

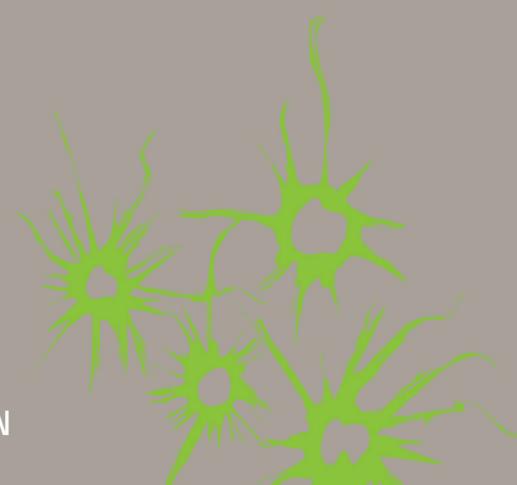
UNIVERSITY OF TWENTE.

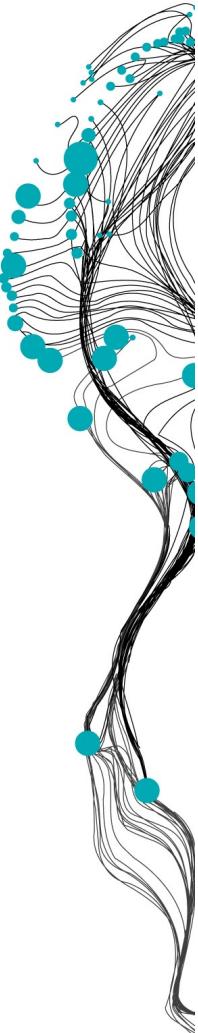
1812  
Mapping time and geovisual analytics

Menno-Jan Kraak



FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION





# 1812 - Mapping time and geovisual analytics

---

- Introduction
- Minard's maps
- Mapping time
- Mapping movements
- Geovisual analytics
- Conclusions

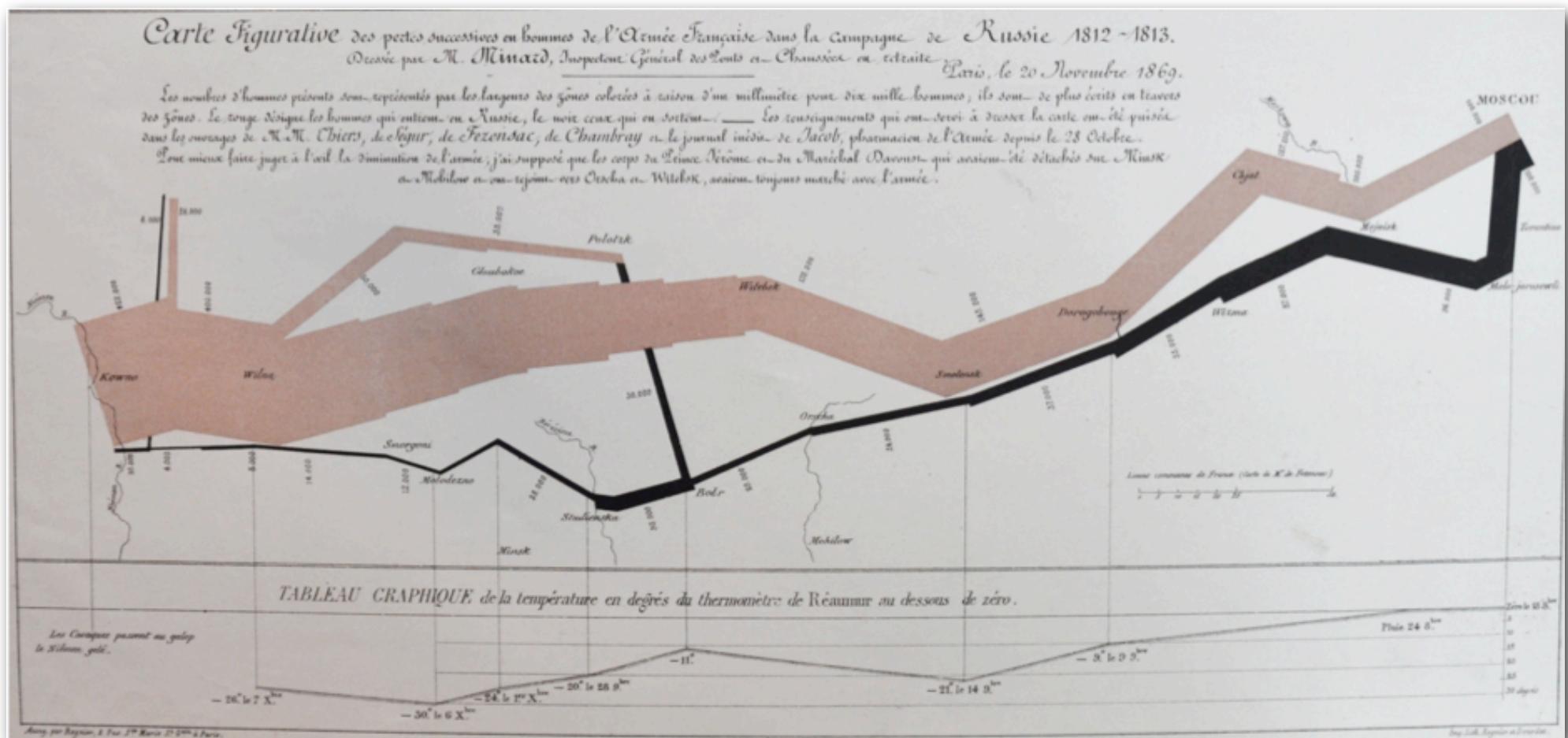


UNIVERSITY OF TWENTE.

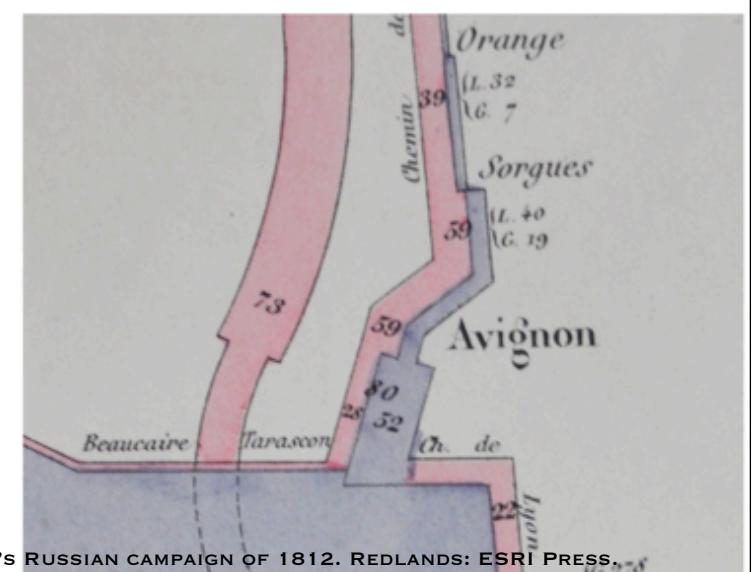
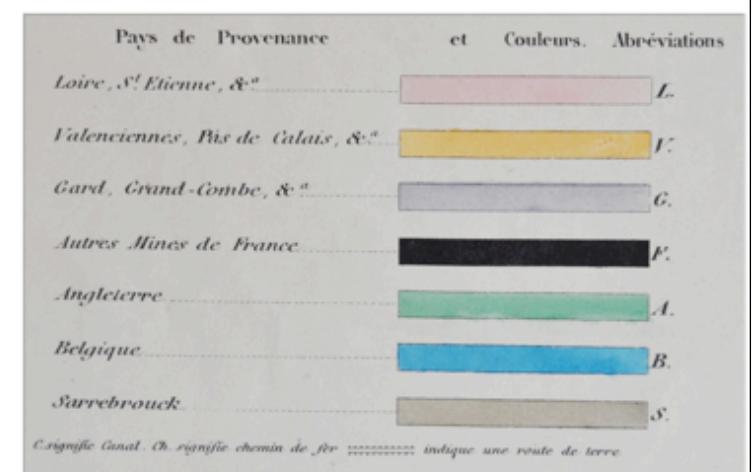
# What if?



# Minard's map of Napoleon's Russian Campaign

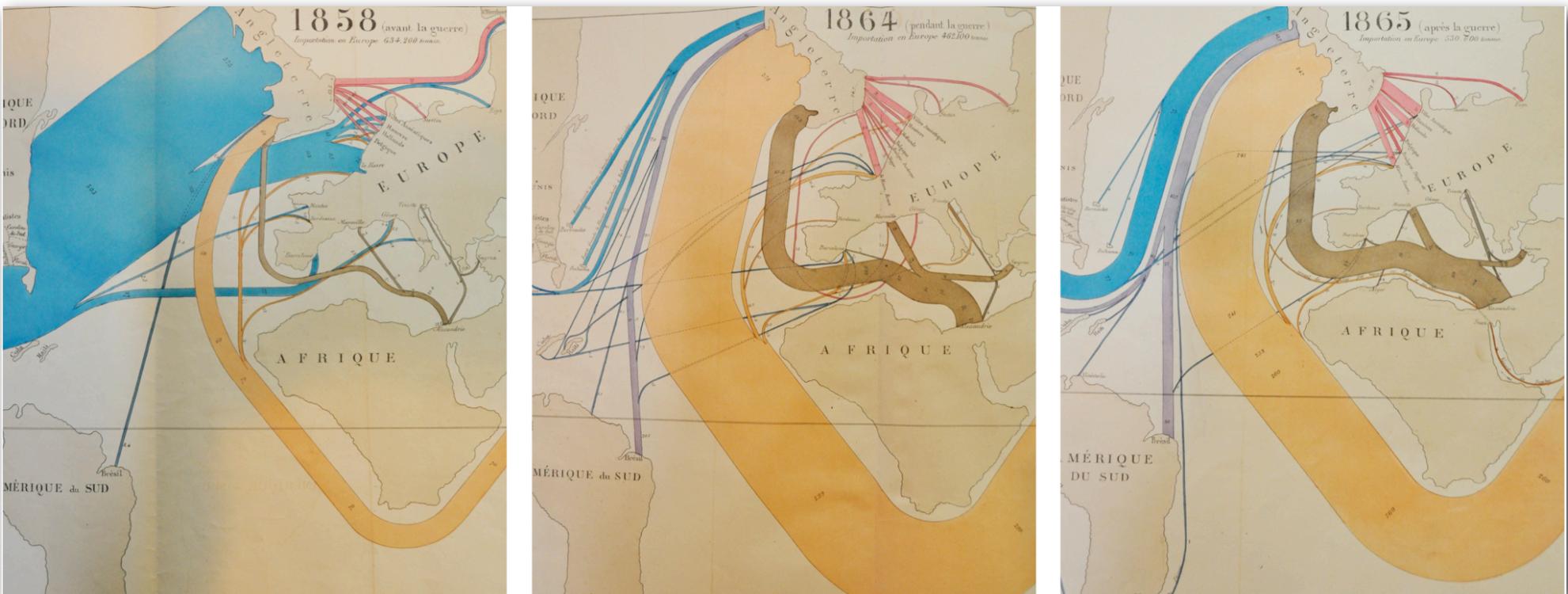


UNIVERSITY OF TWENTE.



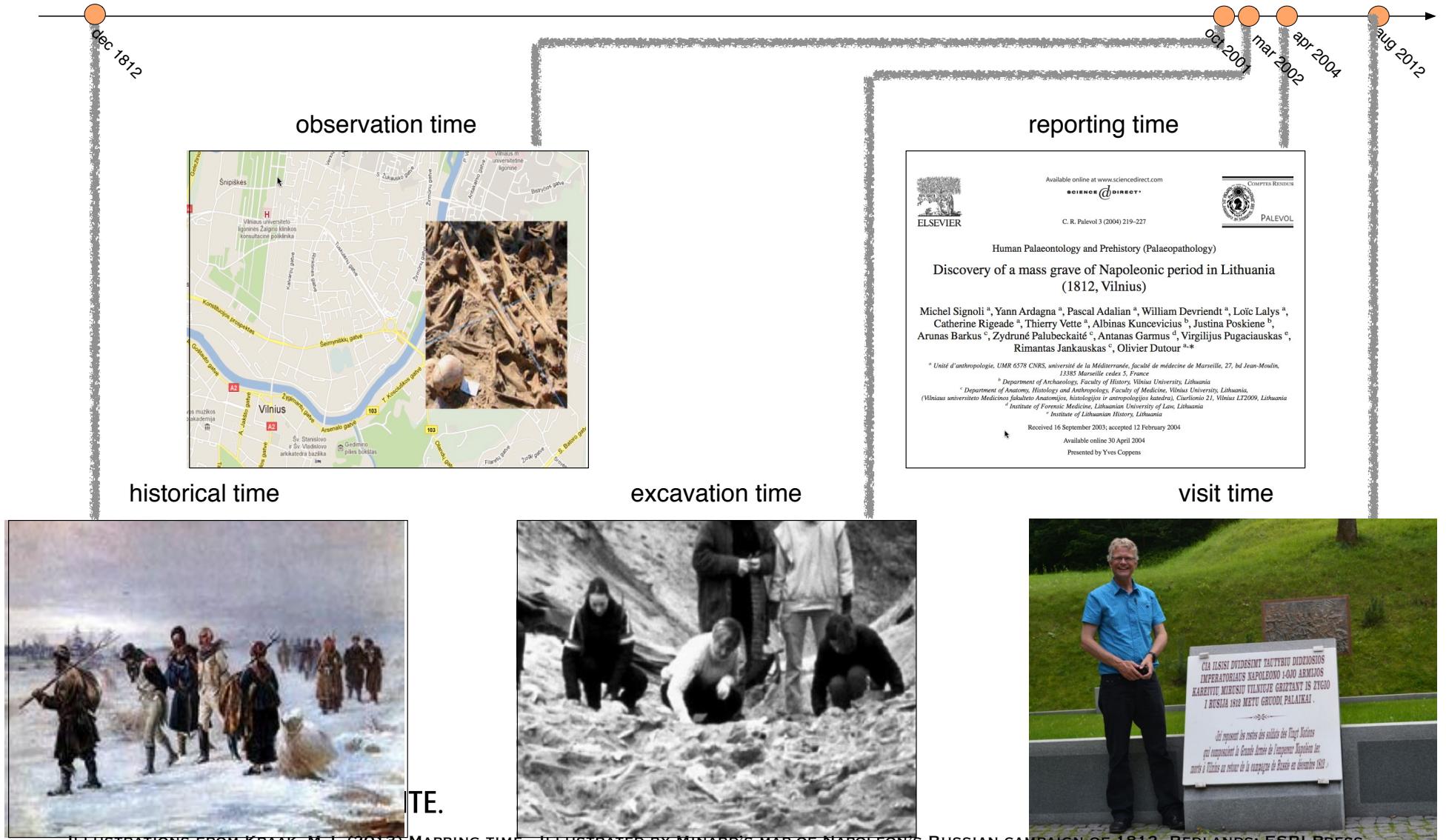
# Time

---

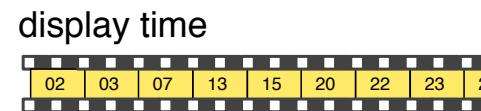
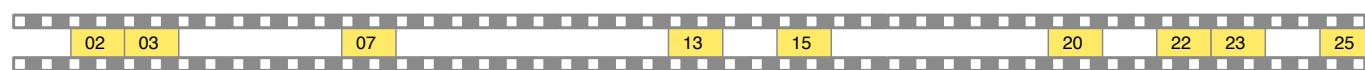
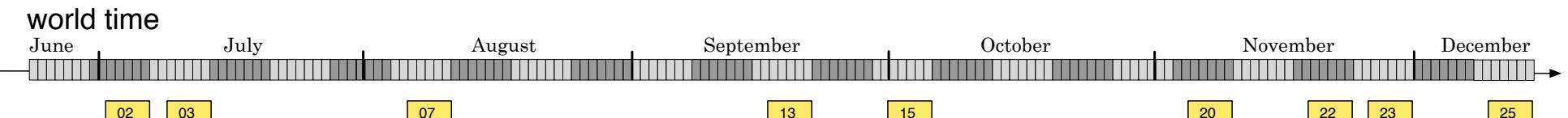
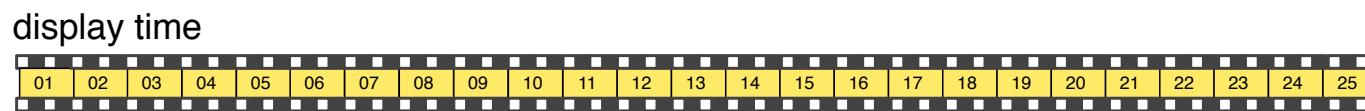
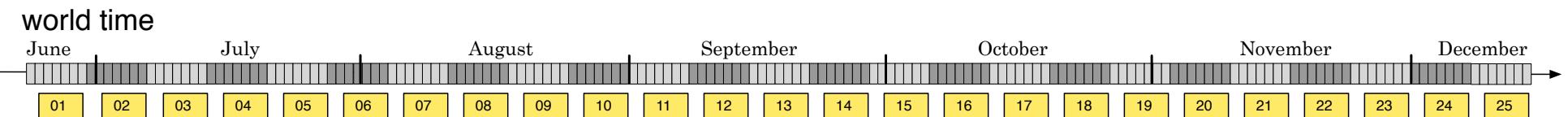


UNIVERSITY OF TWENTE.

# Kinds of time



# Worldtime and display time



# Minard's map and time

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.

Move the mouse on the slider to view  
**Napoleon's Campaigns in Russia**



UNIVERSITY OF TWENTE.

# Question and time

WHETHER THE EVENT TOOK PLACE?



WHEN DID NAPOLEON DEPART FROM MOSCOW?



HOW OFTEN DID THE TROOPS ATTACK BEFORE THEY CAPTURED THE CITY?



HOW LONG DID IT TAKE TO TRAVEL FROM SMOLENSK TO MOSCOW?



HOW FAST DID THE DIFFERENT CORPSES TRAVEL BETWEEN ORCHA AND BOBR?



IN WHAT ORDER DID THE CORPSES I AND II ARRIVE AT BORODINO?

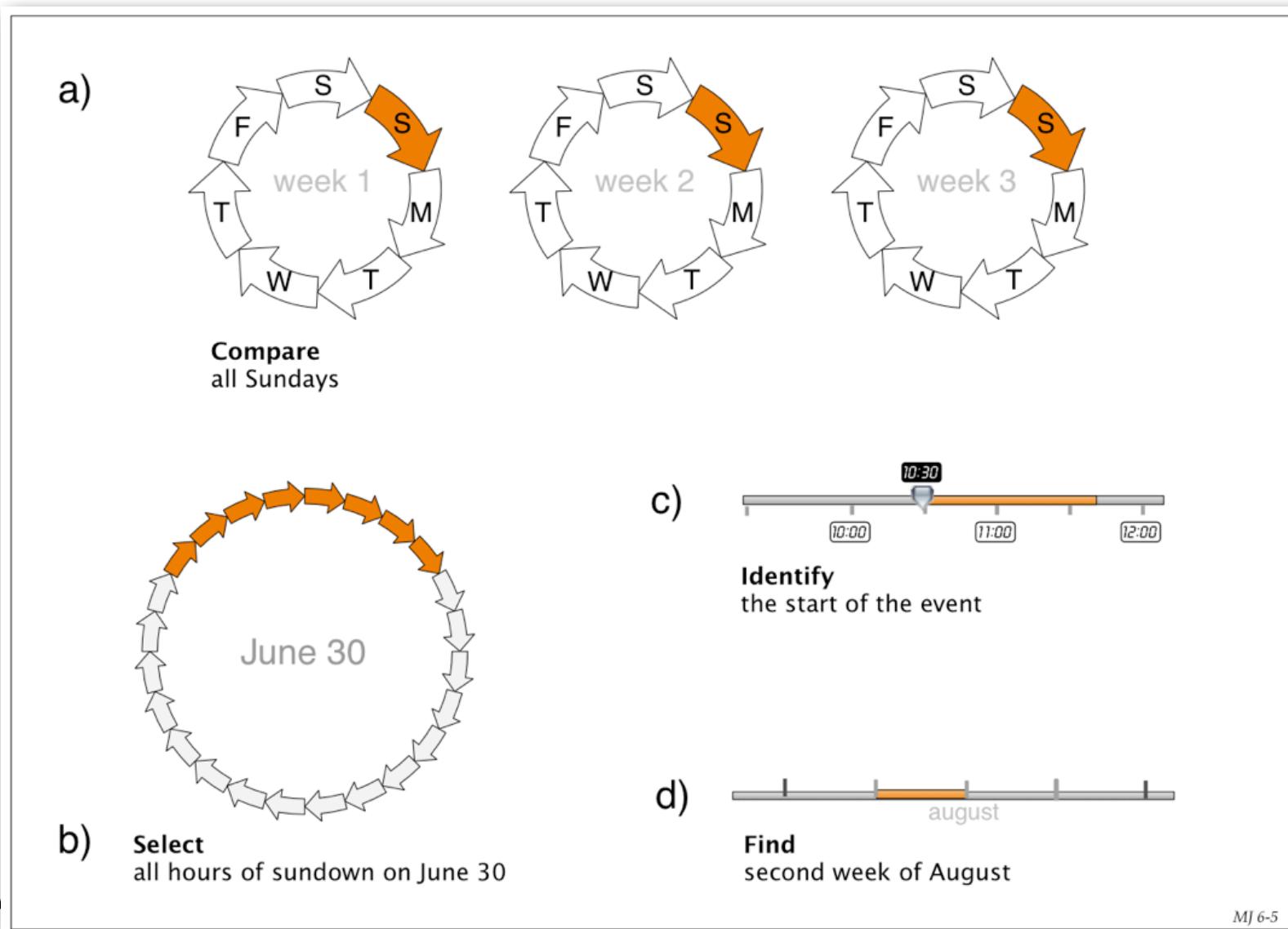


MJ 3-11

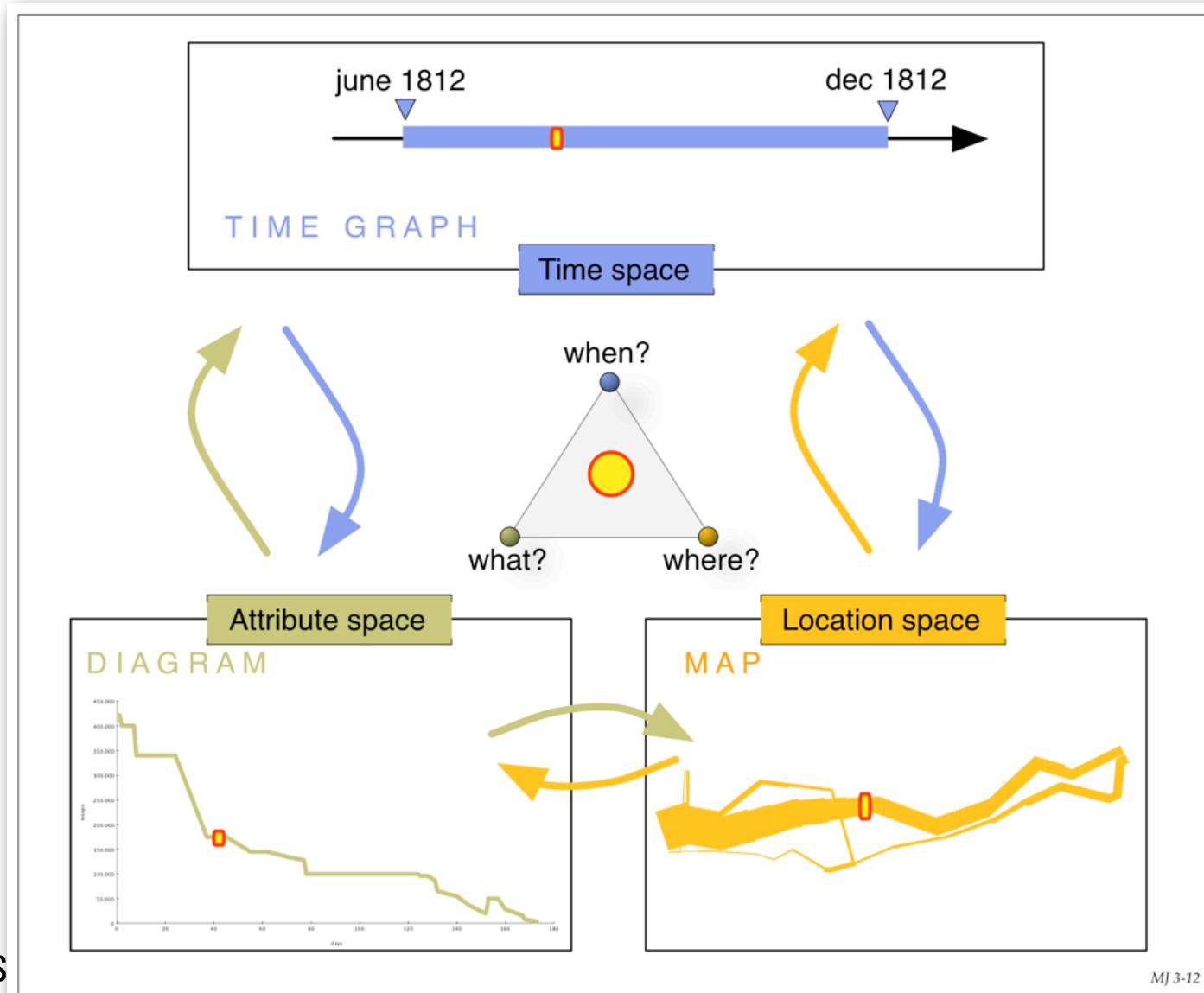


UNIVERSITY OF TWENTE.

# Temporal actions



# At work with spatio-temporal data: coordinated multiple views



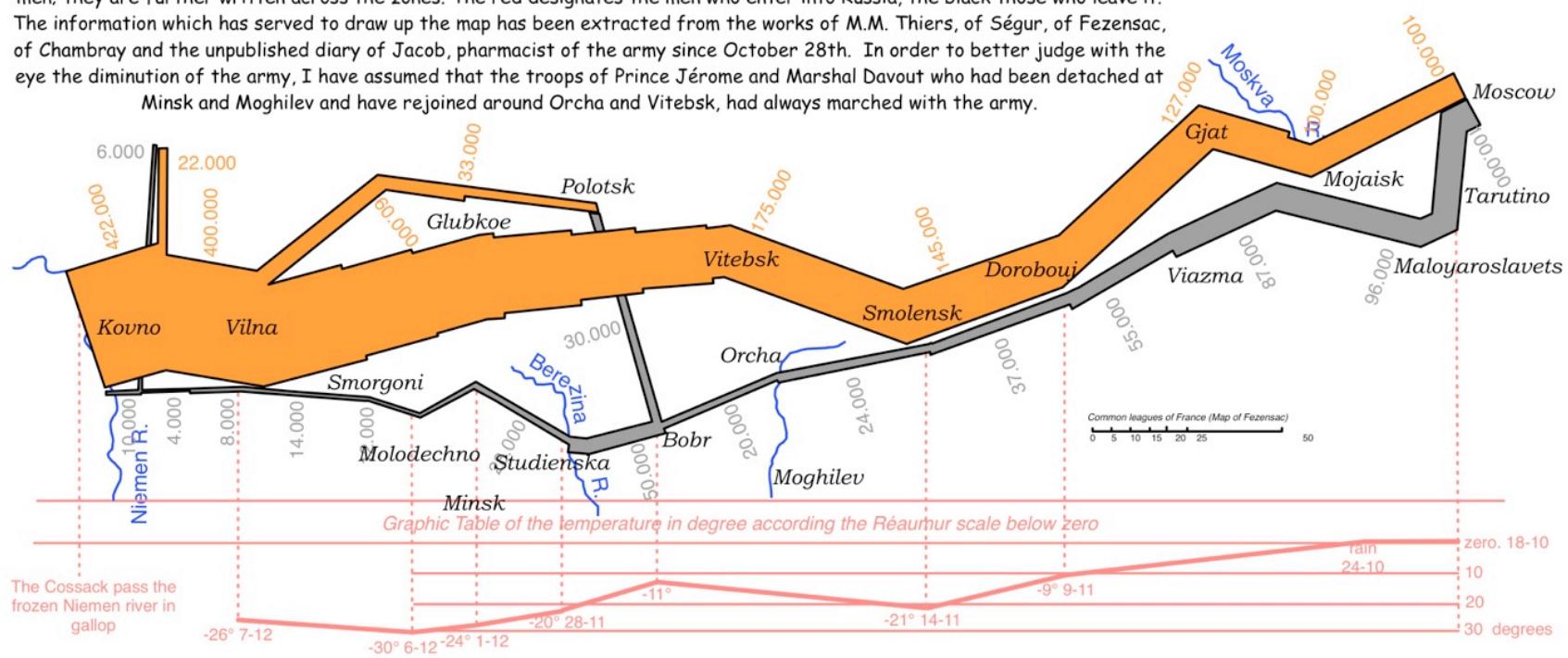
# The Map, 1869

**Figurative Map of the successive losses of men of the French army during the Russian Campaign 1812-1813**

Drawn by M. Minard, Inspector General of Bridges and Roads in retirement.

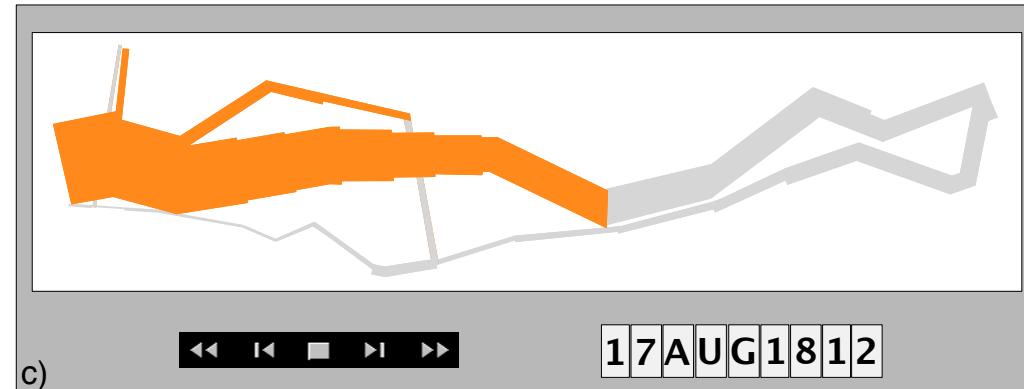
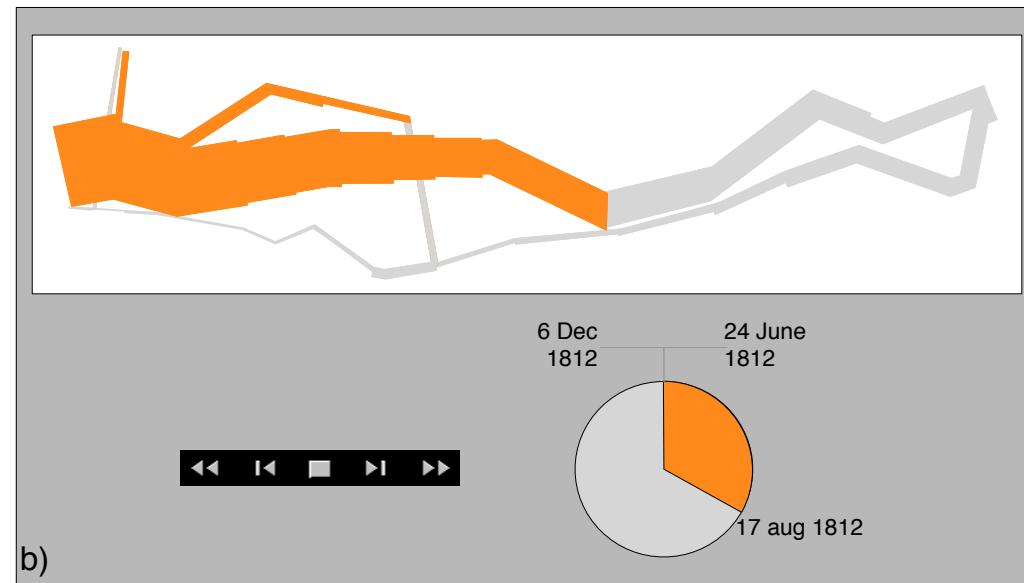
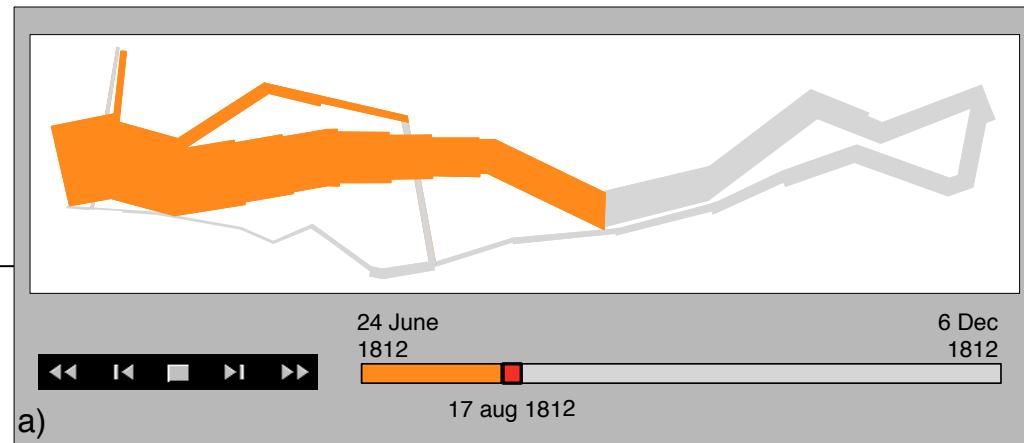
Paris, November 20, 1869

The number of men present are represented by the width of the colored zones at a rate of one millimeter for every ten thousand men; they are further written across the zones. The red designates the men who enter into Russia, the black those who leave it. The information which has served to draw up the map has been extracted from the works of M.M. Thiers, of Séjur, of Fezensac, of Chambray and the unpublished diary of Jacob, pharmacist of the army since October 28th. In order to better judge with the eye the diminution of the army, I have assumed that the troops of Prince Jérôme and Marshal Davout who had been detached at Minsk and Moghilev and have rejoined around Orcha and Vitebsk, had always marched with the army.

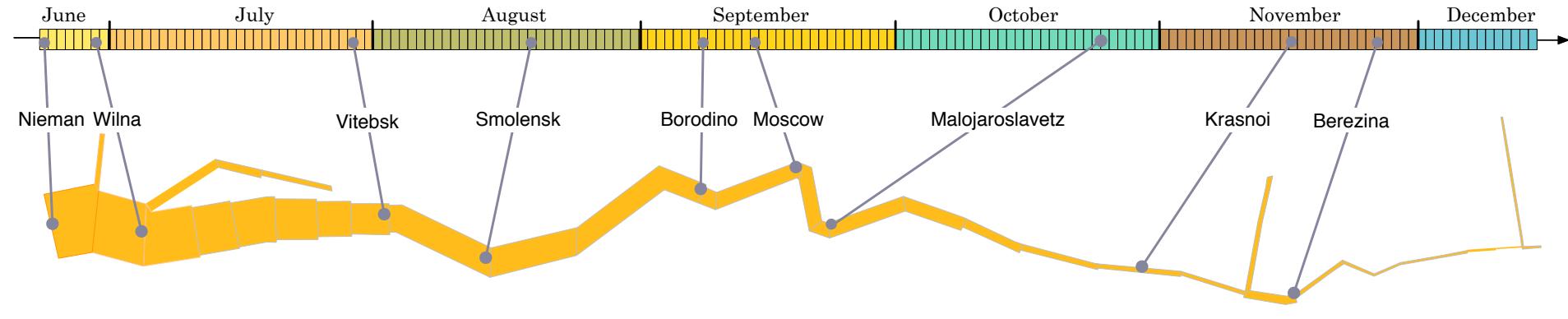


UNIVERSITY OF TWENTE.

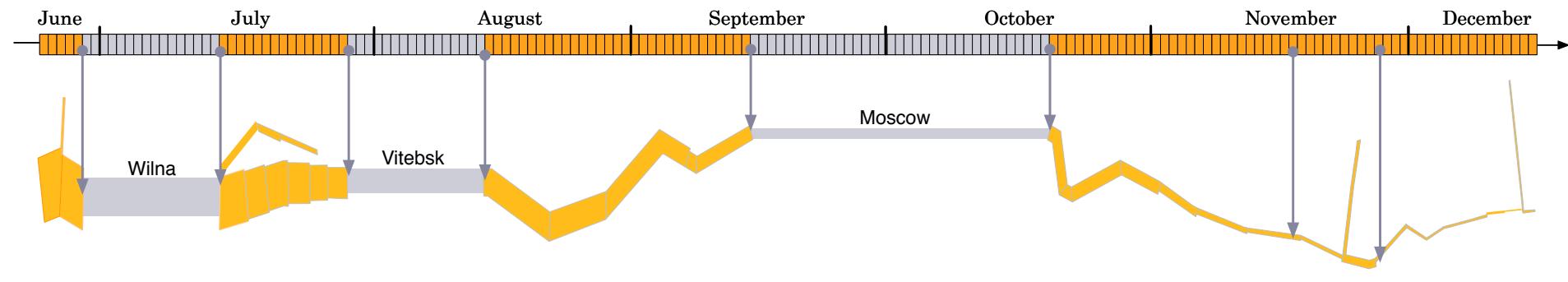
# Map time



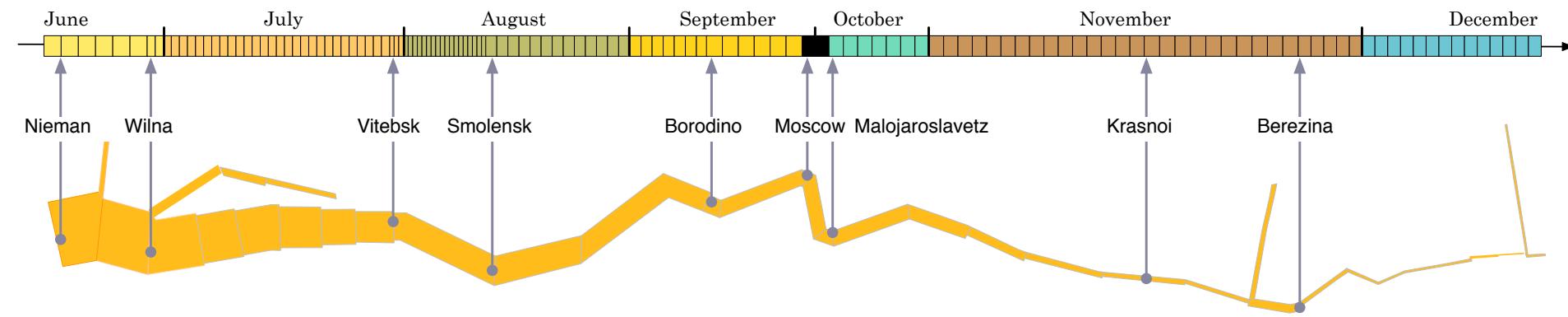
### a) Time and geography



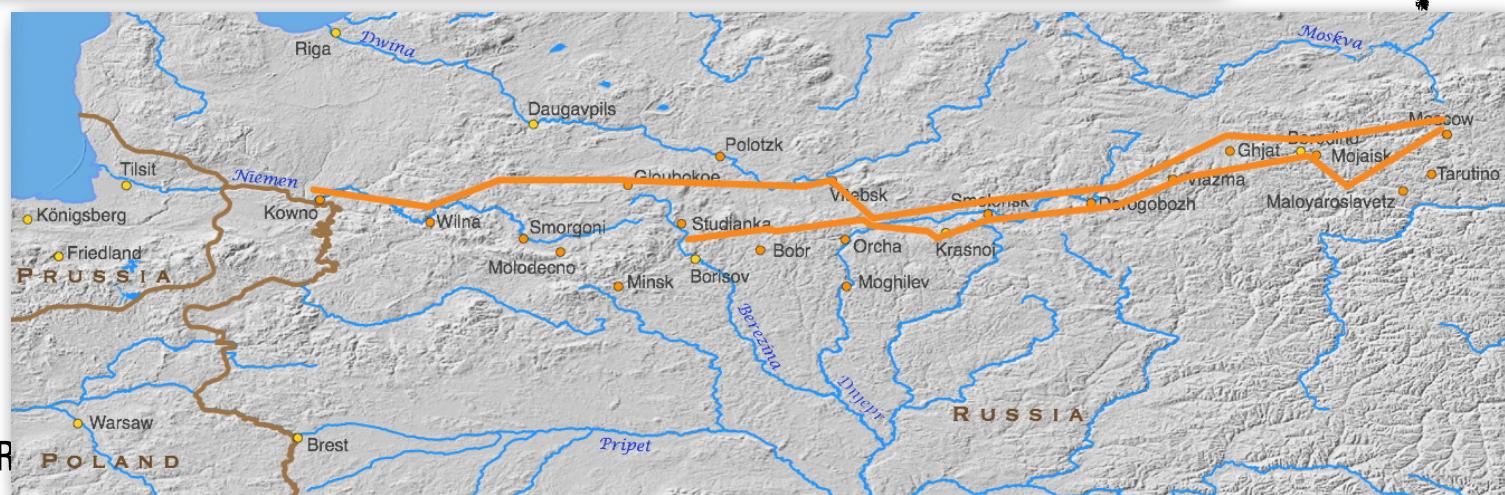
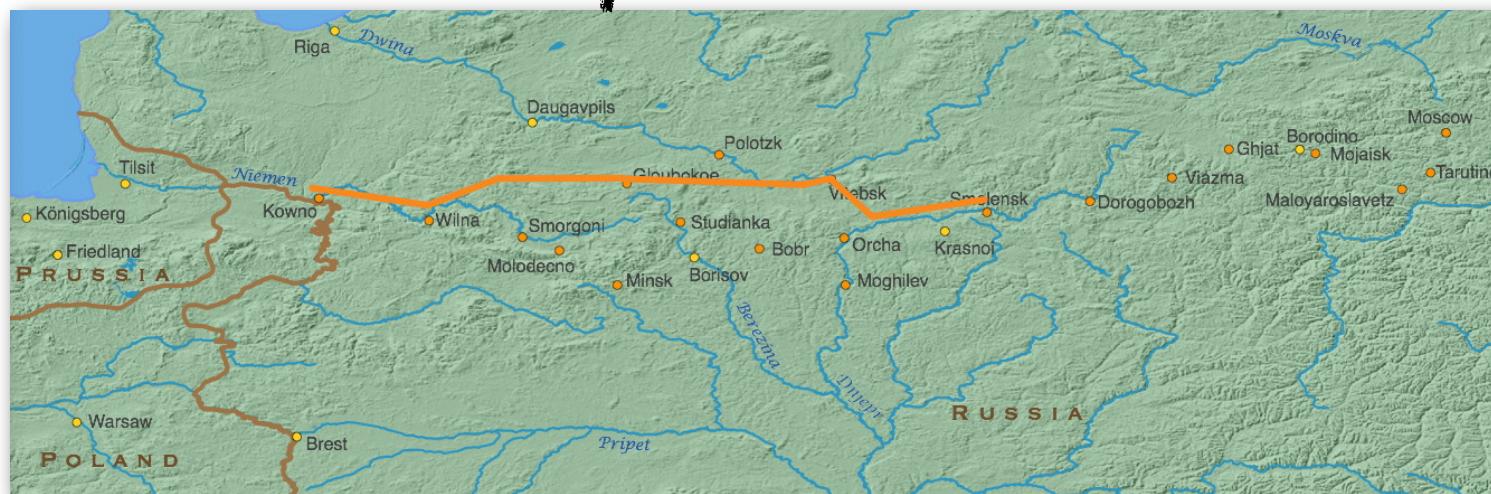
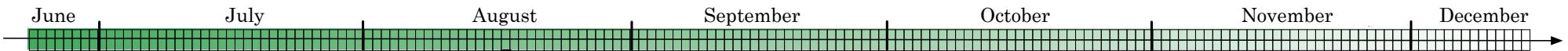
### b) From time to geography



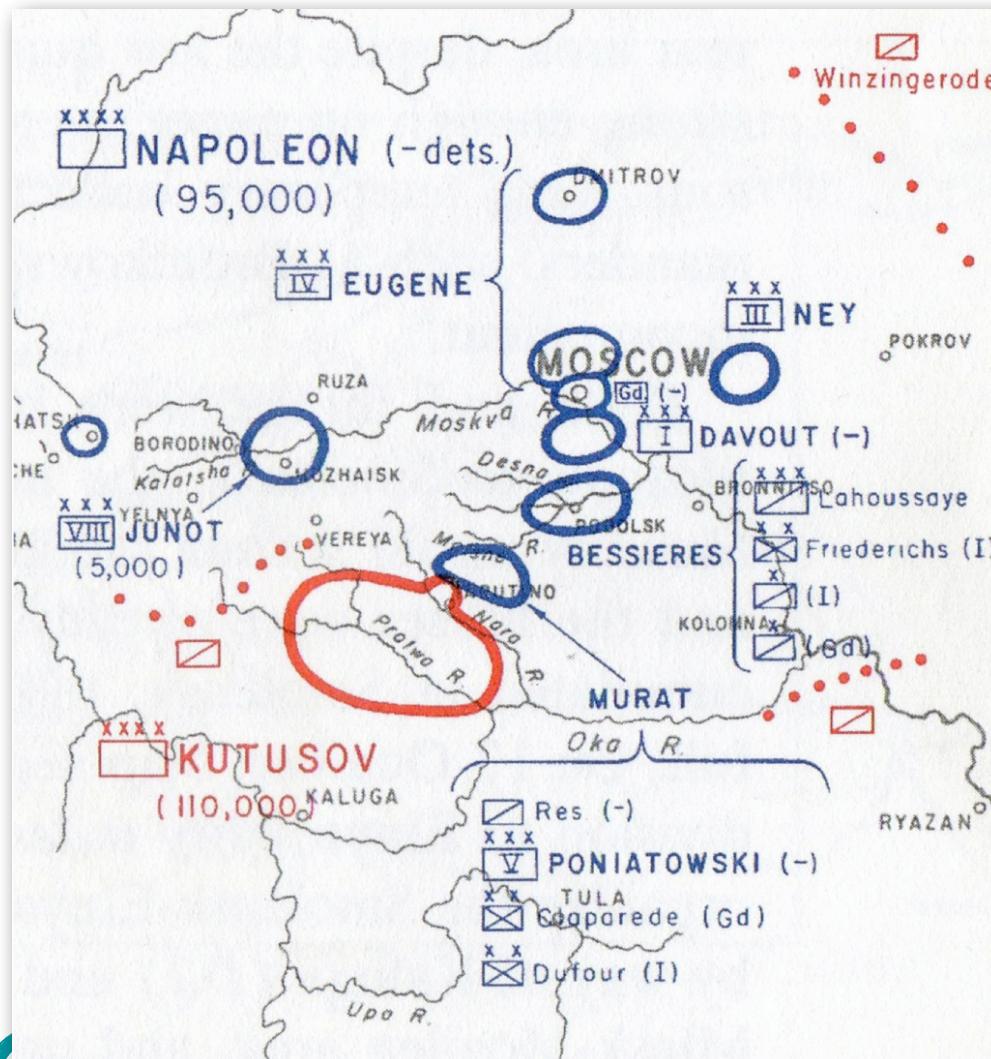
### c) From geography to time



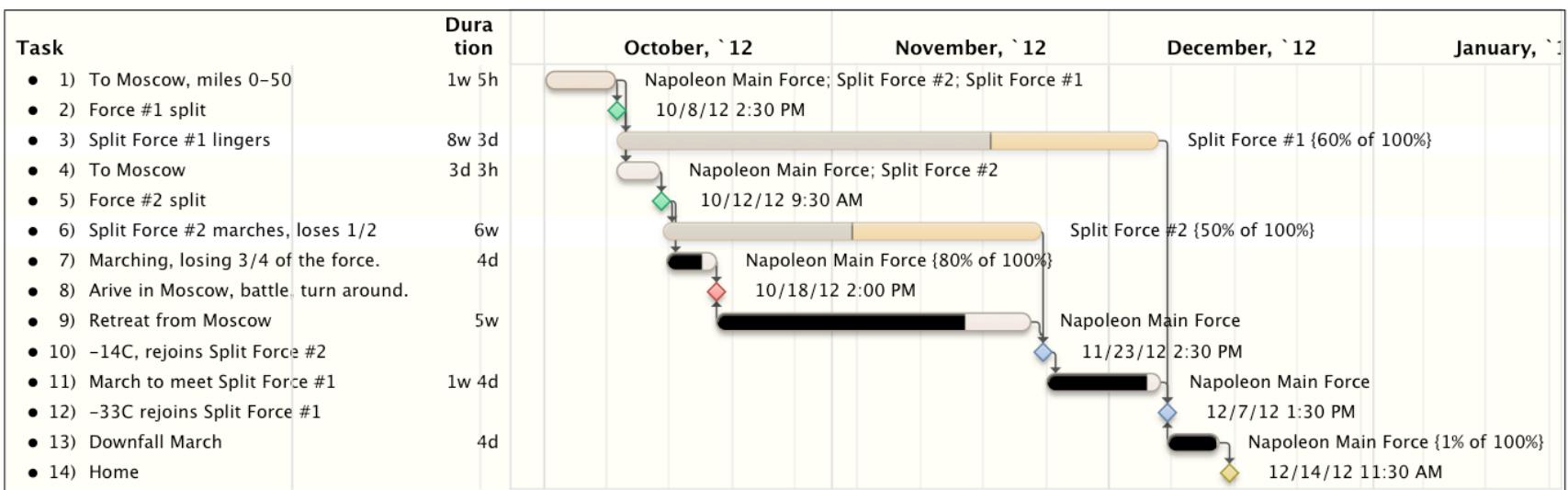
# Summer and winter time



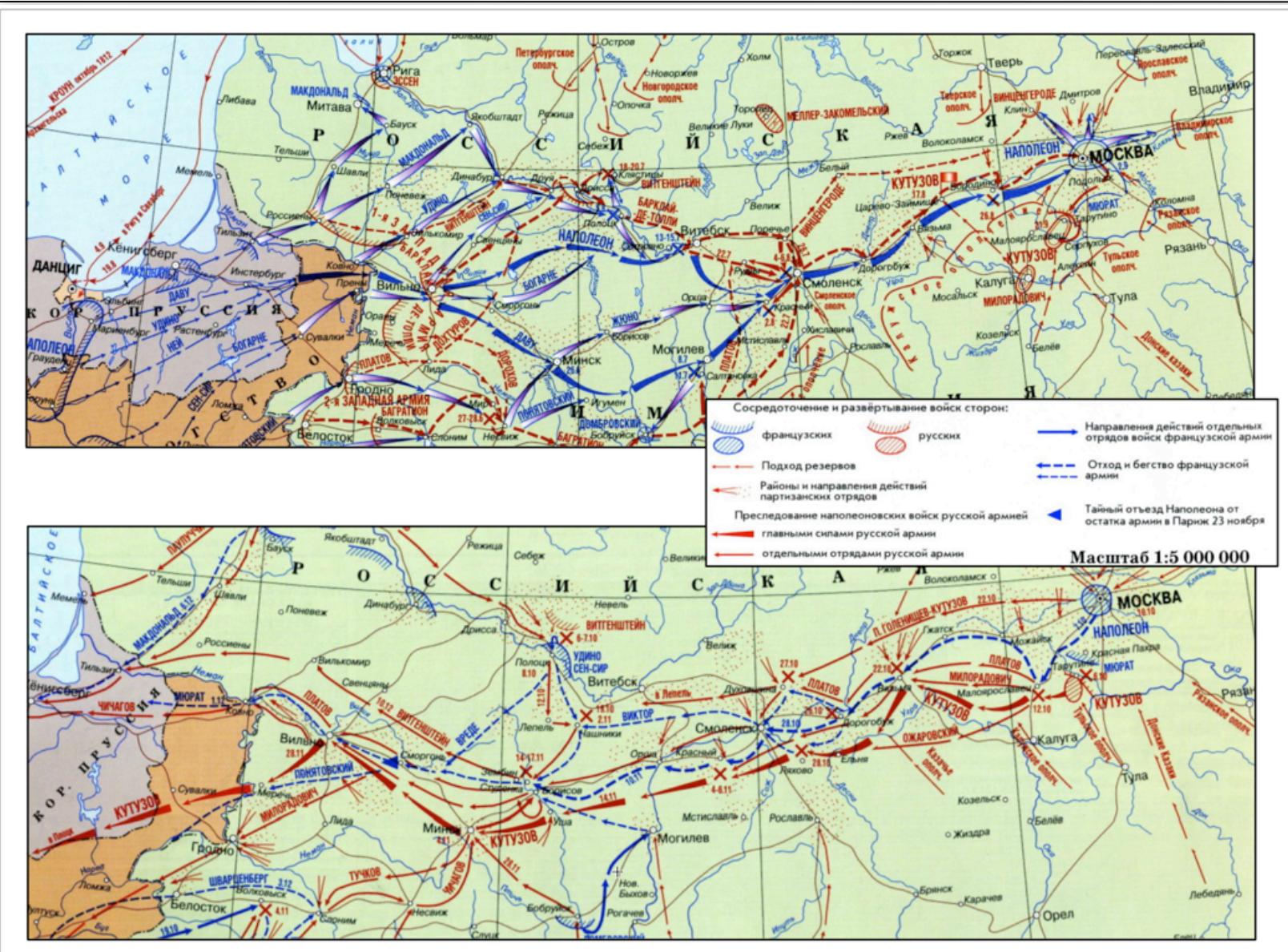
# Alternative views



# Alternative perspectives



# Russian perspective



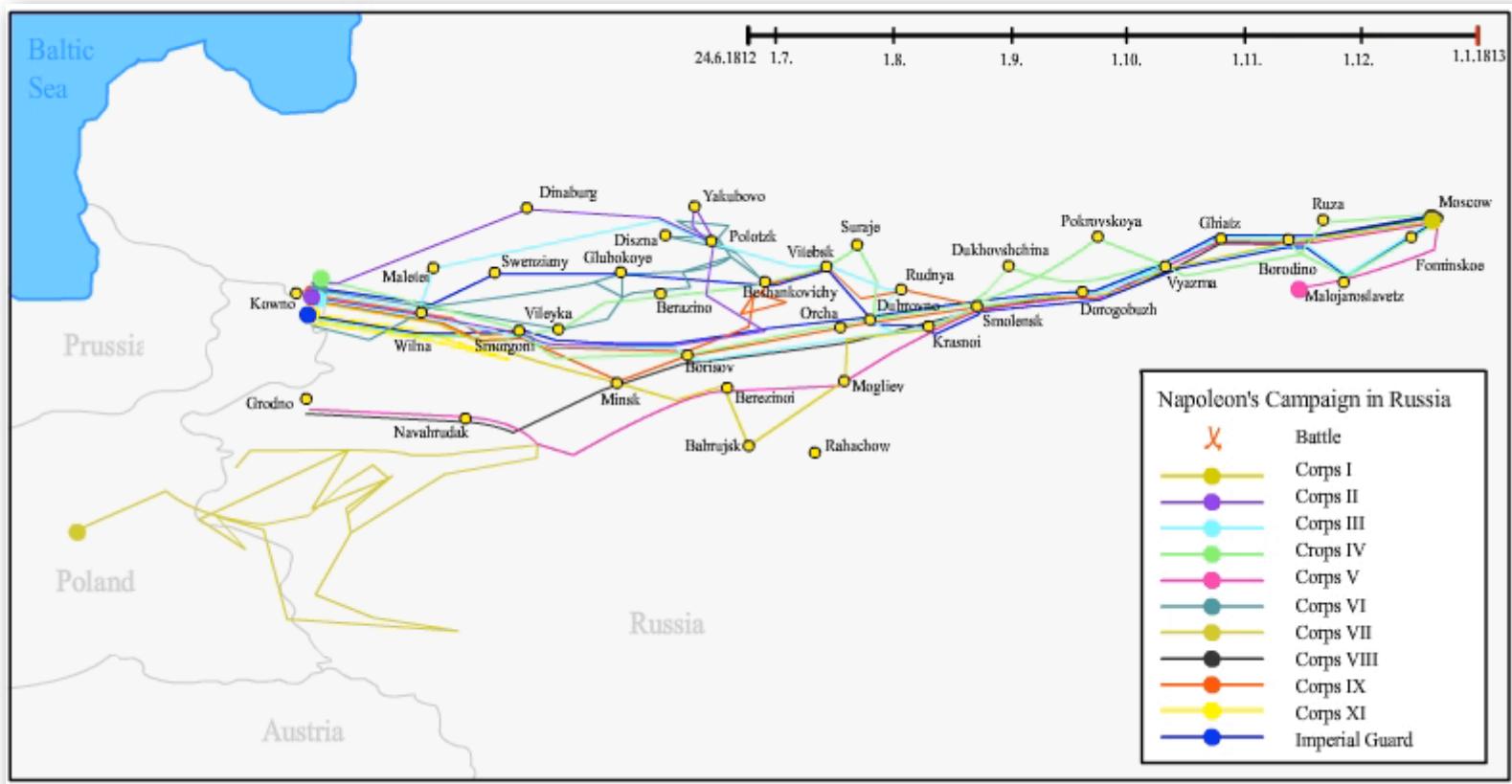
# Napoleon's army



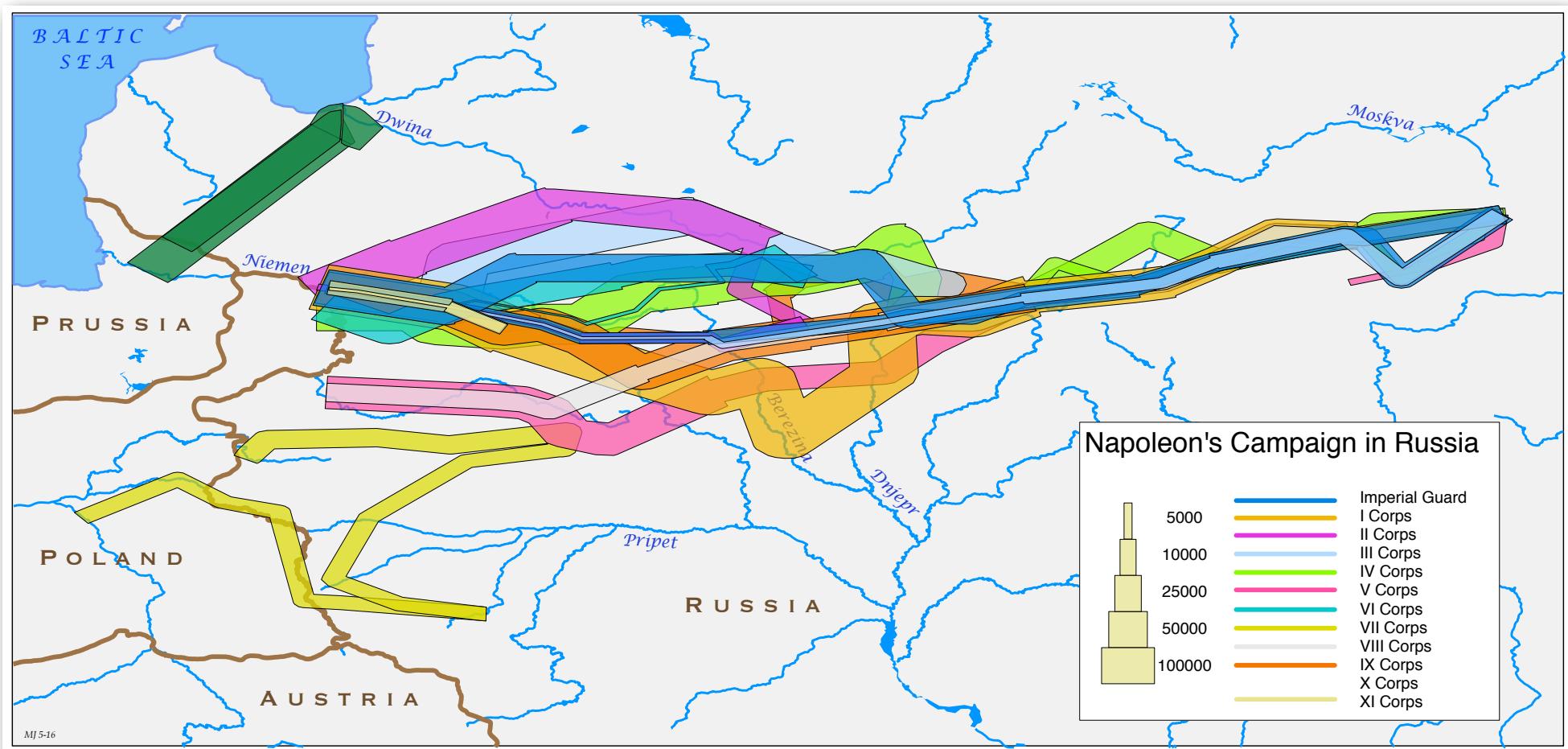
UNIVERSITY OF TWENTE.

ILLUSTRATIONS FROM KRAAK, M.J. (2013) MAPPING TIME - ILLUSTRATED BY MINARD'S MAP OF NAPOLEON'S RUSSIAN CAMPAIGN OF 1812. REDLANDS: ESRI PRESS.

# Movements of the Grand Armee

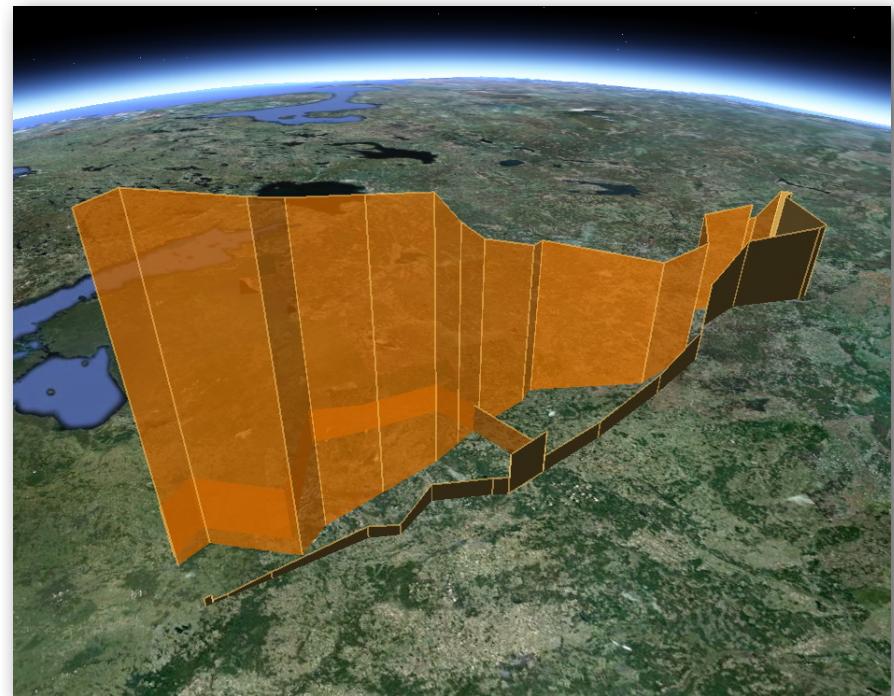
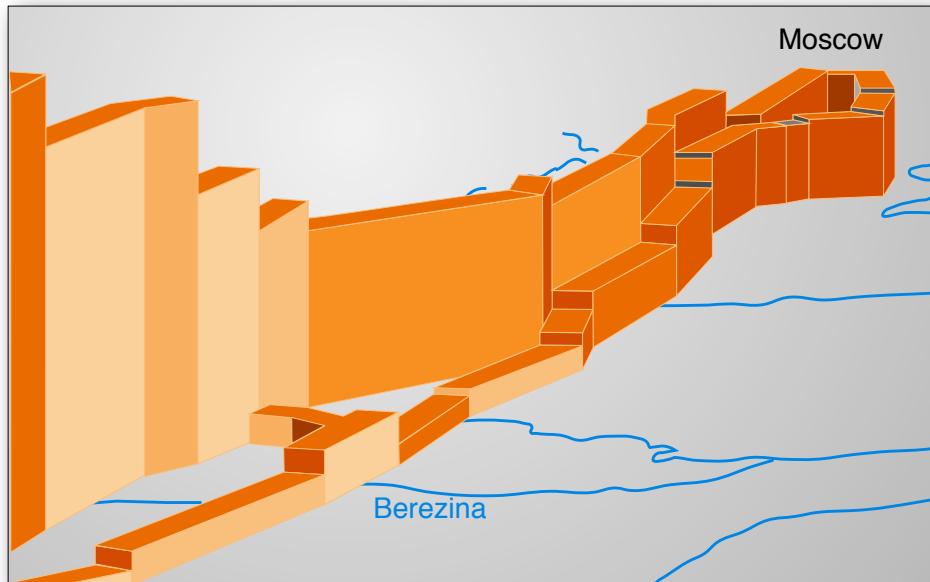


# Napoleon's armies



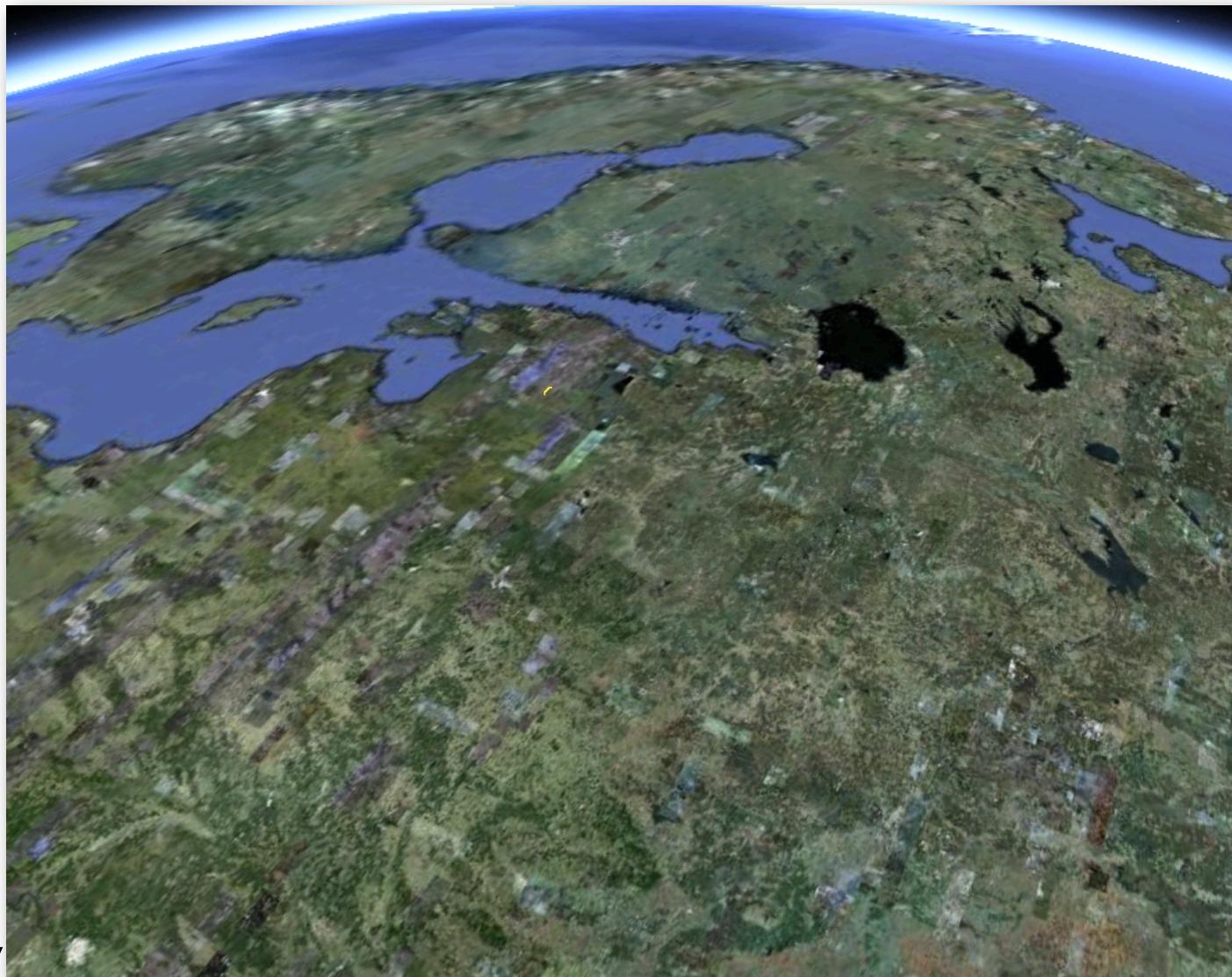
## 3D view

---



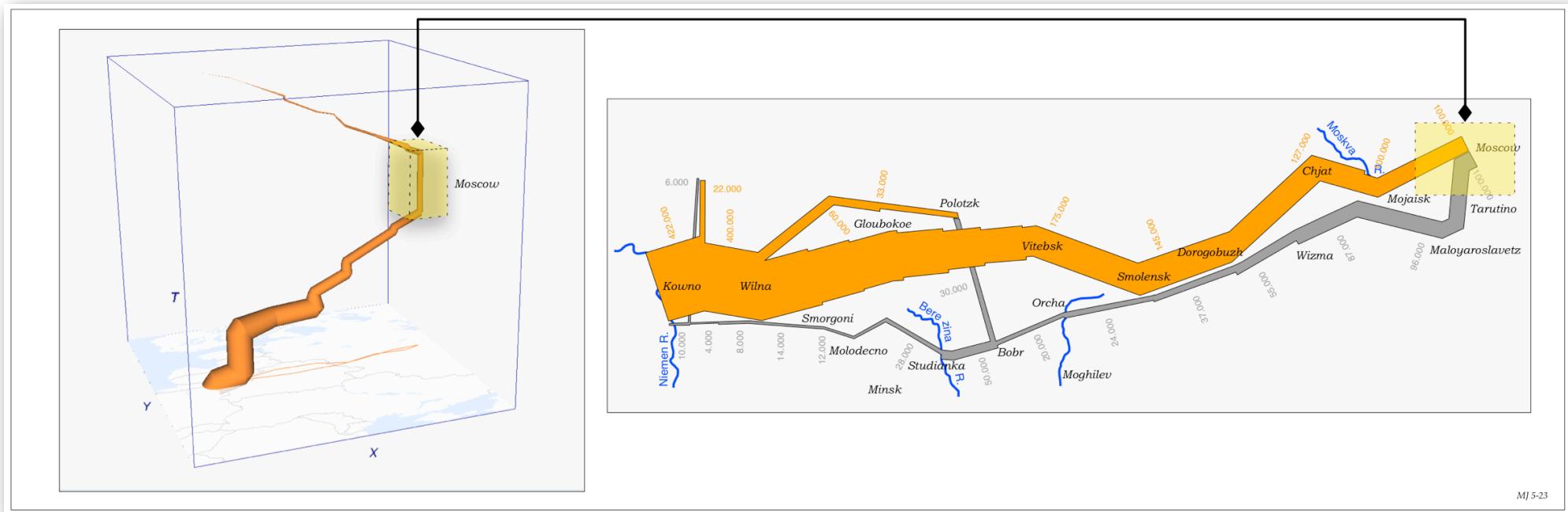
# Minard & Google Earth

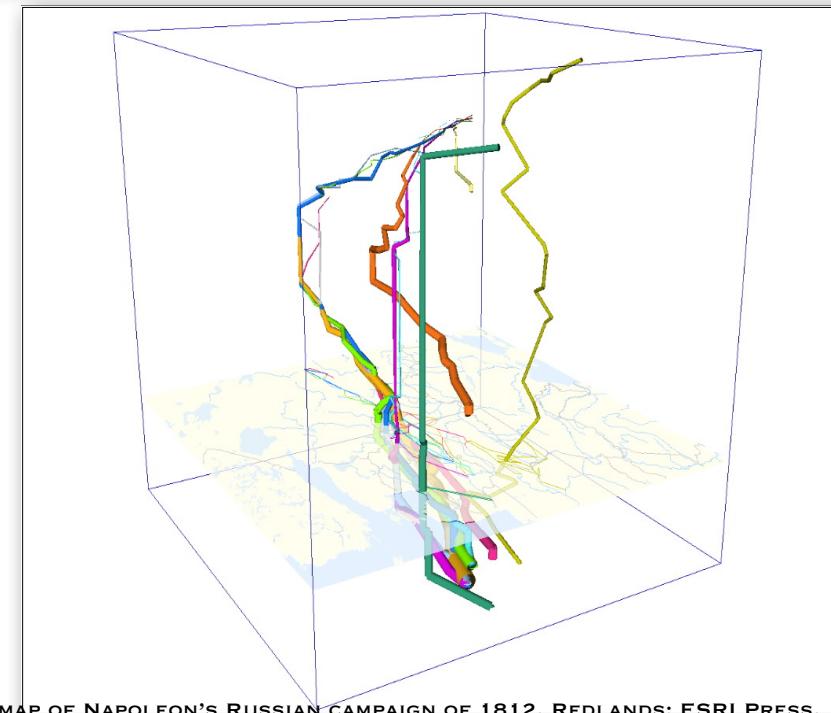
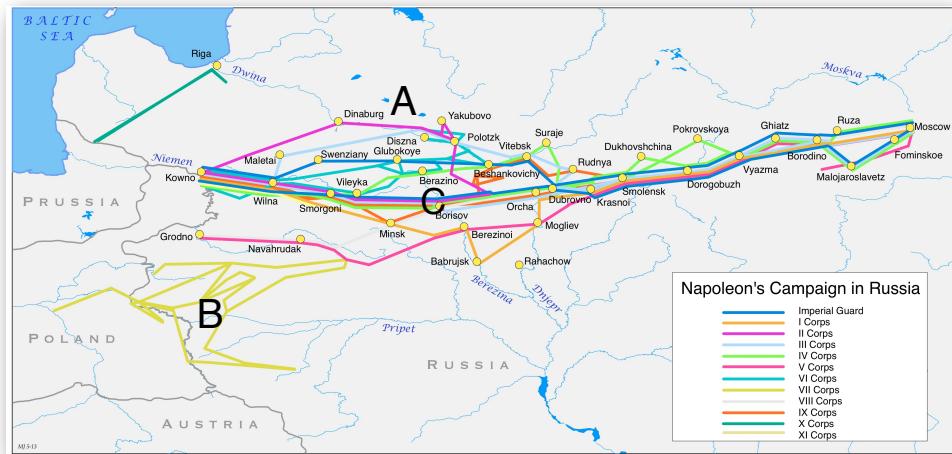
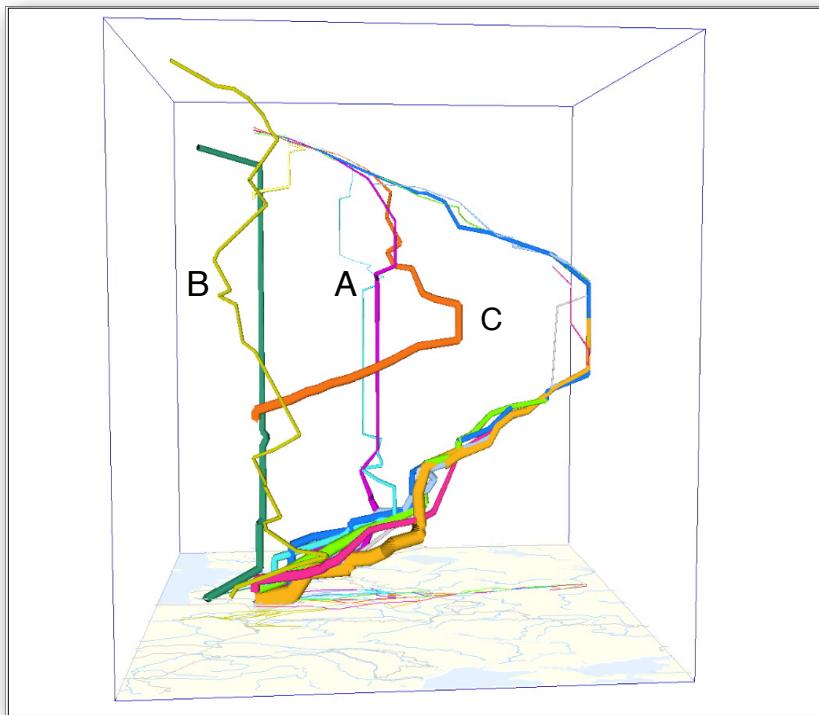
---



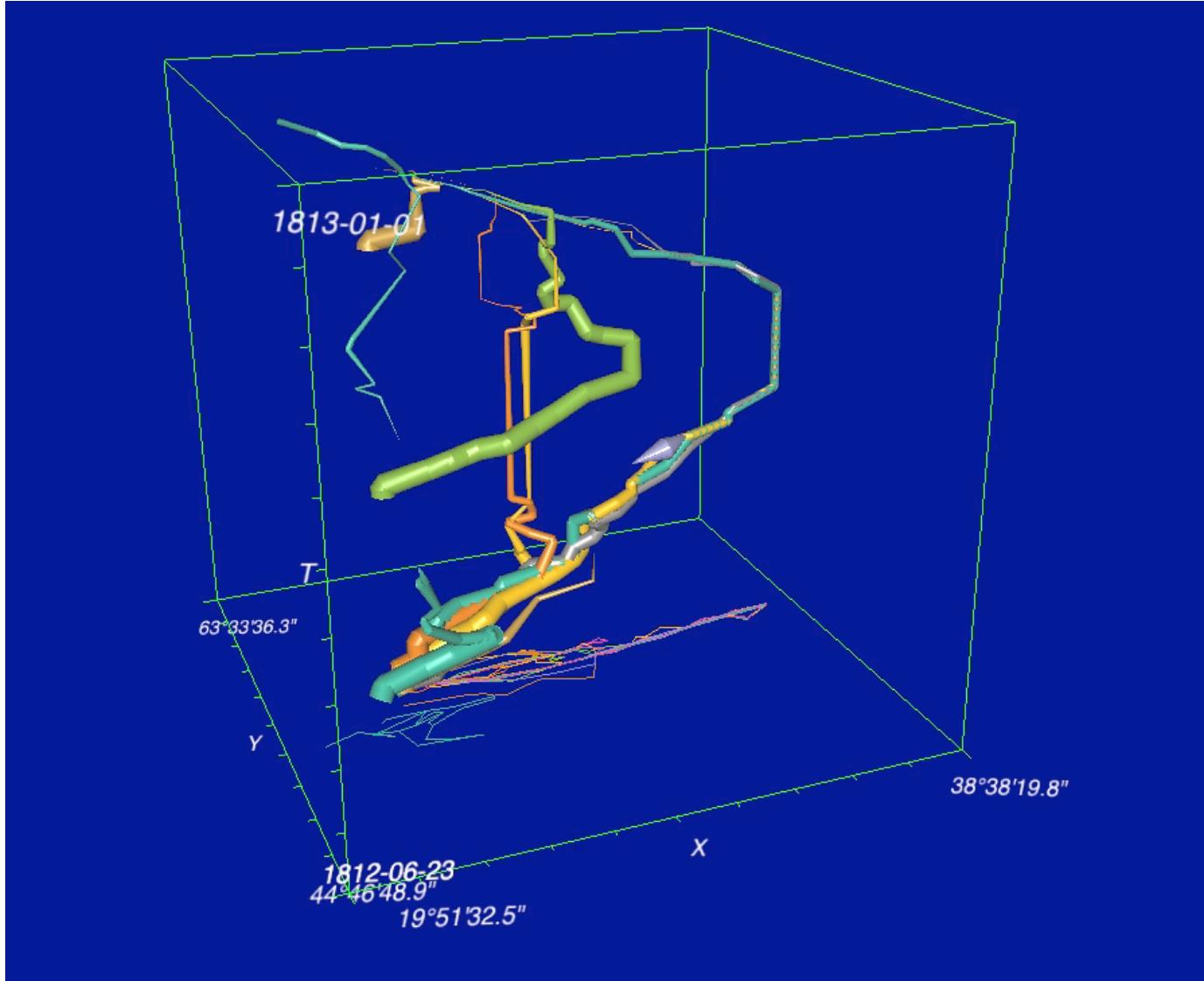
UNIVERSITY

# Ruimte en tijd

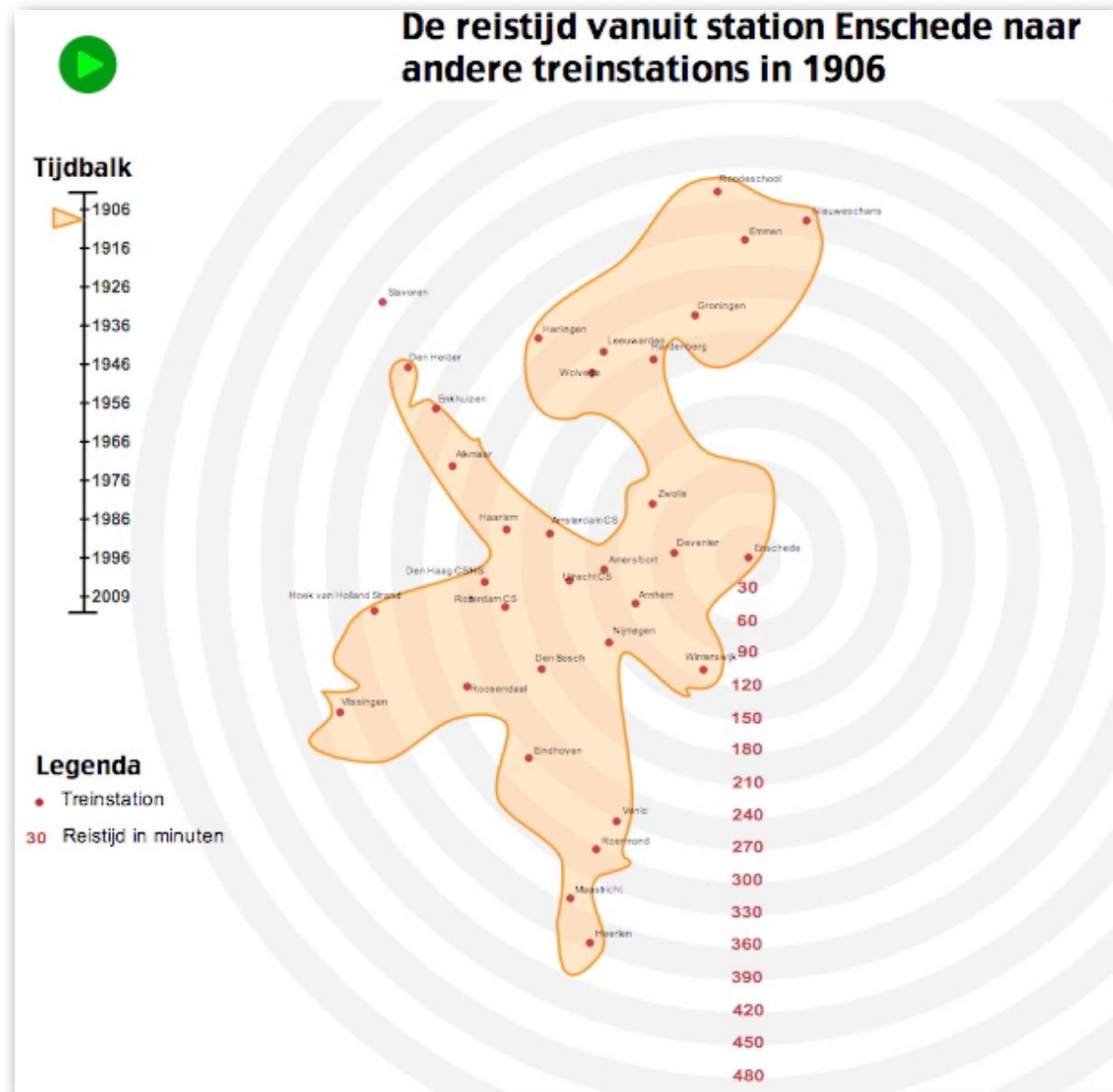
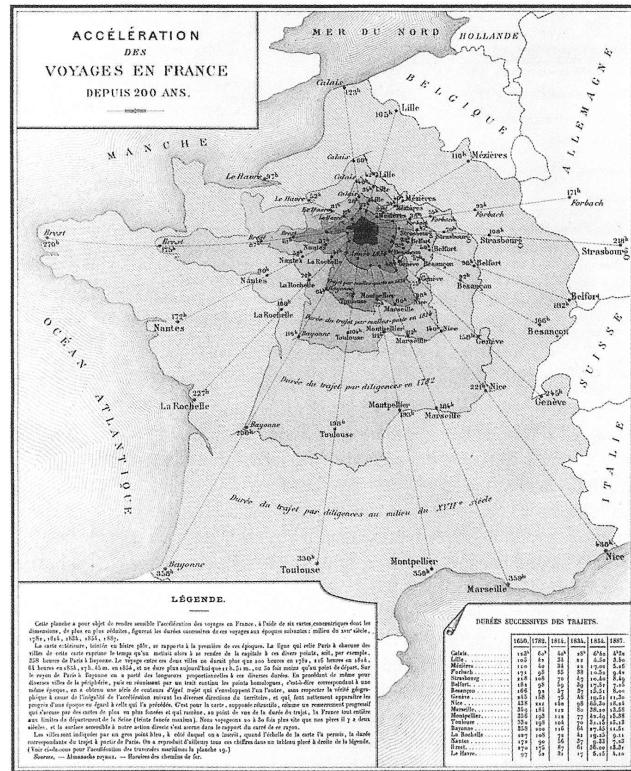




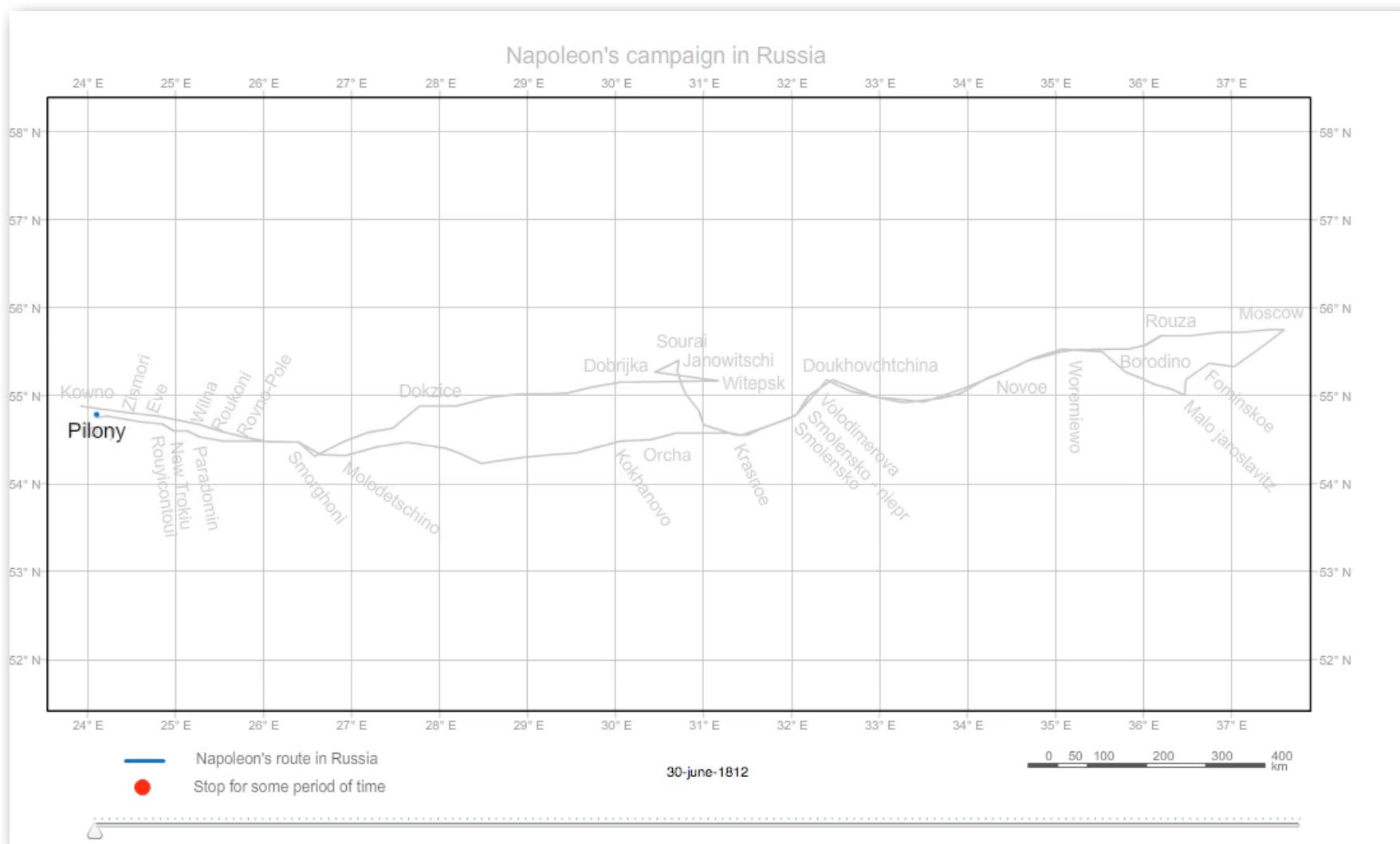
# Space-Time cube



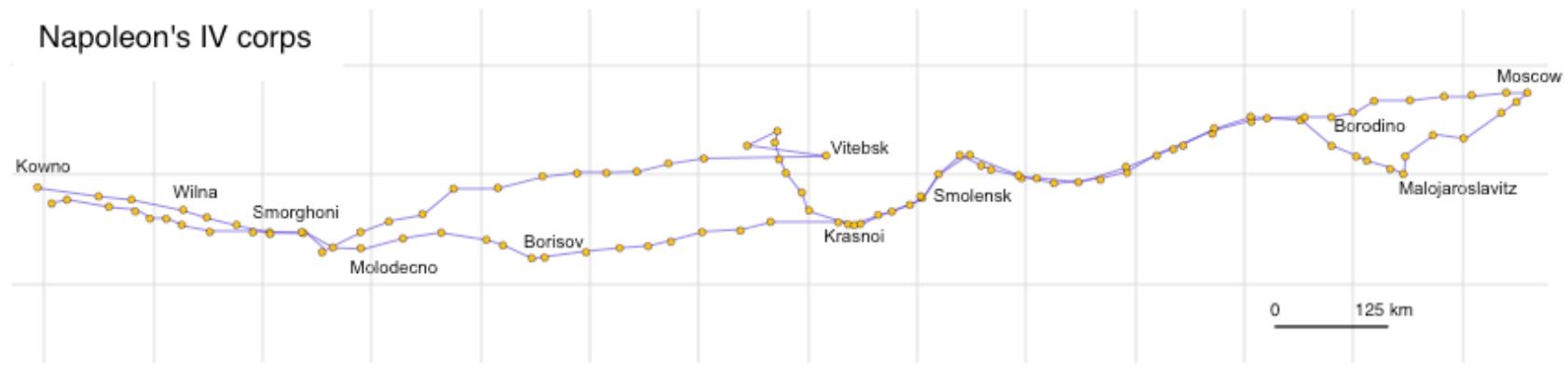
# Cartogram



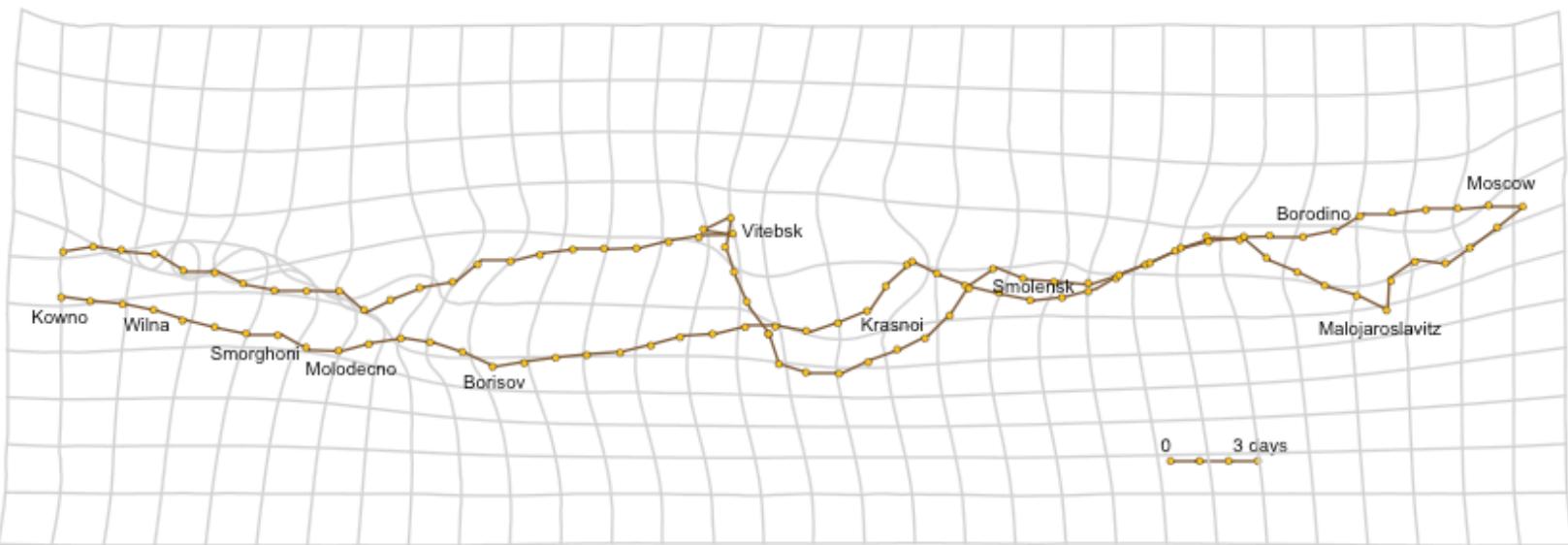
# 4th Corps



Napoleon's IV corps



a)



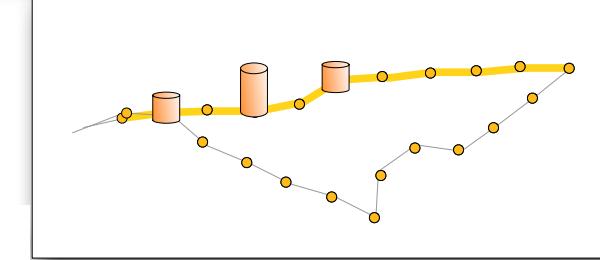
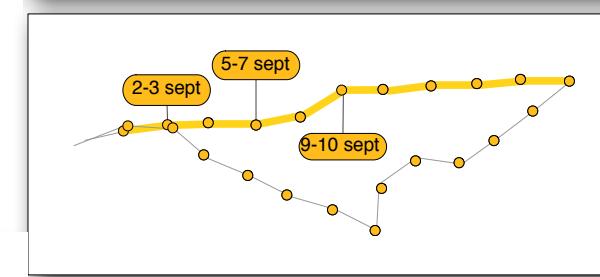
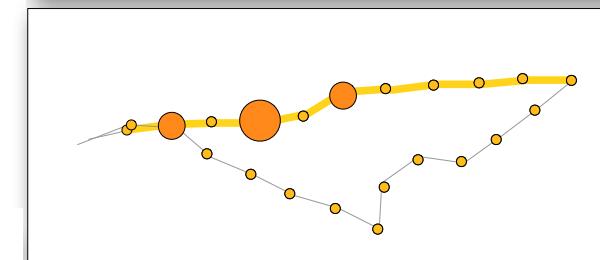
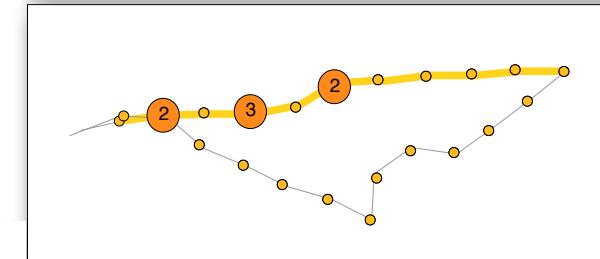
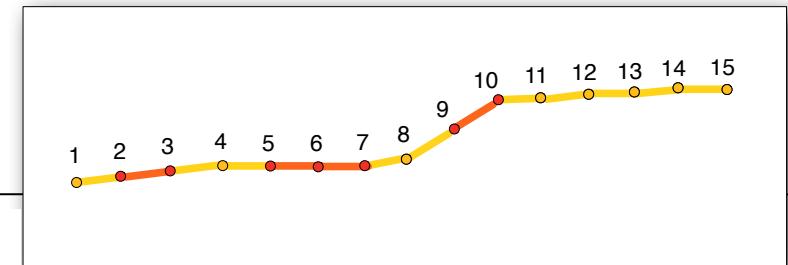
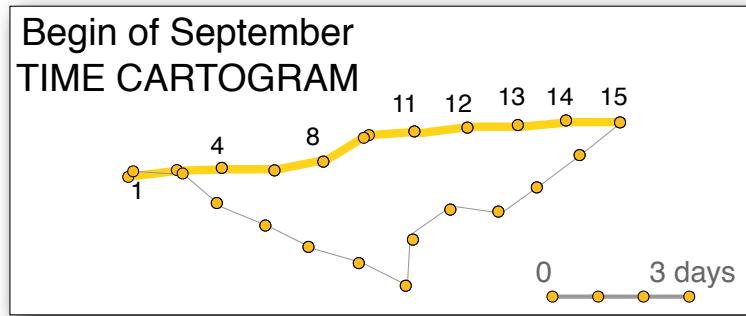
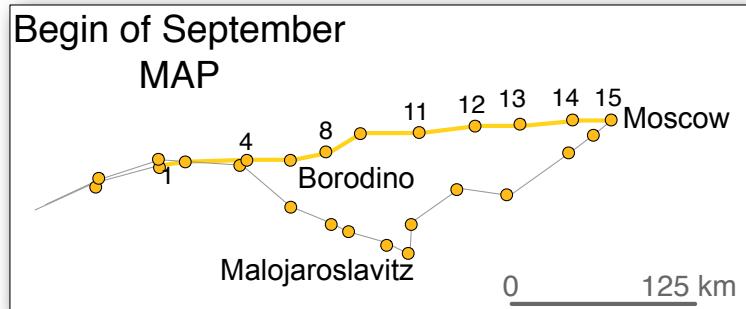
b)



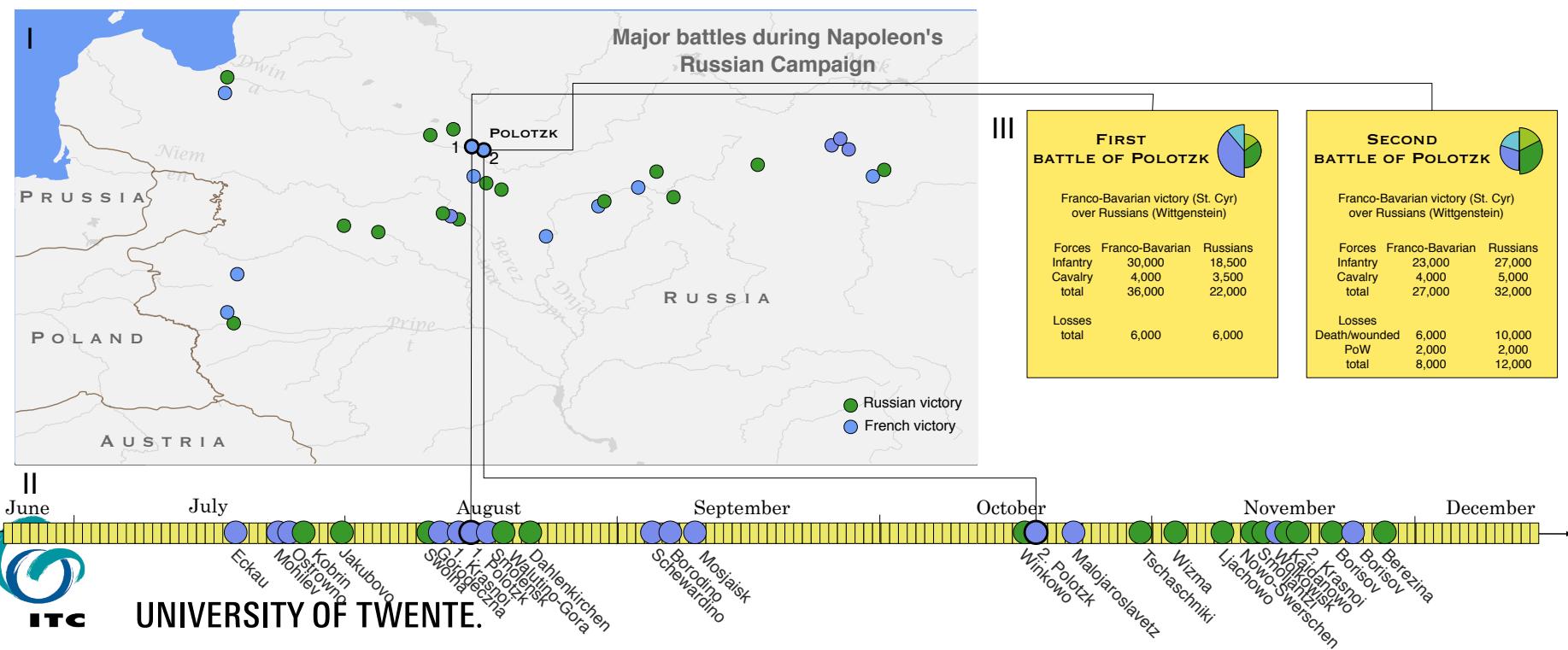
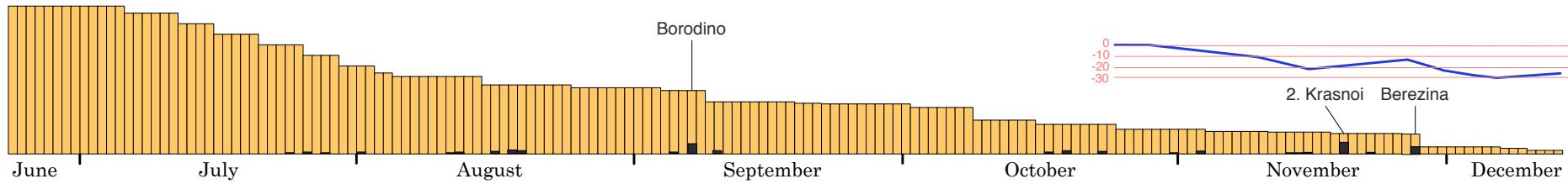
UNIVERSITY OF TWENTE.

ILLUSTRATIONS FROM KRAAK, M.J. (2013) MAPPING TIME - ILLUSTRATED BY MINARD'S MAP OF NAPOLEON'S RUSSIAN CAMPAIGN OF 1812. REDLANDS: ESRI PRESS.

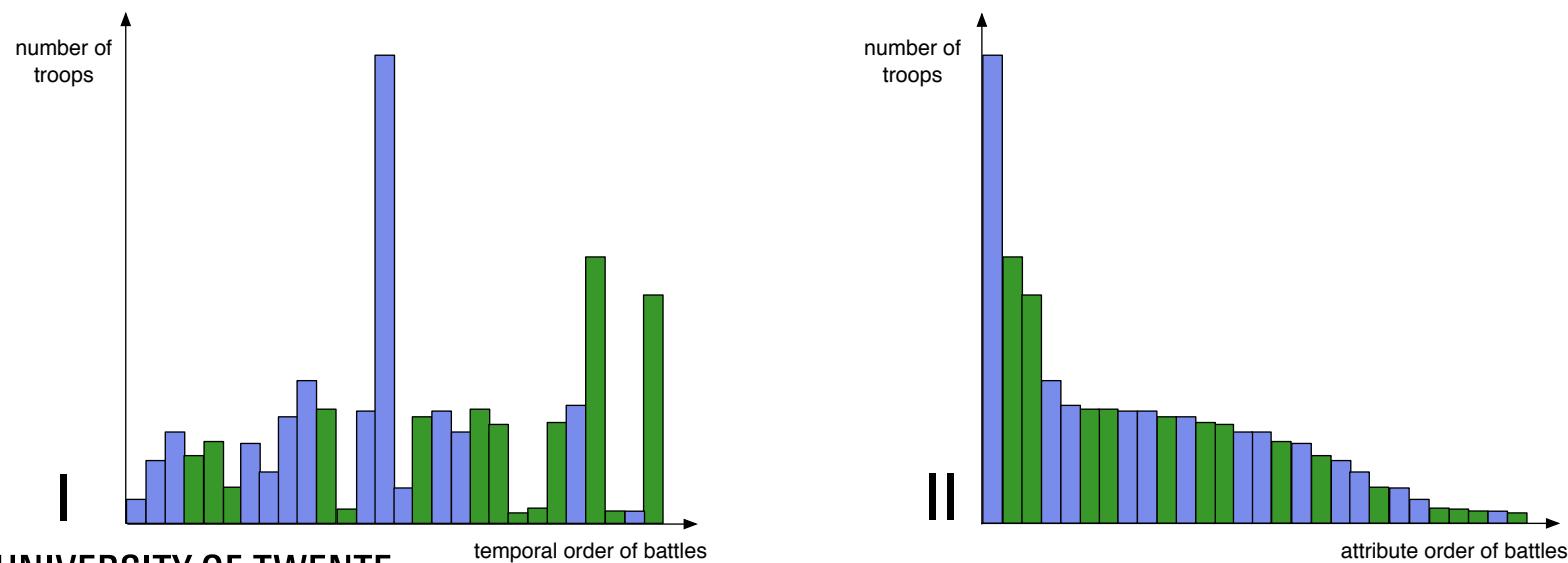
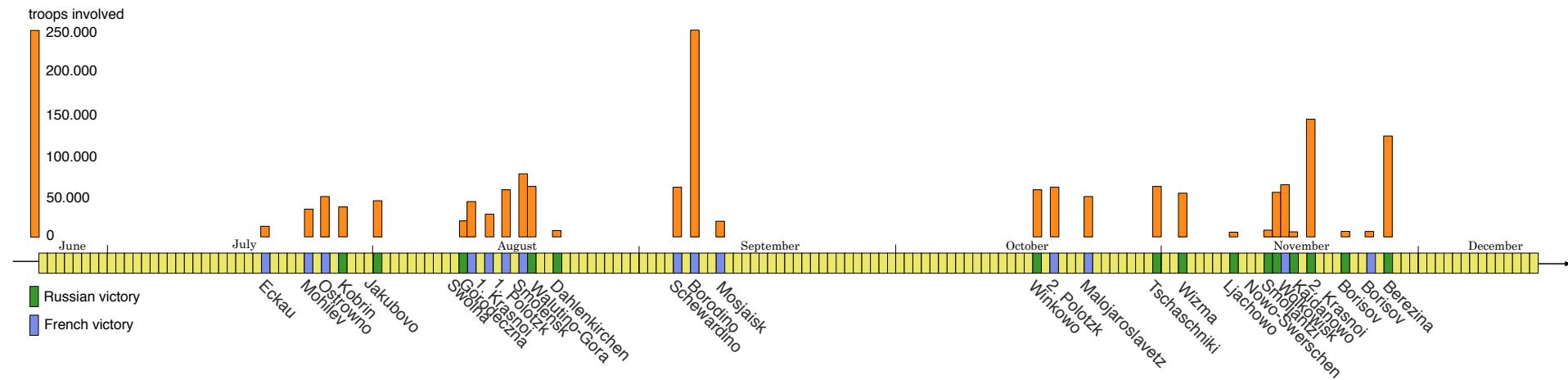
# What about stops?



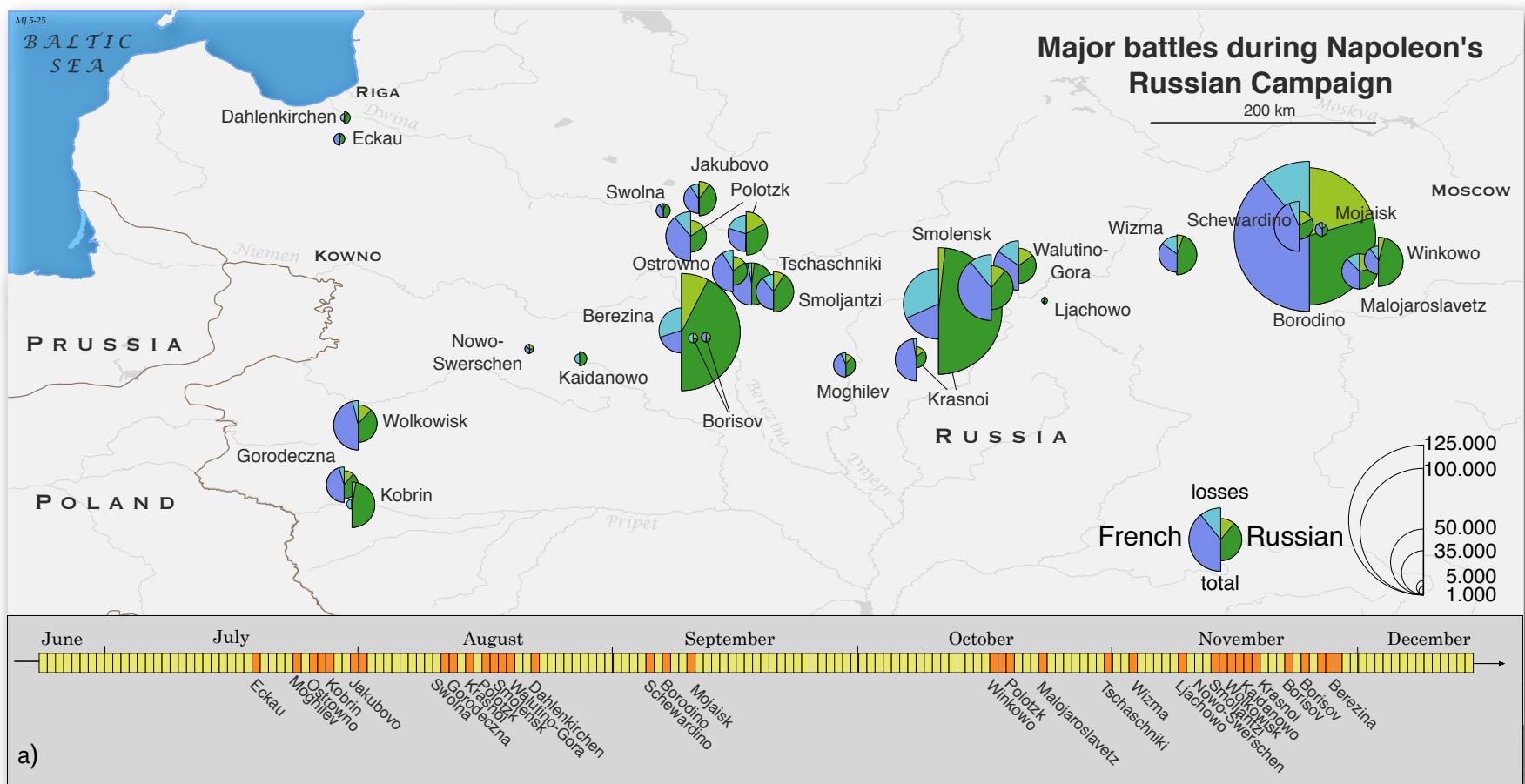
# Soldiers and Battles



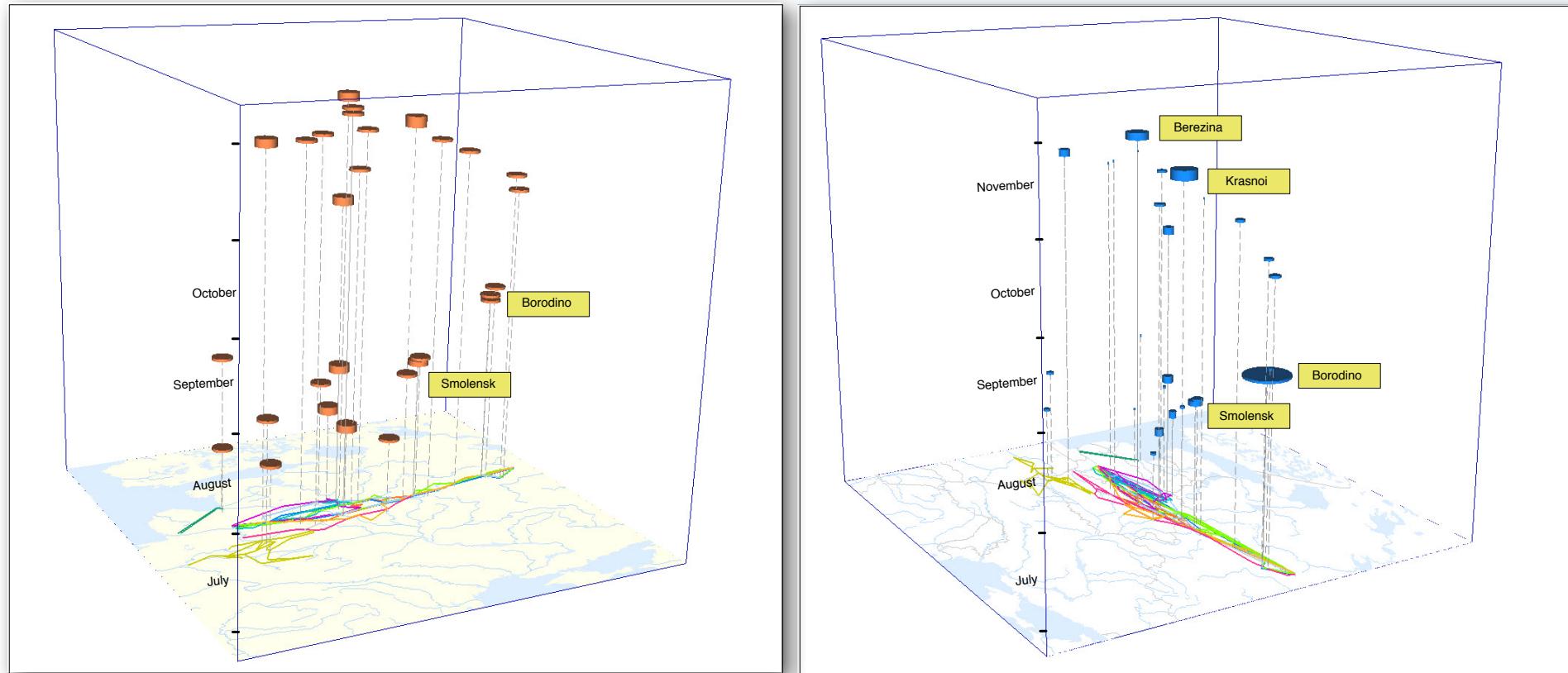
# Soldiers and battles



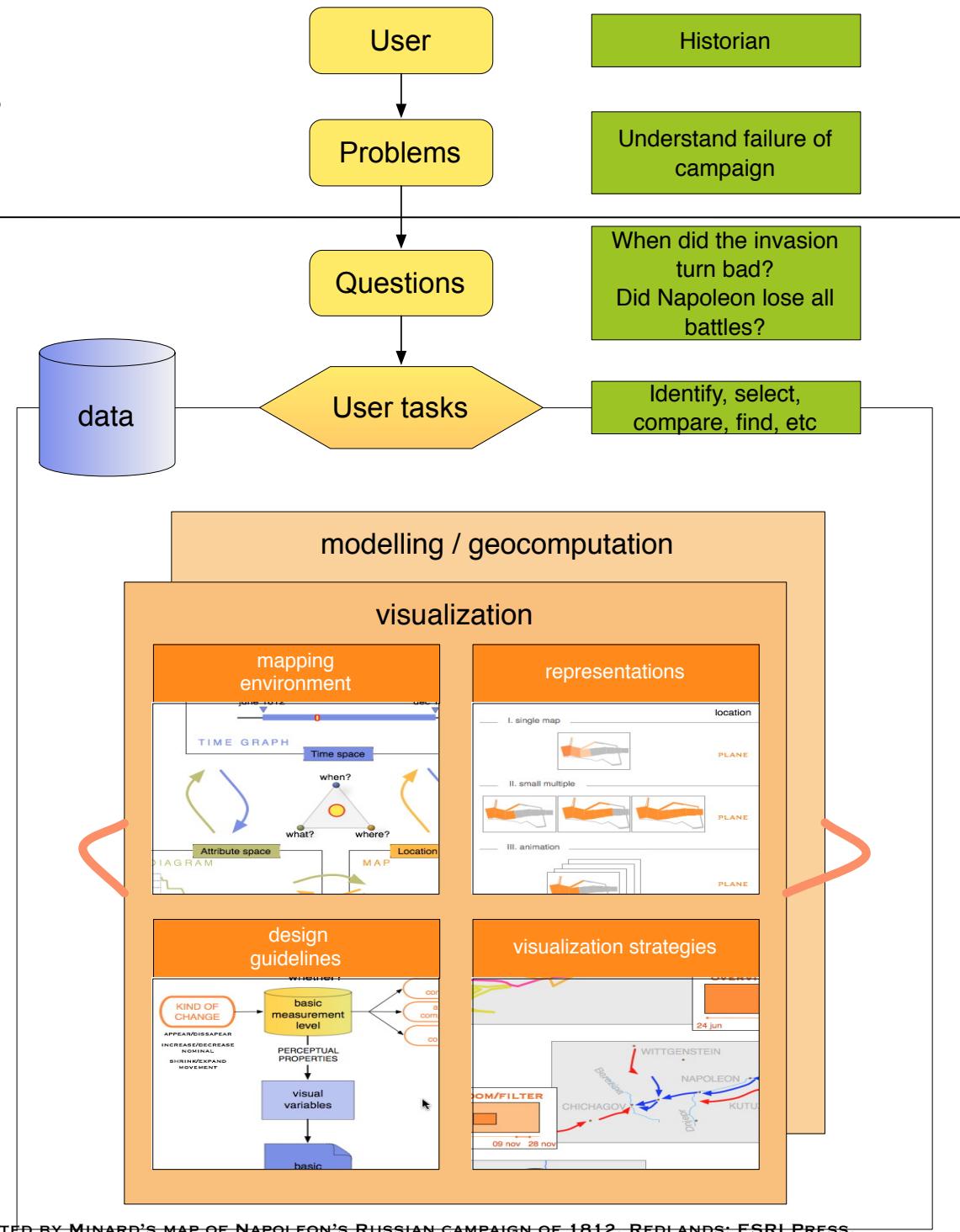
# Battles and space



# Battles and time

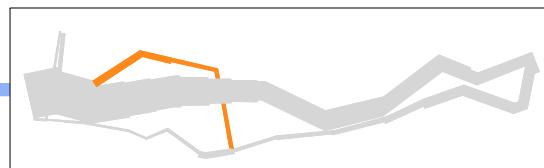


# Geovisual analytics environment



# Present versus explore

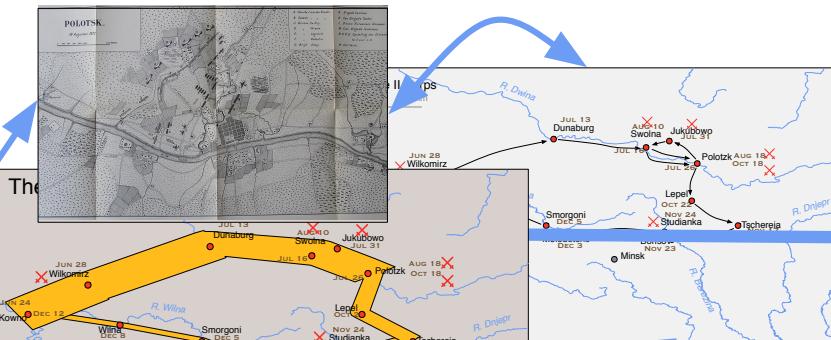
date	location	name	troops	battle	losses
24 jun 1812	54 54 00	23 54 00 Kowno	40065		
28 jun 1012	55 14 55	24 45 54 Wilkomiz	38000	x	1500
13 jul 1812	55 53 00	26 32 00 Dunaburg	32000		
16 jul 1812	55 46 02	27 56 48 Szwina	24000		
20 jul 1812	55 46 09	28 46 32 Polotsk	22000		
31 jul 1812	55 44 59	28 37 03 Jukubowo	20000	x	4900
10 aug 1812	55 46 02	27 56 48 Szwina	19000	x	2500
18 aug 1812	55 29 09	28 46 32 Polotsk	14000	x	4000
18 oct 1812	55 29 09	28 46 32 Polotsk	18000	x	4000
22 oct 1812	54 52 53	28 41 35 Lepel	14000		
17 nov 1812	54 33 08	29 06 58 Tschereia	8000		
23 nov 1812	54 13 52	28 30 17 Borisov	7000		
24 nov 1812	54 19 38	28 21 25 Studianka	4500	x	2500
3 dec 1812	54 19 07	26 51 28 Molodeschno	4200		
5 dec 1812	54 28 55	26 24 01 Smorgoni	4000		
8 dec 1812	54 41 21	25 16 47 Wilna	3800		
12 dec 1812	54 54 00	23 54 00 Kowno	3600		



information

PRESENT

date	location	name	troops	battle	losses
24 jun 1812	54 54 00	23 54 00 Kowno	40065		
24 jun 1012	54 54 00	23 54 00 Kowno	40065		
24 jun 1812	54 54 00	23 54 00 Kowno	40065		
24 jun 1812	54 54 00	23 54 00 Kowno	40065		
24 jun 1812	55 14 55	24 45 54 Wilkomiz	38000	x	1500
13 jul 1812	55 53 00	26 32 00 Dunaburg	32000		
16 jul 1812	55 46 02	27 56 48 Szwina	24000		
20 jul 1812	55 46 09	28 46 32 Polotsk	22000		
31 jul 1812	55 44 59	28 37 03 Jukubowo	20000	x	4900
10 aug 1812	55 46 02	27 56 48 Szwina	19000	x	2500
18 aug 1812	55 29 09	28 46 32 Polotsk	14000	x	4000
18 oct 1812	55 29 09	28 46 32 Polotsk	18000	x	4000
22 oct 1812	54 52 53	28 41 35 Lepel	14000		
17 nov 1812	54 33 08	29 06 58 Tschereia	8000		
23 nov 1812	54 13 52	28 30 17 Borisov	7000		
24 nov 1812	54 19 38	28 21 25 Studianka	4500	x	2500
3 dec 1812	54 19 07	26 51 28 Molodeschno	4200		
5 dec 1812	54 28 55	26 24 01 Smorgoni	4000		
8 dec 1812	54 41 21	25 16 47 Wilna	3800		
12 dec 1812	54 54 00	23 54 00 Kowno	3600		



knowlegde

EXPLORE



UNIVERSITY OF TWENTE.

# Battle at the Berezina

**BEREZINA 20**

Copyright © 2011 Kim Meints and Victory Point Games  
Graphics/Artwork © 2011 Chris Magoun

The map shows a hexagonal grid representing the Berezina River region. The river flows from the south through Stakhow, Bytci, Studianka, and Kostrova, eventually emptying into the Dnieper. The grid is numbered from 0101 to 1914. Green hexes represent forested areas, while light blue hexes represent water and ice. Various settlements are marked with small icons: Zenablin, Brili, Stakhow, Bytci, Studianka, Nemonitsa, Stari-Borisov, and Borissov. French units are represented by blue icons, and Russian units by red icons. Bridge crossing markers are placed along the river banks, indicating successful crossings (green), damaged bridges (orange), or failed attempts (red).

**GAME TURNS**

25 Nov	Afternoon	7	Evening	12	Night	18
26 Nov	Evening	8	Night	13	Morning	19
27 Nov	Morning	9	Mid-day	14	Mid-day	20
28 Nov	Mid-day	10	Afternoon	15	Evening	21
29 Nov	Afternoon	11	Evening	16	Morning	22
30 Nov	Morning	12	Mid-day	17	Mid-day	23

**FRONTIER CROSSING**

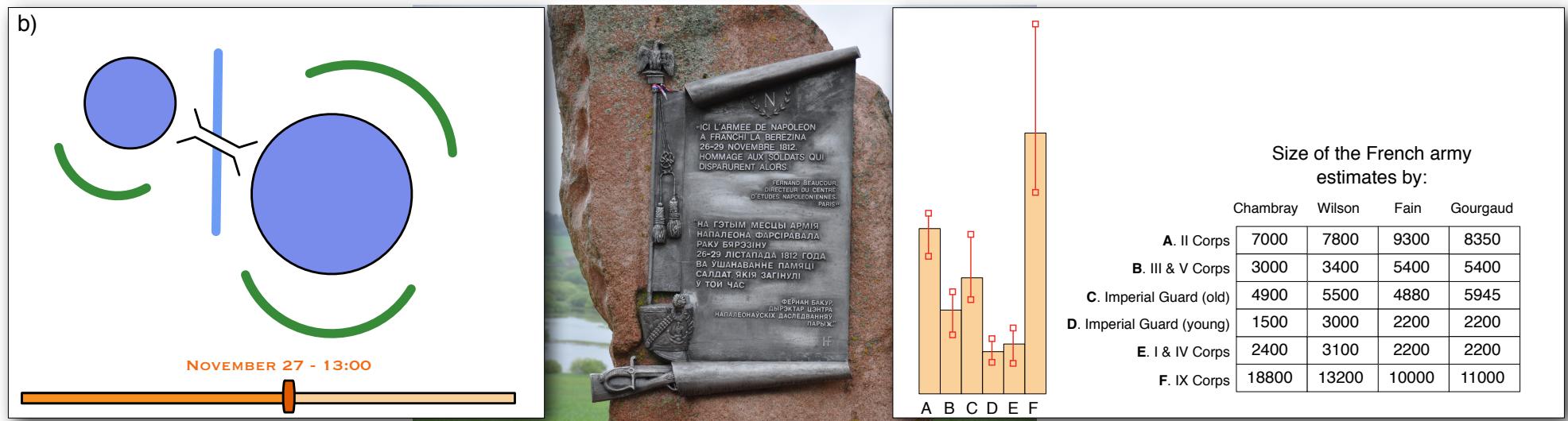
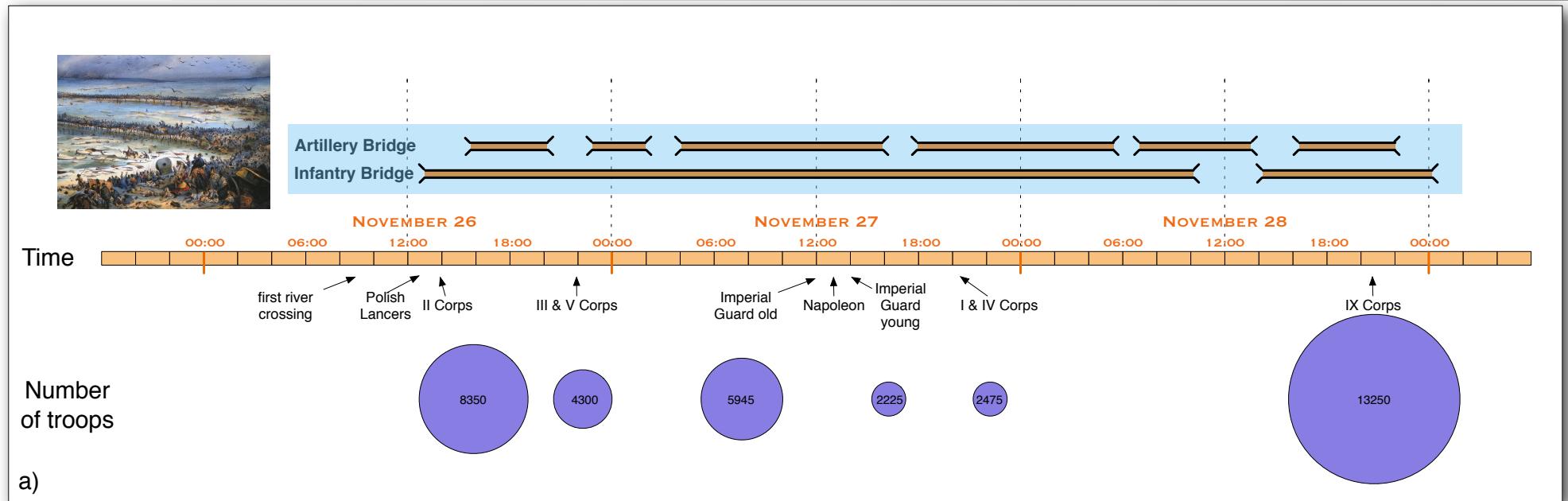
- = Unit attempting to cross remains in place (i.e. it fails to cross) and the Bridge is Damaged (flip the marker to its "No Pontoon Bridges" side).
- = Unit successfully crosses to the opposite bank, but the Bridge is damaged (flip the marker to its "No Pontoon Bridges" side).
- - ■ = Unit successfully crosses to the opposite bank and the Bridge remains intact.

**STRAGGLER SPECIAL EFFECTS**

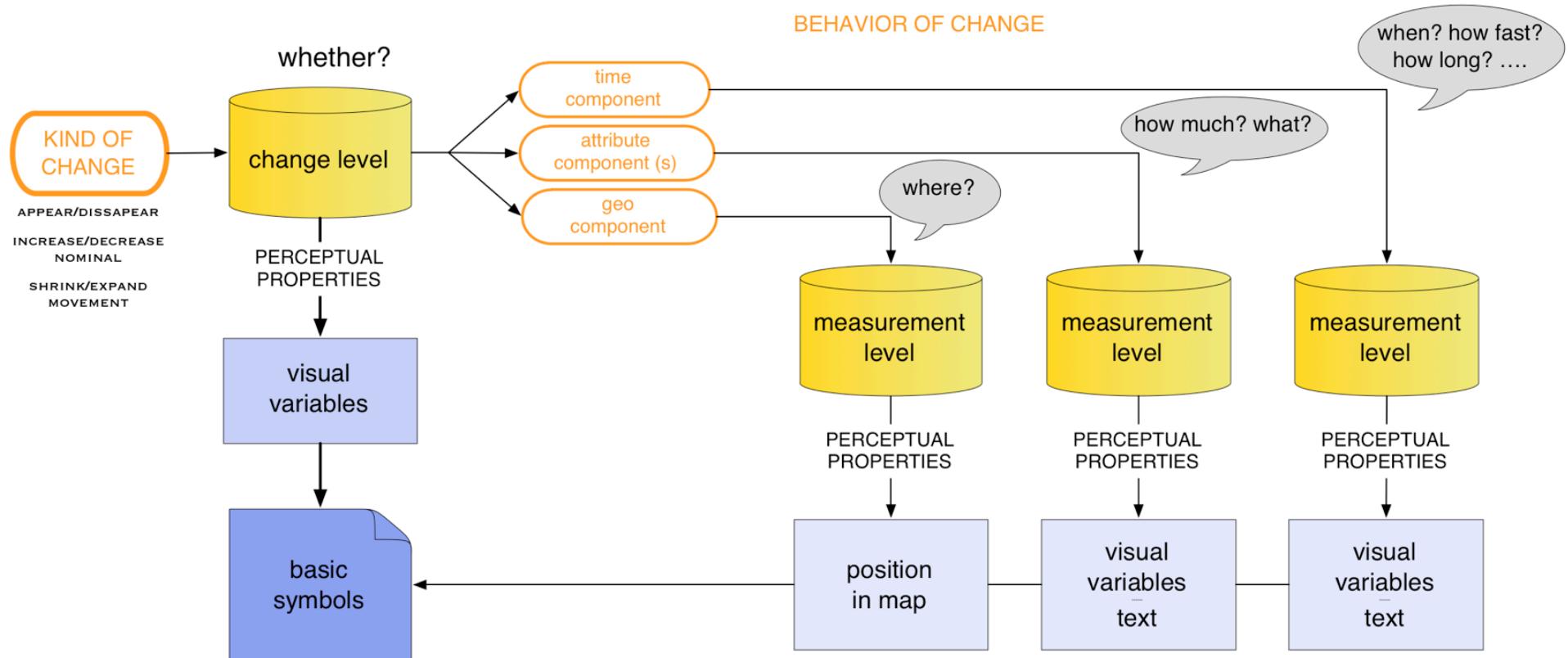
- Stragglers never exert a ZOC.
- French can't commit reserves if only participant in battle are Stragglers.
- If routed, Stragglers are Broken instead.
- Stragglers can not be rallied.

ILLUSTRATIONS FROM KRAAK, M.J. (2013) MAPPING TIME - ILLUSTRATED BY MINARD'S MAP OF NAPOLEON'S RUSSIAN CAMPAIGN OF 1812. REDLANDS: ESRI PRESS.

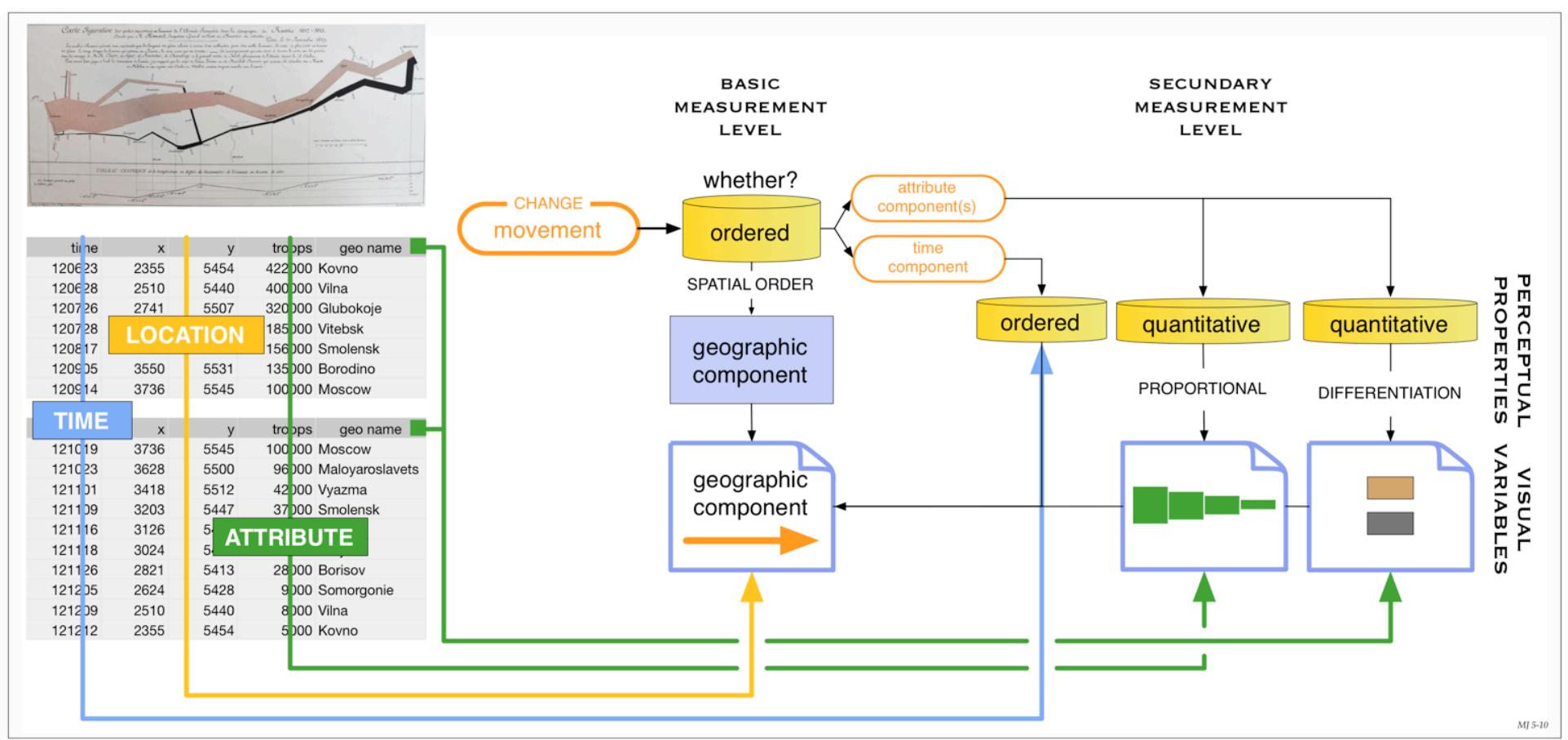
# Exploring the Berezina crossing



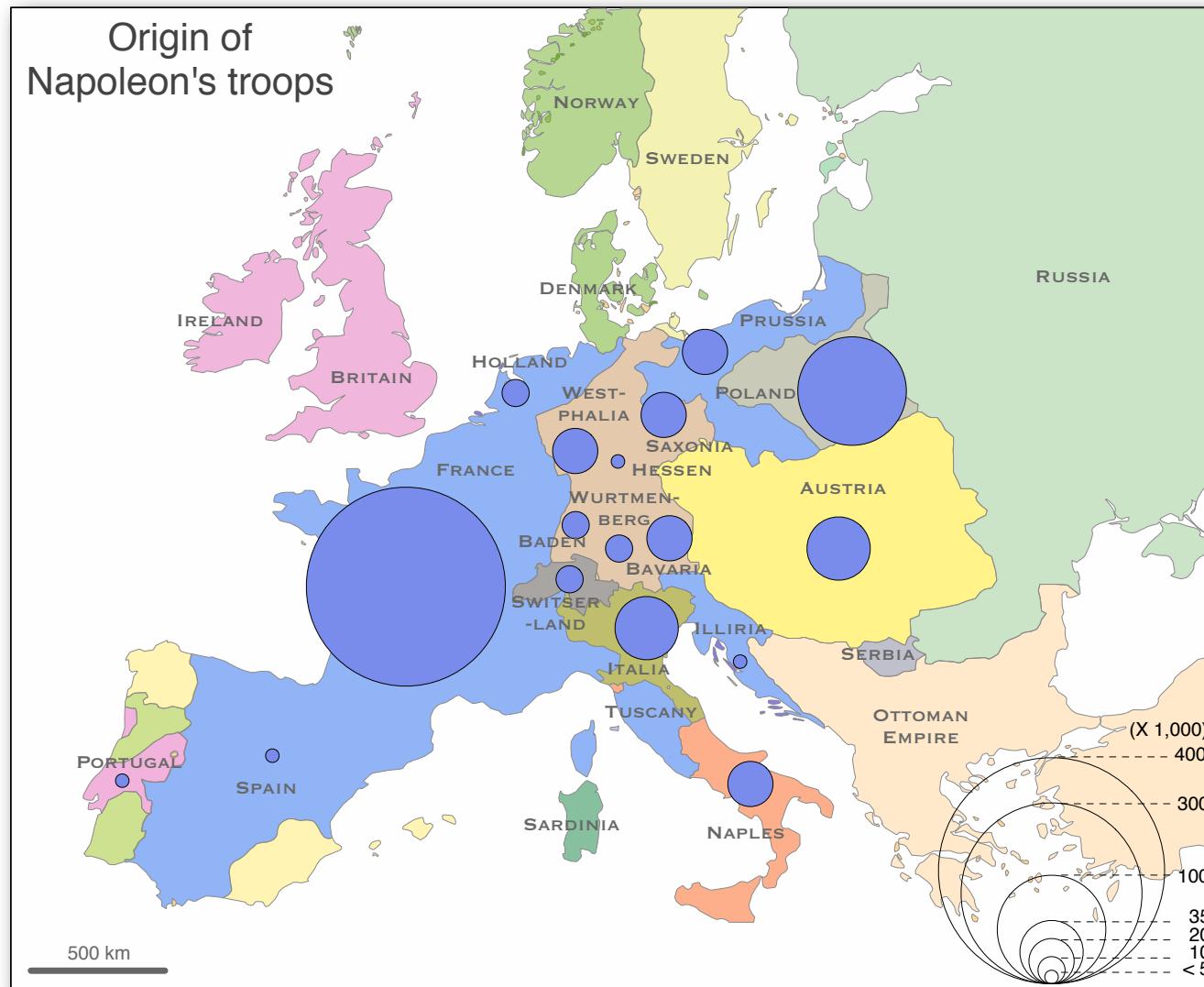
# Temporal data analysis

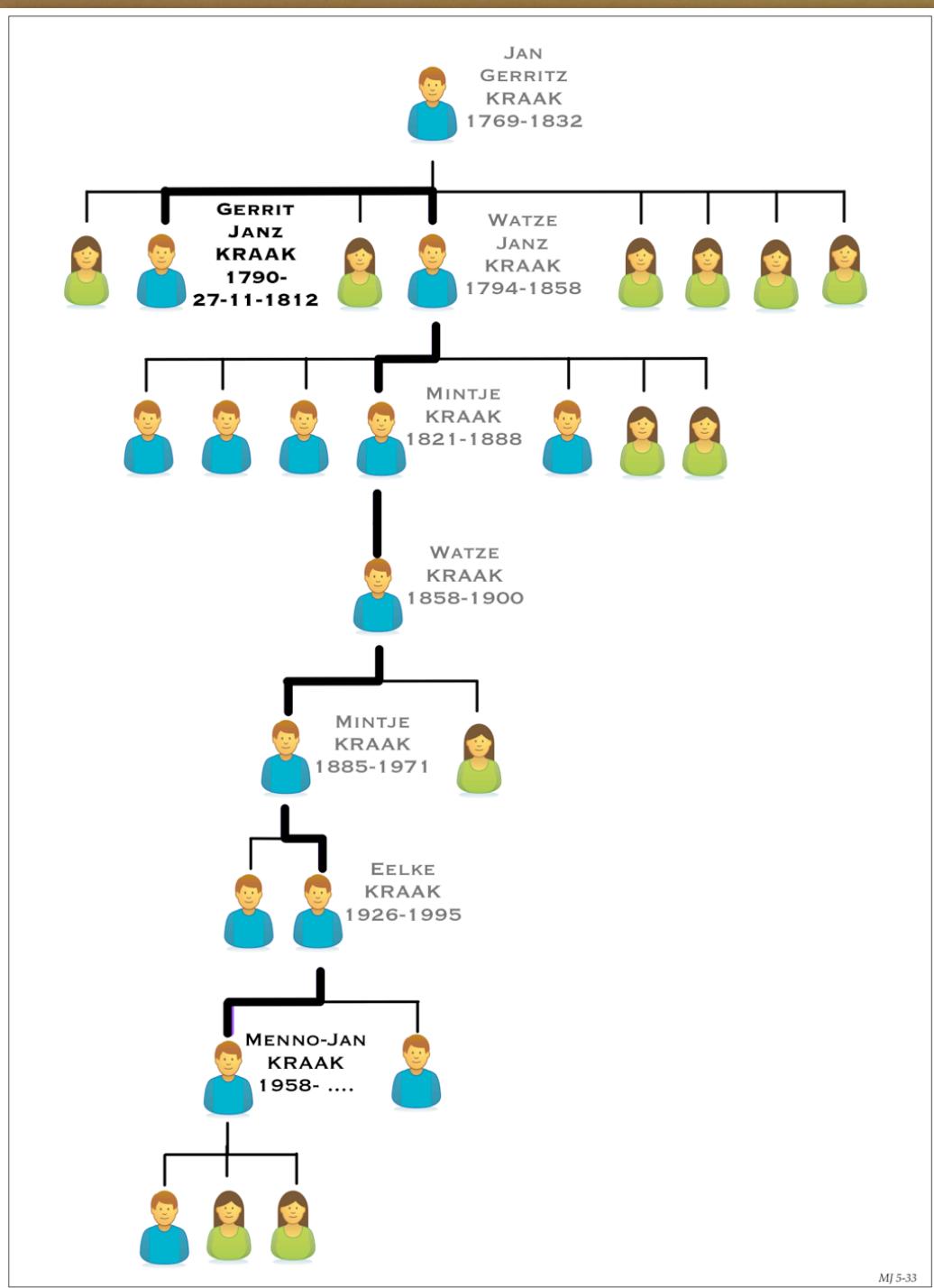


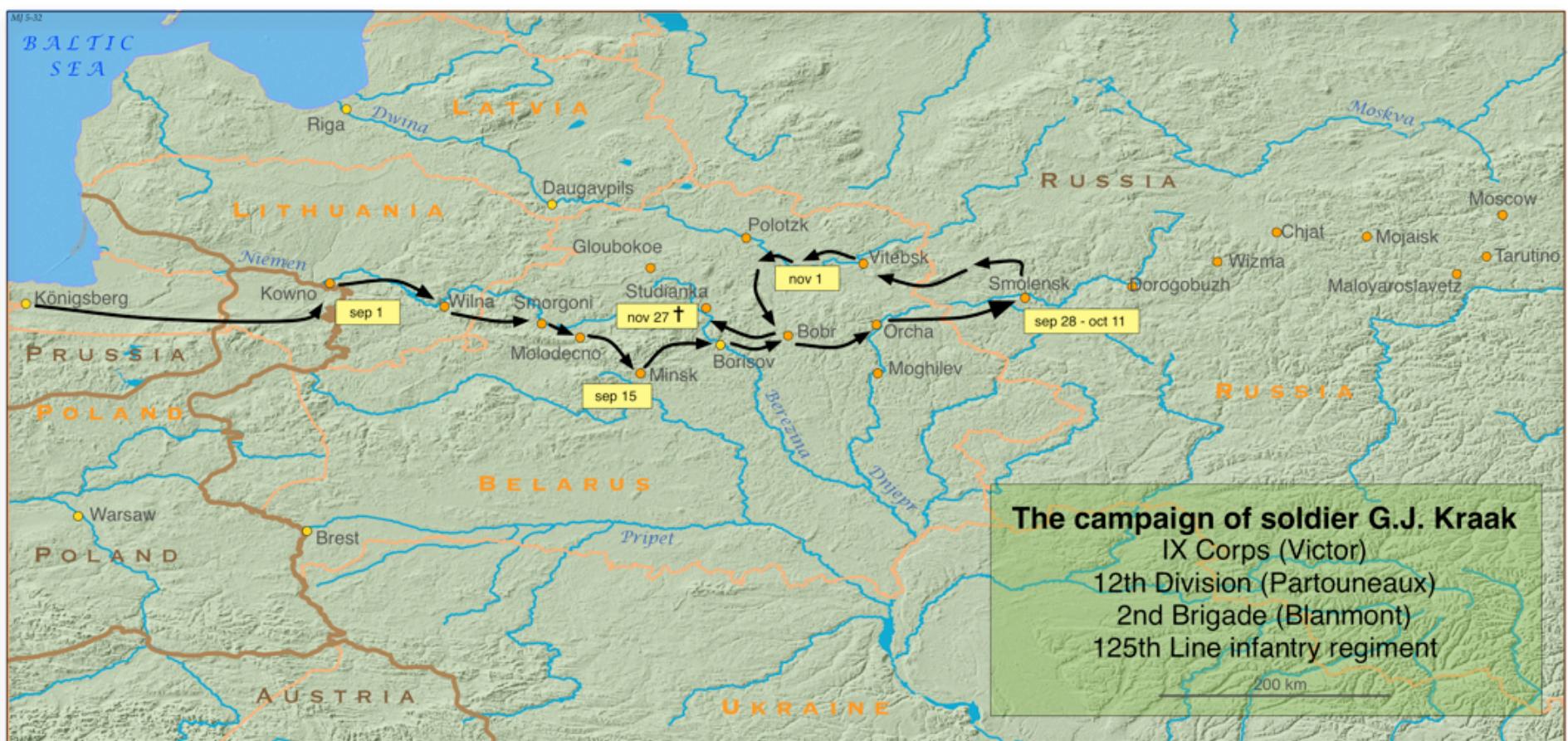
# Minard's data analysis



# The composition of the army







N. 2298 Kraak (prénoms) Gerrit fils de Jan Kraak et de Reitske Watsons né le 28 février à Sneek canton de département de Friesland taille d'un mètre et 62 centimètres, visage rond front large yeux bleus nez large bouche moyenne menton rond cheveux blonds sourcils blonds marques particulières	Possessions Guerres Arrivé au Corps le enrôlé volontaire incorporé, venant du 2e Infanterie conscrit de l'an remplaçant un conscrit de l'an du département d compris sur la liste de désignation du canton de sous le N. son dernier domicile était à Sneek département de Friesland profession	Bat. Comp. Volontaires 1. Badi Comp. Volontaires	Soldat le 7 Septembre 1809	même mutation que ce Degur I
--	--	---	----------------------------	------------------------------

ITC

UNIVERSITY OF TWENTE.

