

An investigation in the requirements and design of an online cartographic data comic editor

Christopher Hogg, TU Wien

25.10.2017

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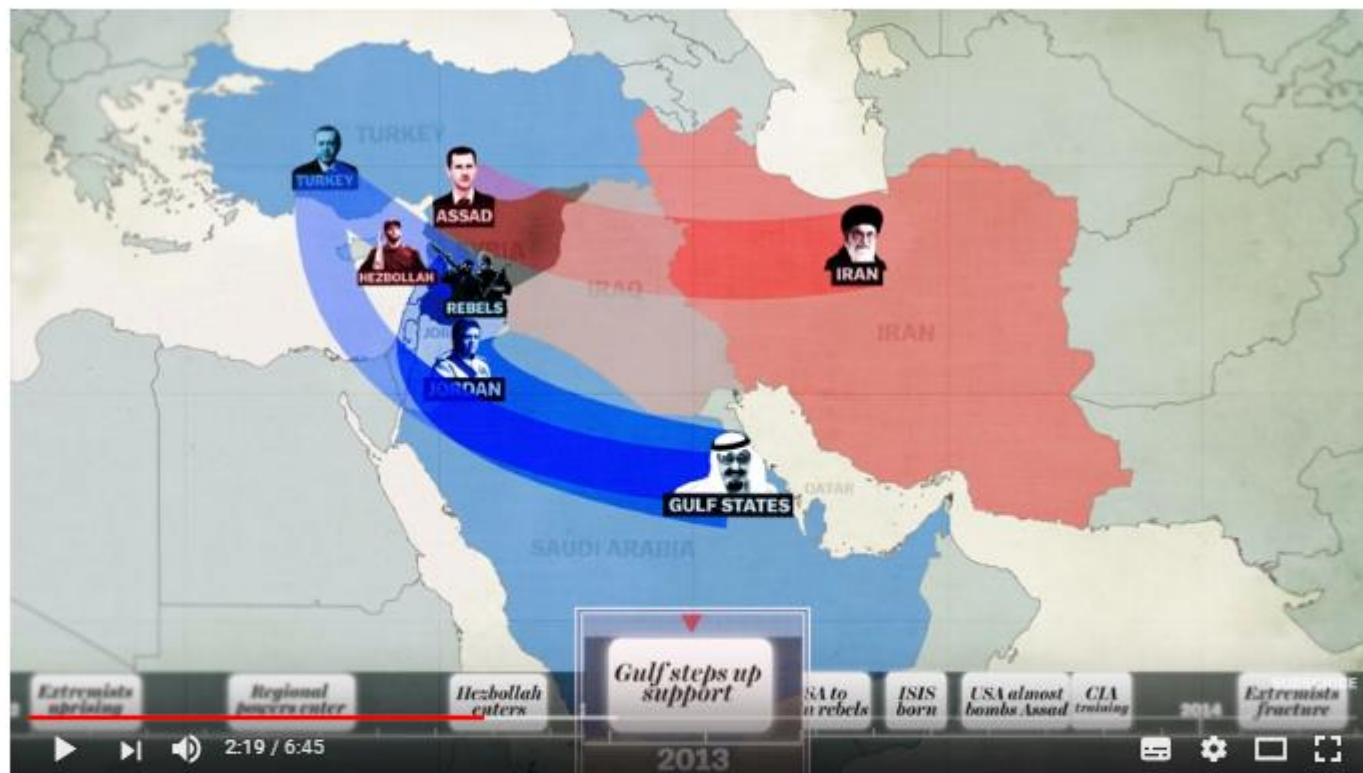
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On the U-Bahn...





Syria's war: Who is fighting and why

3,418,690 views

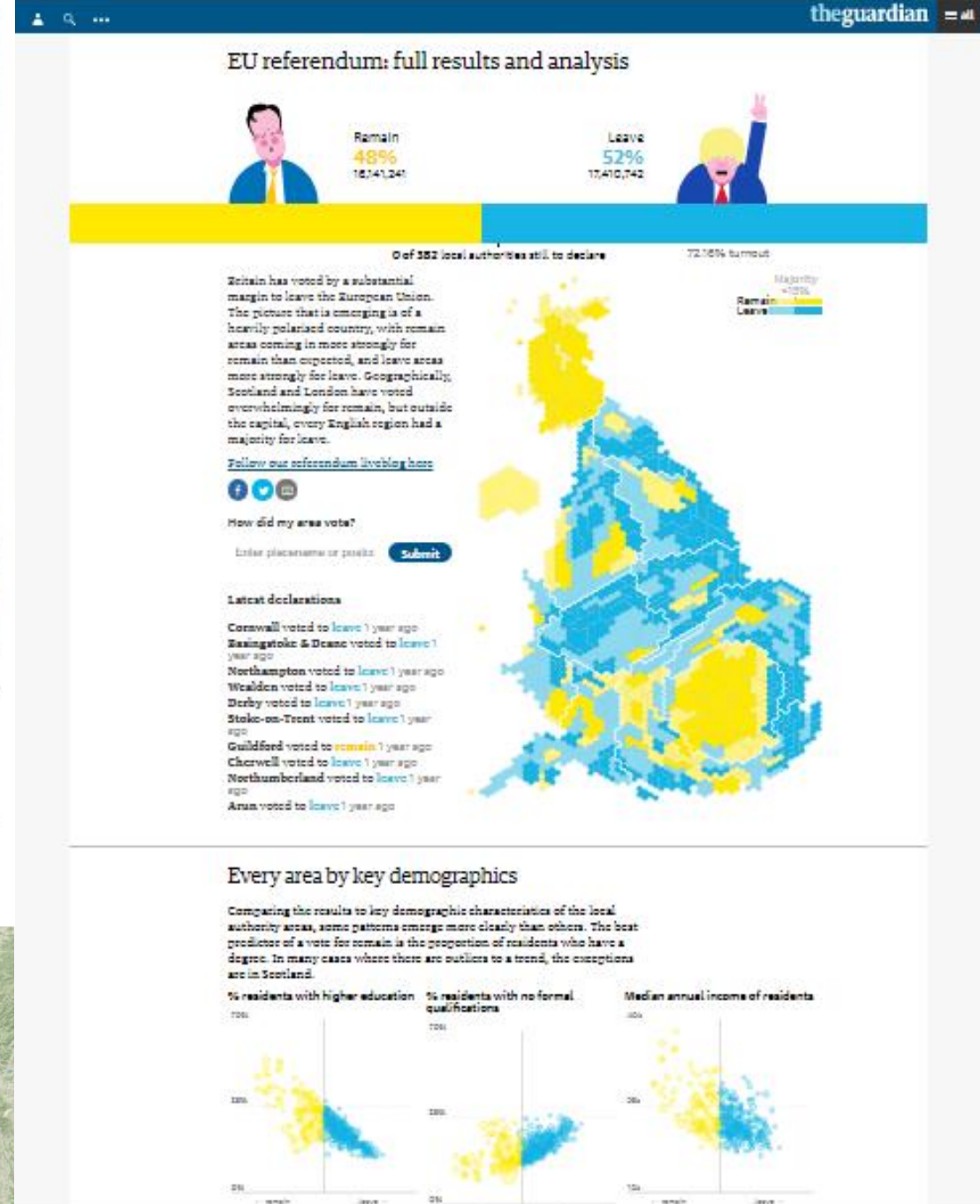


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Narrative Visualisations

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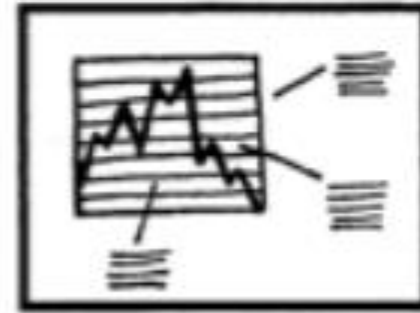
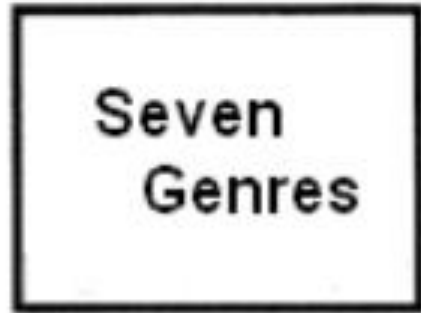
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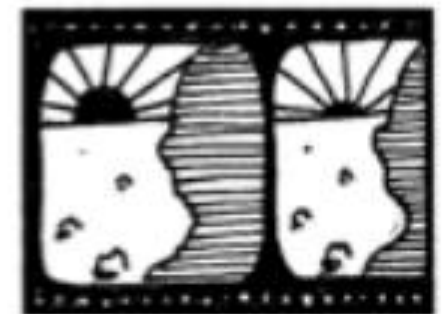
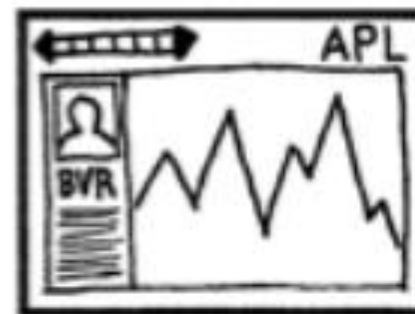
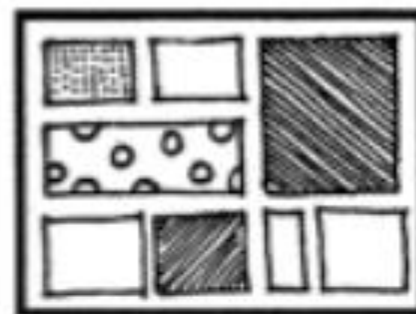
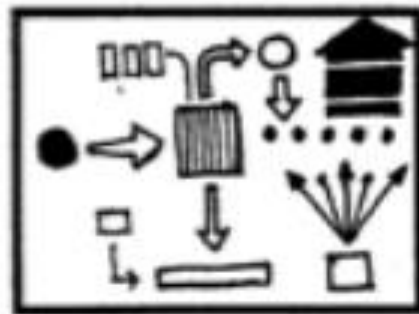
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Magazine Style

Annotated Chart

Partitioned Poster



Flow Chart

Comic Strip

Slide Show

Film/Video/Animation

Segel and Heer , 2010

Narrative Visualisations

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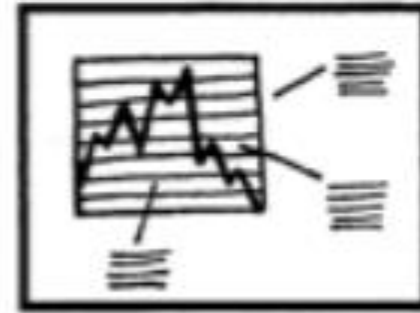
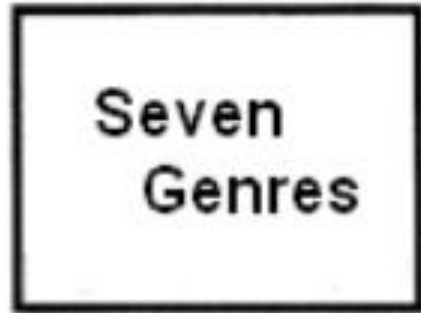
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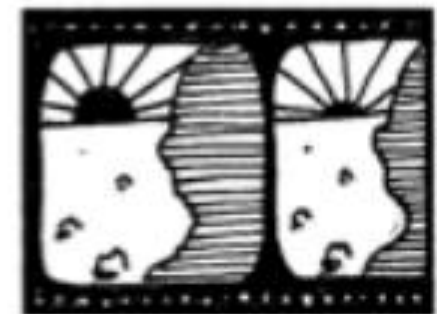
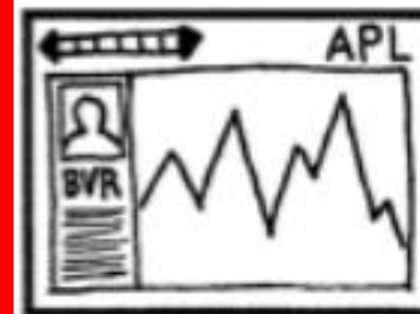
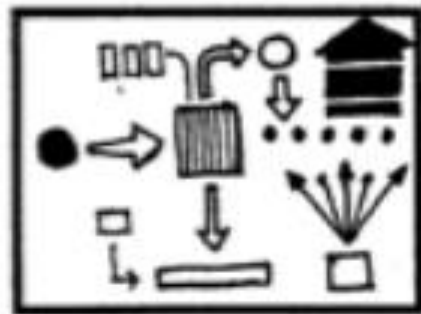
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Partitioned Poster



Flow Chart

Comic Strip

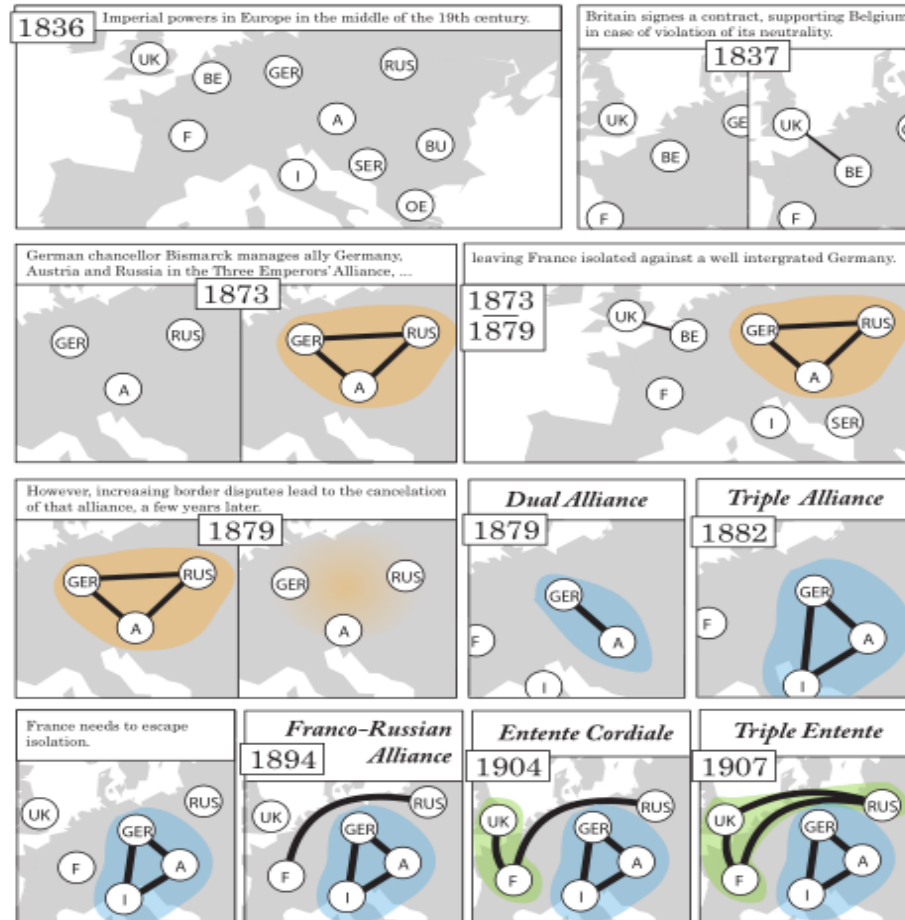
Slide Show

Film/Video/Animation

Segel and Heer , 2010

Comic Definition

European Alliances before World War I (1836-1914)



Bach et al. (2016)

“comic consists of a sequence of panels organized into one-dimensional tiers (or strips) and separated by gutters, or spacing, between the panels [15, 29].” Zhao et al 2015.

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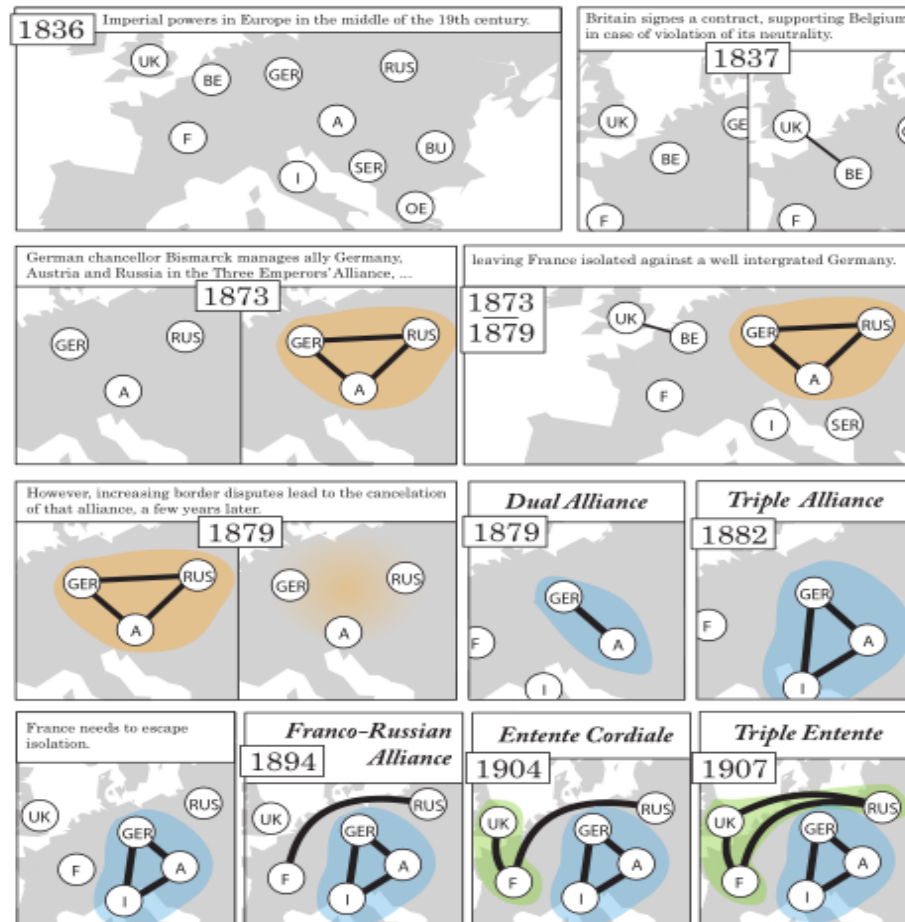
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Data Comic Definition

European Alliances before World War I (1836-1914)



Bach et al. (2016)

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1. Visualisation: The charts and graphs.
2. Flow: A series of panels. One message per panel.
3. Narration: Adds context to the data.
4. Words and pictures.

Bach et al. (2017)

Narrative Structure

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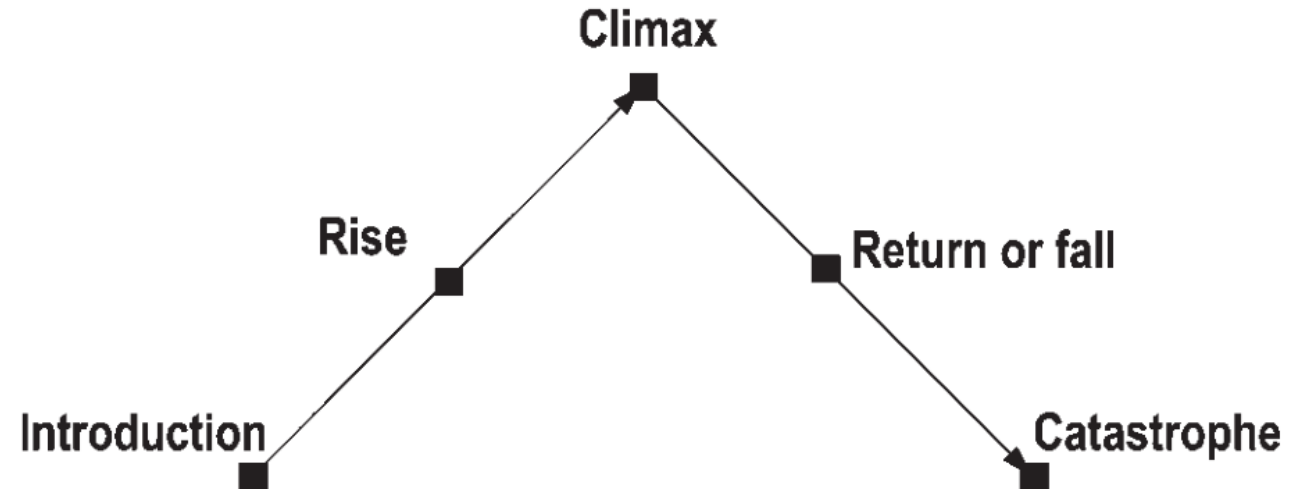
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- Cohn (2013): EIP. Establisher, Initial, Peak, Release.
 - Movies etc.
- Kosara (2017): CFXO. Claim, Fact, Explanation and Conclusion (CFXO).
 - In newspapers



Existing Technology

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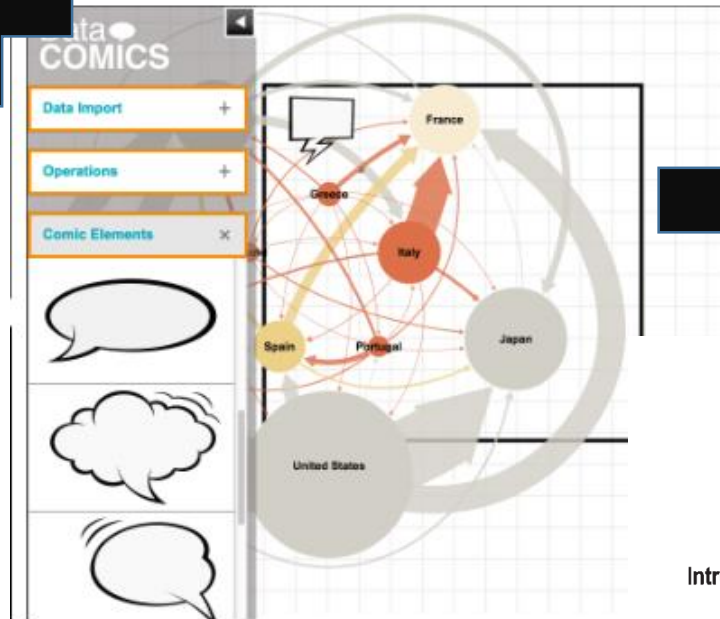
Part 4

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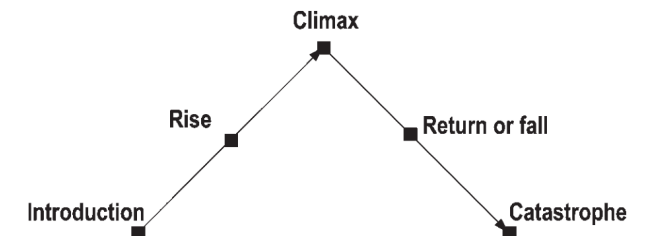


esri

Zhao et al (2015)



Cohn, 2013;
Kosara, 2017



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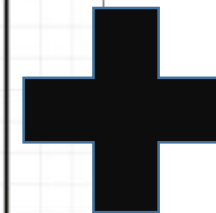
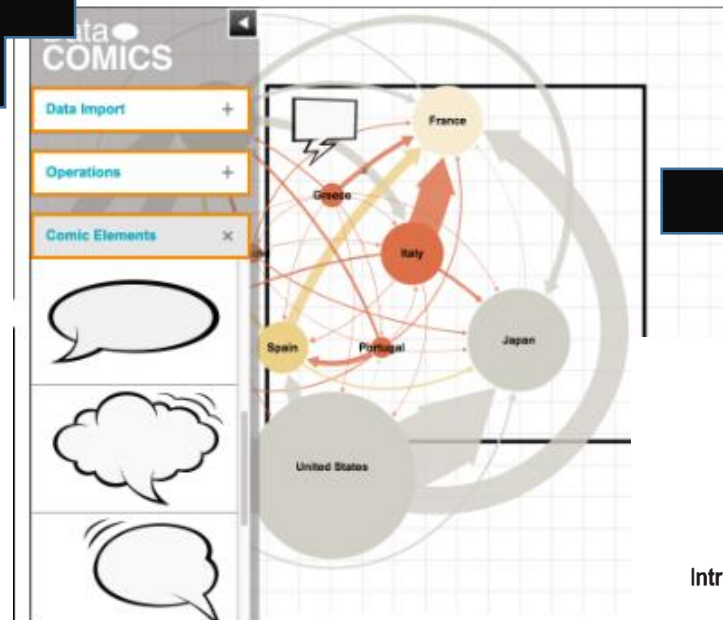
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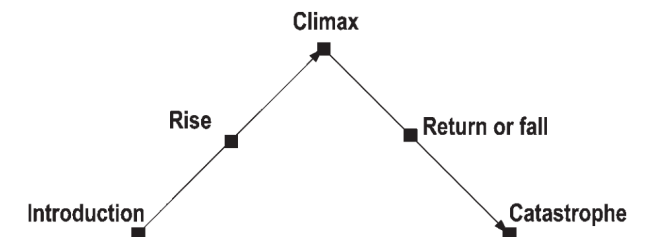


esri

Zhao et al (2015)



Cohn, 2013;
Kosara, 2017



Research Questions

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Conclusion

1. What are the characteristics of an online cartographic data comic?
2. What are the requirements for a software which will allow someone to create an online cartographic data comic?
3. What are the requirement/ feature deficits in the existing software?
4. Do the derived requirements, when implemented into a software, allow the creation of an online cartographic data comic?
 - Does the designed software fulfil the requirements of three example use case scenarios for an online cartographic data comic creator?

Overall Framework (Method)

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User-Centred Design

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Conclusion

- Interfaces should be “easy to learn and pleasant to use” - Nielsen(1992).
- How? By focusing on the user throughout the planning and design stage.

1 Know the User (RQ 1 & RQ2)

- Result: User Requirements and Use Case Scenarios

2 Competitive Analysis of Existing Software (RQ3)

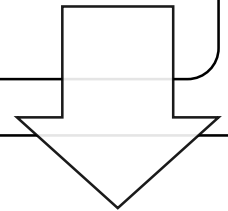
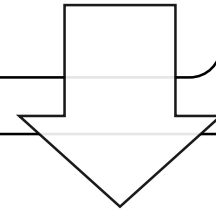
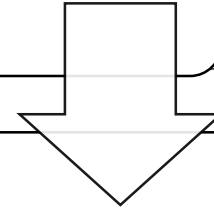
- Result: Prioritised Software Feature List

3 Static Prototype Creation (RQ4)

- Result: Design of interface.

4 Prototype Evaluation (RQ5)

- Result: Recommendations for design of future interface.



1 Know the User (RQ 1 & RQ2)

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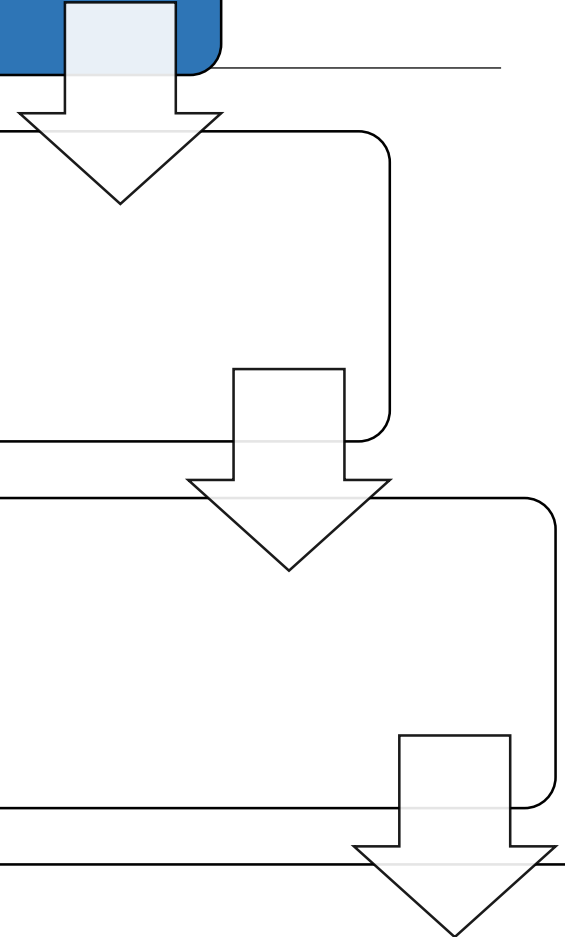
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Method: Options

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- Suchan and Brewer (2000):
 - Questionnaires, surveys, focus groups, ethnographic analysis, **interviews**.
- Data journalists: who had created narrative visualisations.
- Academics: who did not create narrative visualisation before.

Method: Semi – Structured Interviews

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- If I told you (or a member of your team) to create a narrative visualisation, what software would you use?
- Why have you/ have you not created a narrative visualisation?
- How would you structure the stories?
- Do you follow any guidance in creating a narrative visualisation?
- Why did you chose these maps in particular?



Result: Cartographic Data Comic Definition

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| Characteristic | Source |
|--------------------------------------|--|
| Visual Element | |
| Sequence of panels | (Zhao, Marr and Elmqvist, 2015) |
| Panels separated by gutters | (Zhao, Marr and Elmqvist, 2015; Bach et al., 2017) |
| Data graphics | (Bach et al., 2017) |
| Text Element | |
| Narration | (Bach et al., 2017) |
| Contains both words and pictures | (Bach et al., 2017) |
| Cartographic Element | |
| Maps are predominantly thematic maps | (Bach, 2017) |

Online Cartographic Data Comic Definition

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| Characteristic | Source |
|---|--|
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| Text Element | |
| Narration | (Bach et al., 2017) |
| Contains both words and pictures | (Bach et al., 2017) |
| Cartographic Element | |
| Contains a map on more than half the frame | Author |
| Maps have horizontal or vertical orientation | Interview participant |
| Maps are predominantly thematic maps | (Bach, 2017) |
| Highlighting map content with annotations, highlights, arrows and boxes | Interview participant |
| Online Capability | |
| Interaction: Vertical scrolling of maps | Interview participant |
| Responsive Design. | Interview participant |
| Each frame fits with the website brand. | Interview participant |
| Maps can be shared on social media | Interview participant |
| Export functions | |
| Interactive Web Application (HTML/CSS). | Interview participant |
| Animated GIF | Interview participant |

16 Requirements : Grouped Into 6

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| Code | Criteria | Code | Criteria |
|--------------------------|---|--------------------------|---|
| Responsive Design | | Map Visual Design | |
| M1 | Responsive Design produced | V1 | Ability to use themes |
| M2 | Vertical scrolling of created output | V2 | Text Annotations |
| M3 | Horizontal and vertical maps can be created | V4 | Symbol Annotations |
| Sharing | | Ease of Use | |
| S1 | Share on social media | E1 | Programming requirements |
| S2 | Fast loading of maps | E2 | Walkthrough/ Wizard |
| Export Functions | | Sequencing | |
| Xp1 | Export as a single Interactive Map | Se1 | Ability to guide the user in different narrative structures |
| Xp2 | Creation of a GIF | Se2 | Ability to output a sequence |
| Xp3 | Data Comic Design | | |
| Xp4 | Creation of an interactive <i>sequence</i> of maps. | | |

Use Case Scenarios

- 3 use case scenarios were also developed based on it.

1 Know the User (RQ 1 & RQ2)

- Result: 16 User Requirements and 3 Use Case Scenarios

2 Competitive Analysis of Existing Software (RQ3)

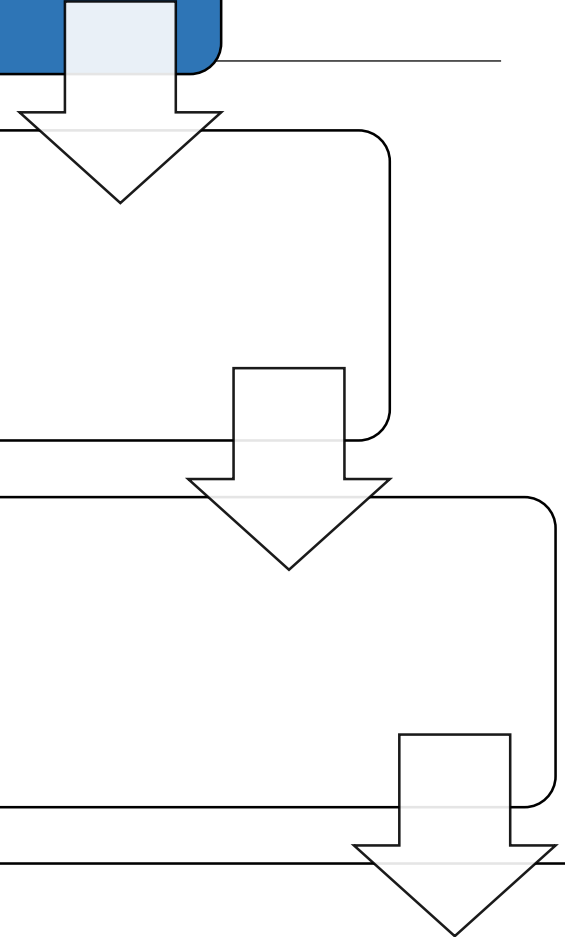
- Result: Prioritised Software Feature List

3 Static Prototype Creation (RQ4)

- Result: Design of interface.

4 Prototype Evaluation (RQ5)

- Result: Recommendations for design of future interface.



1 Know the User (RQ 1 & RQ2)

- Result: 16 User Requirements and User case studies.

2 Competitive Analysis of Existing Software (RQ3)

- Aim: What are the gaps in the existing software?

3 Static Prototype Creation (RQ4)

- Result: Design of interface.

4 Prototype Evaluation (RQ5)

- Result: Recommendations for design of future interface.

Formal Method

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- Adapted from Sveen (2008):
- Define the evaluation criteria.
- Initial filtering.
- Evaluation sheet of software.
- Find the gaps in the requirements of the system from the evaluation sheet.

Evaluation Criteria

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| Code | Criteria | Score 0 = not all essential requirements met | Score 1 = fulfilled all essential requirements | 2: all desired requirements fulfilled |
|-------------------------|------------------------------------|--|--|--|
| Export Functions | | | | |
| Xp1 | Export as a single Interactive Map | Only static maps created | Maps can be hovered over (i.e tool tips) but not clicked on. | Full interactivity export. |
| Xp2 | Creation of a GIF | No GIF export tool. | Creation of GIF, possible but complex. | Easy GIF creation. |
| Xp3 | Data Comic Design | Cannot export as a comic design. | Can export as a slideshow, but not comic. | Can export as a data comic, with image and text. |

Gathering Candidate Software

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Are they able to show a sequence of maps?

*+ two which were mentioned by more than one
interview participant.*

Evaluation sheet of filtered list

| Name | M1 | M2 | M3 | S1 | S2 | Se1 | Se2 | V1 | V2 | V4 | E1 | E2 | Xp1 | Xp2 | Xp3 | Xp4 |
|--------------------------------|----|----|----|----|-----|-----|-----|----|----|----|----|----|-----|-----|-----|-----|
| Mapping Libraries | | | | | | | | | | | | | | | | |
| Mapbox | 1 | 1 | 2 | 1 | 1 | 0 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 0 | 0 | 0 |
| Leaflet | 2 | 1 | 1 | 0 | 1 | 0 | 2 | 0 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 2 |
| Maps with Story Element | | | | | | | | | | | | | | | | |
| Mapme | 2 | 0 | 1 | 1 | 1 | 0 | 2 | 1 | 1 | 0 | 2 | 1 | 2 | 0 | 0 | 1 |
| ESRI Story Maps | 2 | 2 | 2 | 1 | 1 | 0 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 0 | 0 | 1 |
| StorymapJS | 1 | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 2 | 0 | 1 | 0 | 2 | 0 | 0 | 1 |
| Flourish | 2 | 0 | 1 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 2 | 0 | 2 | 0 | 1 | 2 |
| MapStory | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 1 |
| Cartographic plugins | | | | | | | | | | | | | | | | |
| Data Wrapper | 2 | 0 | 2 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 2 | 2 | 0 | 2 | 0 | 0 |
| Javascript Tools | | | | | | | | | | | | | | | | |
| D3 | 2 | 2 | 2 | 0 | 1 | 0 | 2 | 1 | 2 | 2 | 0 | 0 | 2 | 1 | 1 | 2 |
| Openlayers | 2 | 1 | 1 | 0 | 2 | 0 | 1 | 1 | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 1 |
| Data Analysis | | | | | | | | | | | | | | | | |
| R | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Tableau | 1 | 0 | 1 | 0 | 1 | 0 | 2 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 |
| GIS Software | | | | | | | | | | | | | | | | |
| ArcGIS | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 2 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 0 |
| QGIS | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 2 | 1 | 0 | 1 | 0 | 1 |
| Magrit Thematic cartography | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| GIF Maker | | | | | | | | | | | | | | | | |
| Giphy | 1 | 0 | 2 | 1 | 2 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 0 | 2 | 0 | 0 |
| Imaging Tools | | | | | | | | | | | | | | | | |
| Photoshop | 1 | 0 | 2 | 0 | 2 | 0 | 1 | 2 | 2 | 2 | 2 | 1 | 0 | 2 | 2 | 0 |
| Presentation | | | | | | | | | | | | | | | | |
| Powerpoint | 1 | 1 | 2 | 0 | 1 | 0 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 2 | 0 |
| DatacomicJS | 0 | 0 | 1 | 0 | n/a | 0 | 2 | 1 | 2 | 2 | 2 | 0 | 0 | 0 | 2 | 2 |

No Single Technology Meets all of the Requirements

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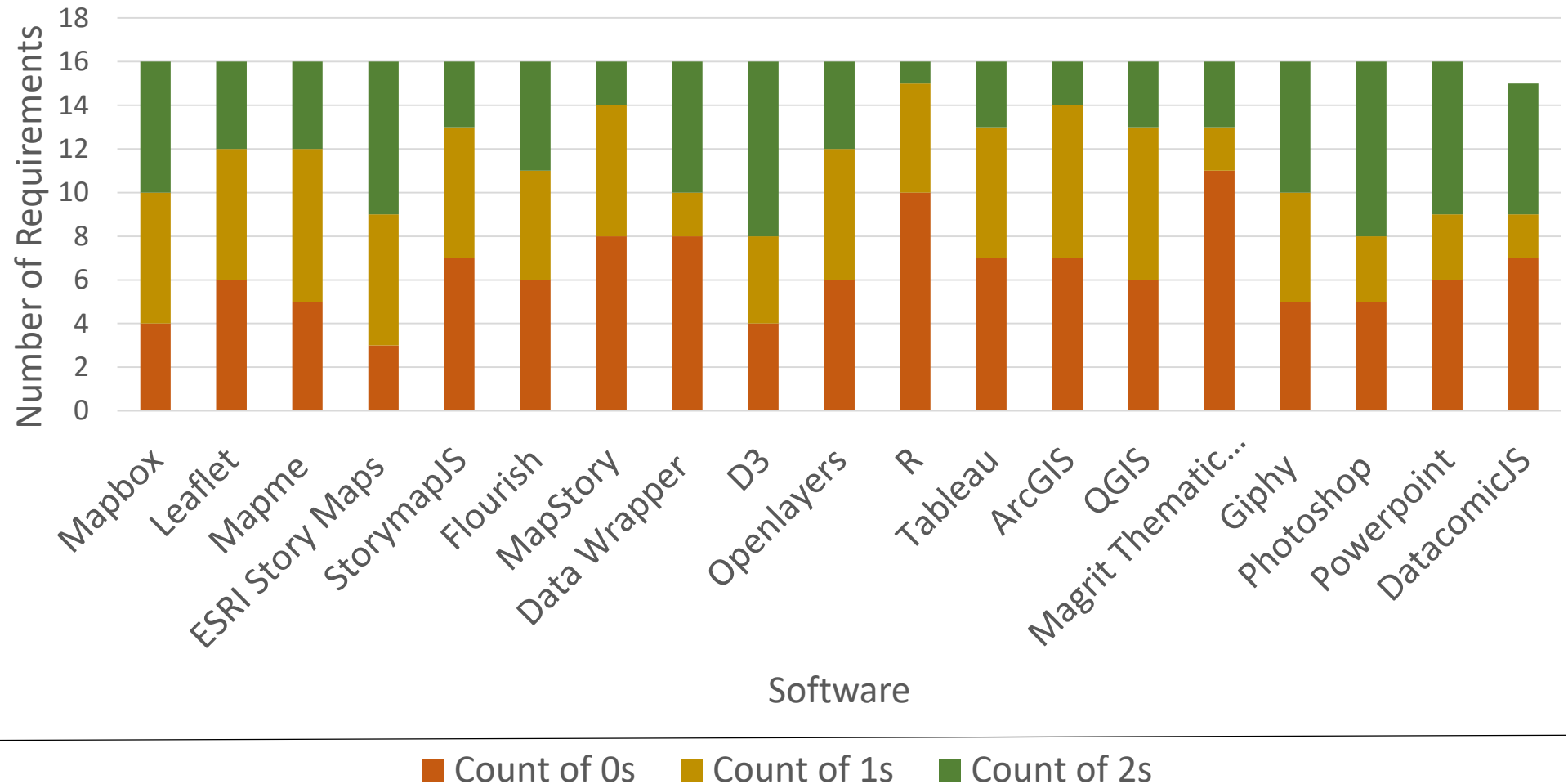
Know the User

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No requirement is available in every technology

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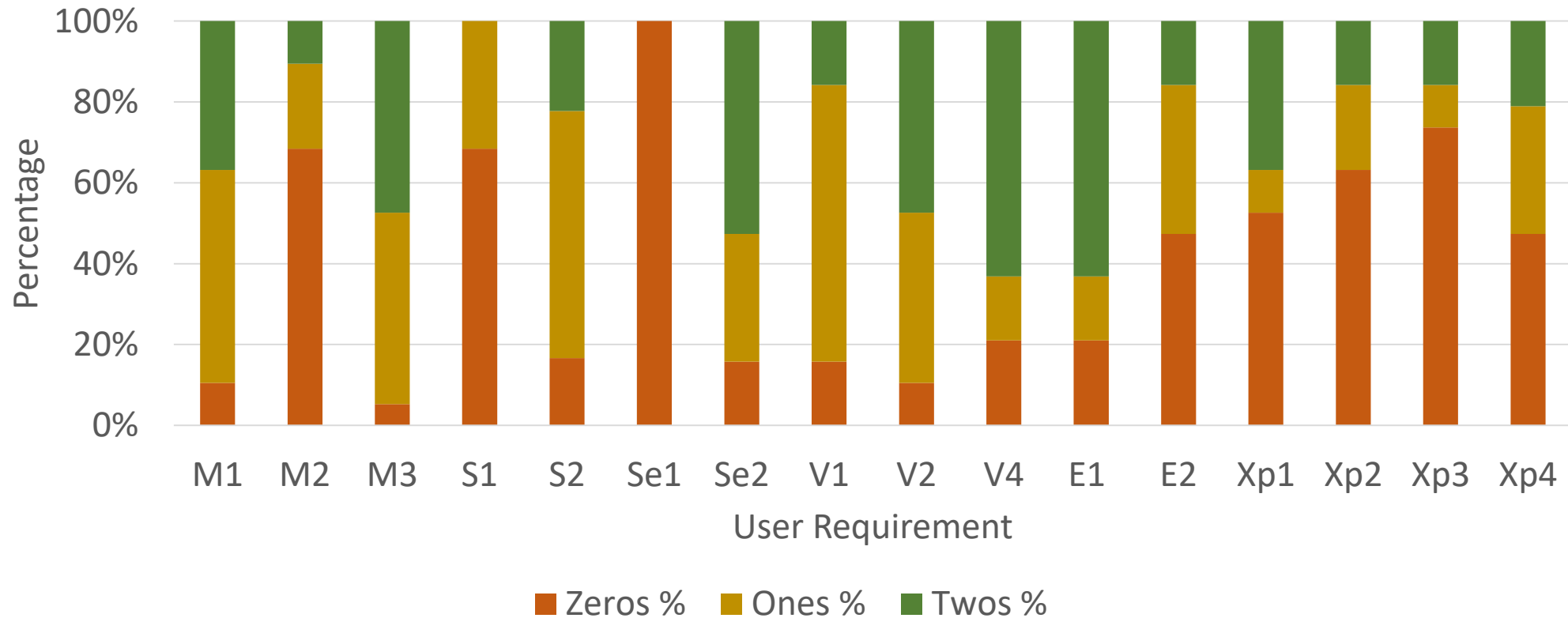
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No requirement is mentioned in every technology

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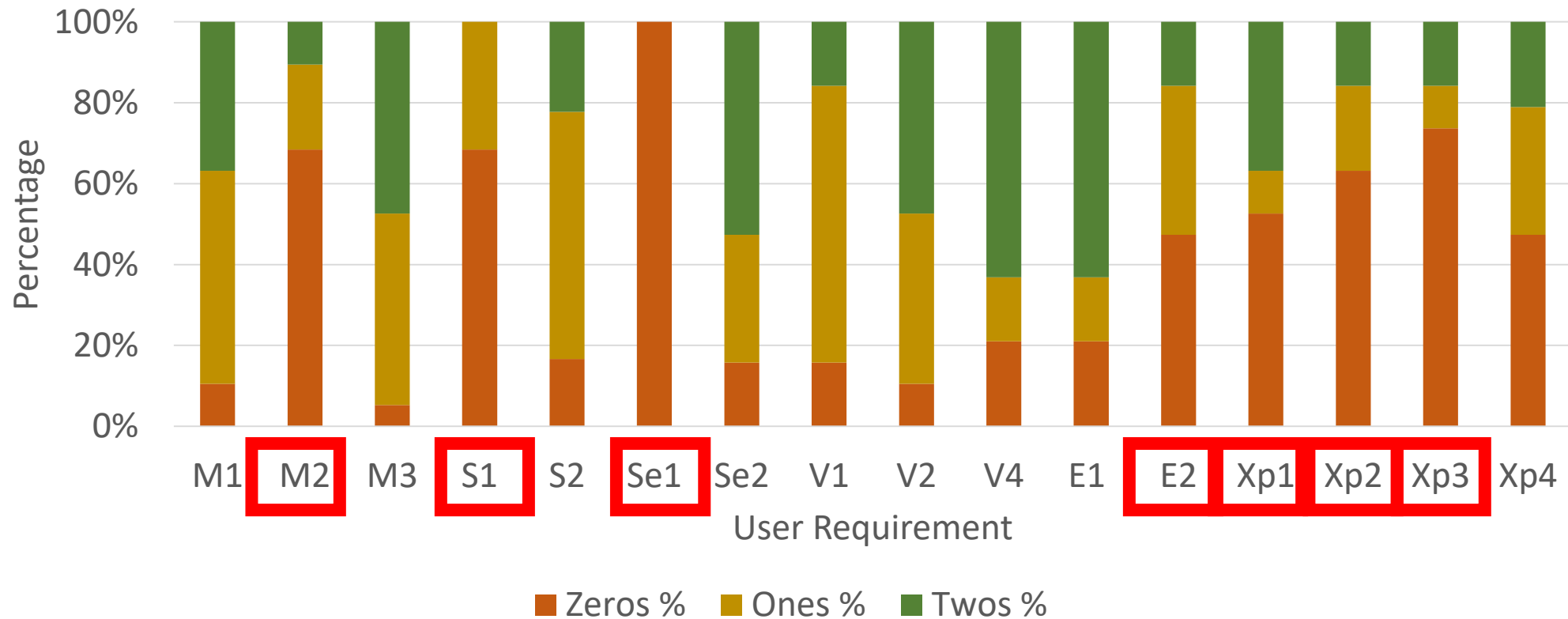
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Prioritised Requirements (Research Question 3)

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- Se1: Ability to guide the user in different narrative structures.
 - E2: Seen through a walkthrough of the creation of a story.
- XP3: Data Comic Design.
- S1: Share on social media.
- Xp1: Export as web application.
- Xp2: Creation of a GIF.
 - Ability to change the time of each frame.
- M2: Vertical scrolling of maps.

1 Know the User (RQ 1 & RQ2)

- Result: 16 User Requirements and User case studies.

2 Competitive Analysis of Existing Software (RQ3)

- **Result: Prioritised Software Feature List.** Narrative Structure guidance, data comic design, ability to share on social media, export as HTML/CSS web application, export as GIF, vertical scrolling.

3 Static Prototype Creation (RQ4)

- Result: Design of interface.

4 Prototype Evaluation (RQ5)

- Result: Recommendations for design of future interface.

1 Know the User (RQ 1 & RQ2)

- Result: 16 User Requirements and User case studies.

2 Competitive Analysis of Existing Software (RQ3)

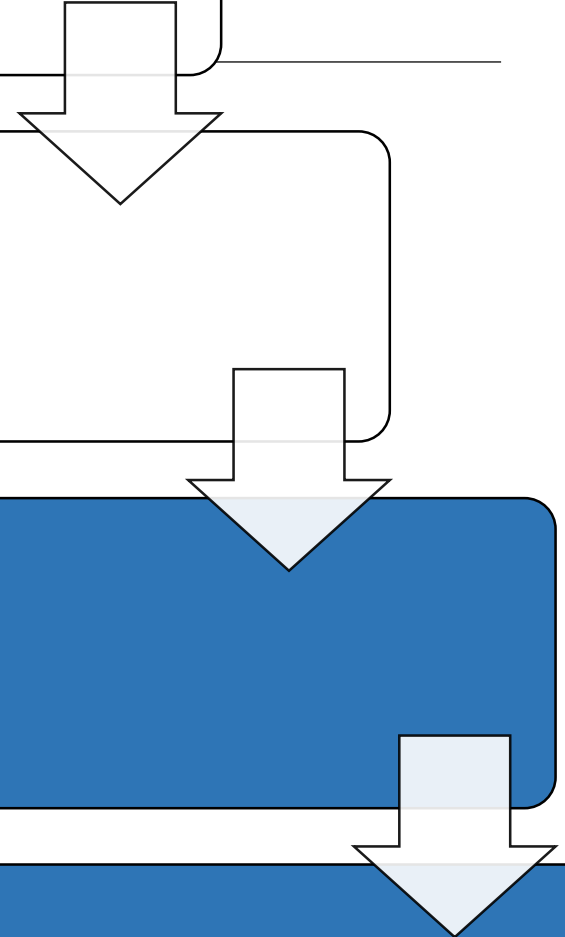
- Result: Prioritised Software Feature List

3 Static Prototype Creation (RQ4)

- Result: Design of interface.

4 Prototype Evaluation (RQ5)

- Result: Recommendations for design of future interface.



Mockup Creation

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- Balsamiq Mockups
- 9 static mockups were developed of representative screens.

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- Options for Mockup Evaluation from Roth et al (2015):
 - Expert Based
 - User-based methods: interviews, focus groups etc.
 - Theory Based
- Convergent Approach Recommended- with a focus of user based design.

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- Options for Mockup Evaluation from Roth et al (2015):
 - Expert Based
 - User-based methods: interviews, focus groups etc.
 - **Theory Based**
- Convergent Approach Recommended- with a focus of user based design.

Scenario Based Design

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- Creating of a user story from a hypothetical user.
- MacEachren et al (2008).

The Cartographic journal Vol. 45 No. 4 pp. 246-260 November 2008
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REFEREED PAPER

Design and Implementation of a Model, Web-based, GIS-Enabled Cancer Atlas

Alan M. MacEachren¹, Stephen Crawford², Mamata Akella¹ and Gene Lengerich³

¹Department of Geography, The Pennsylvania State University, University Park, PA 16802, USA, E-mail: maceachren@psu.edu. ²Center for Environmental Informatics, The Pennsylvania State University, University Park, PA. ³Department of Health Evaluation Sciences, The Pennsylvania State University, University Park, PA

The design and development of a highly interactive web-based, GIS-enabled atlas is reported. The atlas is a prototype, designed as a model for implementation of atlases to support government cancer-control activities. This model integrates symbolisation and design principles from print cartography, interaction strategies from exploratory geovisualisation, and web-map/web-feature service advances from GIS. The atlas has been implemented using a client-server architecture. It makes use of two open-source GIS tools, PostGIS (as the system database) and GeoServer (to connect the database to the client mapping application). The client mapping application has been built in Macromedia Flash. The entire client-server architecture is described, then direct primary emphasis is focused on the client mapping application. For this component of the system, the interface design strategy is detailed, the approach taken to implement this strategy in Flash is documented, and the mechanisms developed to build dynamic links from the client to the underlying database through the server are outlined. Features of the atlas are presented through a prototypical use scenario for a target user.

Keywords: geovisualization, web atlas, health mapping, web feature services

INTRODUCTION

Recent advances in web mapping technologies have the potential to make a dramatic impact on the public health role of geographic information represented on and accessed through maps. Thus far, much of the research and development has focused on building the geographical

user. We close with discussion of the potential of this atlas to serve as a model for other application domains and of plans for our own future work that builds on this base.

BACKGROUND

The research reported here integrates ideas and technolo-

Scenario Based Design

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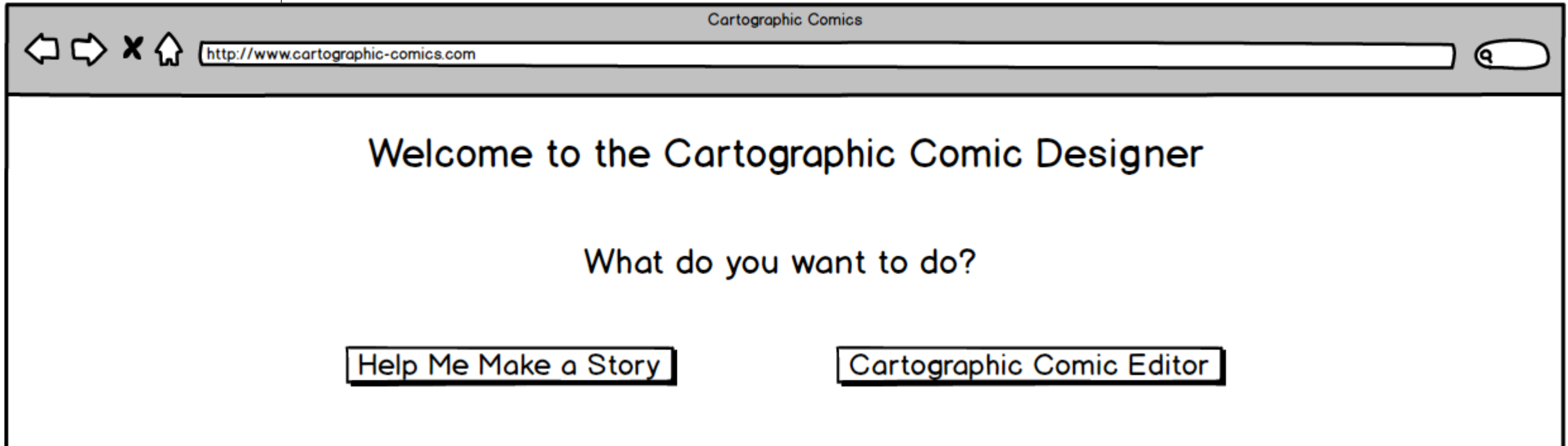
Competitive Analysis

Prototype Creation

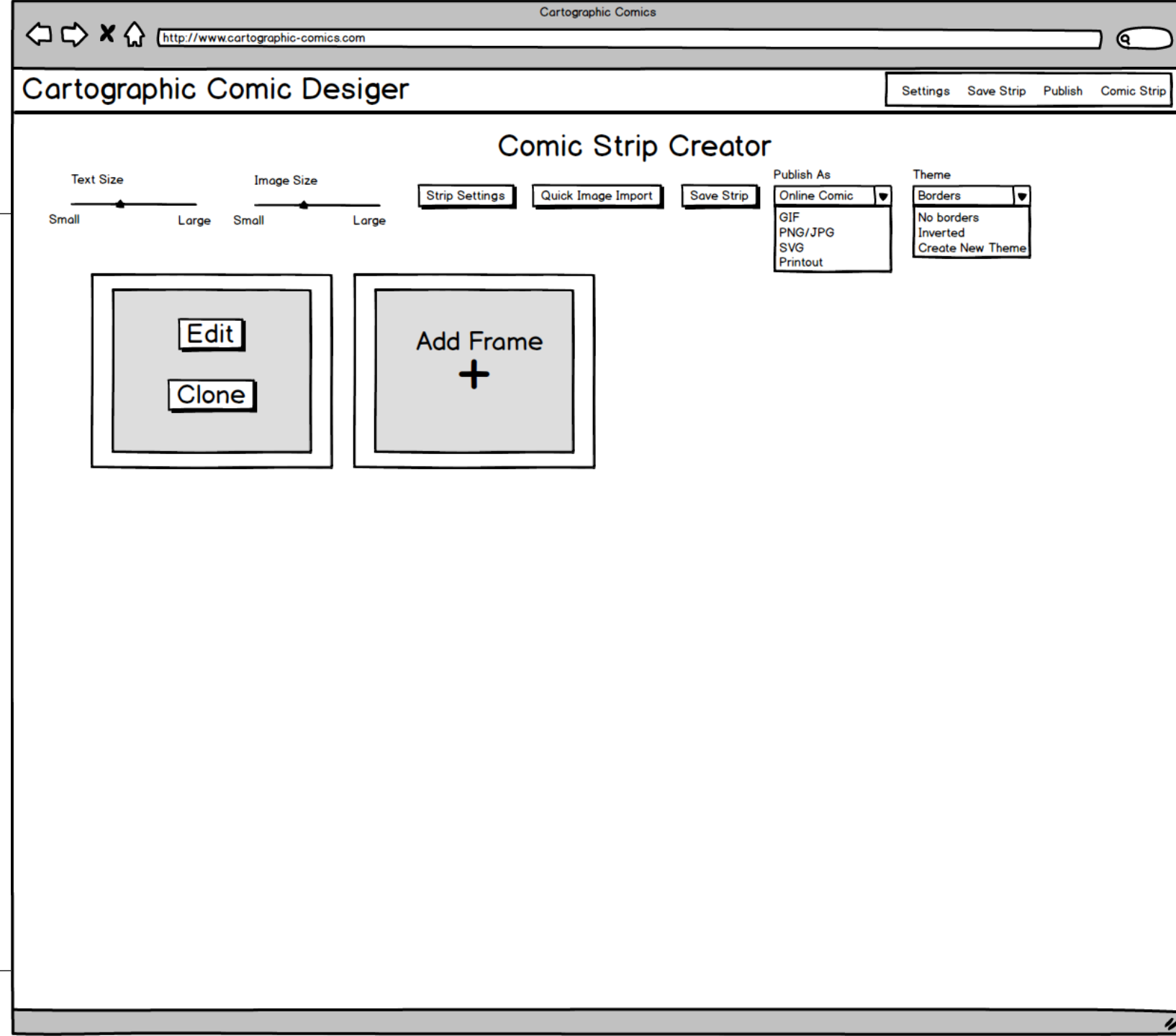
Prototype Evaluation

Conclusion

- Bob: data journalist working for the fictional *Vienna Daily News* writing a report of Malaria.
- Use Case
 - 1. To create an interactive GIF showing a time progression of Malaria through time.
 - 2. To create a longer form of narrative visualisation or data comic will allow the user to scroll down and interact with the data on their own terms.



- REQ:
- M2 ✓
- S1
- Se1
- E2 ✓
- Xp1
- Xp2
- Xp3



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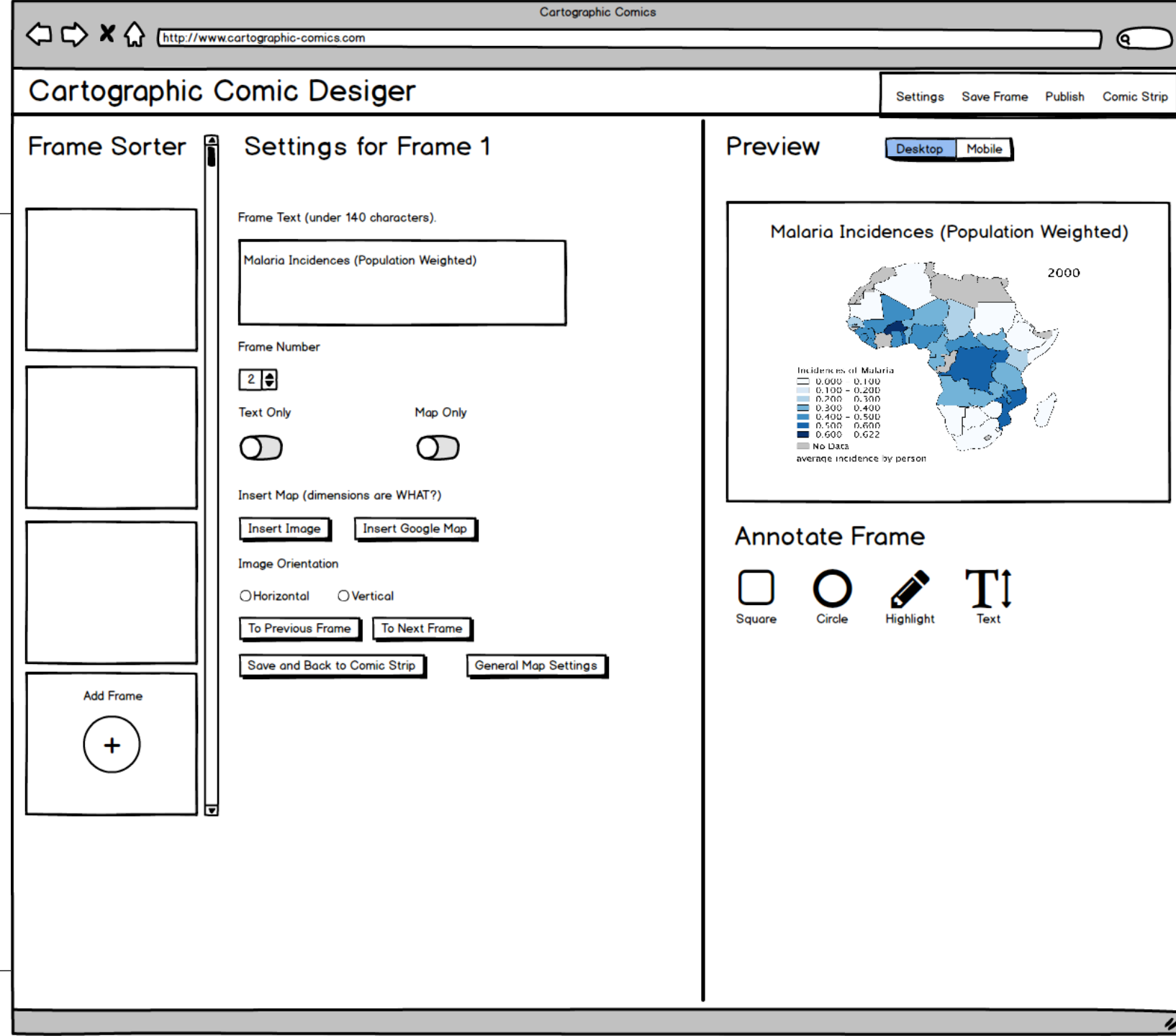
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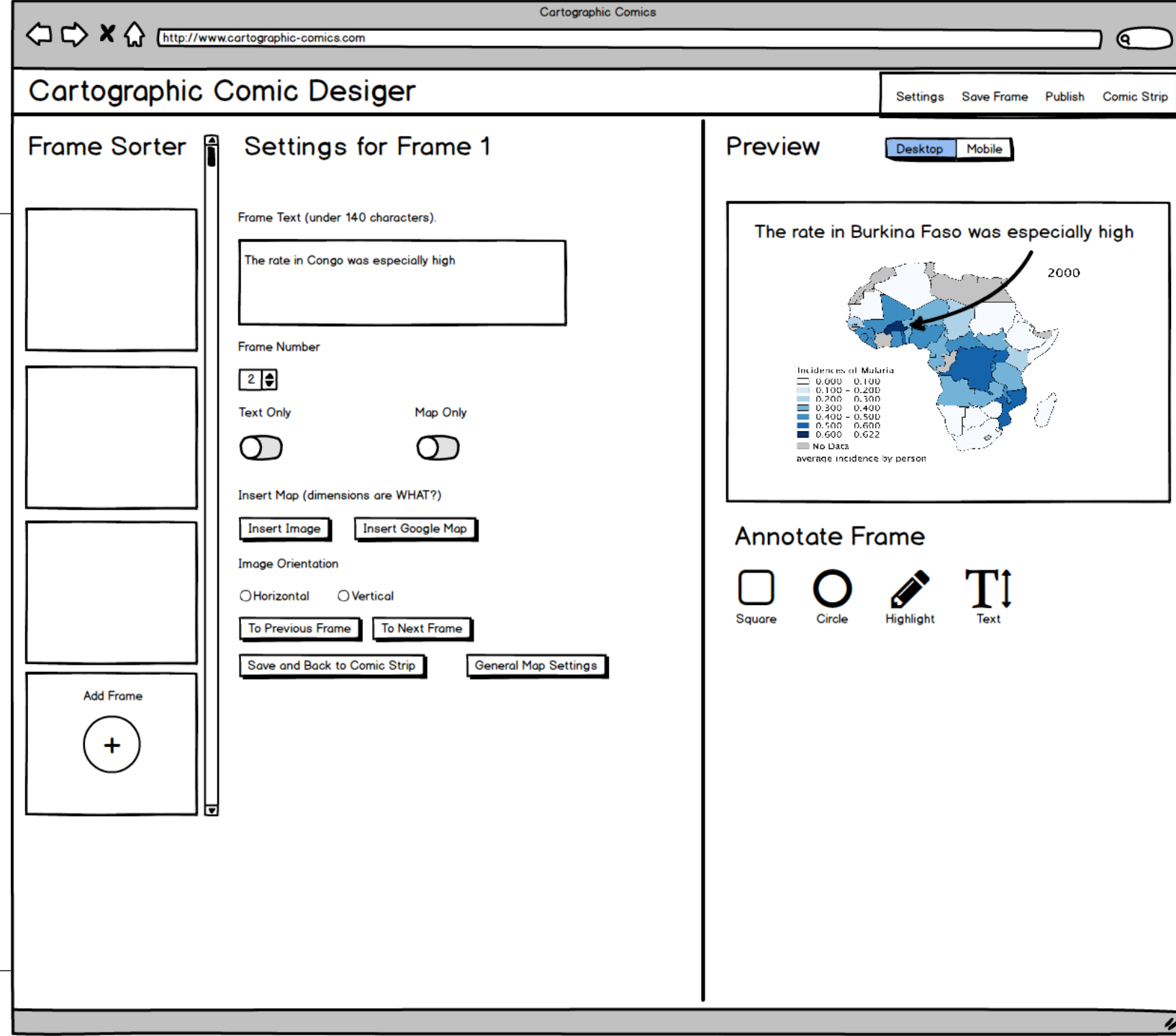
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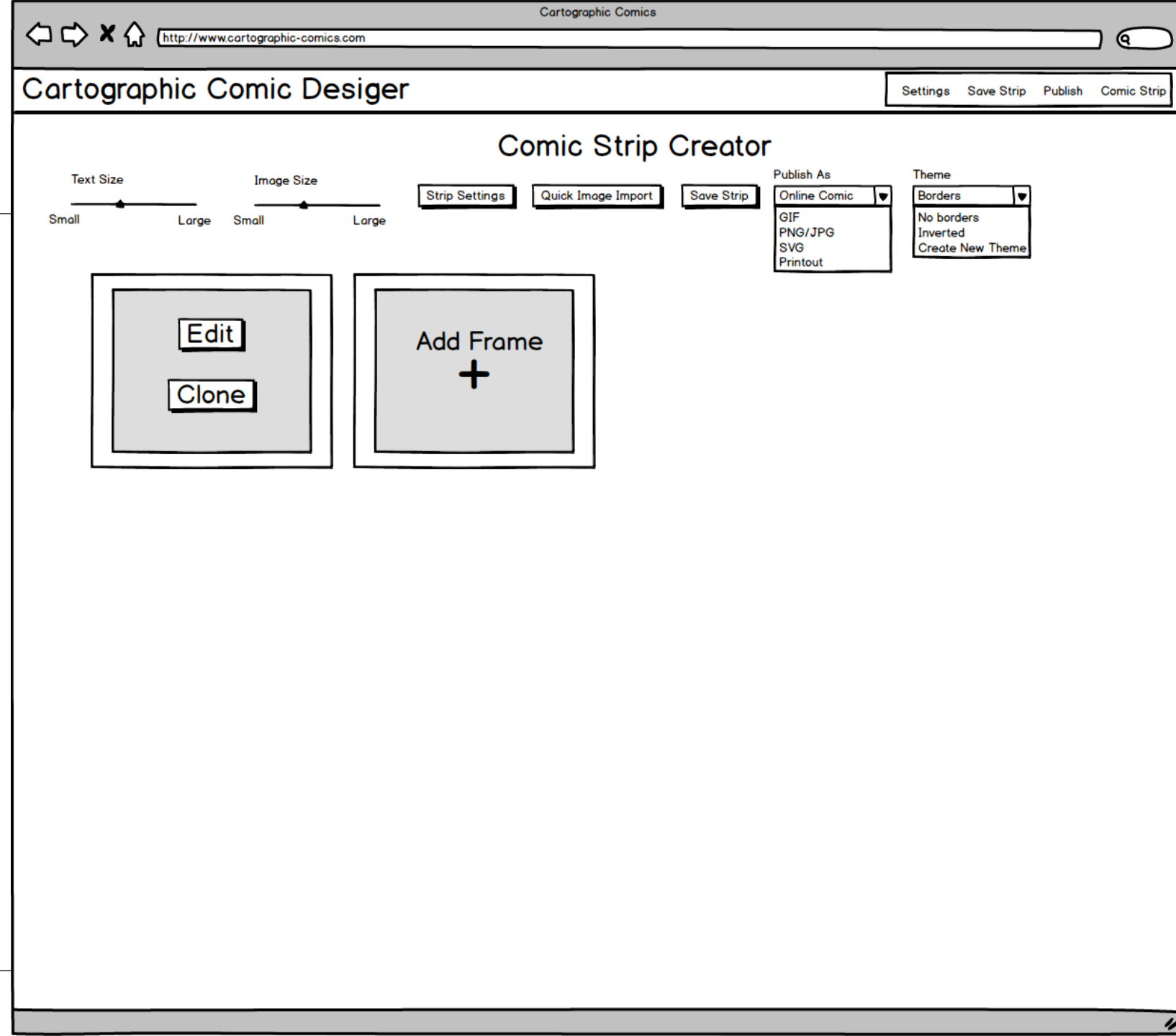
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- **REQ:**
- M2 ✓
- S1 ✓
- Se1
- E2 ✓
- Xp1 ✓
- Xp2
- Xp3

- REQ:
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- S1
- Se1
- E2 ✓
- Xp1
- Xp2
- Xp3



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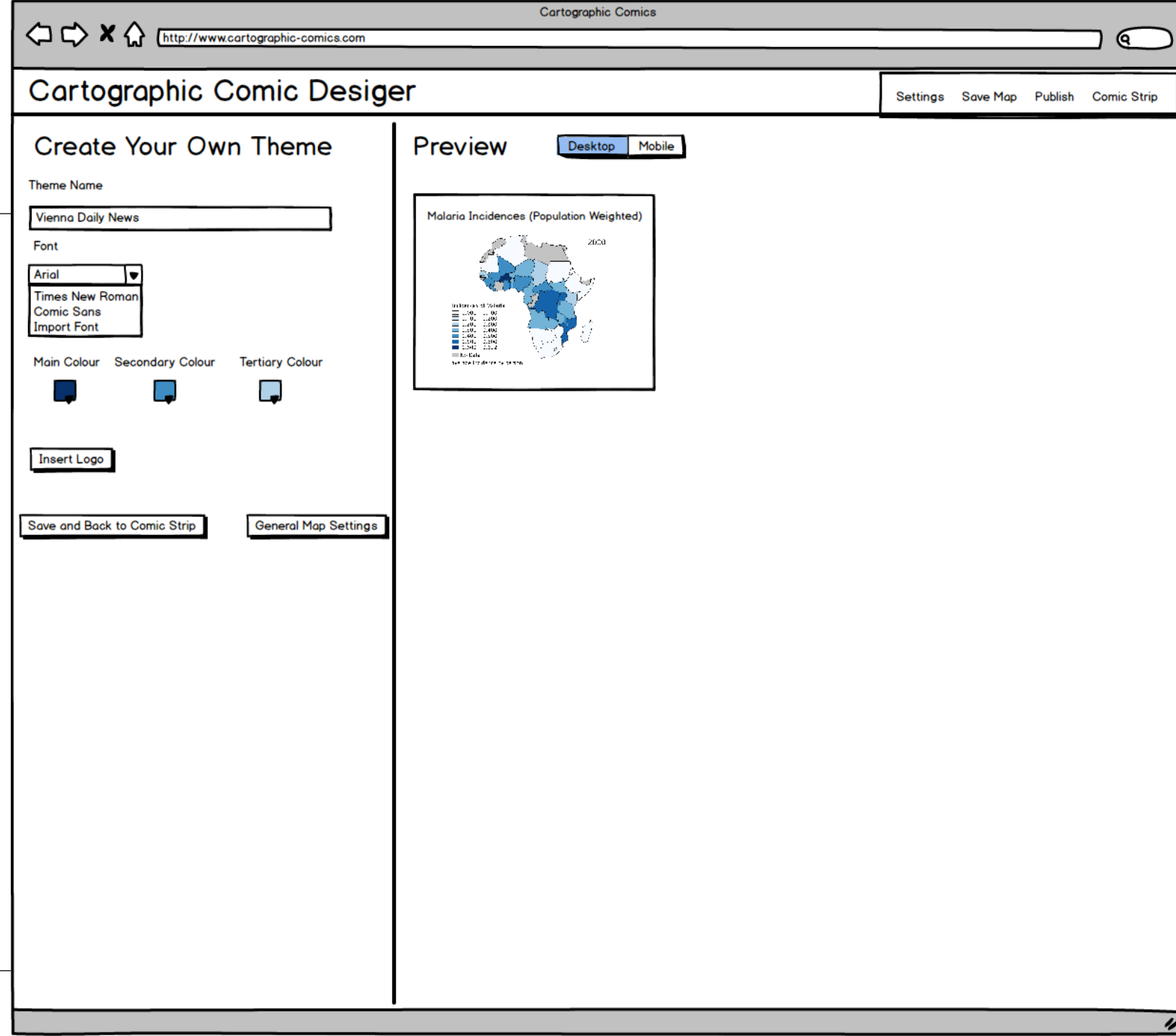
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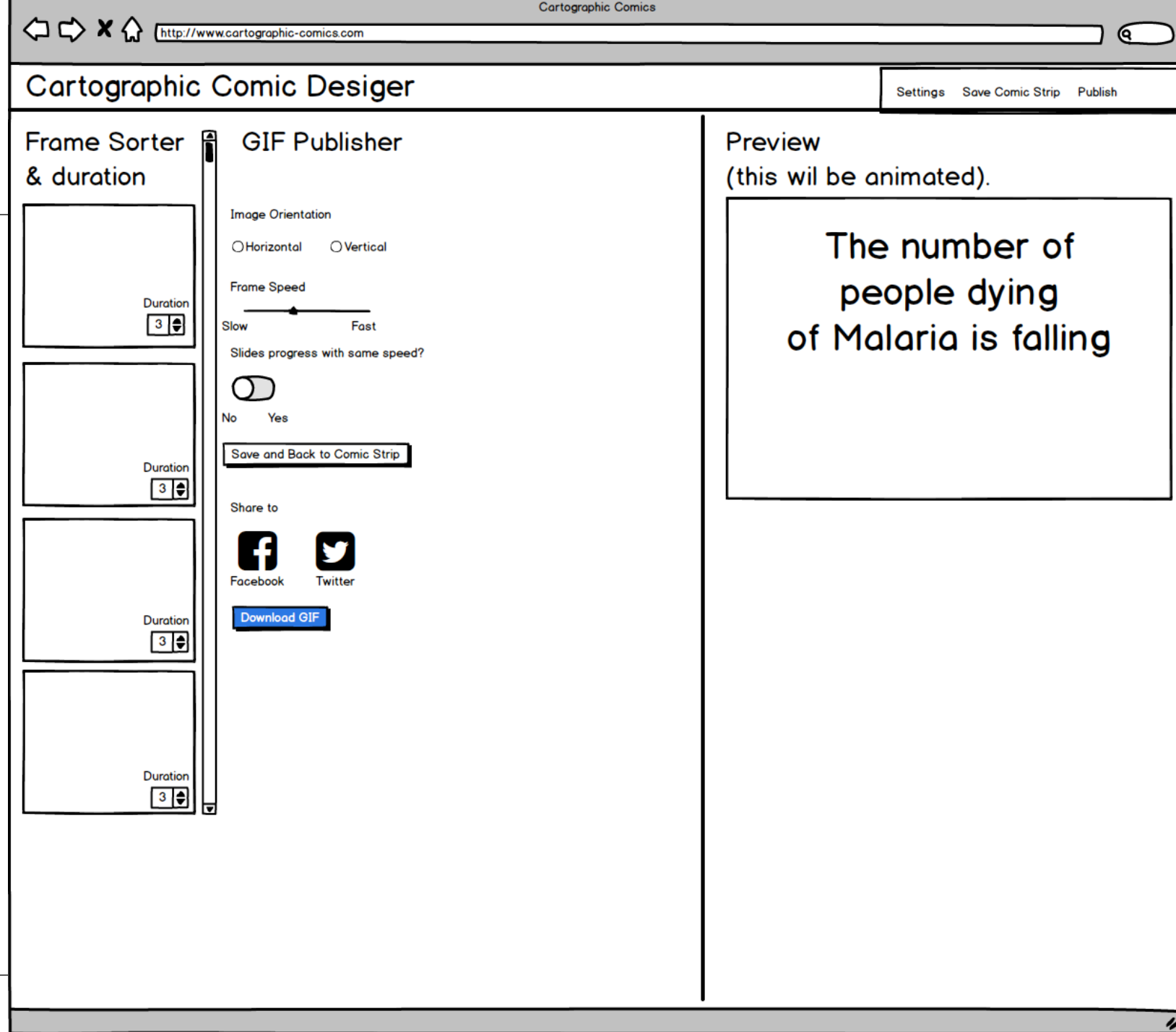
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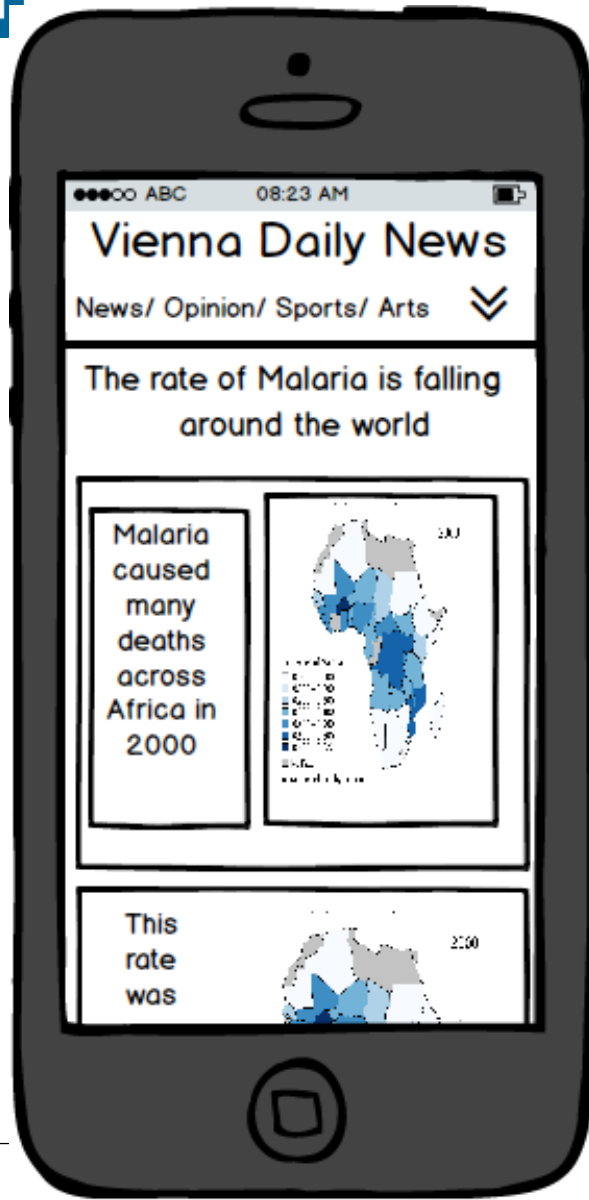
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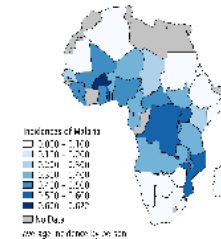
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Malaria

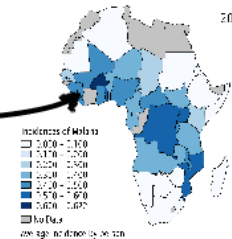


The rate of Malaria is falling around the world

Malaria caused many deaths across Africa in 2000



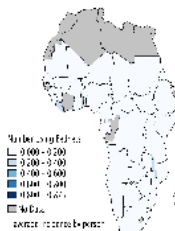
This rate was especially high in Burkina Faso



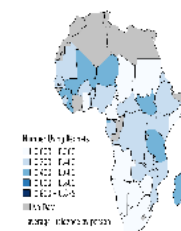
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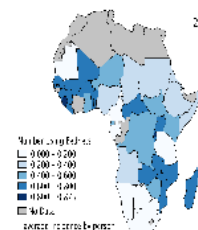
In 2010, an international effort began which provided bednets across Africa



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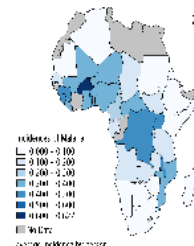


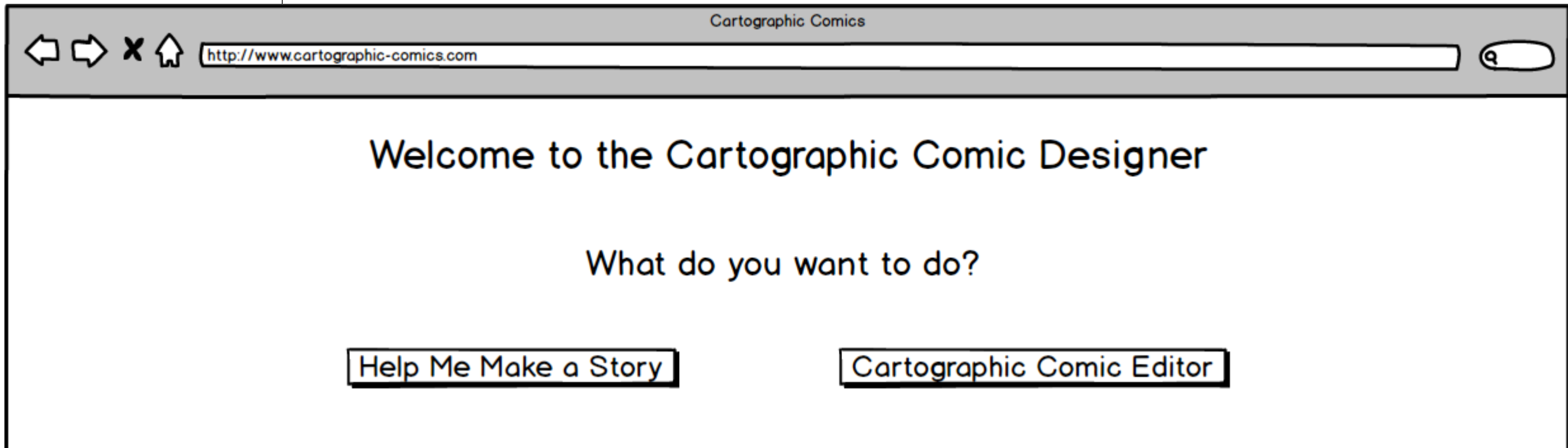
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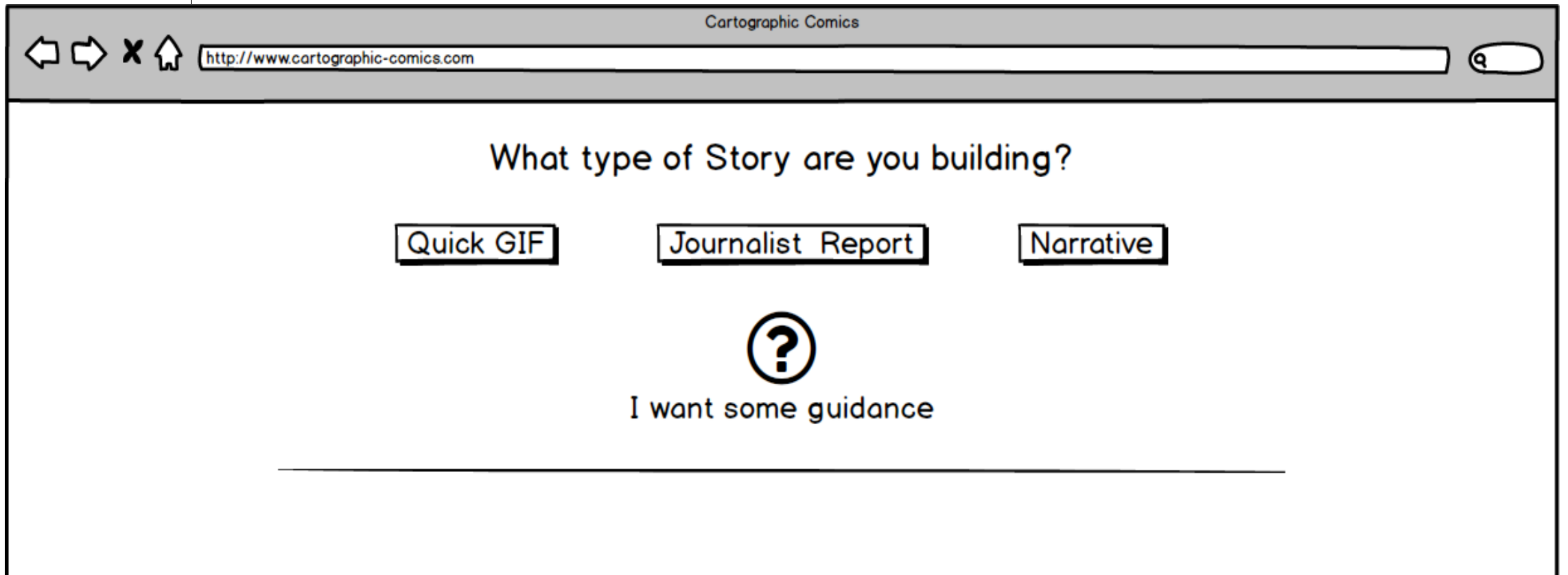
Since 2010 the incidences of Malaria have dramatically fallen.

It fell
consistently
across all
countries
between 2010
and 2015





Walkthrough of Narrative Structure



Conclusion (Research Question 4):

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- Final conclusion since each build on top of each of them.
- Most requirements were met for the mockup.
- Tutorial was not very clear.

Limitations

- All sections have limitations.
- User Requirements, particularly the interview technique.

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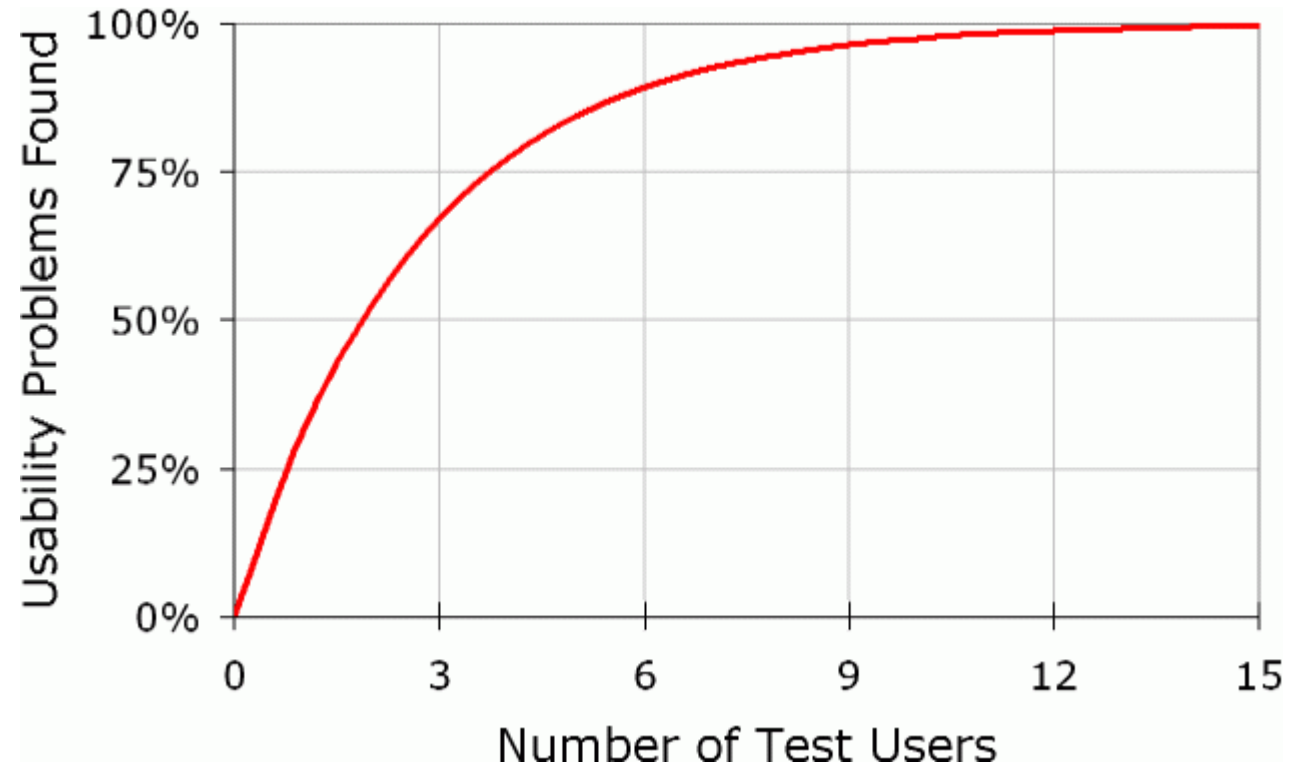
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Can you base a study on 6 people?



Nielsen (2000)

Limitations and Future Research

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- Too limited demographic -> a larger demographic, particularly with non data-journalists
- Austria focused -> make applicable outside of Austria.
- Lack of mapping theory -> make it more “cartographic”.

Any Questions?

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