



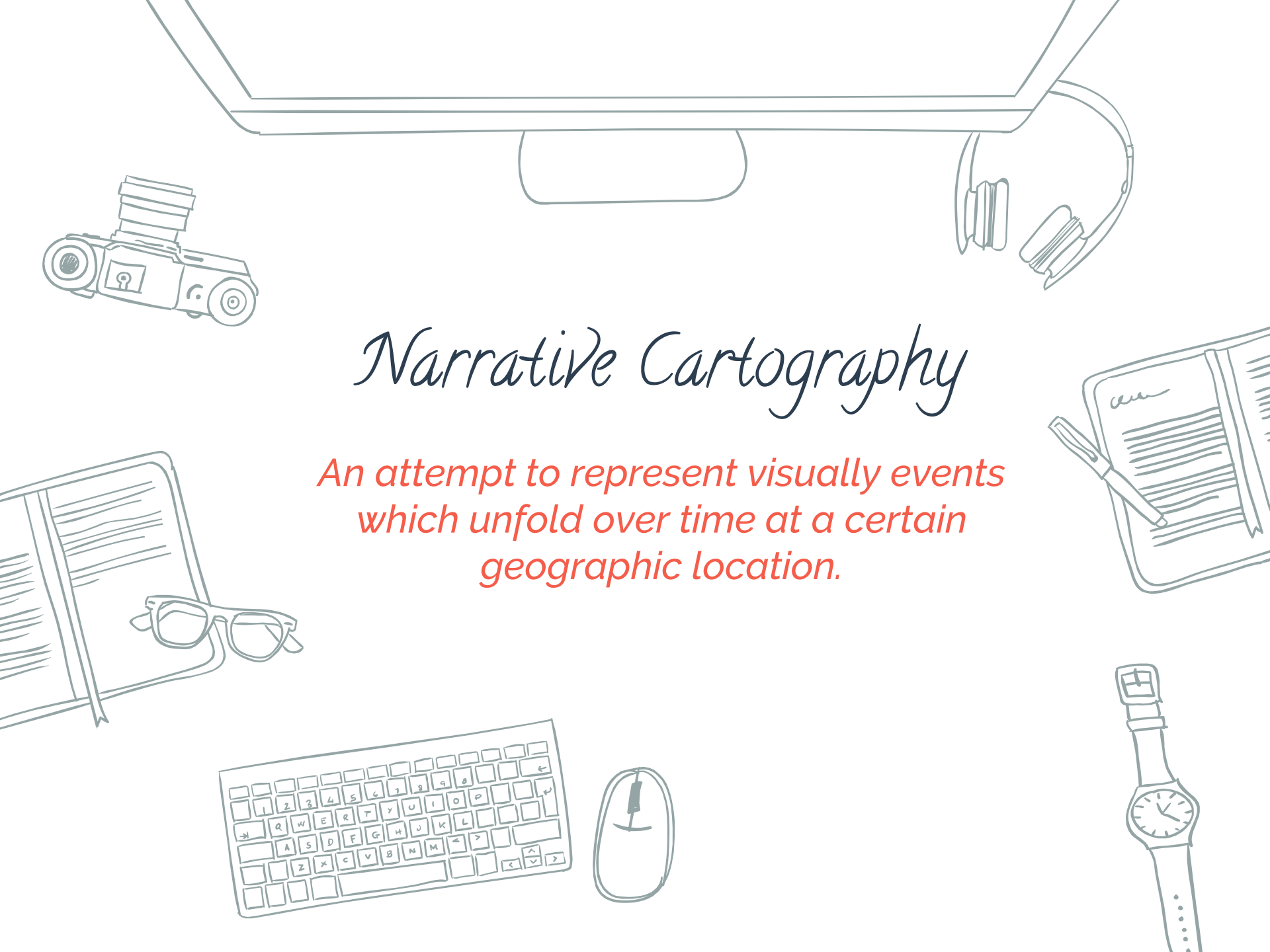
Narrative Cartographic Representations:

Mapping the Spatiotemporal Complexity of Stories



Ana Kuveždić Divjak

Faculty of Geodesy, University of Zagreb



Narrative Cartography

*An attempt to represent visually events
which unfold over time at a certain
geographic location.*

FROM CAIRO TO KHARTOUM (THE GRAPHIC, 1884)

Maps can omit so much and still be perfectly suited to telling the story of the form itself.

[illegible]

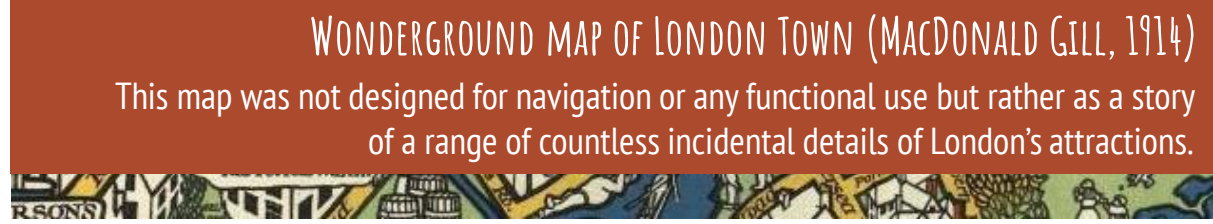
Thirteen years ago, he and his wife, the mother of three large of the family, left their home in the city of New York for the United States. They had been in the city for about a year, but they had not yet found a place to live. They had been in the city for about a year, but they had not yet found a place to live. They had been in the city for about a year, but they had not yet found a place to live.

[illegible]

Thammyong is a large and important town, approximately 100 miles from Luang. It is the capital of the province and the residence of the Viceroy-in-Chief. There is a large market square and a good bazaar. The population is about 20,000. The chief industry is the manufacture of wooden bowls and other things. Indeed, this industry came from outside here, as a large number of Chinese, Japanese and Burmese came here before, and supported all sorts of local, outside, and imported manufactures. The industry was known to the Chinese at an early date.



...and the first sign of the approaching storm.

[illegible][illegible]

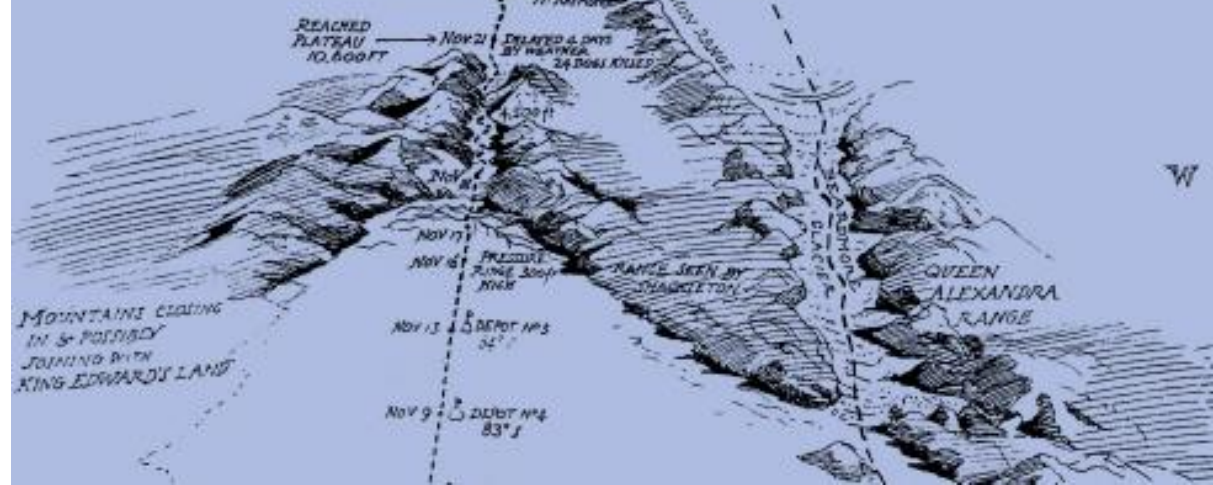
This map was not designed for navigation or any functional use but rather as a story of a range of countless incidental details of London's attractions.



RANGE

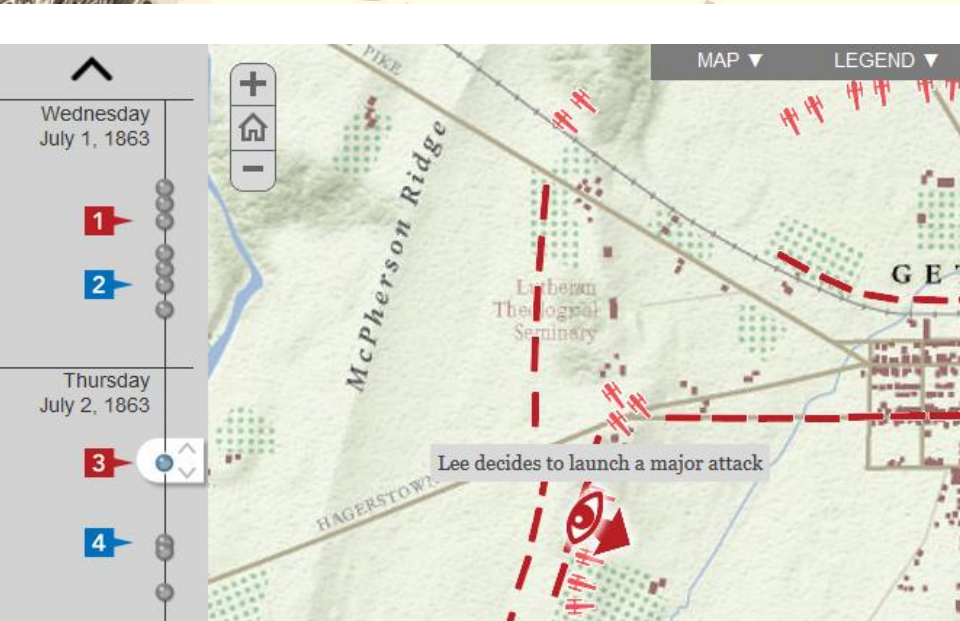
AMUNDSEN'S SOUTH POLE EXPEDITION (GORDON HOME, 1911)

Maps produced around the time of the expeditions illustrated the stories, trials and tribulations of the famous treks to reach the South Pole.

[illegible]



THE ISLAND (STEPHEN WALTER, 2008)
 Entirely hand drawn, the space is filled with a local information based on authors' knowledge, feelings and impressions of a place.



BATTLE OF GETTYSBURG (ESRI, 2013)
 The use of preconfigured templates from Esri's Story maps has become one way in which people can author their stories as a narrative maps.

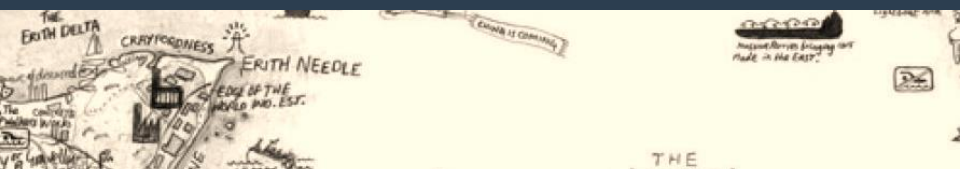


IN THE SHADOW OF FORECLOSURES (NEW YORK TIMES, 2008)
 The New York Times creates consistently high quality maps and graphics to tell their stories.



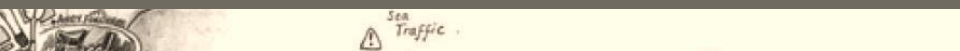
THEY WOULD NOT TAKE ME THERE (HERMANN AND PEARCE, 2008)
 A map that traces the story of Champlain's journeys, an example of a literary geography being brought to life through cartography.

Narrative map, narrative cartographic visualization, literary map, story map, fictional cartography, geospatial storytelling



THE ISLAND (STEPHEN WALTER, 2008)

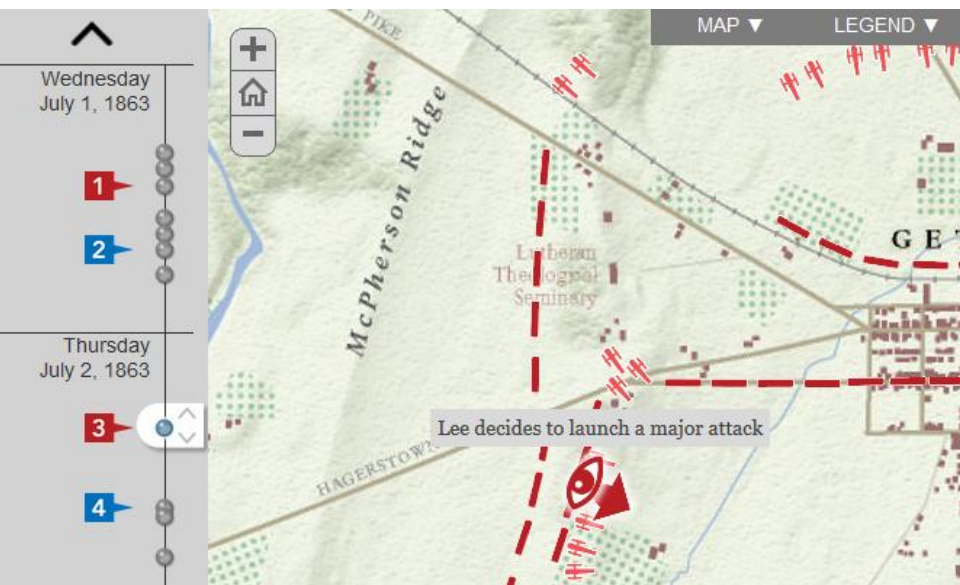
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In the Shadow

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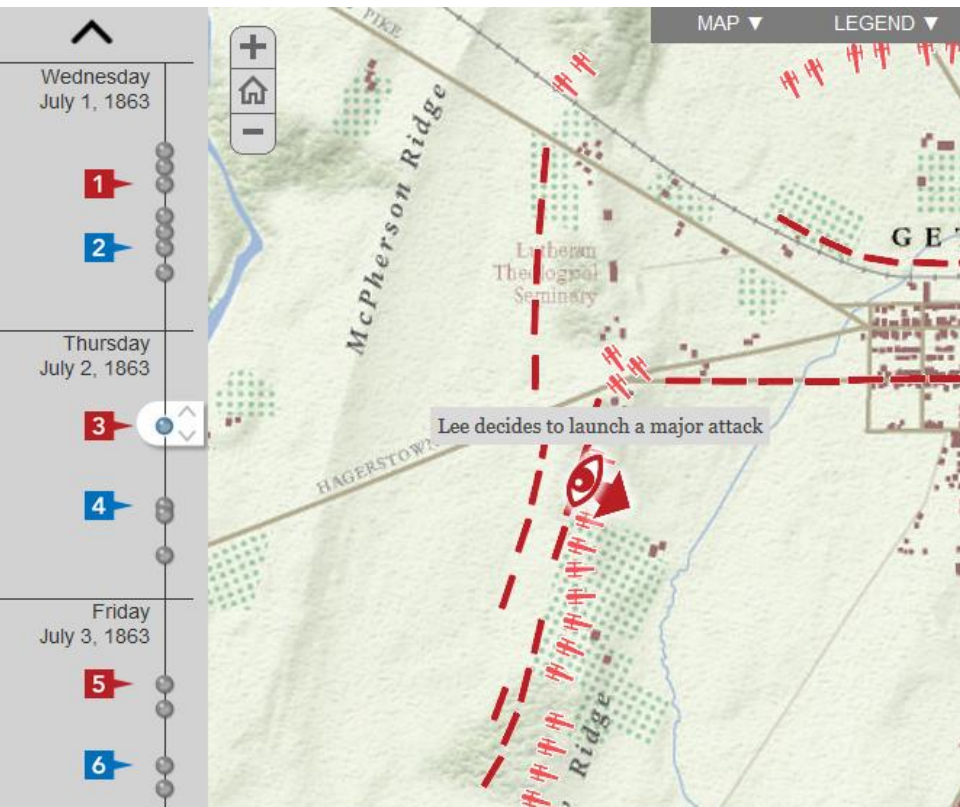
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THEY WOULD NOT TAKE ME THERE (HERMANN AND PEARCE, 2008)

A map that traces the story of Champlain's journeys, an example of a literary geography being brought to life through cartography.

A horizontal strip showing a map of the Gateway Point area, handwritten notes, and a 3D bar chart. The map includes labels like "GATEWAY POINT", "Filthy Waters", and "DEPT". The handwritten notes include "GATEWAY POINT" and "Filthy Waters". The 3D bar chart shows data for "Merced 21.3%", "Great Falls 2.3%", "Blaine 6.7%", and "17.2%".



Narrative cartography: an attempt to represent visually events which unfold over time at a certain geographic location

Research question for the narrative cartography:

- How can authors design maps that allow users to simultaneously experience events and their importance in the space?

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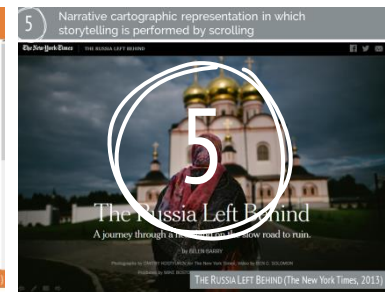
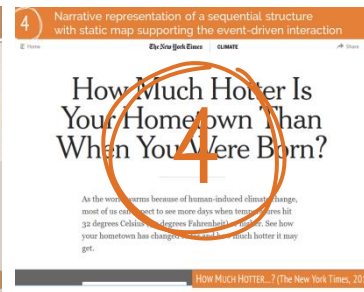
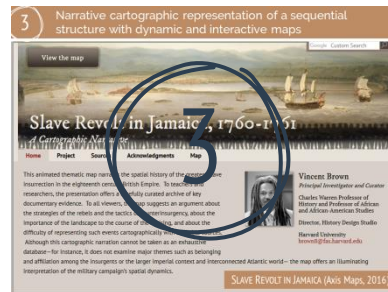
Requirements for the narrative cartography:

- Mapping narratives requires the development of specific forms of cartographic representations that simultaneously present the diverse and complex **spatiotemporal** dimension of the narrative, as well as its **geography** (locations in the story) and **geometry** (relationships between story elements).

Narrative cartography: an attempt to represent visually events which unfold over time at a certain geographic location

Materials and Methods:

■ Selection 5 different forms of online narrative maps

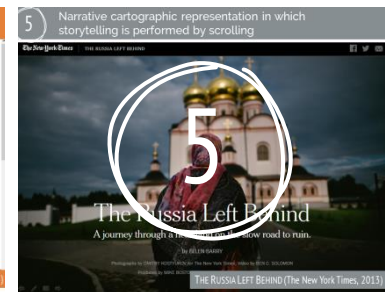
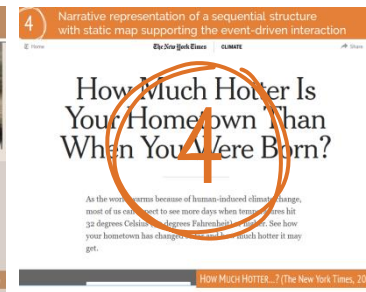
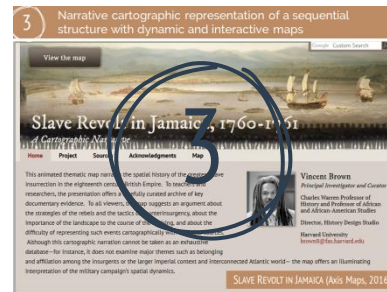


➔ Comparative analysis of the selected examples

Narrative cartography: an attempt to represent visually events which unfold over time at a certain geographic location

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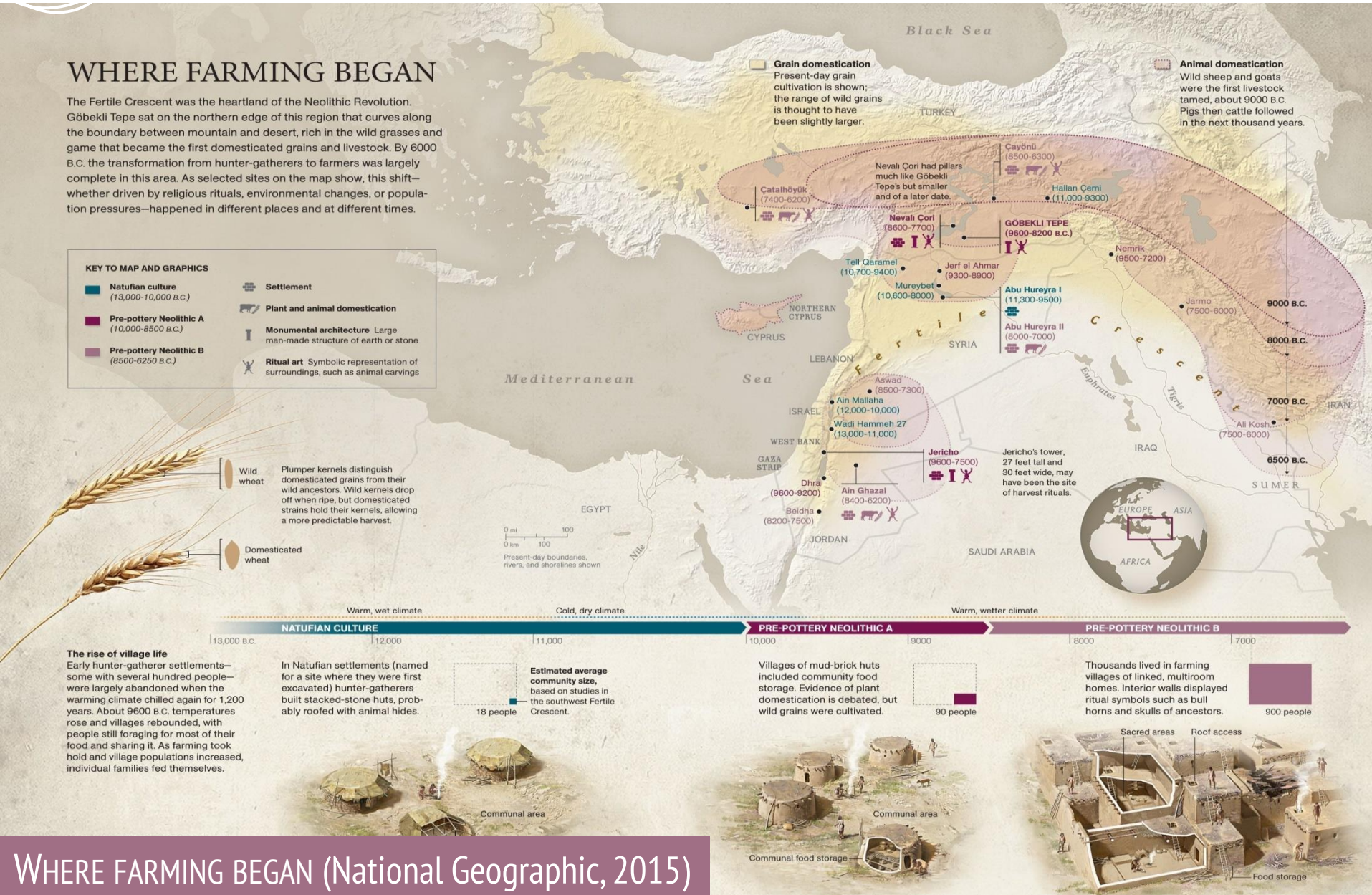
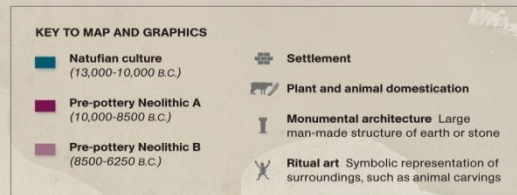
➔ Comparative analysis of the selected examples

Research goal:

- To identify and describe the spectrum of techniques that today's narrative cartographic representations are using for mapping the spatiotemporal complexity of stories.

WHERE FARMING BEGAN

The Fertile Crescent was the heartland of the Neolithic Revolution. Göbekli Tepe sat on the northern edge of this region that curves along the boundary between mountain and desert, rich in the wild grasses and game that became the first domesticated grains and livestock. By 6000 B.C. the transformation from hunter-gatherers to farmers was largely complete in this area. As selected sites on the map show, this shift—whether driven by religious rituals, environmental changes, or population pressures—happened in different places and at different times.



2

Narrative cartographic representation of a sequential structure with static and dynamic view-only maps



The Journey of Yellowstone Elk

Share: [f](#) [t](#) [p](#) ...

Follow the Elk's Perilous Journey

Scroll to continue



THE JOURNEY OF YELLOSTONE ELK (National Geographic, 2016)

North American Elk Range

Elk were once ubiquitous in North America. Yet like bison, they were nearly hunted to extinction in the late 19th century. Elk have since rebounded and, thanks to better wildlife management, have recolonized much of their former range. In Wyoming, state and federal agencies keep elk numbers up by stocking select winter feeding grounds with hay.

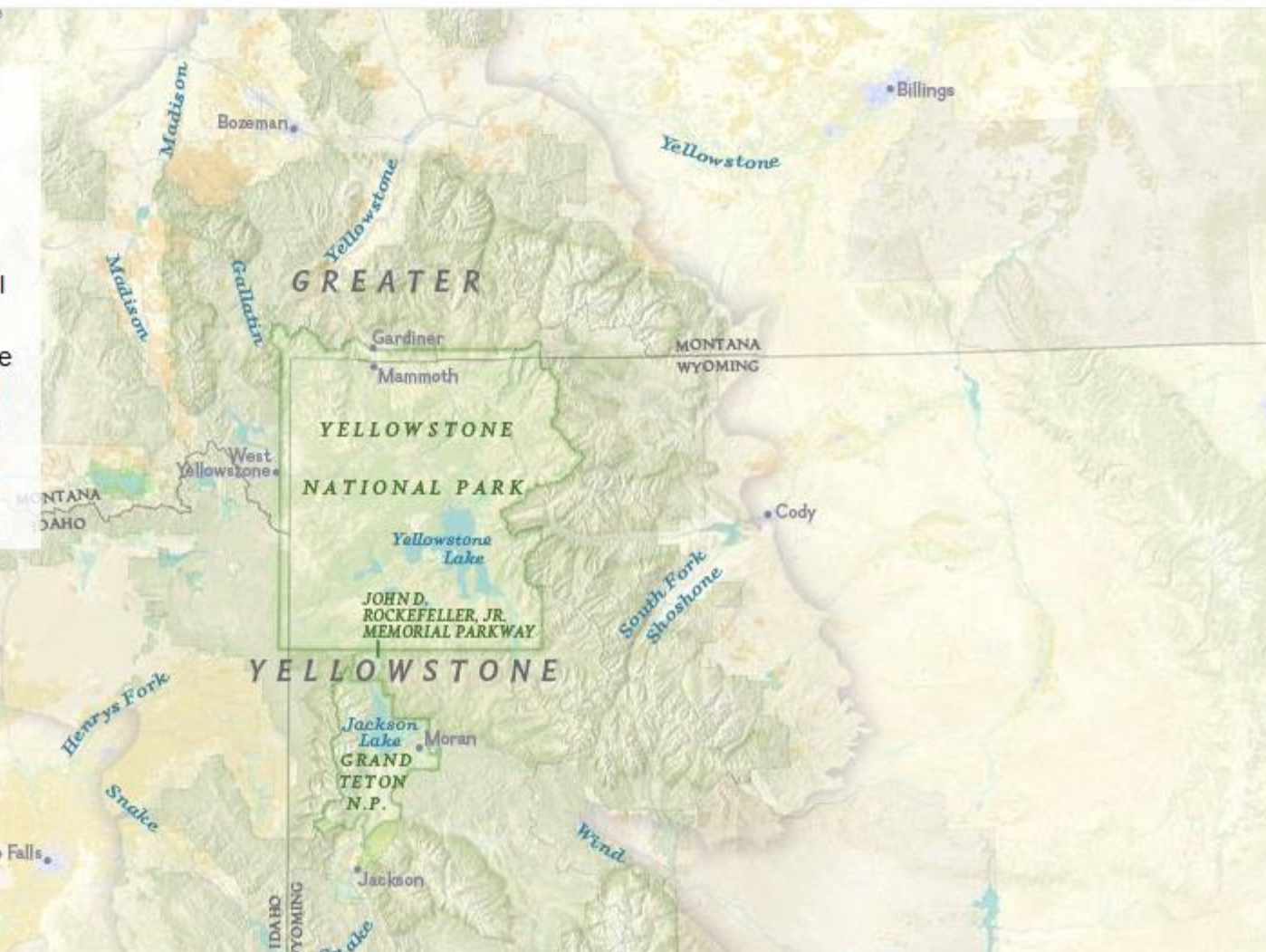


The Journey of Yellowstone Elk

Share: [f](#) [t](#) [p](#) ...

Greater Yellowstone Ecosystem

This map shows the boundary used by the Greater Yellowstone Coordinating Committee, a federal partnership. Wildlife officials and researchers say that managing the region as a single ecosystem—an approach that's controversial with many nonfederal landowners—is key to increasing sustainability.





Greater Yellowstone Superherd

Nine discrete elk herds, totaling 10,000 to 20,000 individuals, compose what ecologist Arthur Middleton calls the Greater Yellowstone superherd. These herds spend their summers in the core protected area of the Greater Yellowstone Ecosystem. Their seasonal migrations—into the park each spring, then back out again in autumn—are among the most stable, the most arduous, and the most studied.

The Journey of Yellowstone Elk

Share: [f](#) [t](#) [p](#) ...

Winter

This map is one of the first to use GPS data from collared elk to depict all of the herds' migration corridors—the veins and arteries of Yellowstone. Elk are shown here in their winter feeding grounds.

 Winter range

March



50 km
30 mi



The Journey of Yellowstone Elk

Share: [f](#) [t](#) [p](#) ...

Pulse of the Park

The herds flow back out into the surrounding region when autumn snow begins to fall.

-  Winter range
-  Summer range

August



THE JOURNEY OF YELLOSTONE ELK (National Geographic, 2016)

50 mi

Narrative cartographic representation of a sequential structure with static and dynamic view-only maps

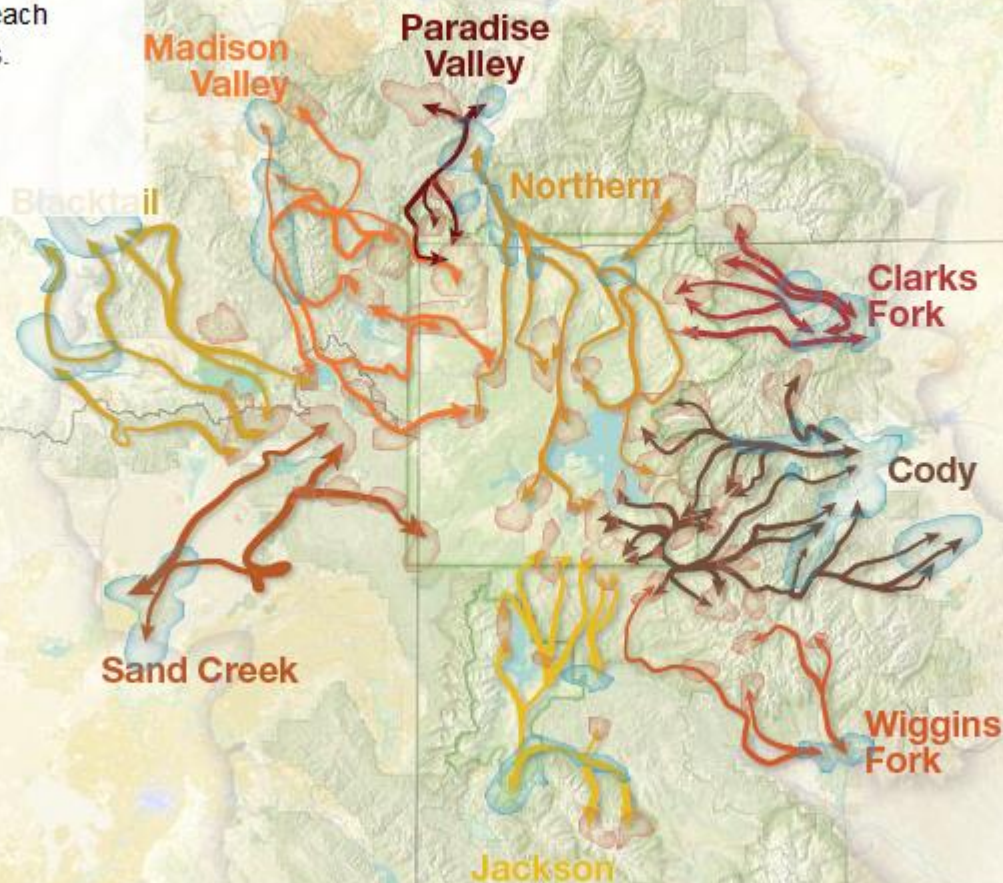


The Journey of Yellowstone Elk

Share: [f](#) [t](#) [p](#) ...

This map shows the migratory routes of nine elk herds, each named for where it winters.

- Winter range
- Summer range



THE JOURNEY OF YELLOSTONE ELK (National Geographic, 2016)

The Cody Herd

About 6,000 elk comprise the Cody herd. Some spend winter along the Shoshone River, but the majority cluster near the Greybull. This group makes one of the world's most dramatic migrations. To reach lofty, remote plateaus each spring, they traverse steep mountain passes and swollen rivers. On the return trek in fall, they must contend with hunters.

Narrative cartographic representation of a sequential structure with static and dynamic view-only maps

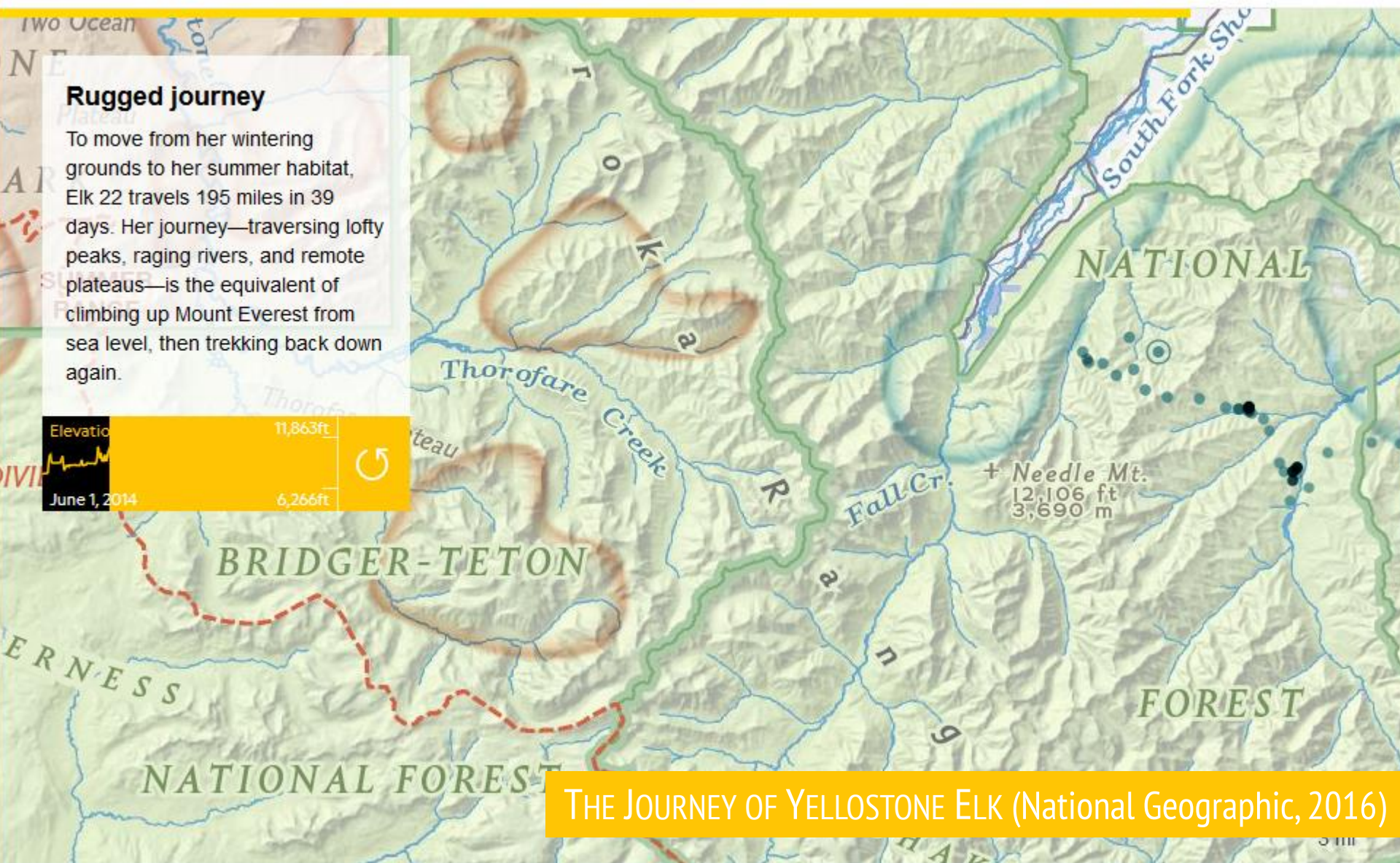


The Journey of Yellowstone Elk

Share: [f](#) [t](#) [p](#) ...

Rugged journey

To move from her wintering grounds to her summer habitat, Elk 22 travels 195 miles in 39 days. Her journey—traversing lofty peaks, raging rivers, and remote plateaus—is the equivalent of climbing up Mount Everest from sea level, then trekking back down again.



THE JOURNEY OF YELLOSTONE ELK (National Geographic, 2016)

Narrative cartographic representation of a sequential structure with static and dynamic view-only maps

A photograph of an elk standing in a snowy, mountainous landscape. The elk is facing right, looking towards the horizon. The background shows rolling hills and mountains covered in snow under a pale sky.

DESIGN AND DEVELOPMENT: BRIAN JACOBS, JULIA SMITH, VITOMIR ZARKOVIC. MAPS: MARTIN G. MACHE. VIDEO: JOE RIIS. PHOTOGRAPHS: DAVID GUTTENFELDER, CHARLIE HAMILTON JAMES, JOE RIIS. SCIENTIFIC ADVISER: ARTHUR MIDDLETON, YALE SCHOOL OF FORESTRY AND ENVIRONMENTAL STUDIES. GIS: THEODORE A. SICKLEY, MATTHEW M. HAYES AND JEROD A. MERKLE, WYOMING MIGRATION INITIATIVE, UNIVERSITY OF WYOMING. TEXT: JEREMY BERLIN. MAP EDIT: GUS PLATIS.

SOURCES: MATTHEW KAUFFMAN, WYOMING MIGRATION INITIATIVE, UNIVERSITY OF WYOMING; JAMES E. MEACHAM AND ALETHEA Y. STEINGISSER, INFOGRAPHICS LAB, UNIVERSITY OF OREGON; ANDREW J. HANSEN, MONTANA STATE UNIVERSITY; SARAH DEWEY, ANN W. RODMAN, DOUGLAS W. SMITH, DANIEL STAHLER, ERIN STAHLER, AND P. J. WHITE, NATIONAL PARK SERVICE; ERIC COLE, NATIONAL ELK REFUGE; BRUCE B. ACKERMAN AND PAUL ATWOOD, IDAHO FISH AND GAME; RON AASHEIM, JUSTIN GUDE, KELLY PROFFITT, AND NEAL WHITNEY, MONTANA FISH, WILDLIFE AND PARKS; ALYSON COURTEMANCH, RENNY MACKAY AND DOUG MCWHIRTER, WYOMING GAME AND FISH DEPARTMENT; THE NATURE CONSERVANCY, WYOMING; NATIONAL CONSERVATION EASEMENT DATABASE; MONTANA DEPARTMENT OF REVENUE; BLM; USGS.

Slave Revolt in Jamaica, 1760-1761

A Cartographic Narrative

[Home](#)[Project](#)[Sources](#)[Acknowledgments](#)[Map](#)

This animated thematic map narrates the spatial history of the greatest slave insurrection in the eighteenth century British Empire. To teachers and researchers, the presentation offers a carefully curated archive of key documentary evidence. To all viewers, the map suggests an argument about the strategies of the rebels and the tactics of counterinsurgency, about the importance of the landscape to the course of the uprising, and about the difficulty of representing such events cartographically with available sources.

Although this cartographic narration cannot be taken as an exhaustive database—for instance, it does not examine major themes such as belonging and affiliation among the insurgents or the larger imperial context and interconnected Atlantic world—the map offers an illuminating interpretation of the military campaign's spatial dynamics.



Vincent Brown

Principal Investigator and Curator

Charles Warren Professor of History and Professor of African and African-American Studies

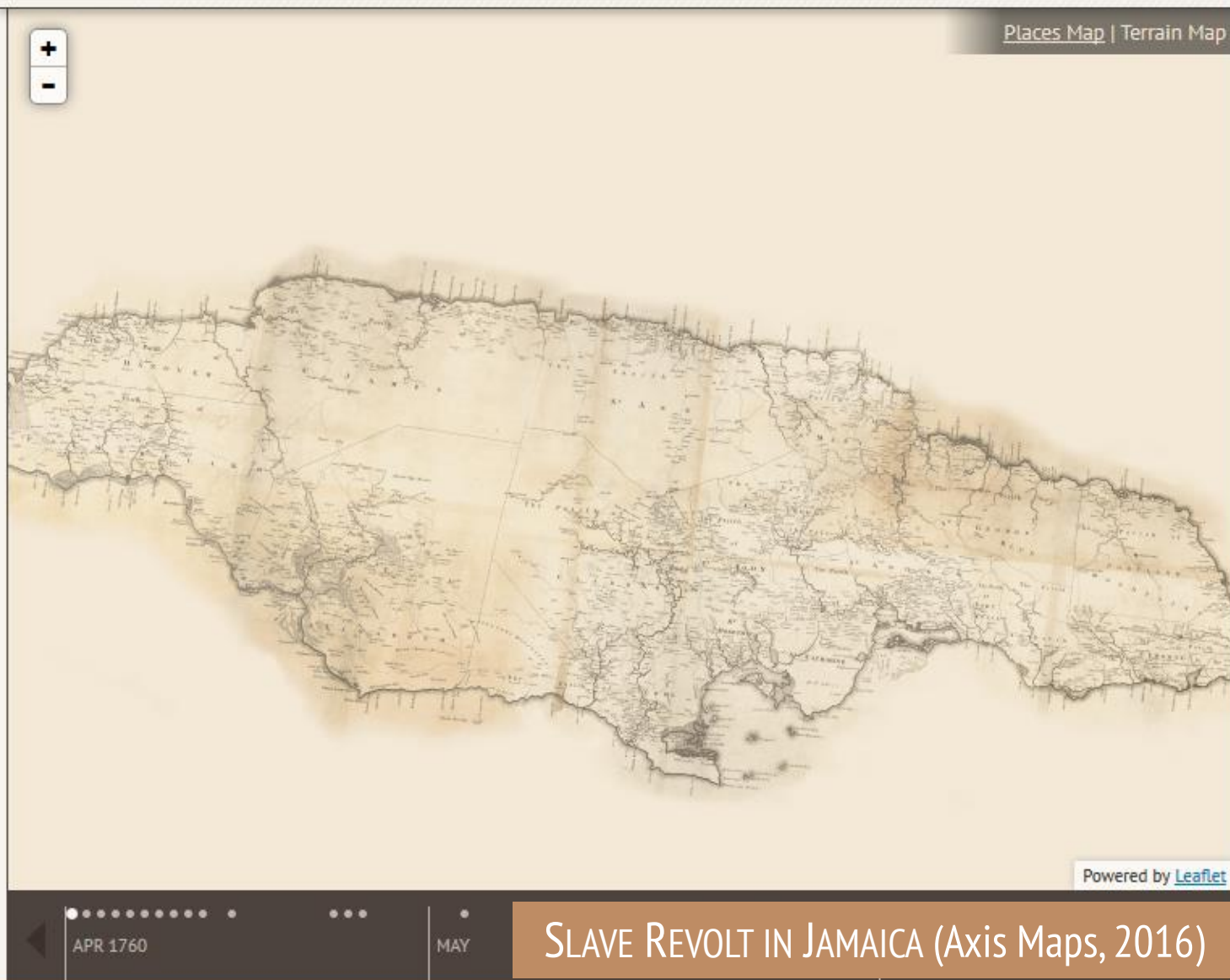
Director, History Design Studio

Harvard University
brown8@fas.harvard.edu

1760-1761

These circumstances show the great extent of the conspiracy, the strict correspondence which had been carried on by the Coromantins in every quarter of the island, and their almost incredible secrecy in the forming of their plan of insurrection; for it appeared in evidence, that the first eruption in St. Mary's, was a matter preconcerted, and known to all the chief men in the different districts; and the secret was probably confided to some hundreds, for several months before the blow was struck.-- Planter and historian Edward Long, History of Jamaica (1774)

► Map Legend



Narrative cartographic representation of a (non)sequential structure with dynamic and interactive maps



PLAY



1 of 2

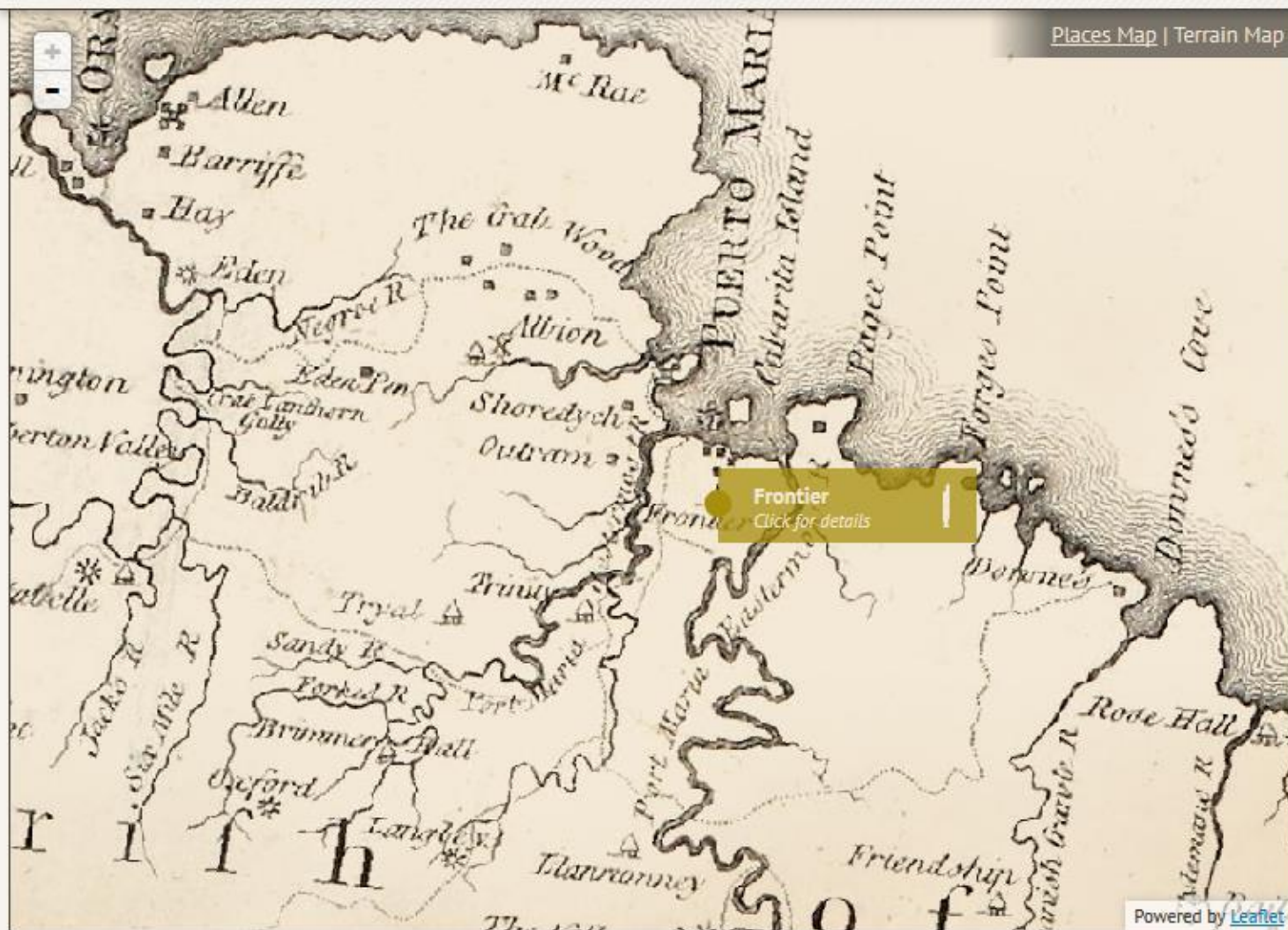
Conspirators on Frontier estate decide to launch the revolt.

April 7, 1760

Two Coromantee Negroes, Tacky and Jamaica, on Frontier Estate (belonging to Ballard Beckford, Esq;) having long been concerting a Rebellion with three other Chieftains of their country, who were each of them to have an Estate for his good Services, they fixed on Easter Monday Night for their rising.-- Letter from a Gentleman at St. Mary, 14 April 1760

"It is believed that the plan was laid for a general insurrection all over the Island by the Corromantee Negroes who are by much the most numerous & resolute; the time fix'd was the Witsun Hollidays but very fortunately the Negroes in St. Marys particularly those upon the Estate that now belongs to Crookshank Mr

► Map Legend



APR 1760

MAY

SLAVE REVOLT IN JAMAICA (Axis Maps, 2016)

Powered by [Leaflet](#)

Narrative cartographic representation of a (non)sequential structure with dynamic and interactive maps



PLAY



7 of 14

At Esher, rebels kill the overseer, a surveyor, and three other white men

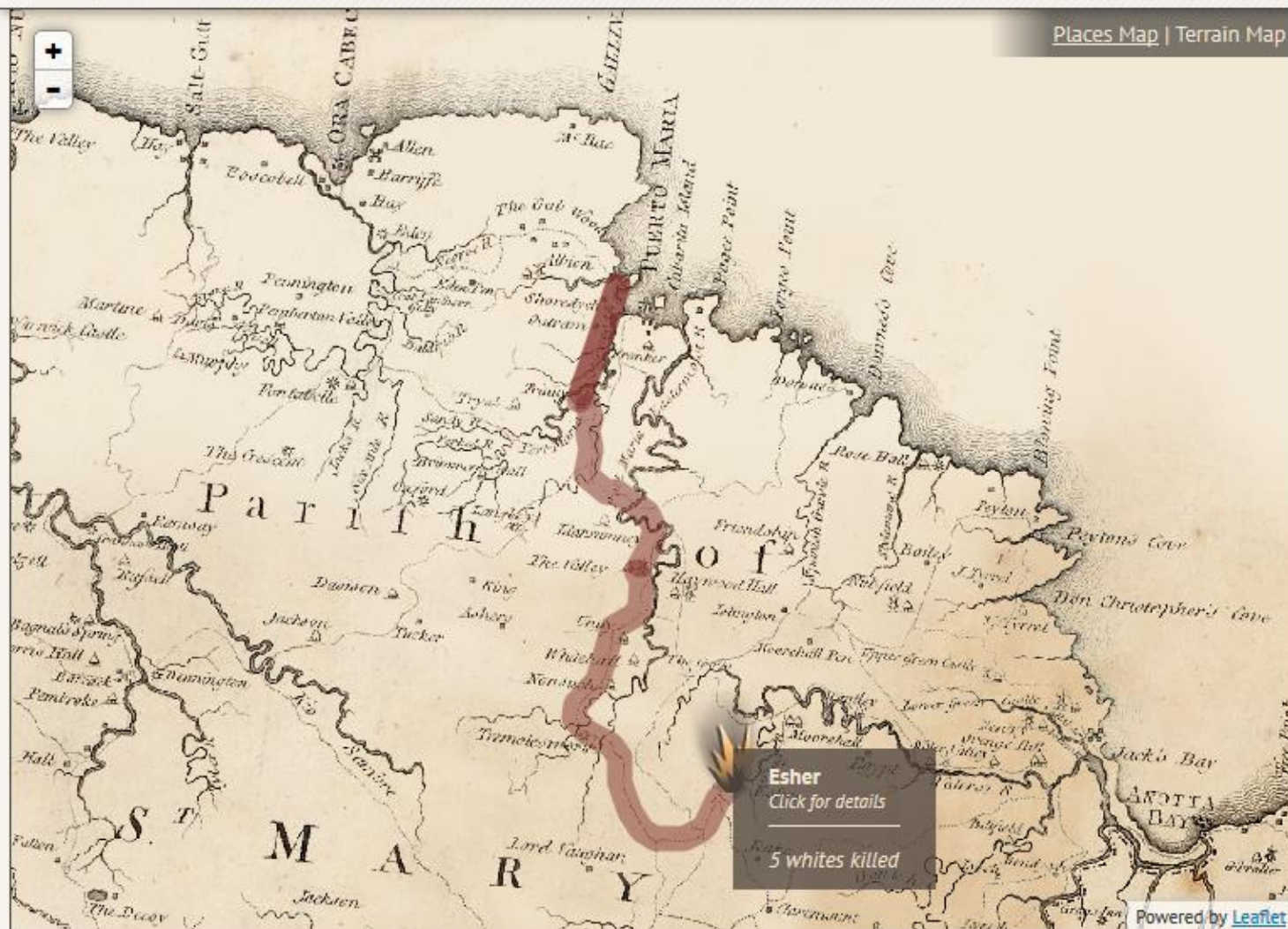
Places Map | Terrain Map

April 8, 1760

Having at Midnight assembled about 90 others, at Mr. Bayly Estate, Trinity (from Esher, Whitehall, Ballard Valley, and other Plantations) they marched to Port Maria ... Killing the Centinel at the Fort, [they] took from thence four Barrels of Powder, a Keg of Musket Balls, and all the Small Arms in the Fort-- Letter from a Gentleman at St. Mary, 14 April 1760

"Being by this time joined by a number of their countrymen from the neighboring plantations, they marched up the high road that led to the interior parts of the country, carrying death and desolation as they went."
—Bryan Edwards, History of the West Indies

"At Day Light they appeared



► Map Legend

APR 1760

MAY

SLAVE REVOLT IN JAMAICA (Axis Maps, 2016)

Narrative cartographic representation of a (non)sequential structure with dynamic and interactive maps



How Much Hotter Is Your Hometown Than When You Were Born?

As the world warms because of human-induced climate change, most of us can expect to see more days when temperatures hit 32 degrees Celsius (90 degrees Fahrenheit) or higher. See how your hometown has changed so far and how much hotter it may get.

4

Narrative representation of a sequential structure with static map supporting the event-driven interaction

Zagreb, Croatia

Birth year

Days at or above 32°C per year

Avg. number of days
at or above 32°C

Scroll to continue

1981

Born

When you were born, the Zagreb area could expect about

5 days per year to reach at least 32 degrees.

1960

1970

1980

HOW MUCH HOTTER...? (The New York Times, 2018)

4

Narrative representation of a sequential structure with static map supporting the event-driven interaction

Zagreb, Croatia

Birth year

Days at or above 32°C per year

Today, the Zagreb area can expect **18 days** at or above 32 degrees per year, on average.

at or above 32°C

1981
Born

2017

0
REMAINING

Read. Watch. Listen. **Four-week free trial.** Ends soon

How MUCH HOTTER...? (The New York Times, 2018)

4

Narrative representation of a sequential structure with static map supporting the event-driven interaction

Zagreb, Croatia

Birth year

Days at or above 32°C per year

Avg. number of days
at or above 32°C

2017

2061

Age 80

Likely range

1981
Born

By the time you're 80, models show there could be **33** of these very hot days. The likely range is between **22 and 40** days.

0

REMAINING

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How MUCH HOTTER...? (The New York Times, 2018)

1960 1970 1980 1990 2000 2010 2020 2030 2040 2050 2060 2070 2080 2090

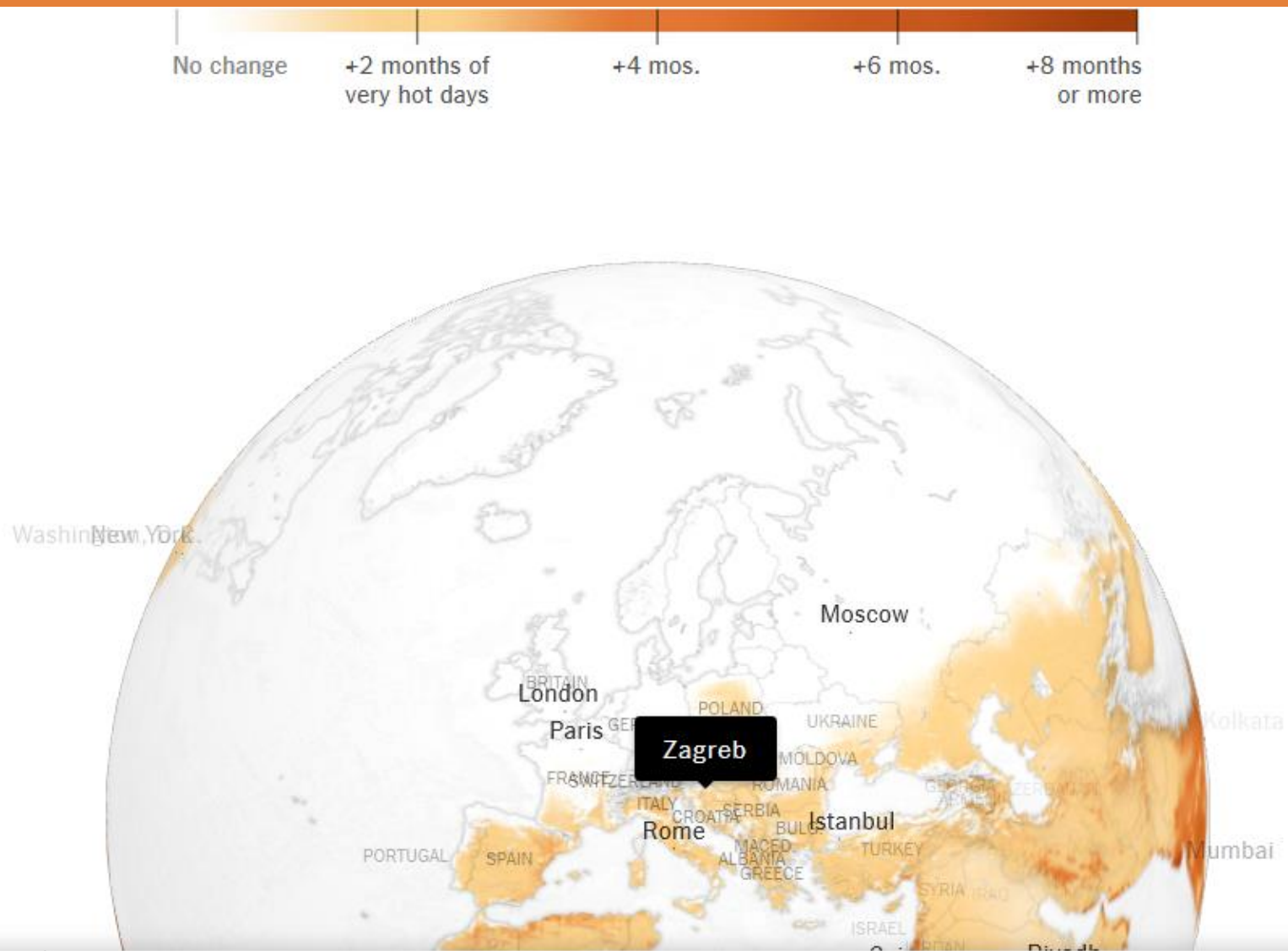
THE ZAGREB AREA is likely to feel this extra heat even if countries take action to lower their greenhouse gas emissions by the end of the century, according to an analysis conducted for The New York Times by the [Climate Impact Lab](#), a group of climate scientists, economists and data analysts from the Rhodium Group, the University of Chicago, Rutgers University and the University of California, Berkeley. If countries continue emitting at historically high rates, the future could look even hotter.

The future projection shown here assumes countries will curb emissions roughly in line with the world's original Paris Agreement pledges (although most countries [do not appear on track to meet those pledges](#)).

On the map below, you can see a global picture of how days at or above 32 degrees could increase by the end of the century.

4

Narrative representation of a sequential structure with static map supporting the event-driven interaction

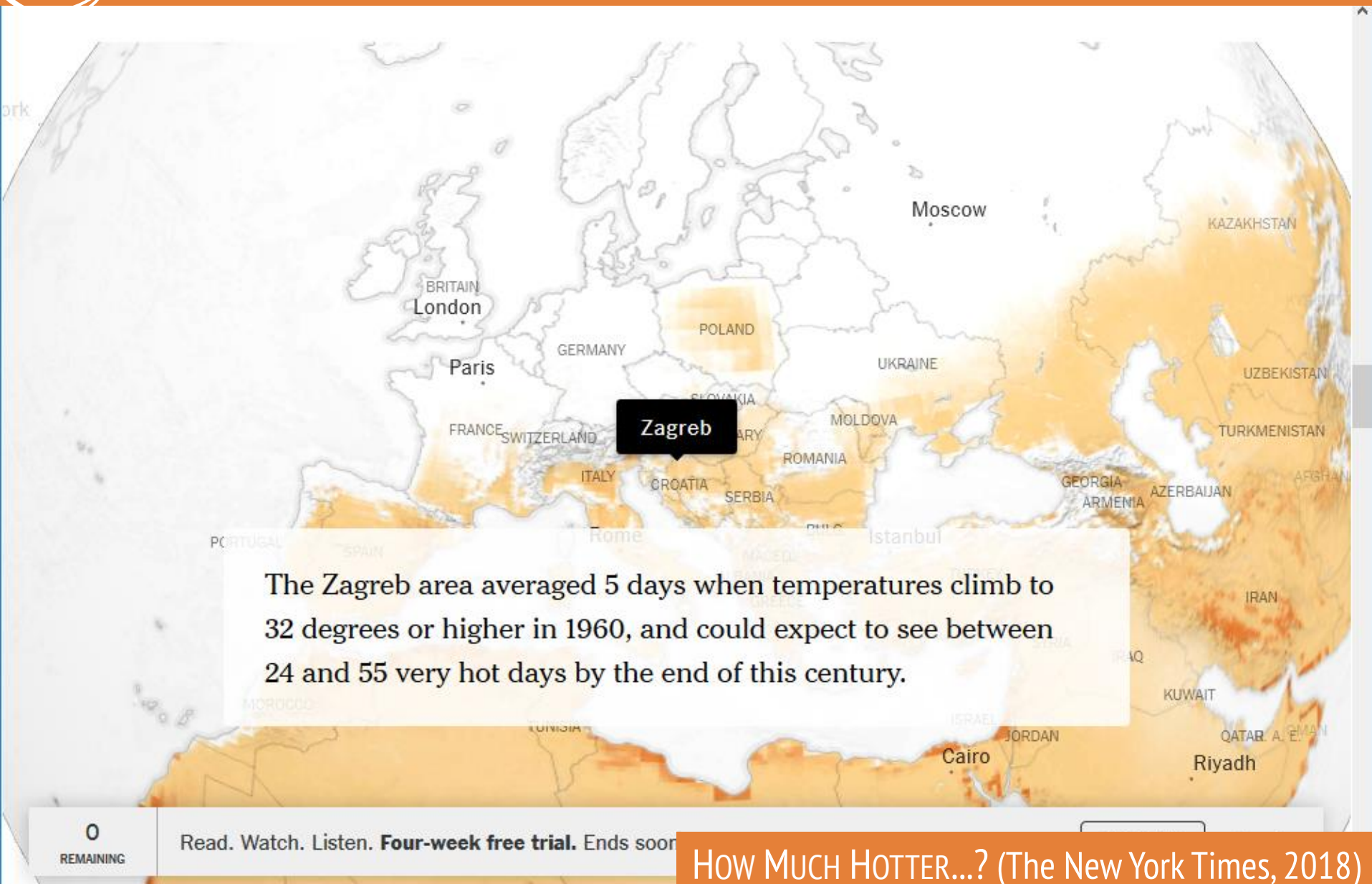


0
REMAINING

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How MUCH HOTTER...? (The New York Times, 2018)

Narrative representation of a sequential structure with static map supporting the event-driven interaction



Narrative representation of a sequential structure with static map supporting the event-driven interaction



Narrative representation of a sequential structure with static map supporting the event-driven interaction



Large relative increases in heat will be felt in more moderate climates, too. Madrid, which averaged 33 days of at least 32-degree heat in 1960, could see such very hot days double or triple by the end of the century.

High heat also affects food production (including lowering [crop yields](#) and [dairy production](#)) and can increase the demand for electricity. More frequent 32-degree days could also exacerbate drought and fire conditions in certain regions.

“More very hot days worldwide bring direct and dangerous impacts on people and the systems on which we depend,” said Cynthia Rosenzweig, head of the Climate Impacts Group at the NASA Goddard Institute for Space Studies. “Food, water, energy, transportation, and ecosystems will be affected both in cities and the country. High-temperature health effects will strike the most vulnerable.”

By NADJA POPOVICH, BLACKI MIGLIOZZI, RUMSEY TAYLOR, JOSH WILLIAMS and DEREK WATKINS

Climate modelling by Climate Impact Lab

Additional design and development by Troy Griggs.

5

Narrative cartographic representation in which storytelling is performed by scrolling

The New York Times

THE RUSSIA LEFT BEHIND



The Russia Left Behind

A journey through a heartland on the slow road to ruin.

By ELLEN BARRY

Photographs by DMITRY KOSTYUKOV for The New York Times; Video by BEN C. SOLOMON

Produced by MIKE BOSTON

THE RUSSIA LEFT BEHIND (The New York Times, 2013)

Narrative cartographic representation in which storytelling is performed by scrolling





LYUBAN

A Modern Train, a Rotting City

A few times every day, the high-speed train between St. Petersburg and Moscow barrels through the threadbare town of Lyuban. When word gets out that the head of Russia's state railway company — a close friend of President Vladimir V. Putin — is aboard, the station's employees line up on the platform standing at attention, saluting Russia's modernization for the seconds it takes the train to fly through. *Whoosh.*

But Vladimir G. Naperkovsky is not one of them. He watched with a cold, blue-eyed stare as the train passed the town where he was born, with its pitted roads and crumbling buildings. At 52, having shut down his small computer repair business, Mr. Naperkovsky is leaving for another region in Russia, hoping it is not too late to start a new life in a more prosperous place. The reasons are many, but his view boils down to this: "Gradually," he said, explaining his view of L

CHUDOVO

A Wedding for a 14-Year-Old



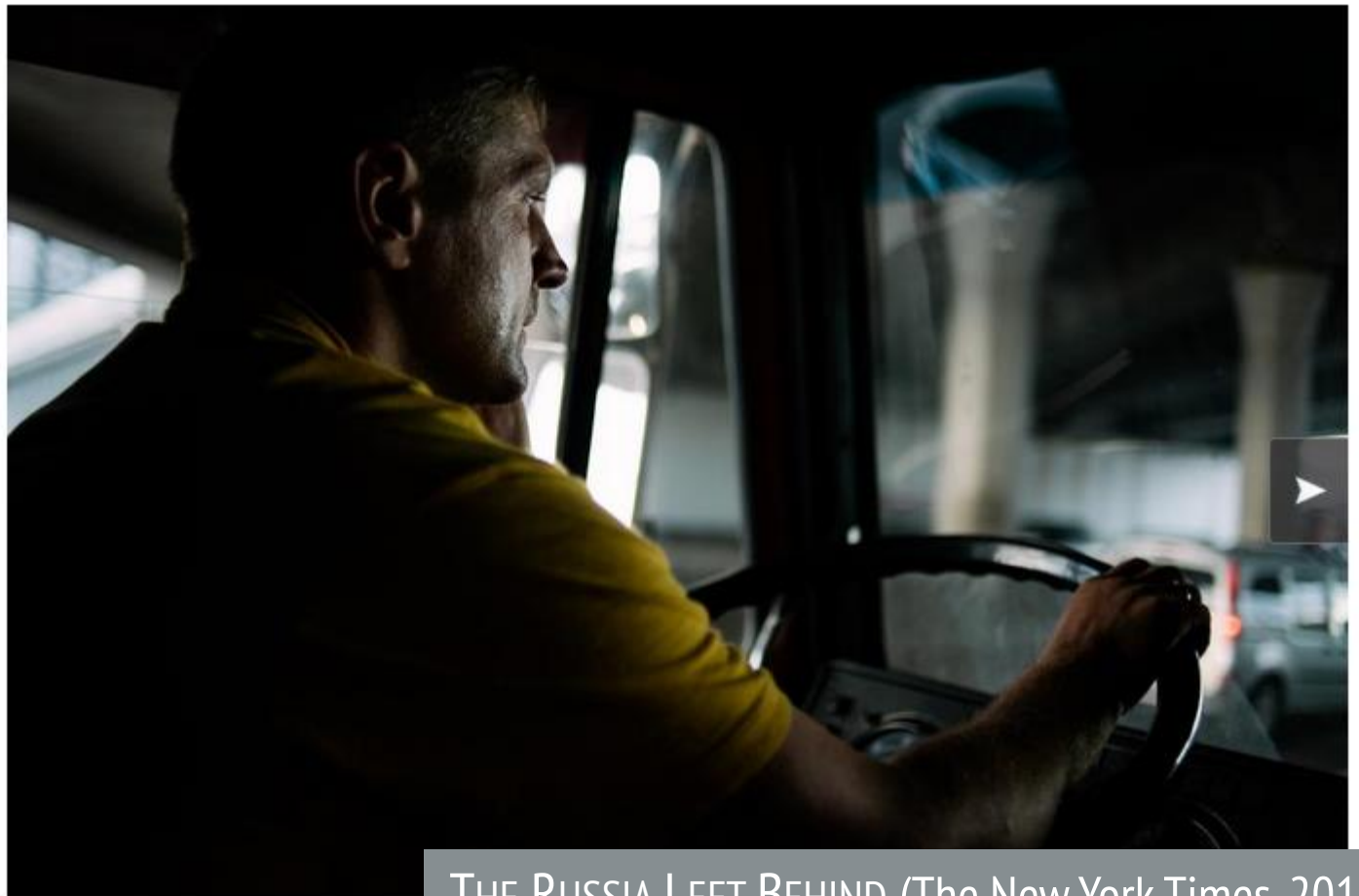
VIDEO | 0:59

A bride, 14, and her groom, 13, celebrated among their Gypsy community, which settled in Chudovo after the 1986 nuclear disaster.

THE RUSSIA LEFT BEHIND (The New York Times, 2013)

CHERNAYA GRYAZ

'Black Dirt'



Mr. Chertkov in the cab of his truck entering Moscow.

THE RUSSIA LEFT BEHIND (The New York Times, 2013)



But then his time came, as well. Mr. Chertkov washed the grease off his thick hands and hauled himself up into the cab of his truck and pulled away.

Proximity to Moscow was hardening him, Mr. Chertkov said, as his rig merged with traffic from the airport. Maybe it was time to check out for a season, park his rig in his native village where people are simpler and more virtuous. Put his keys on the shelf and do nothing until the spring.

But these were the idle thoughts of a man moving at full speed in the direction of the Kremlin. On the right he passed one of Russia's largest shopping malls, and a high wall of housing blocks that are home to some 8,000 new arrivals. After that there was nowhere to go but in.

Translations by Natalia V. Osipova and Philipp Chapkowski

Advertisement

THE RUSSIA LEFT BEHIND (The New York Times, 2013)

GRAPHICAL TECHNIQUES AND INTERACTIVITY

for enforcing the structure and narrative flow

1. Communicating narrative and explaining data

- textual narrative
- text annotations
- labeling
- titling
- flowchart arrows
- tooltips
- element highlighting

2. Linking separated story elements

- through interaction
- through color
- through animation

3. Enhancing structure & navigation

- buttons
- scrolling
- breadcrumbs
- section header marks
- timeline

4. Providing controlled exploration

- dynamic queries
- embedded maps
- exploratory maps

GRAPHICAL TECHNIQUES AND INTERACTIVITY

for enforcing the structure and narrative flow

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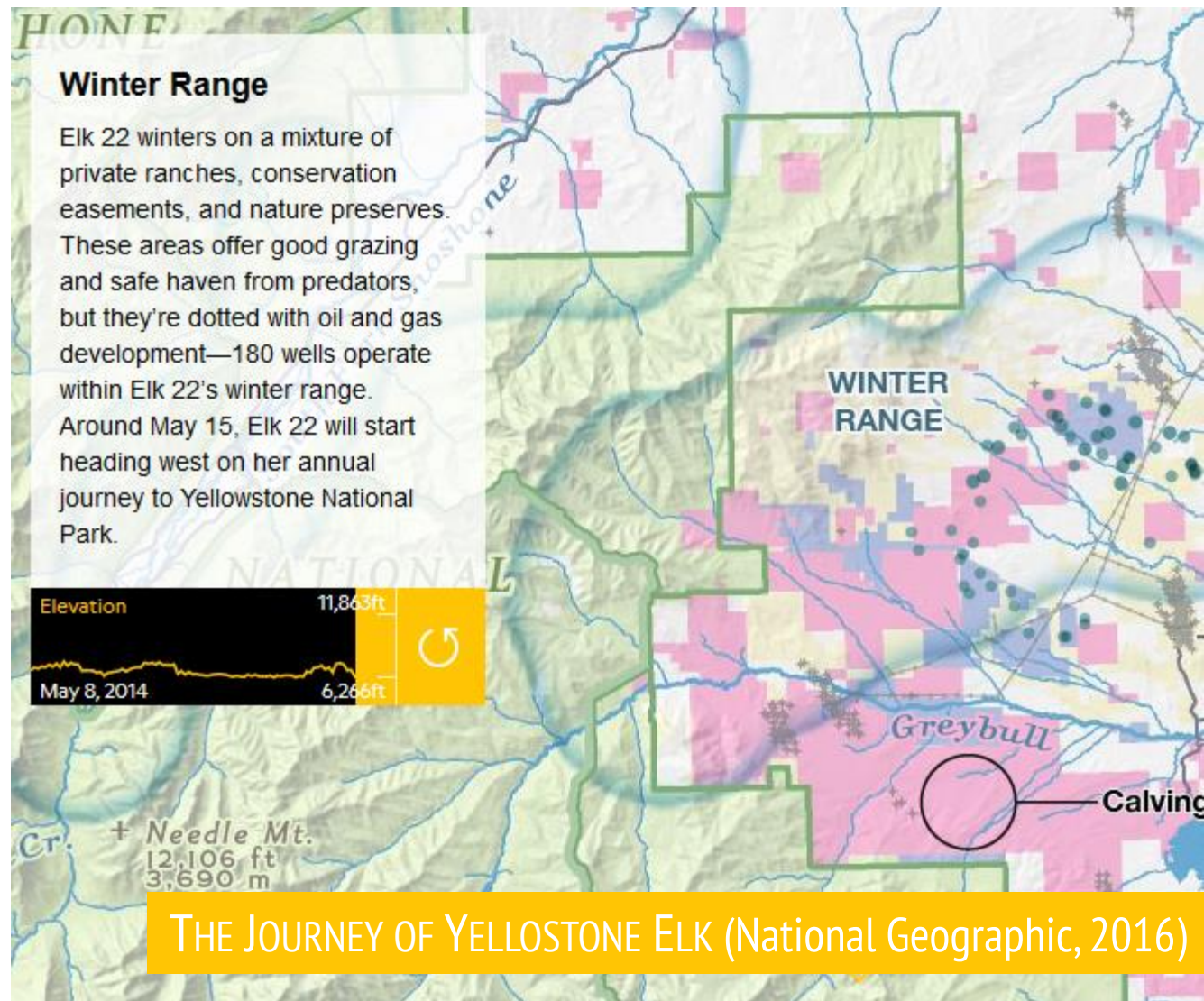
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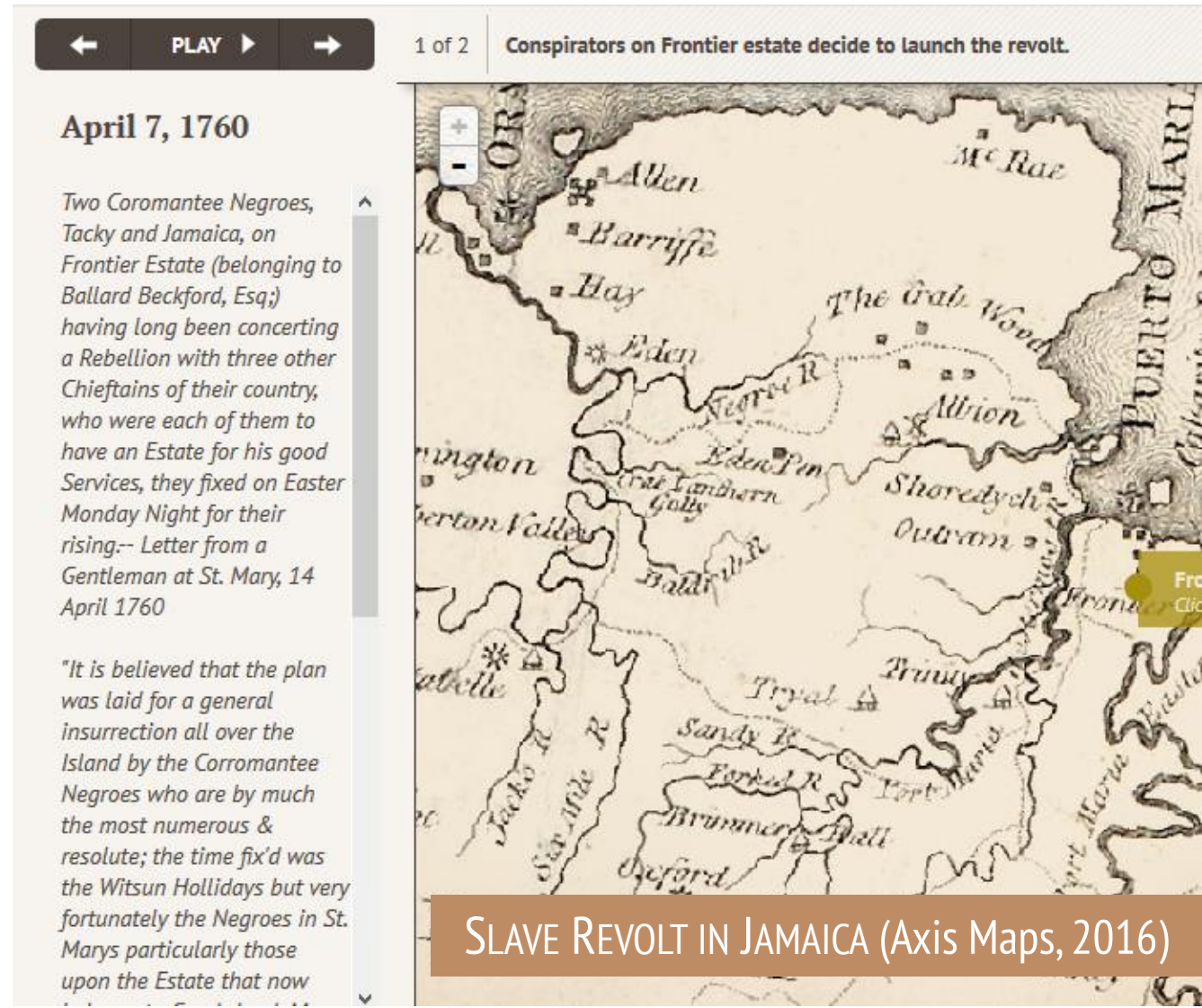


GRAPHICAL TECHNIQUES AND INTERACTIVITY

for enforcing the structure and narrative flow

1. Communicating narrative and explaining data

- textual narrative
- text annotations
- labeling
- titling
- flowchart arrows
- tooltips
- element highlighting



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The New York Times

THE RUSSIA LEFT BEHIND



LYUBAN

A Modern Train, a Rotting City

A few times every day, the high-speed train between St. Petersburg and Moscow barrels through the threadbare town of Lyuban. When word gets out that the head of Russia's state railway company — a close friend of President Vladimir V. Putin — is aboard, the station's employees line up on the platform standing at attention, saluting Russia's modernization for the seconds it takes the train to fly through. *Whoosh.*

But Vladimir G. Naperkovsky is not one of them. He watched with a cold, blue-eyed stare as the train passed the town where he was born, with its pitted roads and crumbling buildings. At 52, having shut down his small computer repair business, Mr. Naperkovsky is leaving for another region in Russia, hoping it is not too late to start a new life in a more prosperous place. The

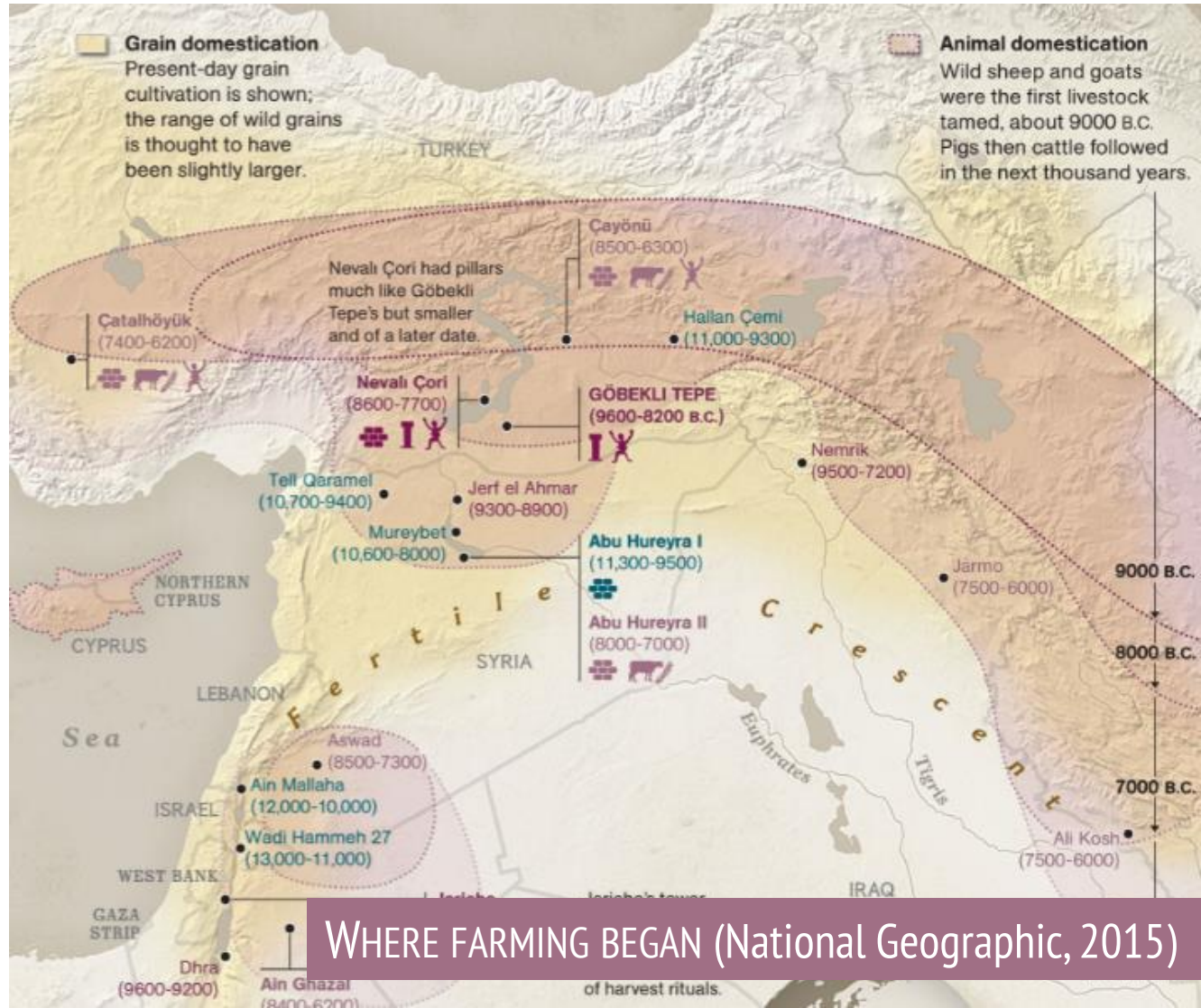
THE RUSSIA LEFT BEHIND (The New York Times, 2013)

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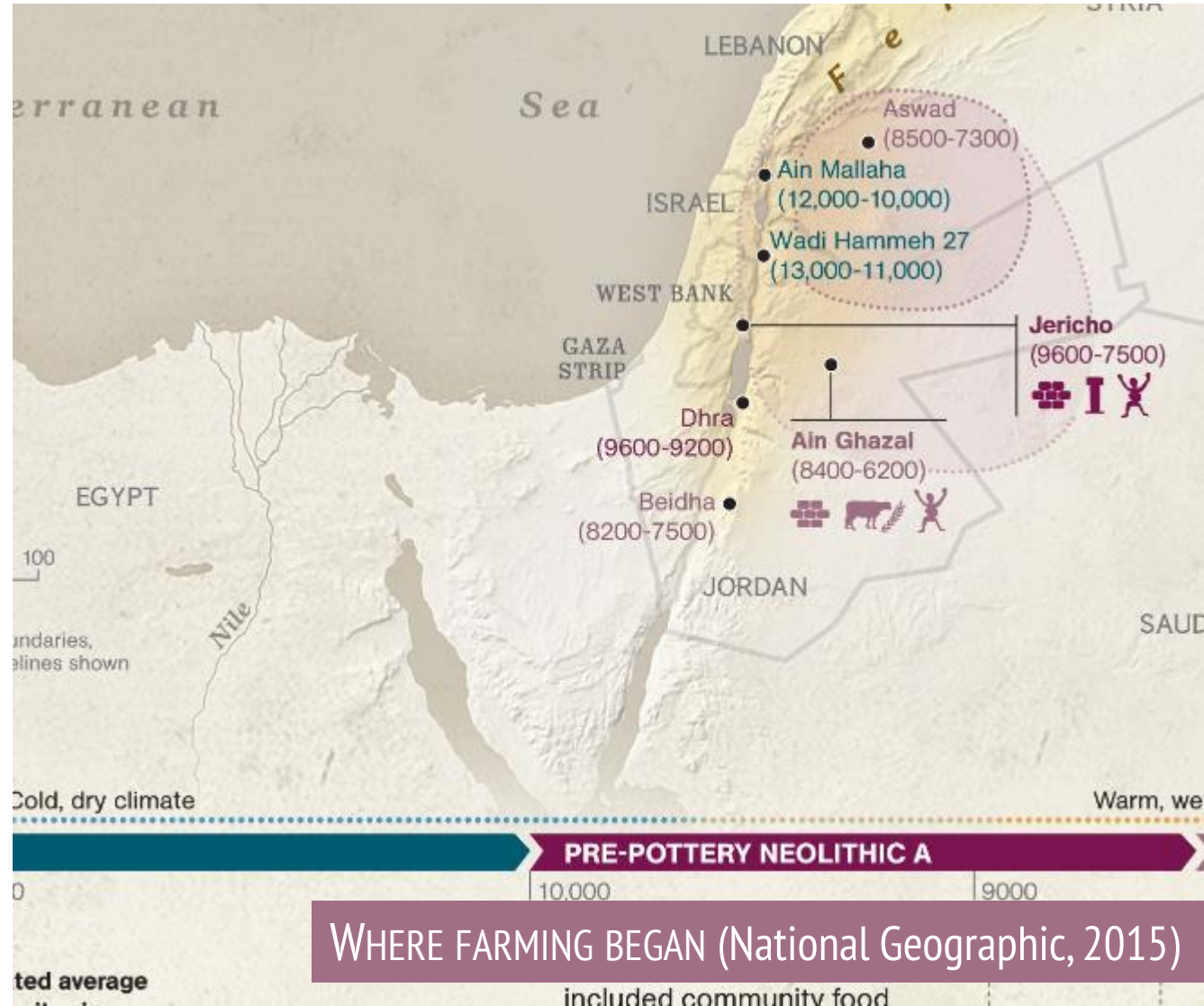


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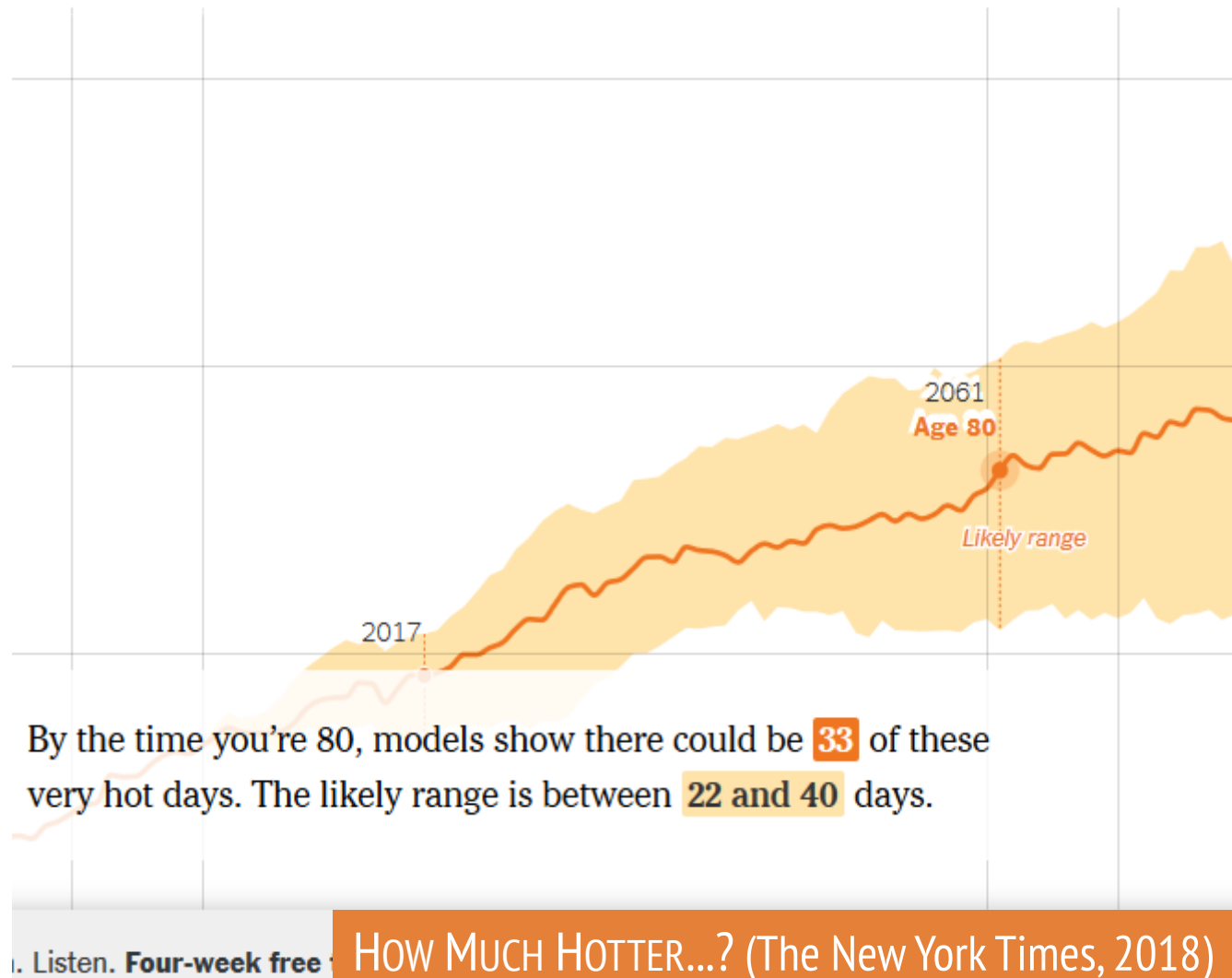


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NEAR VELIKY NOVGOROD

A 70-Mile Traffic Jam



THE RUSSIA LEFT BEHIND (The New York Times, 2013)

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2. Linking separated story elements

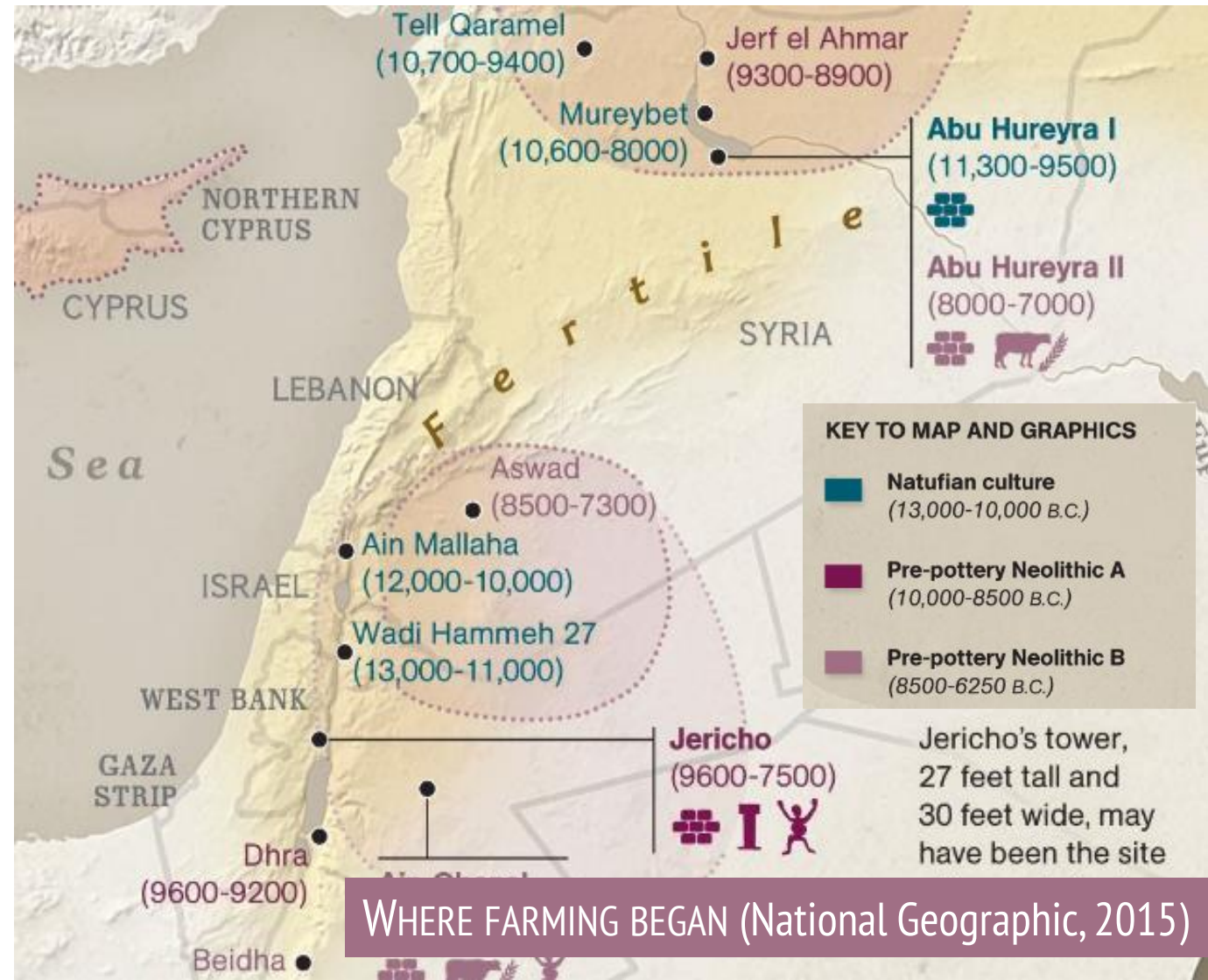
- through interaction
- through color
- through animation

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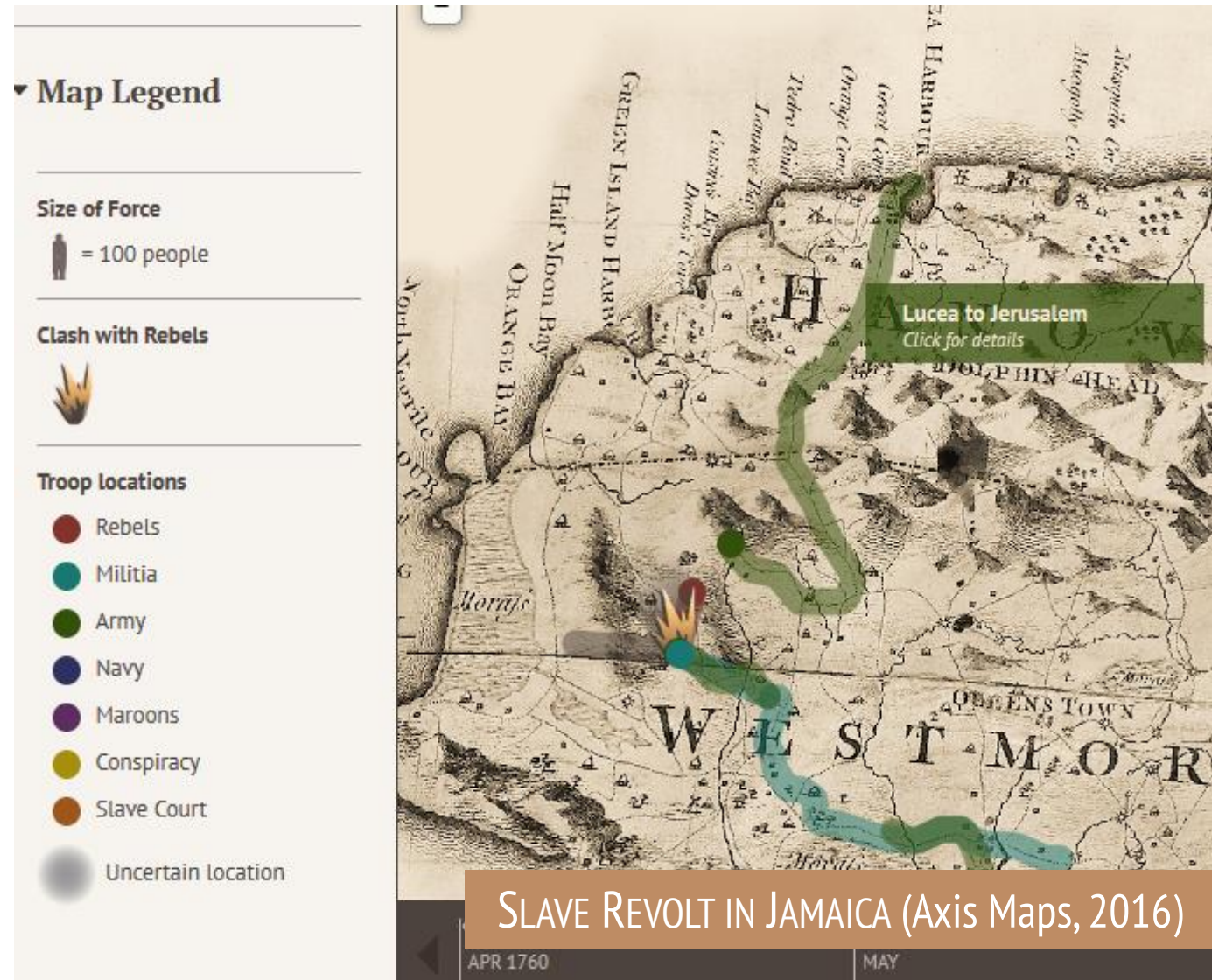


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3. Enhancing structure and navigation

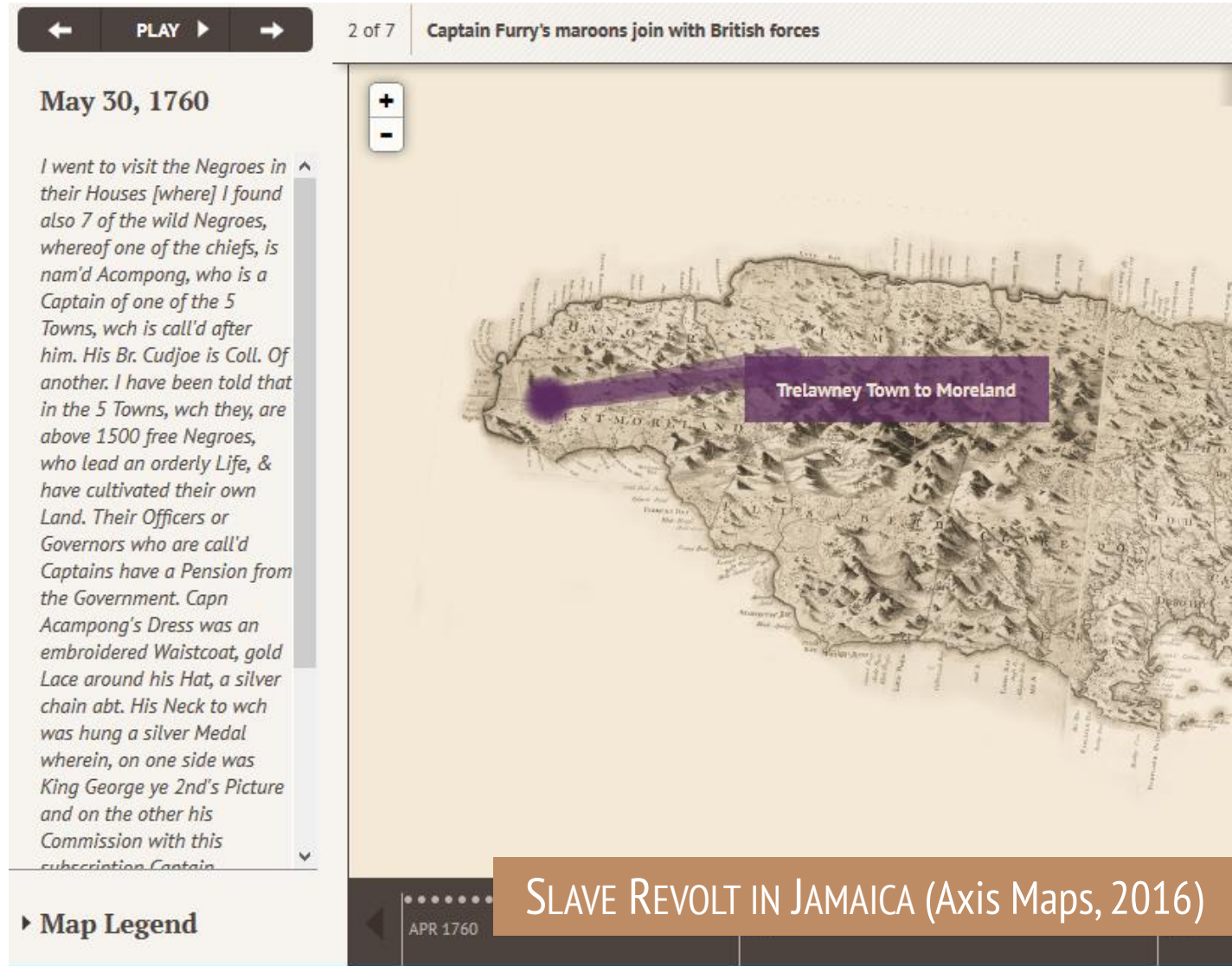
- buttons
- scrolling
- breadcrumbs
- section header marks
- timeline

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How Much Hotter Is Your Hometown Than When You Were Born?

As the world warms because of human-induced climate change, most of us can expect to see more days when temperatures hit 32 degrees Celsius (90 degrees Fahrenheit) or higher. See how your hometown has changed so far and how much hotter it may get.



HOW MUCH HOTTER...? (The New York Times, 2018)

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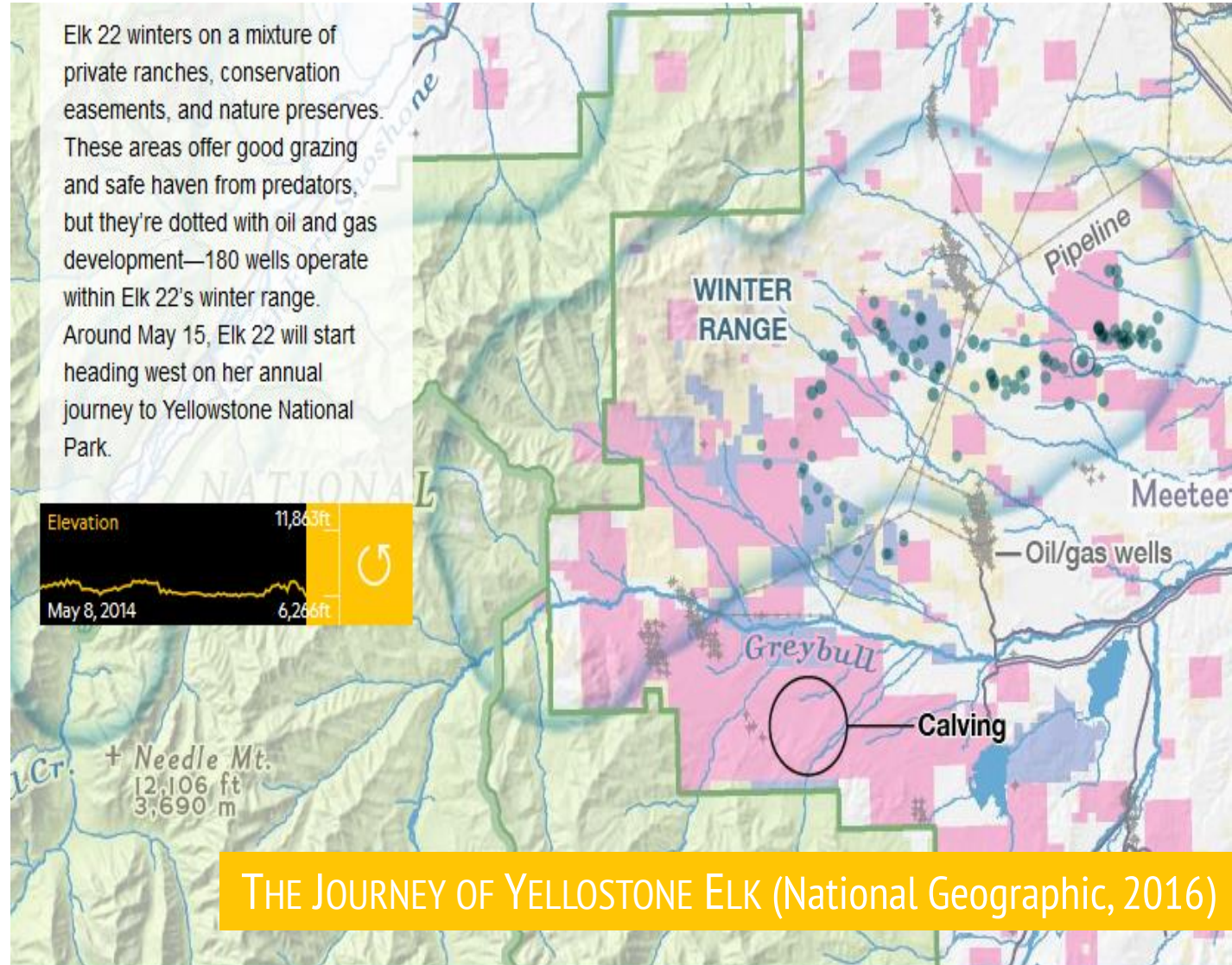
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THE JOURNEY OF YELLOWSTONE ELK (National Geographic, 2016)

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SLAVE REVOLT IN JAMAICA (Axis Maps, 2016)

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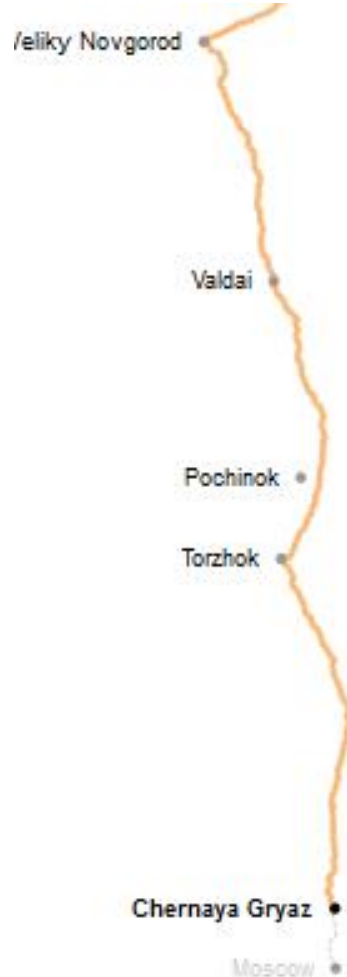
SLAVE REVOLT IN JAMAICA (Axis Maps, 2016)

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THE RUSSIA LEFT BEHIND (The New York Times, 2013)

Aleksandr Chertkov repaired his vehicle near the village of

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4. Providing controlled exploration

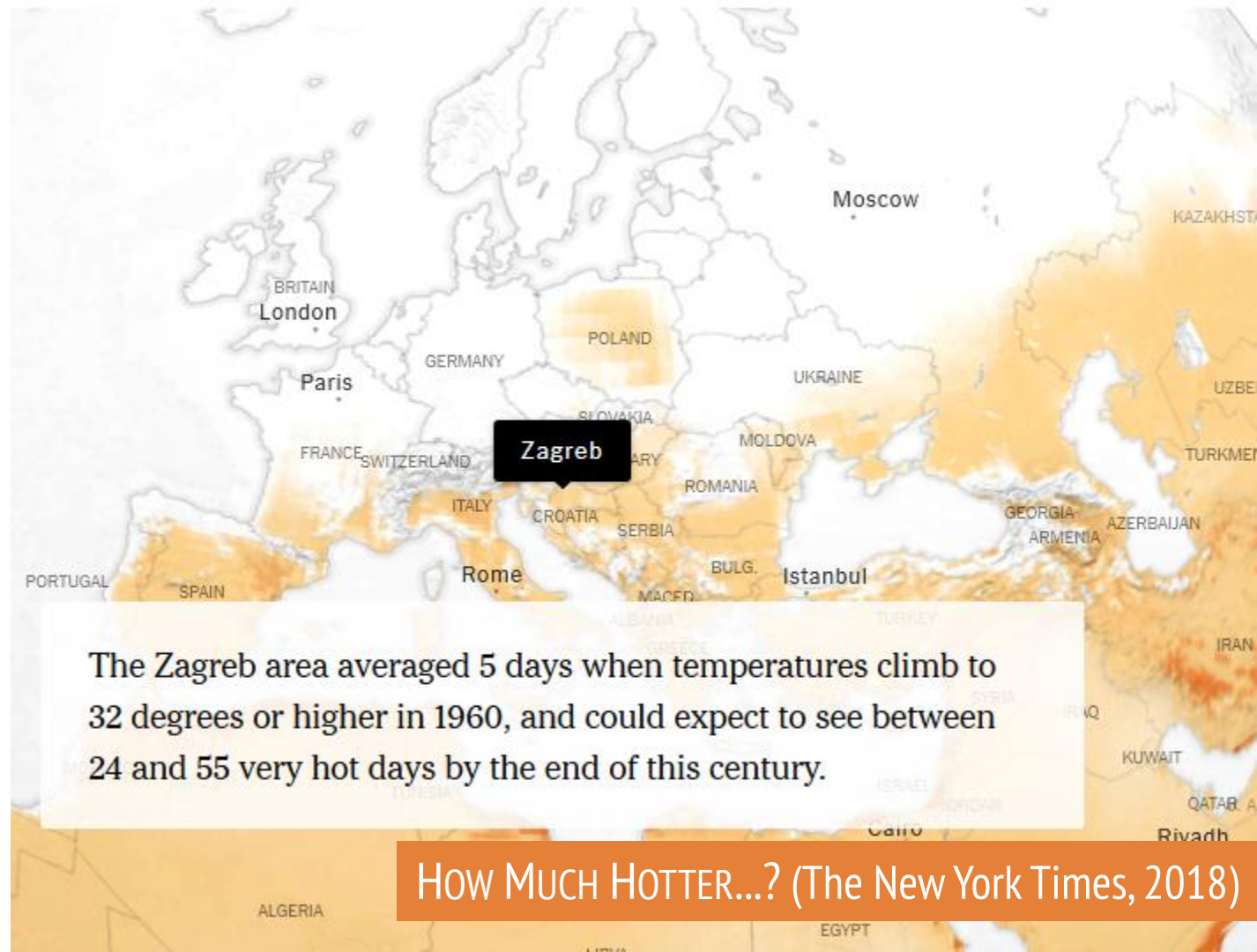
- dynamic queries
- embeded maps
- exploratory maps

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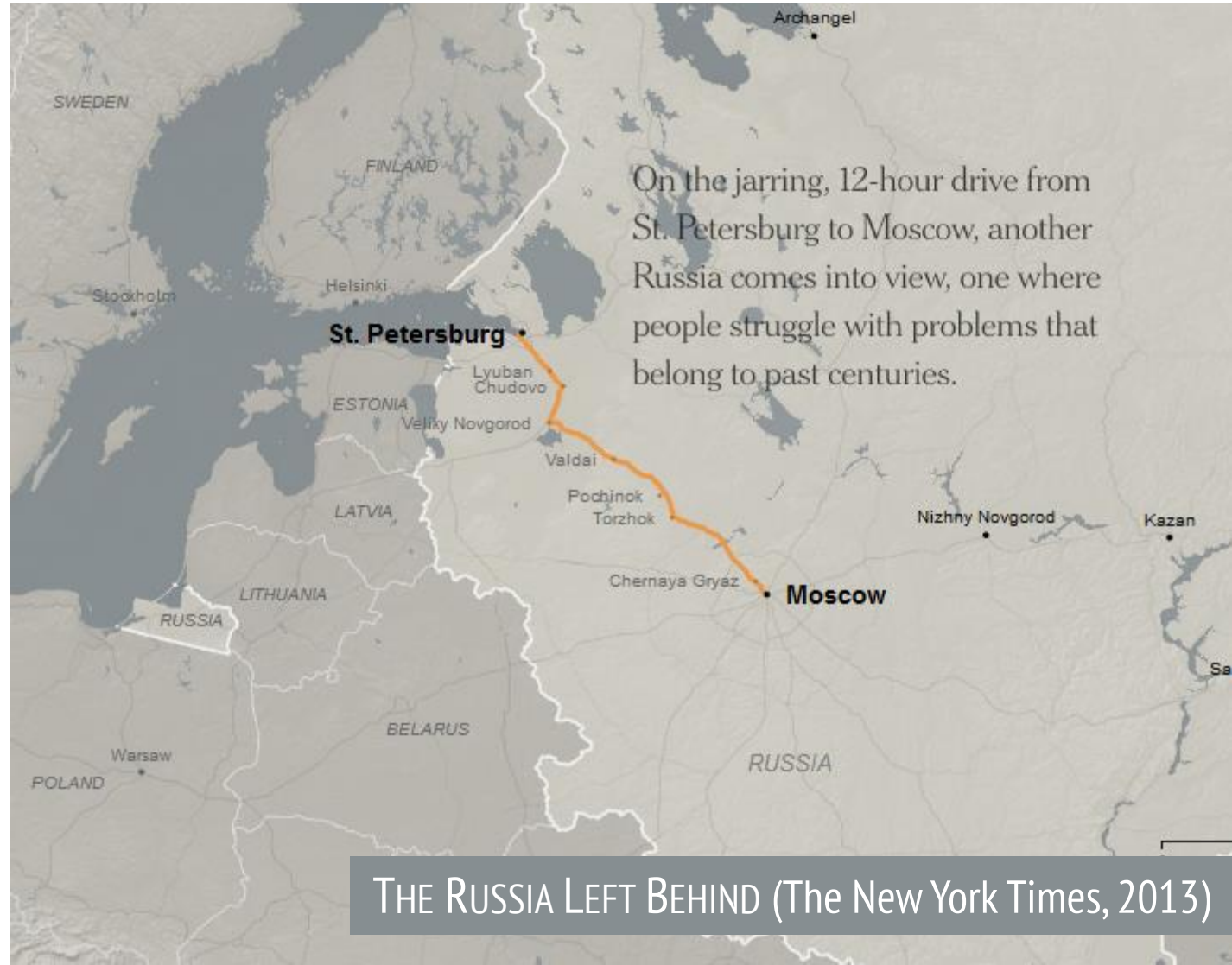


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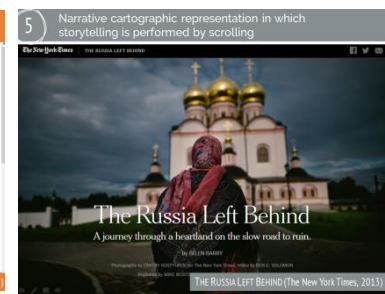
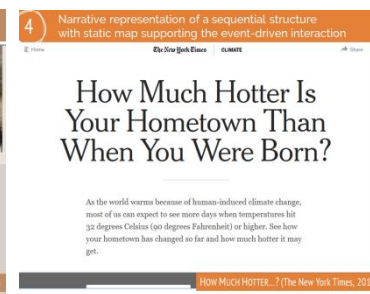
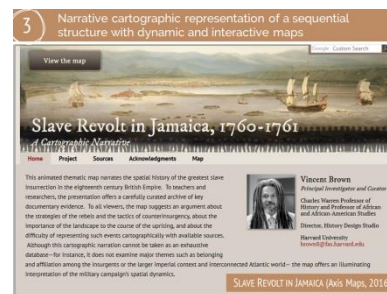
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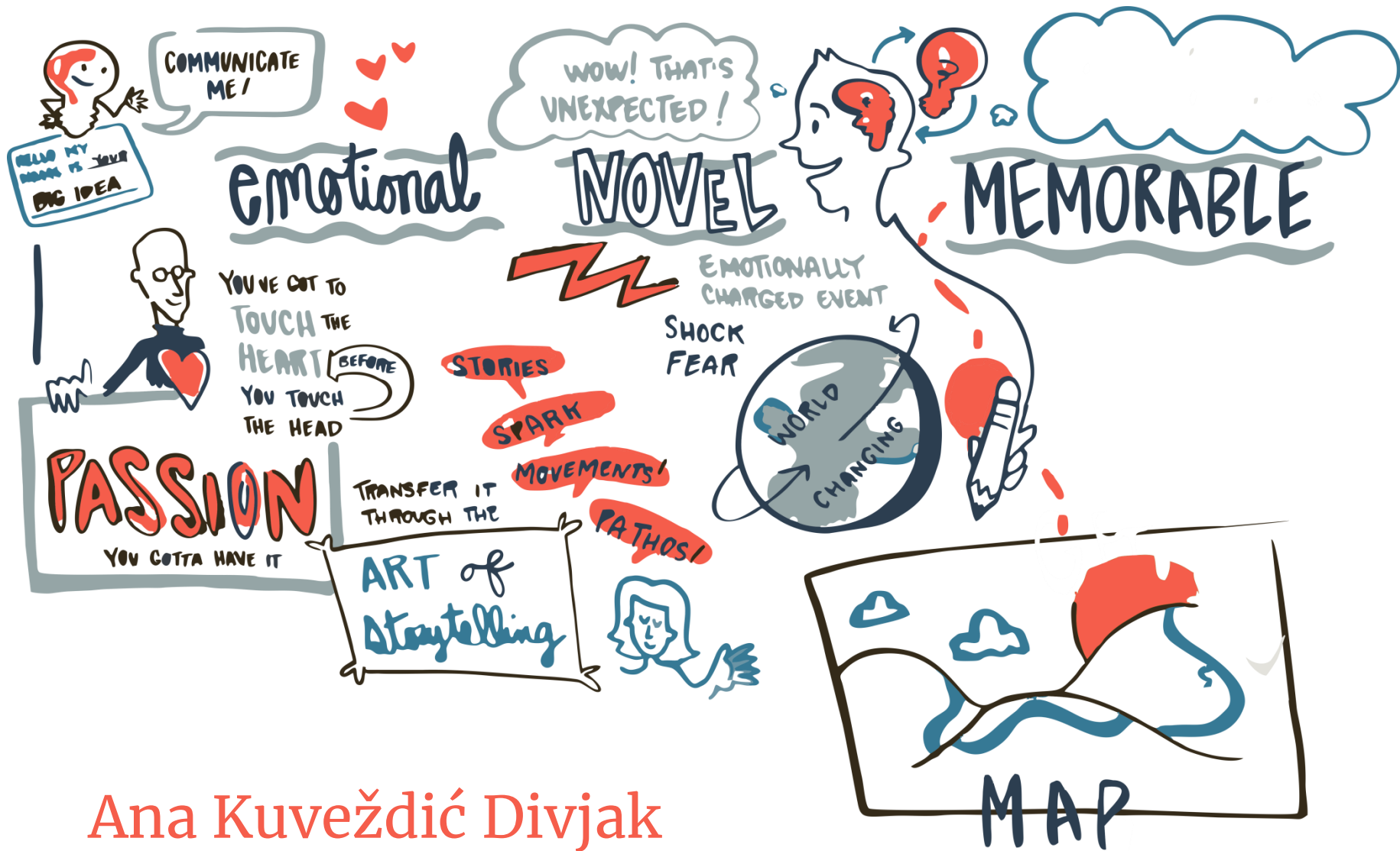
Narrative cartography: an attempt to represent visually events which unfold over time at a certain geographic location

Conclusion:

- A reflection on how authors currently tell stories in cartography.



- Mapping narratives requires the development of specific forms of cartographic representations → graphical techniques and interactivity that could enforce various levels of structure and narrative flow.
- Future work → cognitive and emotional experience of the reader.



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