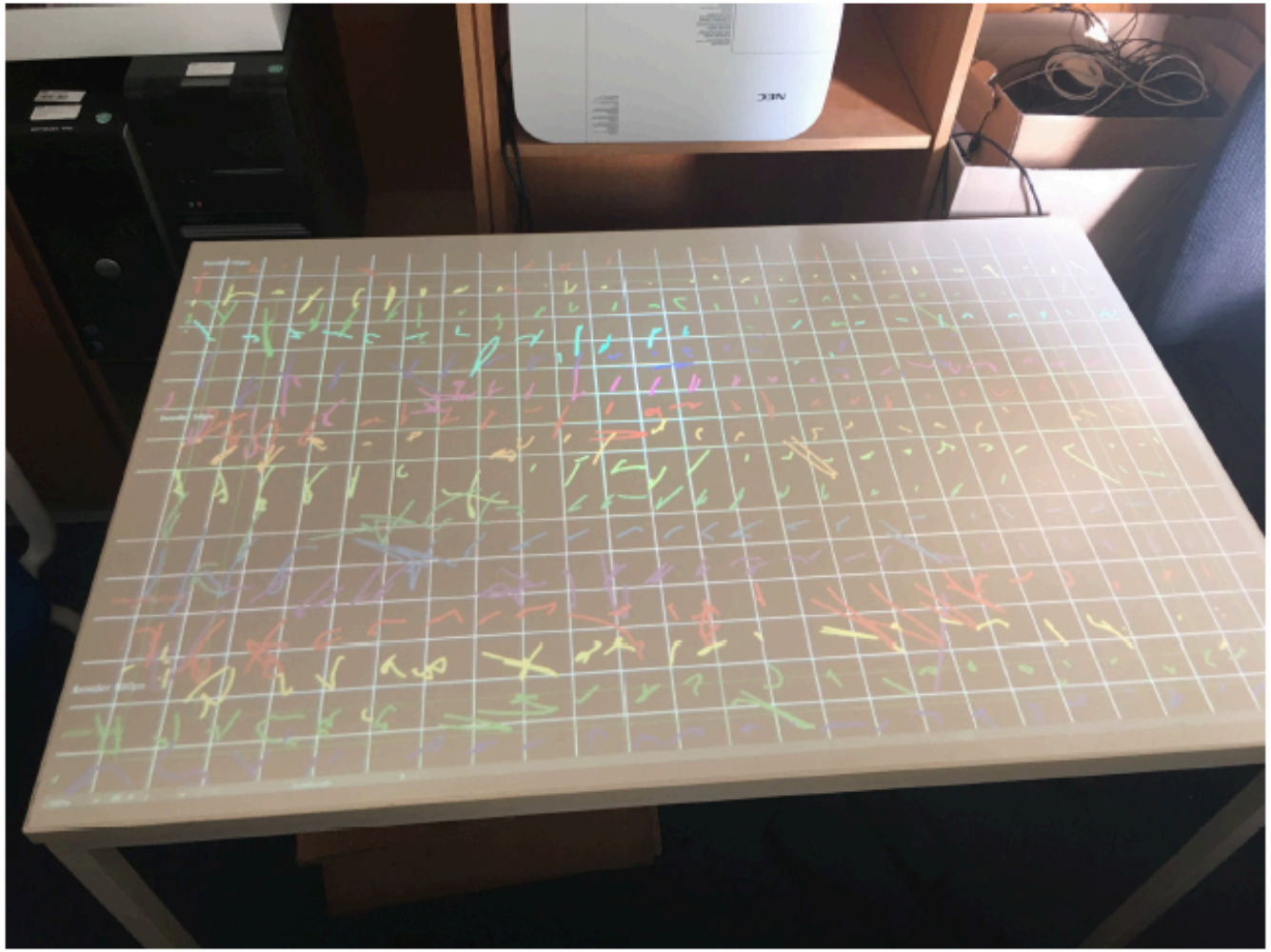
- NEC NP-U310W projector
- Kinect for Windows v1
- White Table 80*115*70(H) cm

AR exhibition

Calibration

-Touchless touch

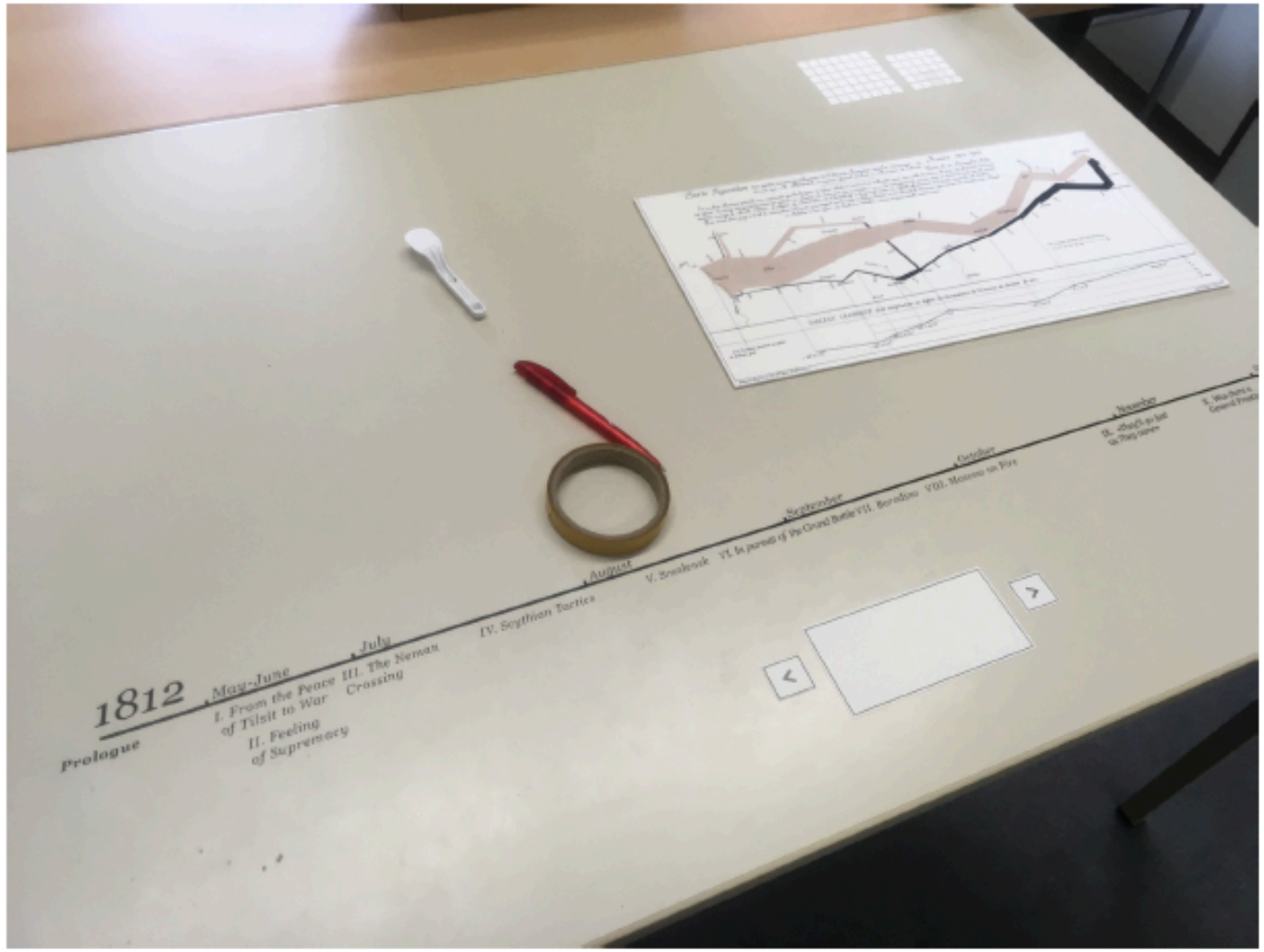
- Preciseness ±5cm



AR exhibition

Application interface

- Timeline with chapters
- Back/forward buttons
- Current date indicator
- Troops indicator



AR exhibition

Storytelling/exhibition application structure.

Content/data:

- Raster/vector geo data
- Day by day table
- TASS articles
- Illustrations

Software:

- Unity: 2D arcade game
- Adobe Illustrator: design

AR exhibition

Types of content

and it’s representation

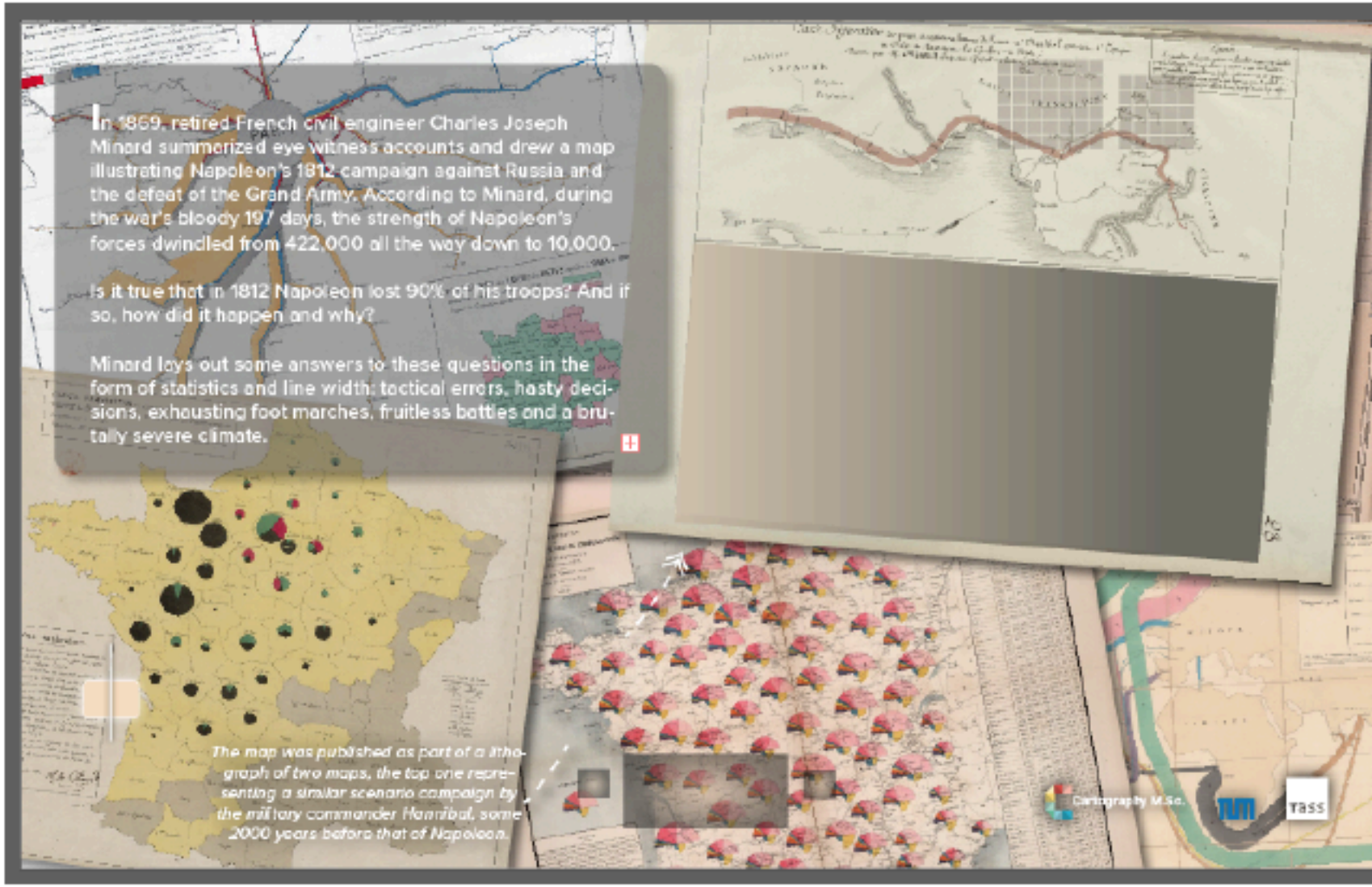
- Background images

AR exhibition

Types of content

and it’s representation

- Background images
- Text

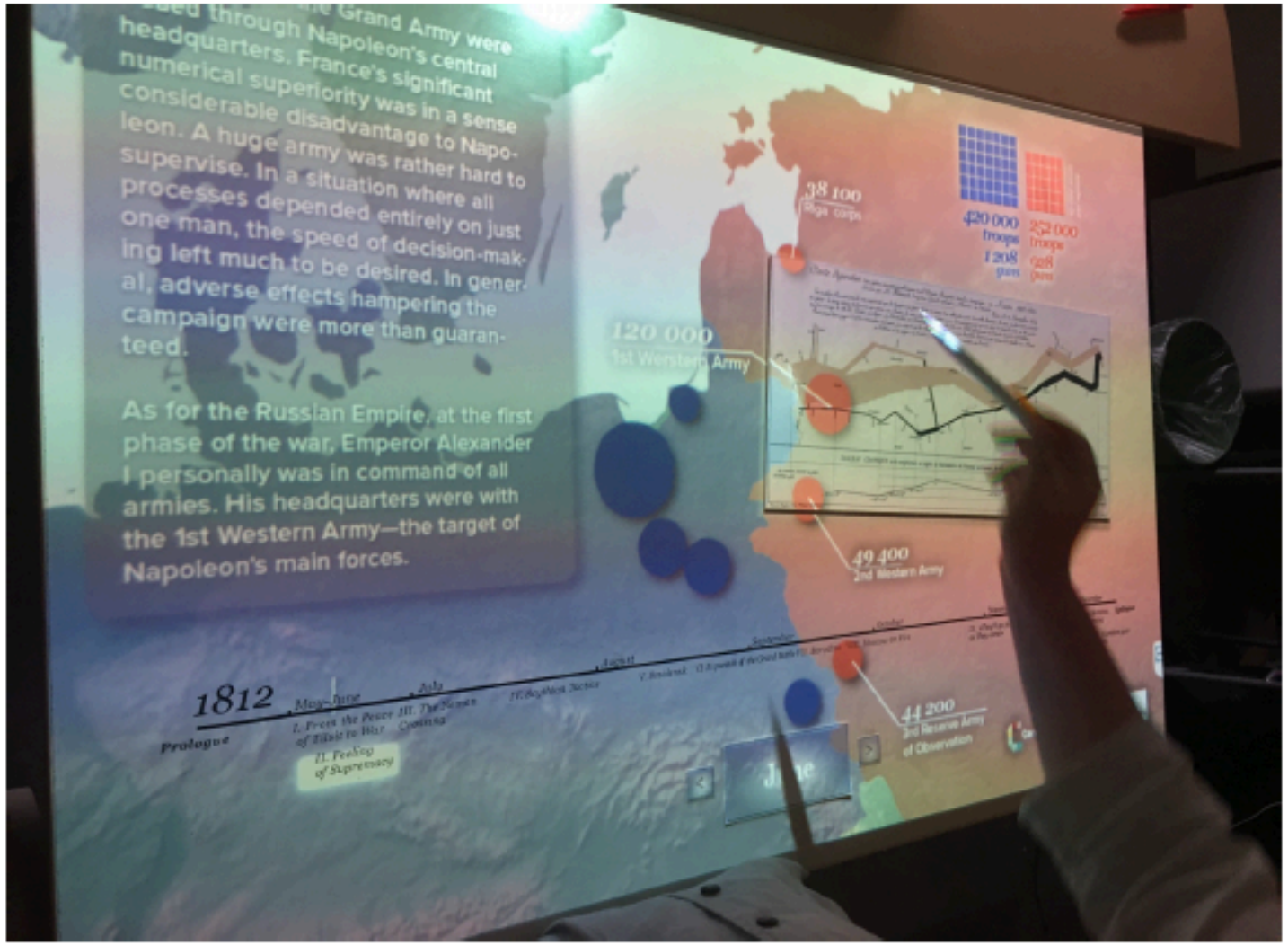


AR exhibition

Types of content

and it’s representation

- Background images
- Text
- Map overview
- Chapters highlight



AR exhibition

Types of content

and it's representation

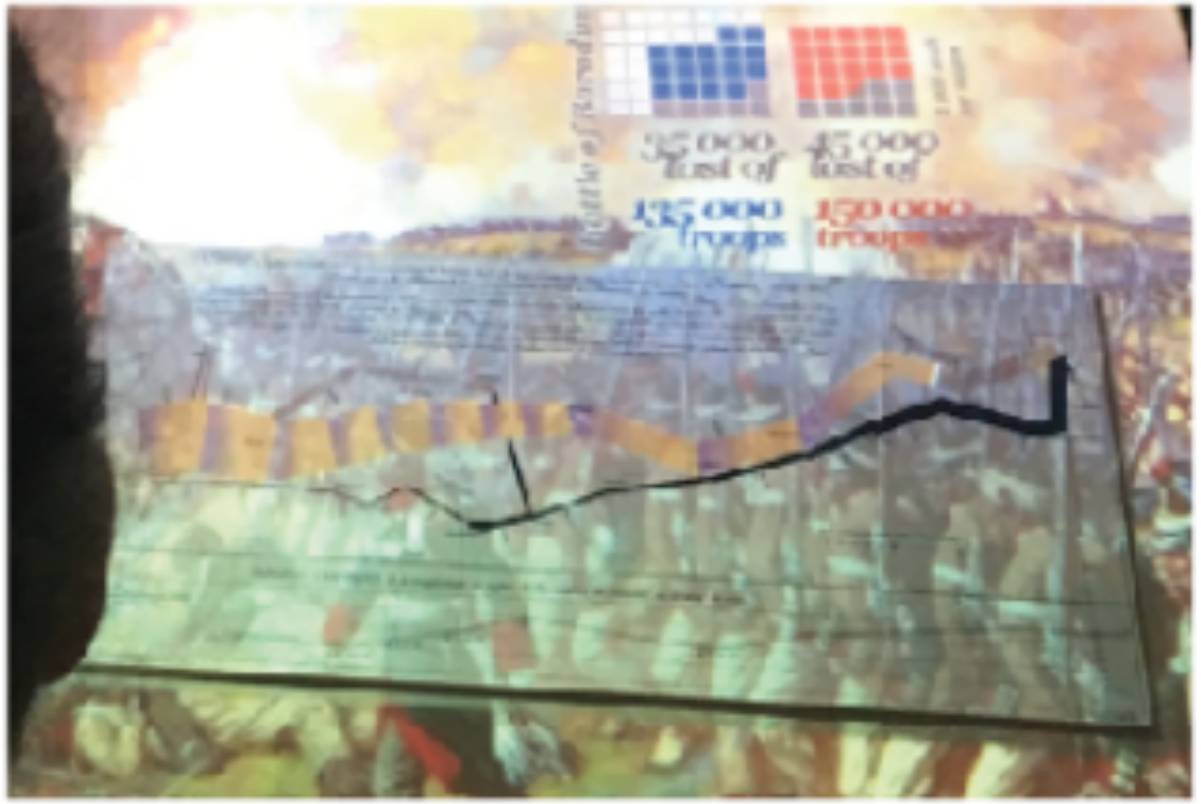
- Background images
- Text
- Map overview
- Chapters highlight
- Dates
- Maps in the text

AR exhibition

Types of content

and it’s representation

- Background images
- Text
- Map overview
- Chapters highlight
- Dates
- Maps in the text
- Map overlay

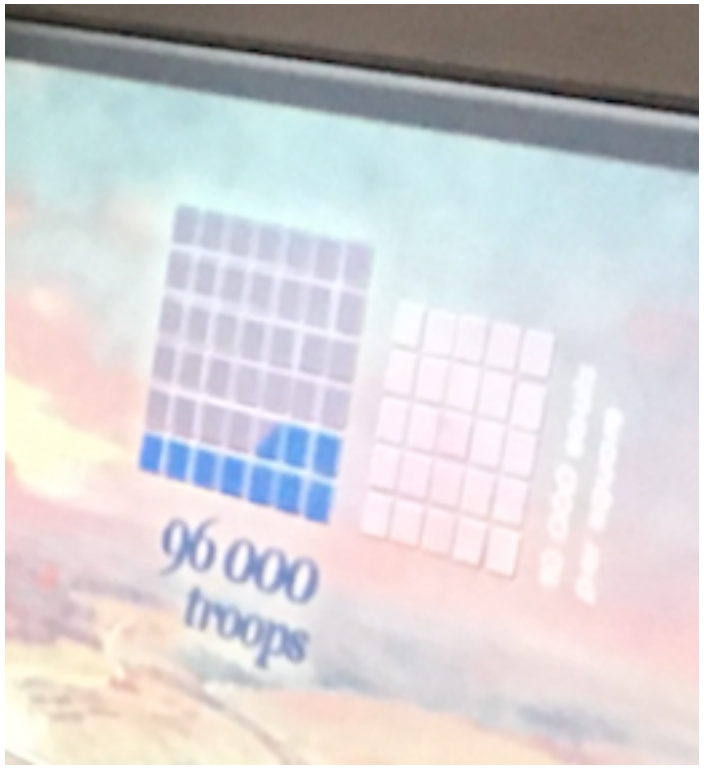


AR exhibition

Types of content

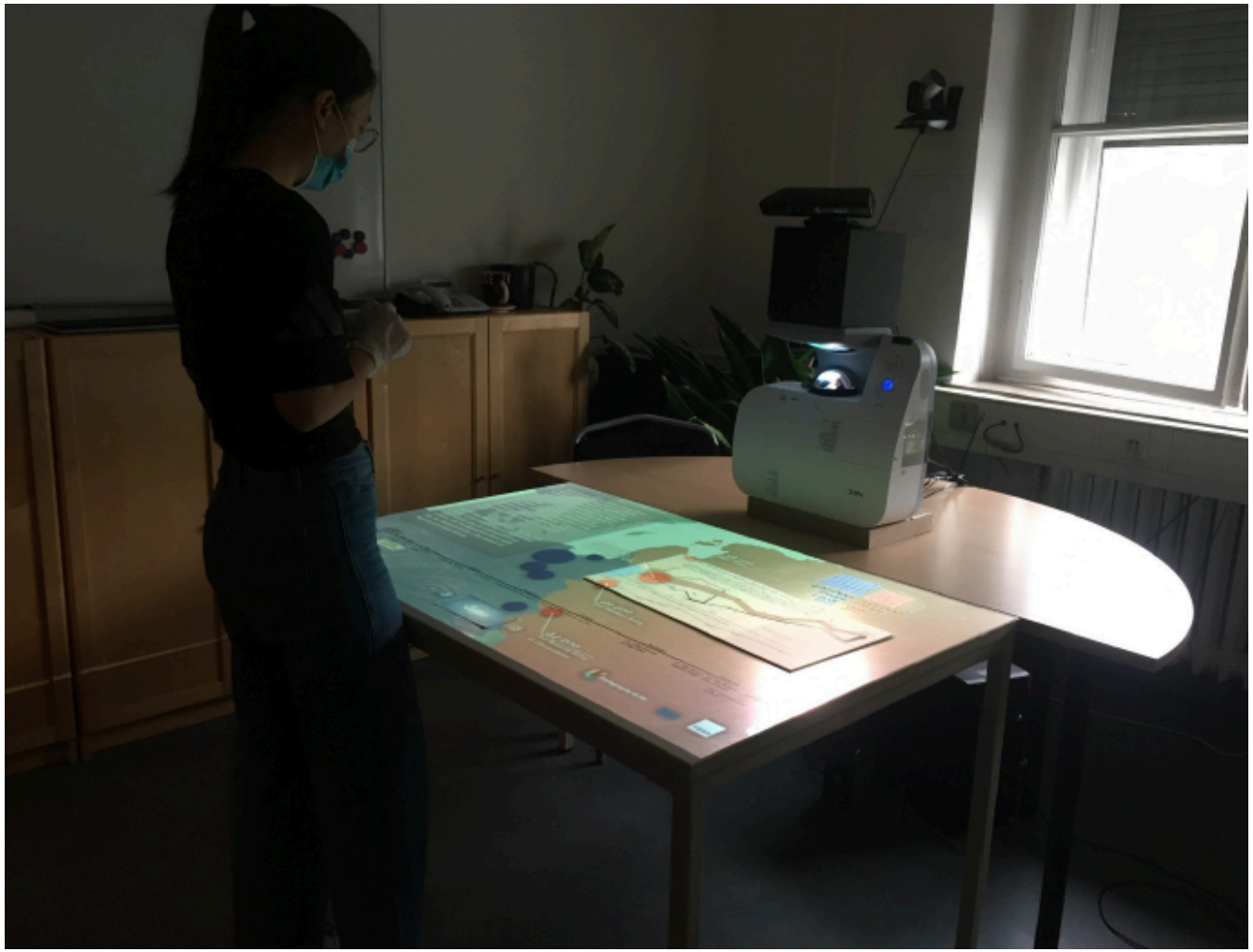
and it’s representation

- Background images
- Text
- Map overview
- Chapters highlight
- Dates
- Maps in the text
- Map overlay
- Troops/battle indicator
- Sound



AR exhibition

Final setup of the AR exhibition prototype

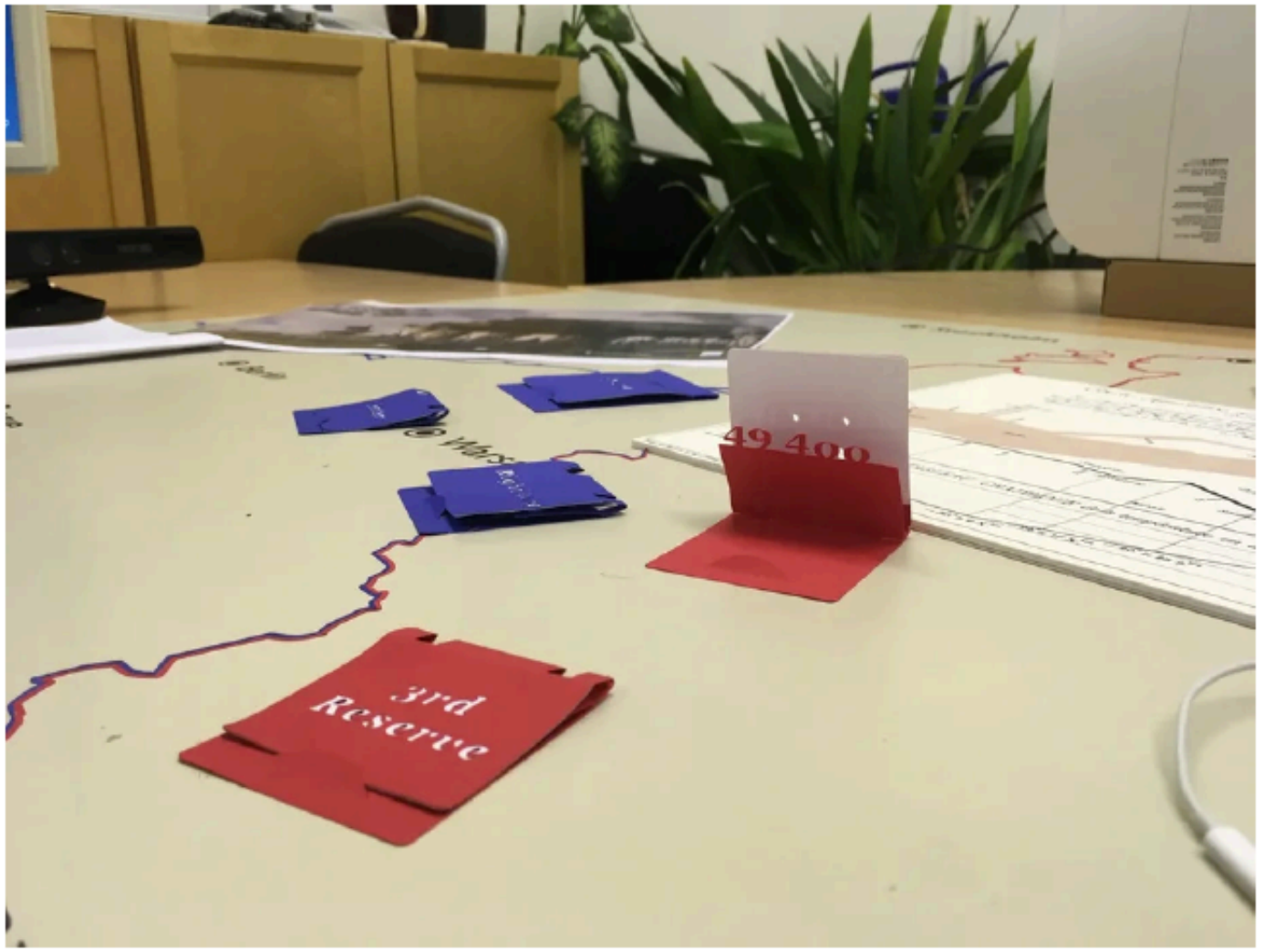


Classical exhibition

- Booklet
- Overview map
- Plastic Minard map overlay
- Pop-up showing armies amount
- Table of contents

Classical exhibition

1. Cutter plotter
2. Paper
3. Foil
4. Glue



Evaluation

25 participants (13 AR + 12 Classical),

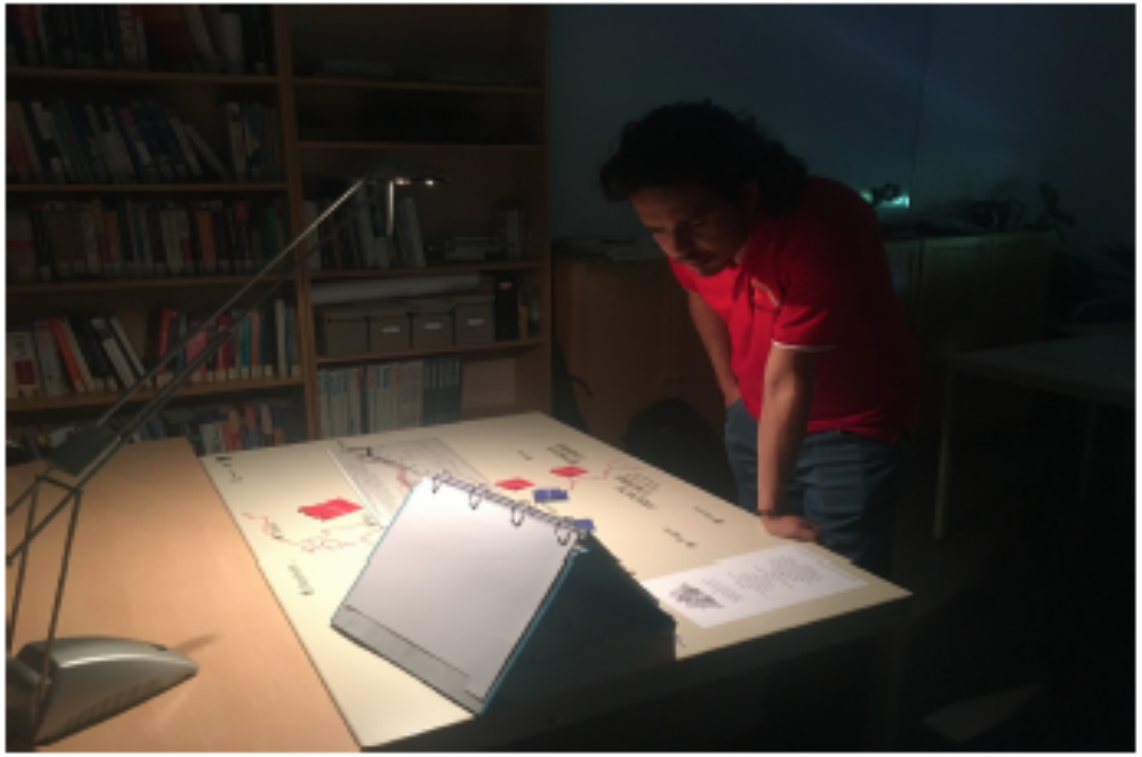
Gender :13/12

Medium age: 21-29

Familiarity with a map

Evaluation

Experiment scenario



Evaluation

Evaluation form

When Napoleon ventured East AR exhibition. User test questionnaire.

I. General info

A. Name: _____

B. Gender:

- ☐ Female
- ☐ Male
- ☐ prefer do not comment

C. Age:

- ☐ 17 or younger
- ☐ 18-20
- ☐ 21-29
- ☐ 30-39
- ☐ 40-49
- ☐ 50-59
- ☐ 60 or older

D. Country of origin : _____

E. Are you familiar with the map of Napoleon's Russian campaign by Charles Minard?

- ☐ never heard about it
- ☐ never seen it
- ☐ quite familiar – have seen it on the lectures/in the media
- ☐ very familiar – I've explored it a lot/ was using in the projects
- ☐ I'm fan - I have poster with it on my wall

II. Please give answers, which you can find in the exhibition materials, to following questions about Napoleon's campaign to Russia

A. What was the amount of troops of French army at:

1. June 1812 _____
2. 16 November 1812 _____
3. 14 December 1812 _____

B. Biggest French army division at June 1812 amount and name

_____

C. Biggest Russian army division at June 1812 amount and name

_____

D. What was the temperature on 1 of December 1812

_____

E. Who is Charles Minard?

_____

F. Where was Napoleon's army located, when the number of troops was 55 000?

_____

G. When and where was the biggest battle of the campaign?

_____

H. When Napoleon's army was indicated on the map with smallest amount?

_____

I. In which month did Napoleon leave for Paris?

_____

J. Who was Fyodor Glinka?

_____

K. When Napoleon arrived at Moscow?

_____

Evaluation

Evaluation form

III. User experience feedback

Please fill this block after you have explored the exhibition and after you have answeried the questions from block II

A.What is your general impresion?

	very	slightly	neither	slightly	very	
I **didn't like** the exhibition						I've **liked** the exhibition
It was **hard** to understand how the interface works and it's logic behind						I've **easily** got the interface and it's logic behind
I think exhibitions like this **can't** be usefull in real museums						I think exhibitions like this **can be** usefull in real museums

B.Please score the different elements of the exhibition

B1. Interface elements: buttons, links to the chapters

	very	slightly	neither	slightly	very	
I **didn't like** the interface						I've **liked** the interface
It was **hard** to understand how to work with this element						It was **easy** to understand how to work with this element
I think this element **can't** be usefull in real museums						I think this element **can** be usefull in real museums

IV.

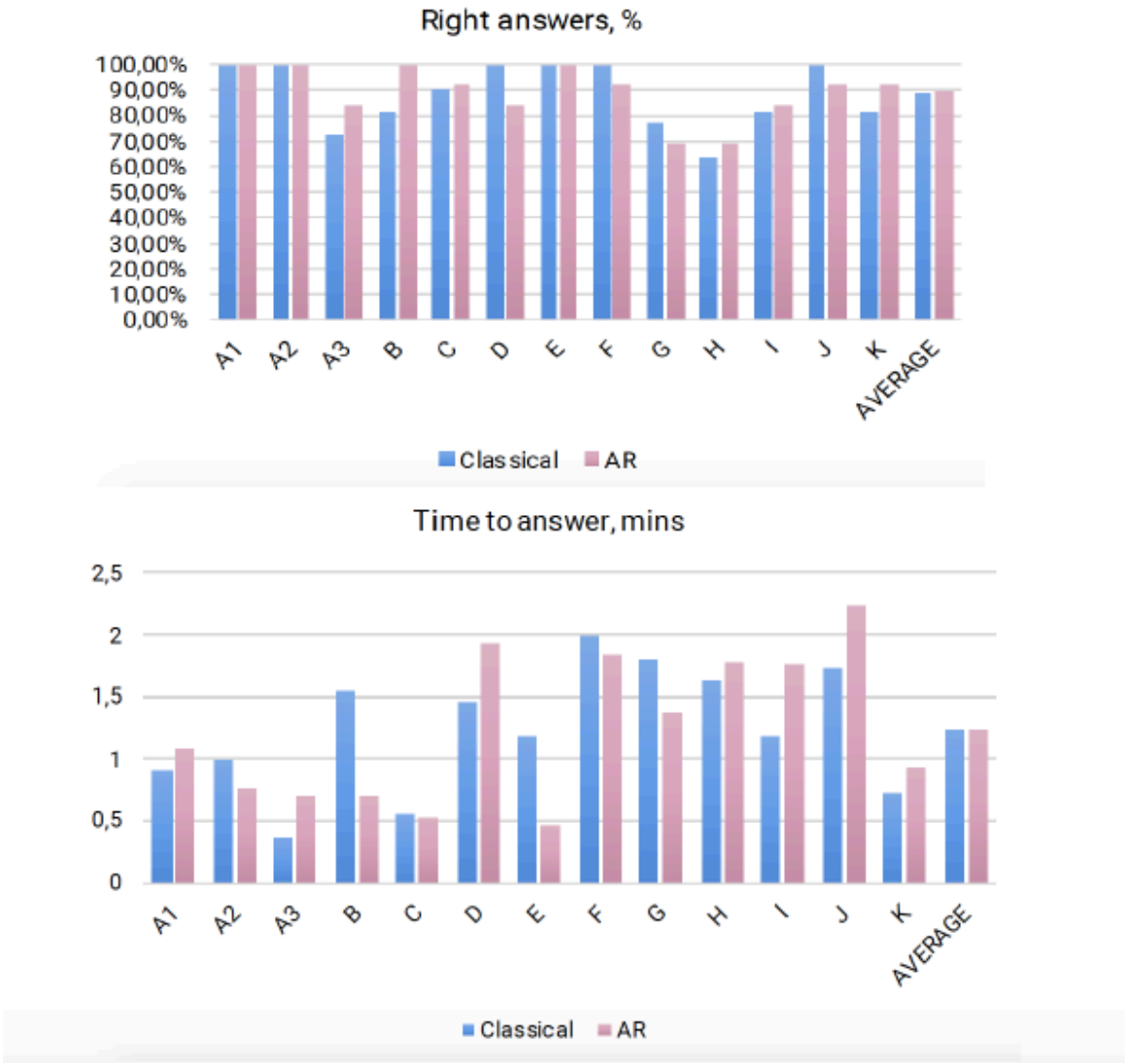
A. Do you have any comments, ideas or advices?

_____

B. If you think exhibitions like that can be useful, what comes to your mind? Which kind of stories could be told in this format_____

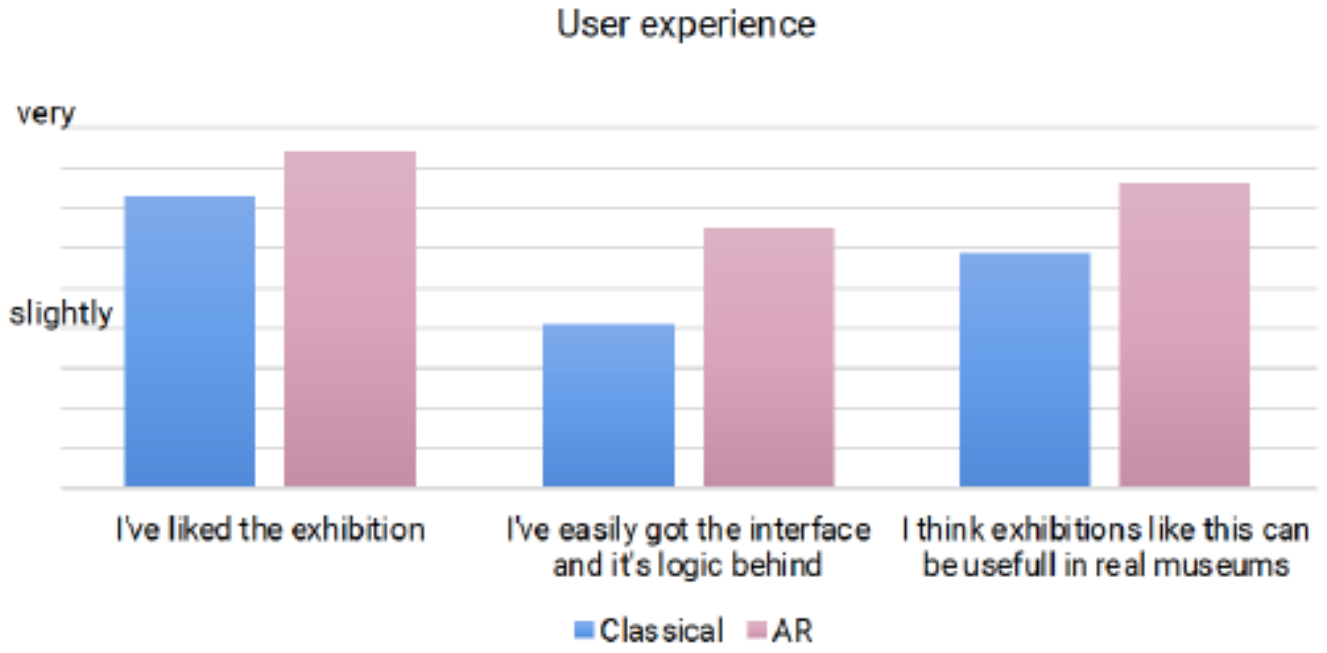
Results

Tasks block evaluation analysis



Results

User experience evaluation analysis



Conclusions and outlook

☑ Hypothesis:

proposed Map-Based Storytelling in Mixed Reality method could enhance user experience: the way of the story exploration will become more entertaining and flexible, and as one of the results, the quality of acquired knowledge will be better than with traditional solutions.

Conclusions and outlook

Research Questions

- ☑ For the proposed method integration of maps in exhibition with the MR method, Spatial AR was chosen as most suitable and entertaining option.
- ☑ The projection of interactive layers can be realized with the creation of Spatial AR in the intersection of the field of view of a depth camera and projector on the table surface with a paper map on it.
- ☑ The users can interact with a touchable flexible interface in Spatial AR. Text, audio, video, overview maps, paper maps with interactive overlays, as well as animations, and other content could be added to a paper map in an exhibition.
- ☑ The method of Map-Based Storytelling in Mixed Reality, as it shows the comparative user experience evaluation, makes storytelling using paper maps more entertaining and is enhancing the potential museums Visitors experience.

Conclusions and outlook

Outlook

- enhanced prototypes

- enhanced experiment: map extent, scale and topic, user groups

- future studies: technologies to compare, content to implement

Thank you
Questions?