A CONCEPTUAL FRAMEWORK FOR INTERACTIVE CARTOGRAPHIC STORYTELLING

NOÉ ABRAHAM LANDAVERDE CORTÉS
February, 2018

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NOÉ ABRAHAM LANDAVERDE CORTPES
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Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-Information Science and Earth Observation.
Specialization: Geoinformatics

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ABSTRACT

ACKNOWLEDGEMENTS

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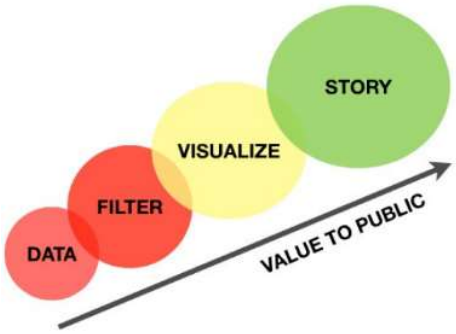
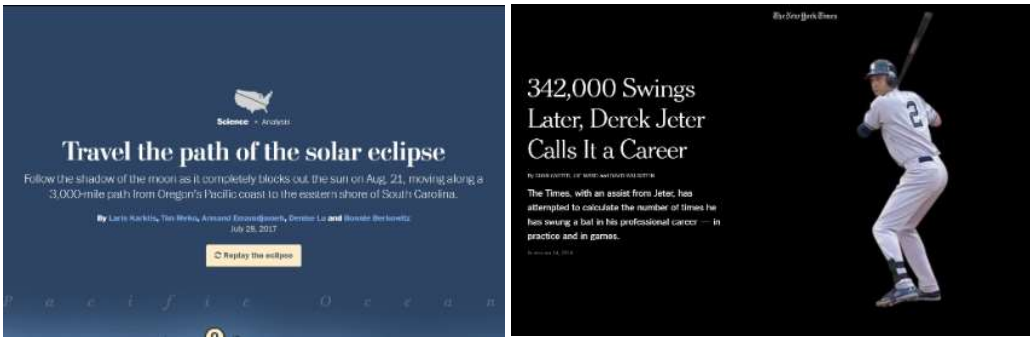


Figure 1-1. The data journalism process. The value for the public increases when facts and discoveries are structures as stories. Adapted from European Journalism Centre [EJC] (2010).



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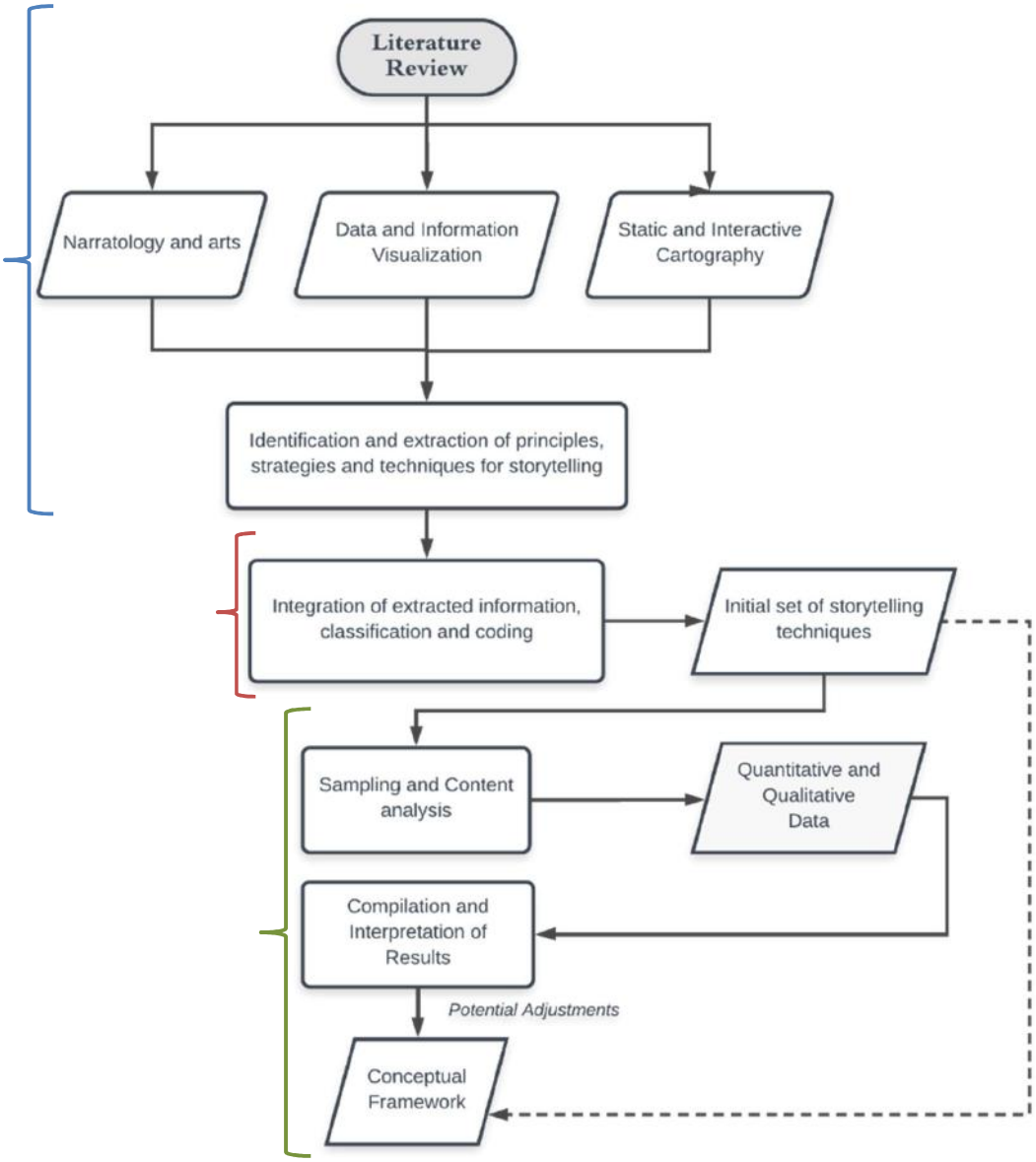

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2.3. Storytelling in visualization

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3. THE STORY MAP

3.1. Maps and stories: An introduction to the Story Map

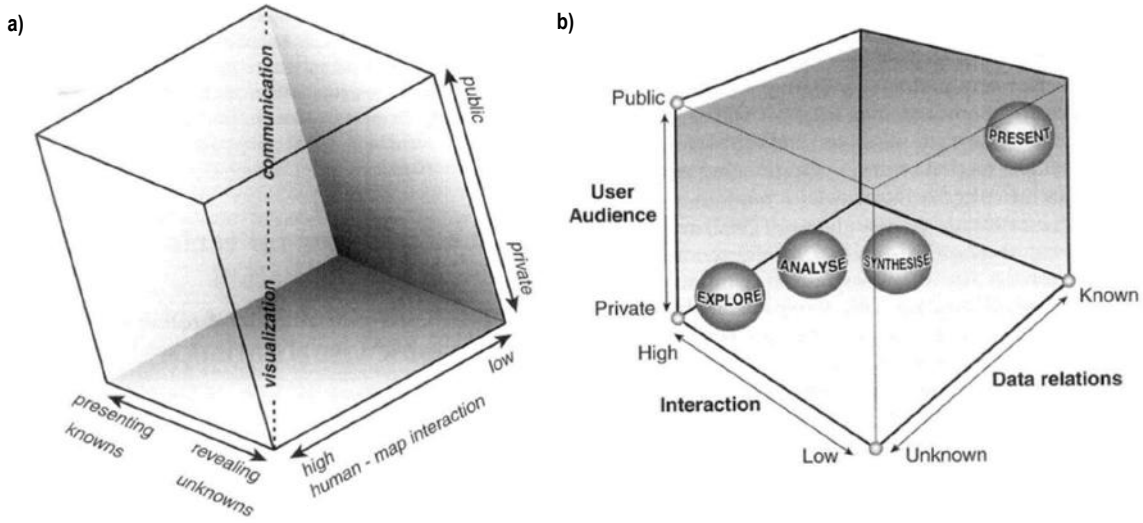

Figure 3-1. a) The cartographic cube representing the map use space b) An adapted version of the cube depicting the 4 different goals of map use: exploration, analysis, synthesis and presentation. Note the two-dimensional axes in b) have been swapped, and the interaction axis is inverted. Extracted from MacEachren and Kraak (2011).

a) **b)**

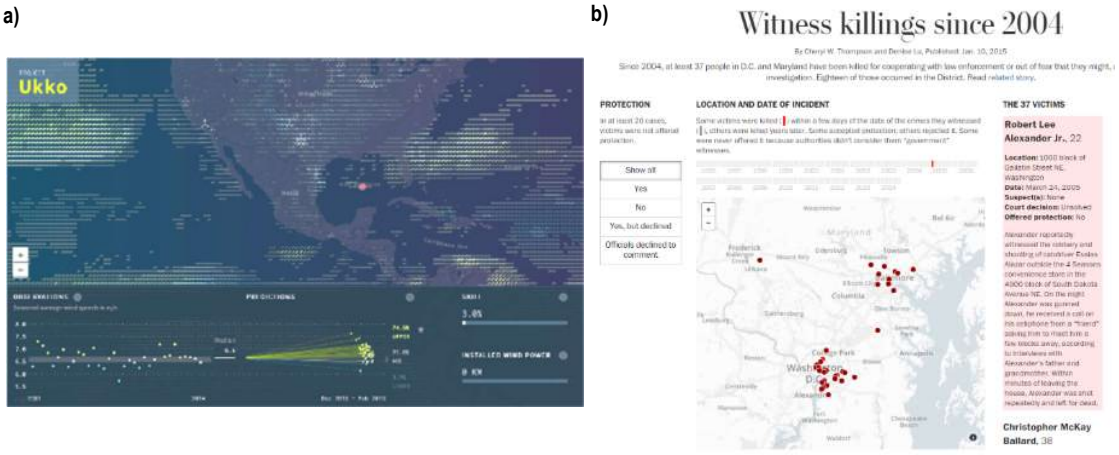

Figure 3-2. a) Stefaner's (n.d.) map of wind speed predictions. The map allows free exploration, similar to a Geovisual Analytics environment. **b)** Thompson and Lu's (2015) map depicting the number of witness deaths since 2004. Users also find themselves in the map, yet it guides the exploration of background information through scrolling and a timeline which locates the victim in time.

3.2. Story and Narrative

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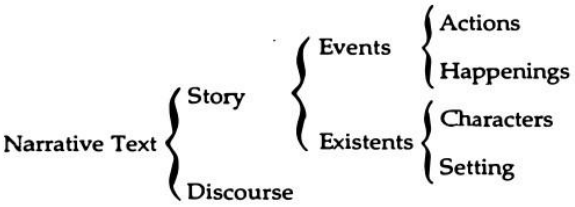

Figure 3-3. The necessary components of a narrative. Extracted from Chatman (1978).

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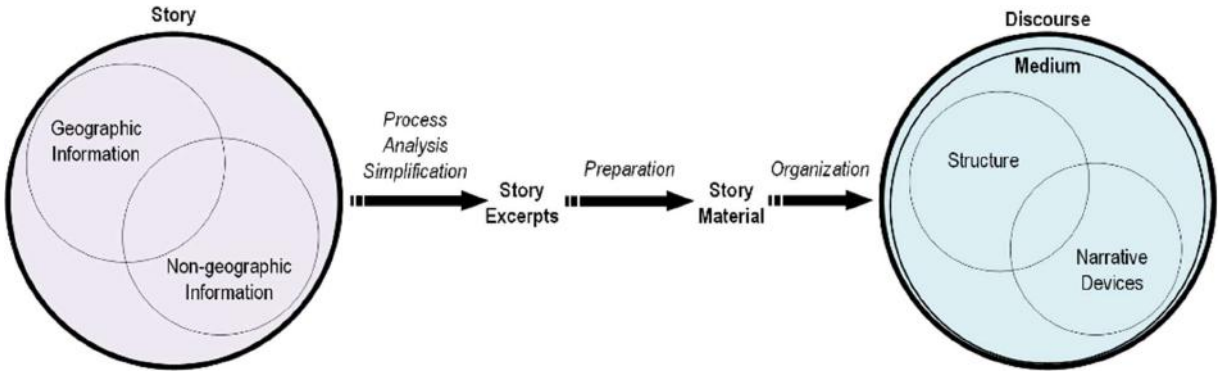

Figure 3-4. Diagram of inherent relationships between story and discourse.
Venn diagrams of Story and Discourse indicate inner elements and relationships as well. Figure by the author.

3.3. Elements of a Story

3.3.1. Non-Geographic Information

3.3.2. Geographic Information

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-
-
-

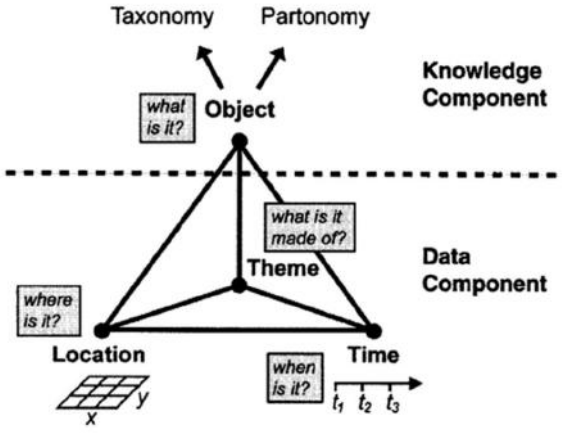

Figure 3-5. Mennis, Peuquet and Qian's (2000) pyramid framework for geographic representations.

What?
Remittance Flows
Where?
Global Phenomenon
When?
Since 2000
Why?
Migration
Who?
Migrants

What?
Migration
Where?
South, Central America and the U.S.
When?
Continual phenomena. In this map, is temporally bounded between 2000 and 2016.
Why?
Inequality, low quality of life, internal conflicts, etc.
Who?
Latin American population

Figure 3-6. Two maps showing two different geographic phenomena at different scales and different data representations. At the top, a map showing the total amount of money sent back home by migrants worldwide. The map at the bottom is a snapshot of a document-like interface containing multiple forms of media and interactive maps for depicting the flow of migrants coming from Latin America. First map extracted from Bauer, Boyandin, & Stalder (2013). The second map was created by the Office of General Assembly and World Mission of the Presbyterian Church (Presbyterian Church Office of General Assembly & World Mission [PCOGA & WM], 2017).

3.3.3. Other key characteristics of stories

-
-
-
-

Figure 3-7. The elements of a story, exemplified with the 5W questions. The "why" in the story and its main message are shaped by the interaction of all the components at the lowest hierarchical level. Modified from Chatman (1978).

3.4. Discourse Elements

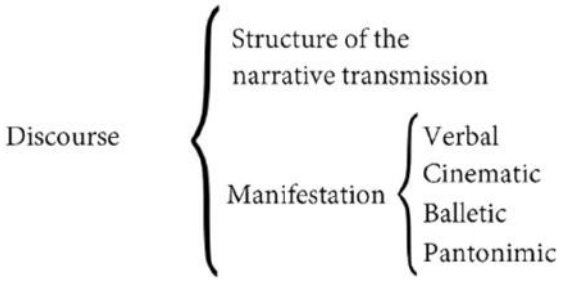

Figure 3-8. The elements of narrative discourse. Extracted from Chatman (1978).

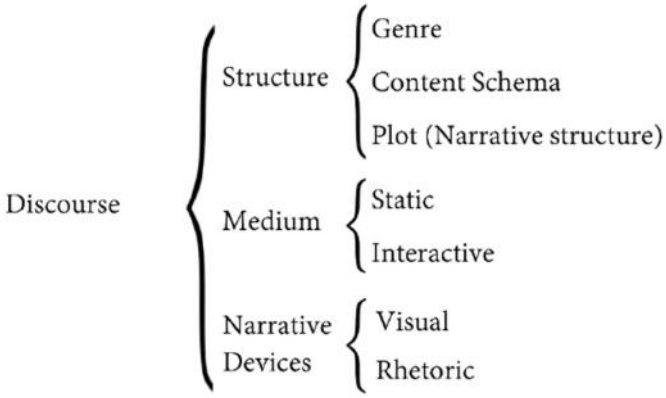

Figure 3-9. Elements of map discourse. Adapted from Chatman (1978).

3.4.1. Map-Based Visual Storytelling Genres (Visual Structure)

Genre	*Definition*

Table 3-1. Map-based visual storytelling genres. Reproduced from Song (2017).

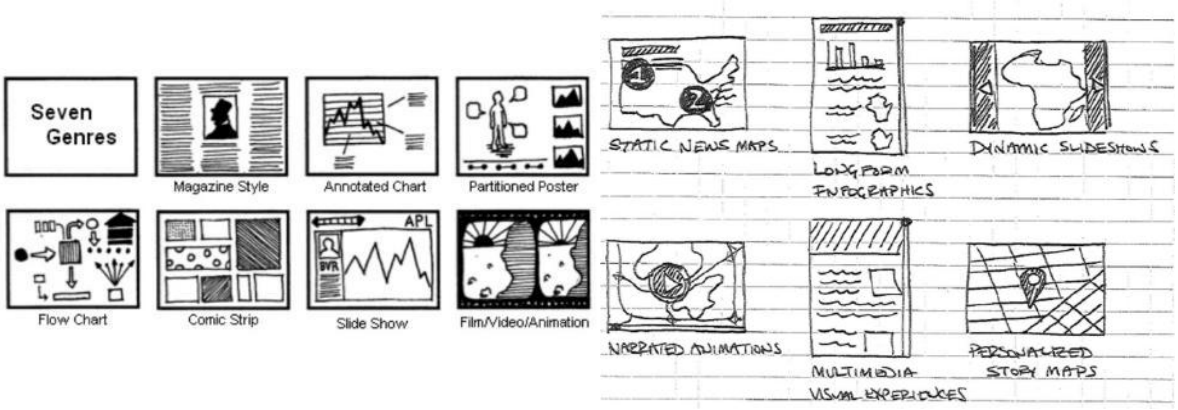

Figure 3-10. The Segel and Heer's (2010) seven genres of narrative visualization (left).
Roth's (2016) taxonomy of Map-based Visual Storytelling genres (right).

3.4.2. Content Schemas

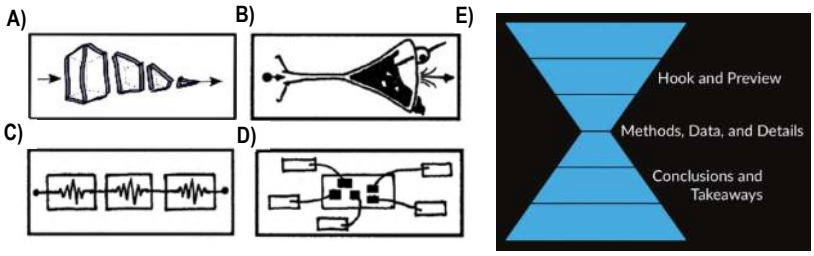

Figure 3-11. Content Schemas. Images B-D extracted from Segel and Heer (2010). Image A created by the author. Image E retrieved from Schwabish (2017).

3.4.3. Plots (Narrative Structures)

3.4.3.1. The Three-Act Narrative Arc

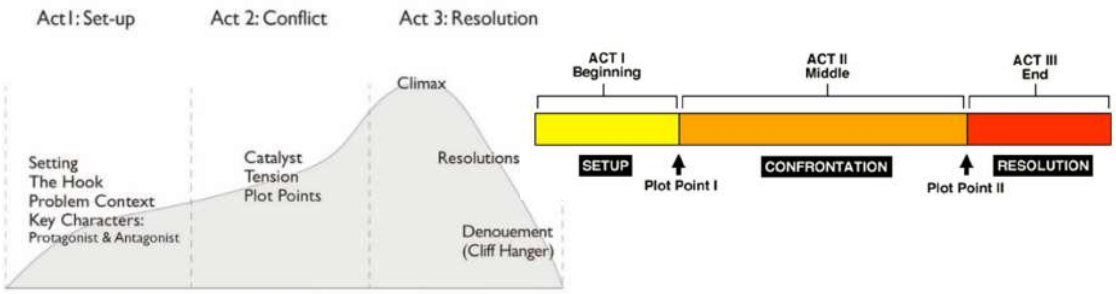

Figure 3-12. The three-act narrative structure plot. On the left, diagram after Young (2012). On the right: Herber, Schiffman, and Anavankot's (2011) linear variant.

Table 3-2. Description of the content and purpose of each act, according to Song (2017).

3.4.3.2. Narrative and Visual Narrative Structures

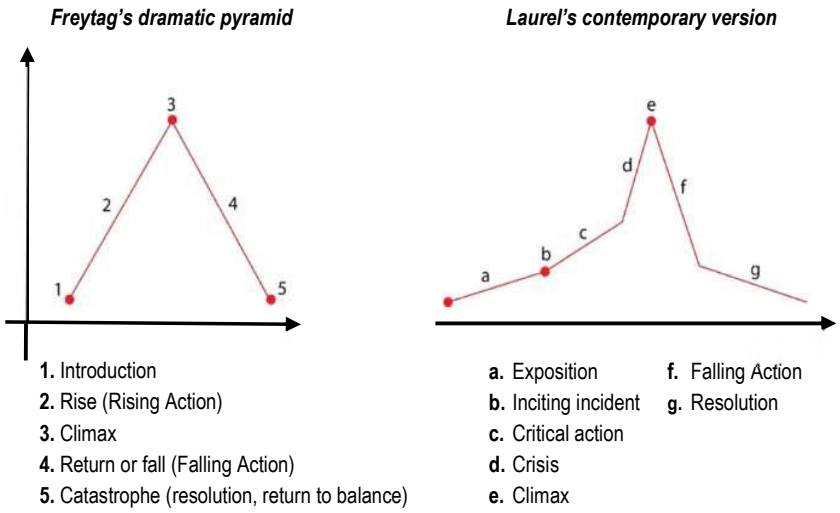

Figure 3-13. Freytag's dramatic pyramid (left) and Laurel's contemporary version of the same pyramid (right). Adapted from Tensen (2014).

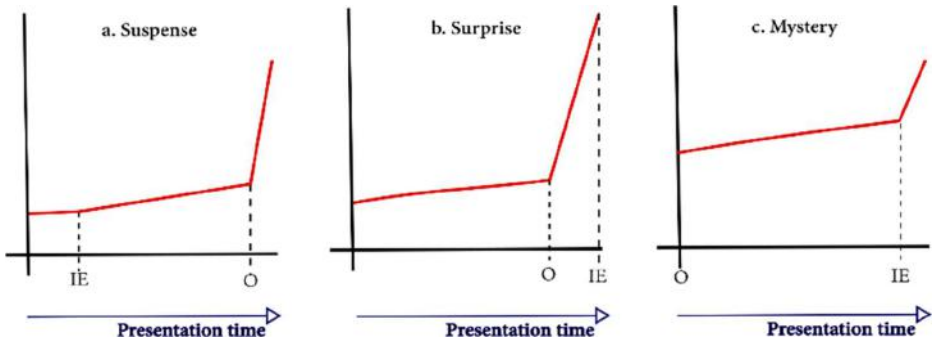

Figure 3-14. The three classical narrative procedures and their course of interest. (IE) is the generating event and (O) is the outcome. **(a) Suspense:** A cause is presented, but the effect is delayed, **(b) Surprise:** An effect is shown that later on appears to be incorrect, **(c) Curiosity/Mystery:** An effect is presented without further information. In the end enough information is given to reconstruct the cause. Adapted from Tan (2013).

Phase → (Establisher) – (Initial (Prolongation)) – Peak – (Release)

Figure 3-15. Cohn's (2013) narrative categories. Images and table adapted from Cohn (2013).

3.4.3.3. The Eight Basic Plots in Earth Sciences

Table 3-3. The eight basic plots in the earth sciences. Adapted from Phillips (2012).

3.5. Synthesis

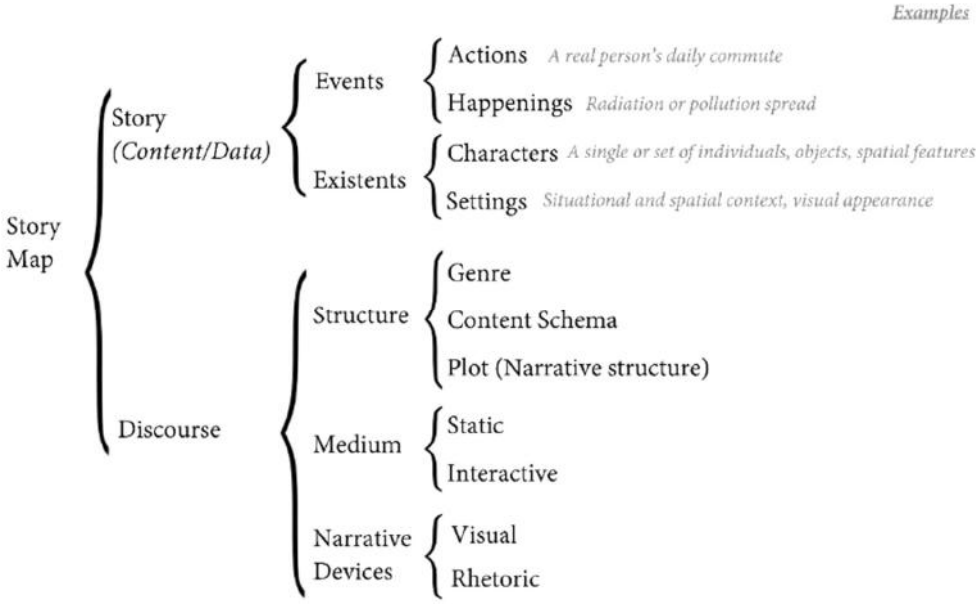

Figure 3-16. Hierarchical diagram comprising the components of a Story Map. Based on Chatman (1978).

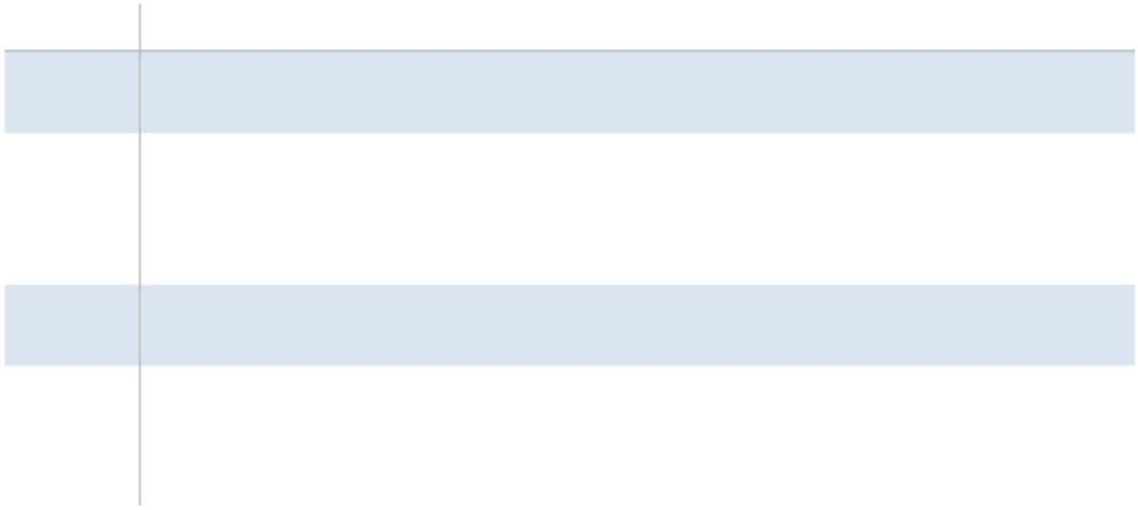

Table 3-4. Definitions for the concepts: Narrative, Story, Discourse, Story Map.

4. METHODOLOGY

4.1. Thematic Analysis (Qualitative Data Collection)

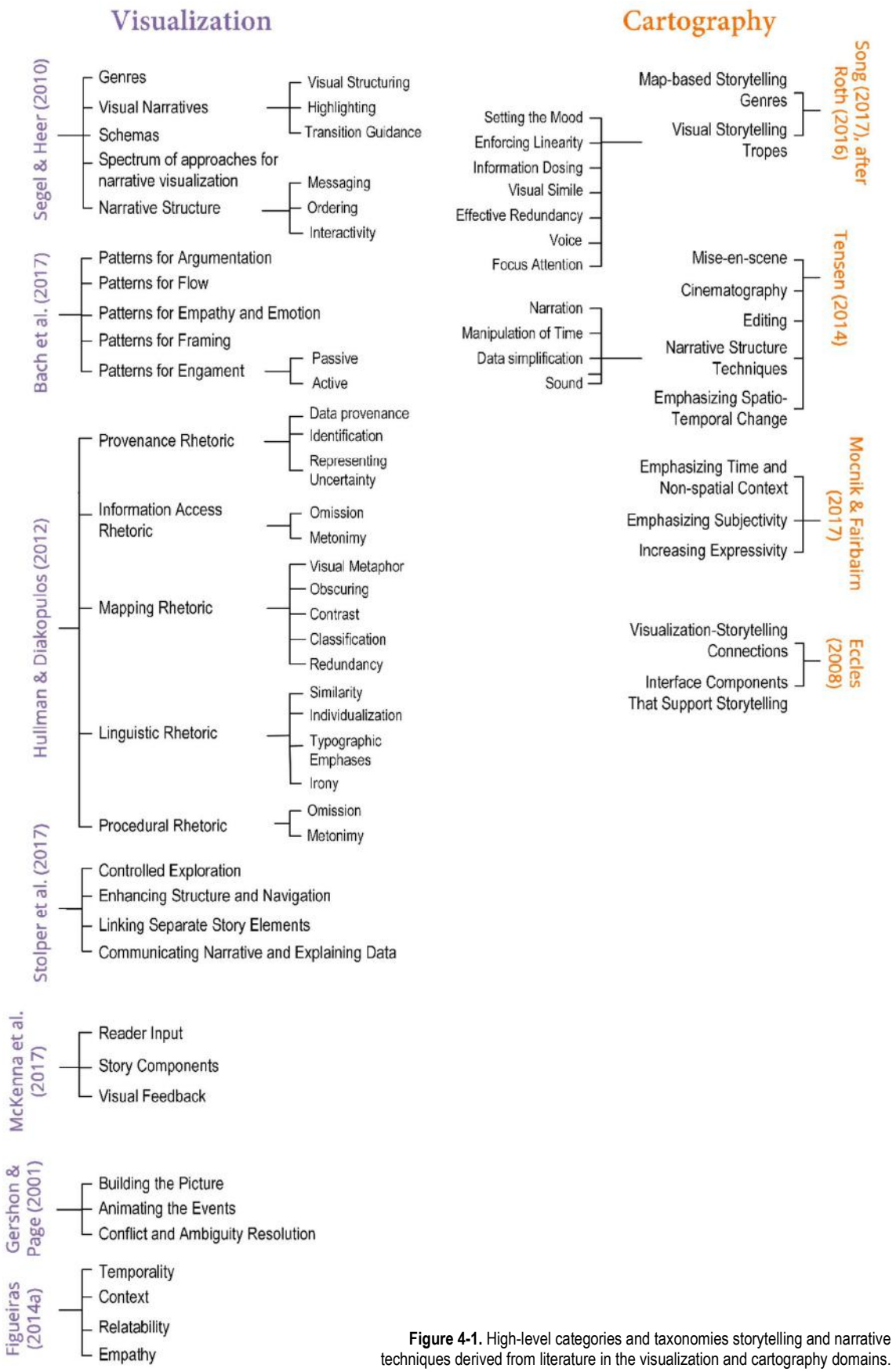

Figure 4-1. High-level categories and taxonomies storytelling and narrative techniques derived from literature in the visualization and cartography domains.

Table 4-1. Summary of the concepts extracted from the visualization subdisciplines.
Numbers between parentheses indicate further low-level techniques within multi-level hierarchies.

Table 4-2. Summary of the most relevant concepts extracted from storytelling and narratives in cartography. Numbers between parentheses indicate further low-level techniques within multi-level hierarchies.

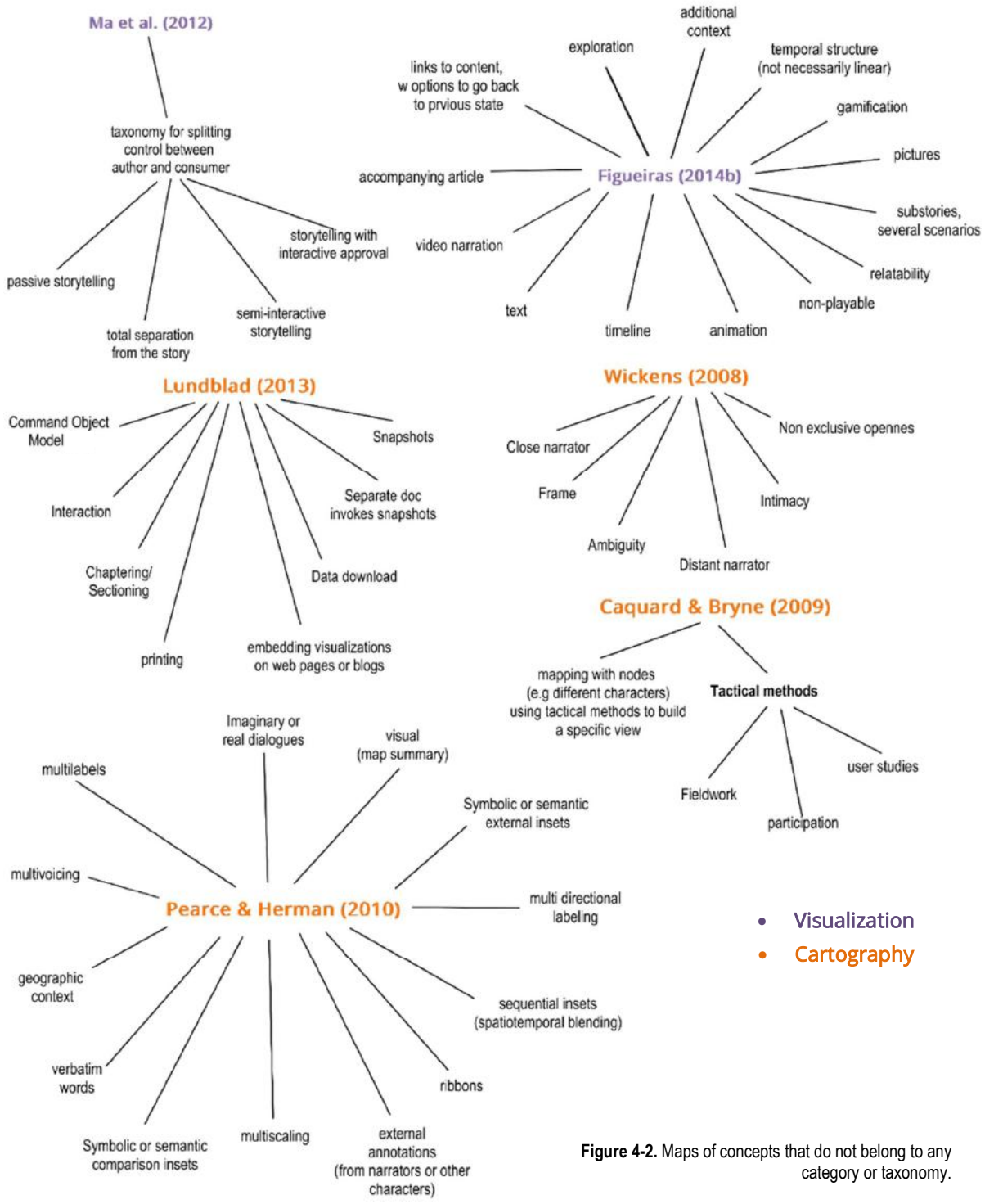

Figure 4-2. Maps of concepts that do not belong to any category or taxonomy.

4.2. Qualitative Data Integration

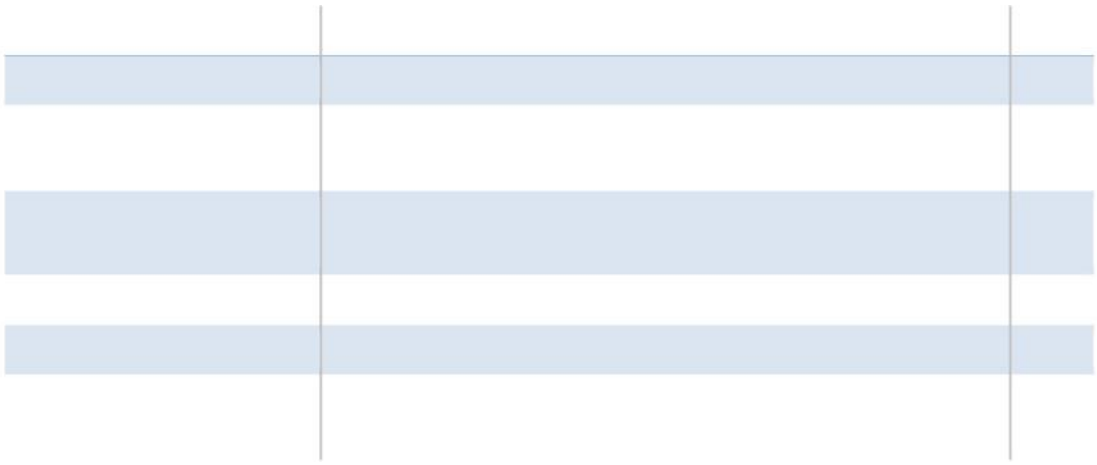

Table 4-3. Summary of the narrative/storytelling techniques integrated and categorized within the first major category: visual narrative tactics.

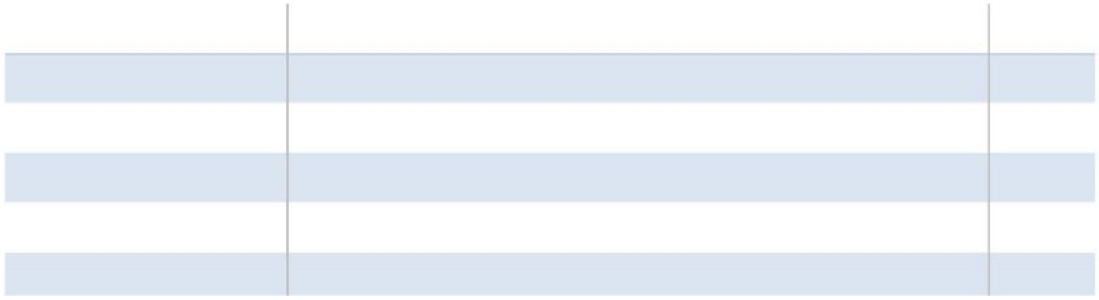

Table 4-4. Summary of the narrative/storytelling techniques integrated and categorized within the second major category: rhetoric devices.

4.3. Quantitative Content Analysis

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Table 4-5. Outline of the supplementary code sets for collecting further cartographic information during the Quantitative Content Analysis.

4.4. Reorderable Matrices

5. AN INTEGRATED FRAMEWORK

Figure 5-1. Concept map indicating how terminology will be addressed in this chapter

5.1. Visual Narrative Tactics

5.1.1. Main Design Alternatives

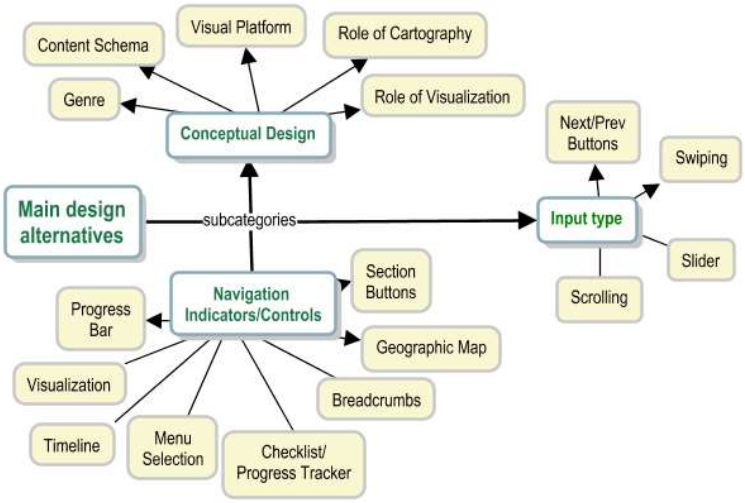

Figure 5-2. Concept map of the first subcategory of Visual Narrative Tactics.

5.1.1.1. Conceptual Design

5.1.1.2. Input Type

5.1.1.3. Navigation Indicators/Controls

5.1.2. Navigation Feedback and Transition Guidance

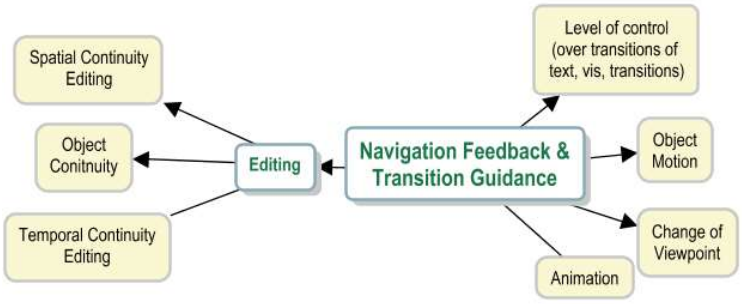

Figure 5-3. Techniques in the Navigation Feedback and Transition Guidance subcategory.

5.1.3. Communication of Narrative and Information

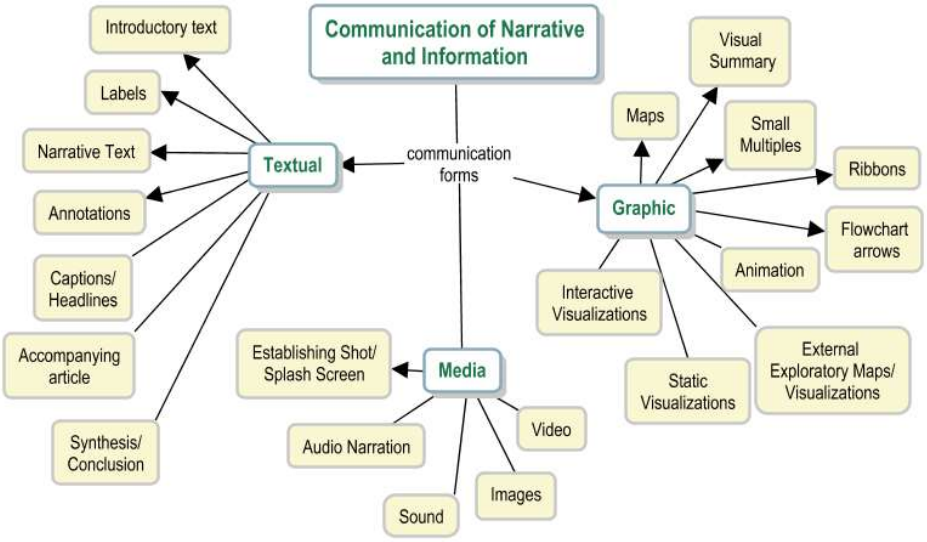

Figure 5-4. Concept map for the Visual Narrative Tactics subcategory named: Communication of Narrative and Information.

Figure 5-5. On the left, an example of cartographic ribbons extracted from Pearce and Hermann's (2010) map of Champlain's travels. On the right (top), an establishing shot giving a very brief introduction to a visualization on the evolution of music taste (Polygraph, 2016). Below, the animation of a bear in an empty background is played while content is loaded in *"A Bear's Eye View Of Yellowstone"* (Hello Monday et al., 2016).

5.1.4. Techniques for Emphasis

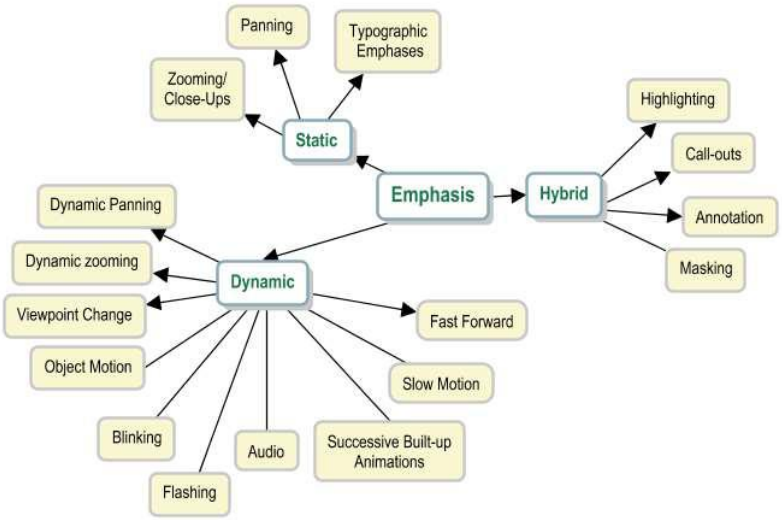

Figure 5-6. Concept map of techniques for emphasis.

Static

Dynamic

Hybrid

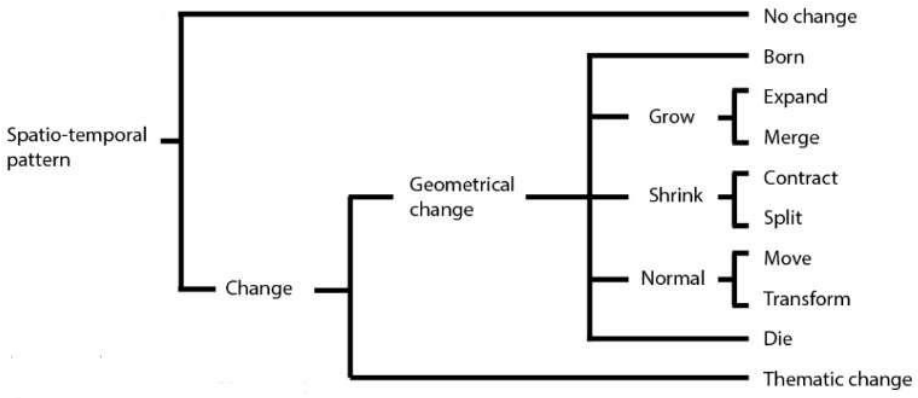

Figure 5-7. Spatio-temporal change patterns (STCPs) proposed by Ping, Xinming, and Shengxiao (2008). Figure adapted from Tensen (2014).

5.1.5. Techniques for Linking

5.1.6. Techniques for Interaction

Table 5-1. Enabling and Work operators in the Operators subcategory of techniques for interaction. Definitions obtained from Roth's (2013a) cartographic interaction taxonomy.

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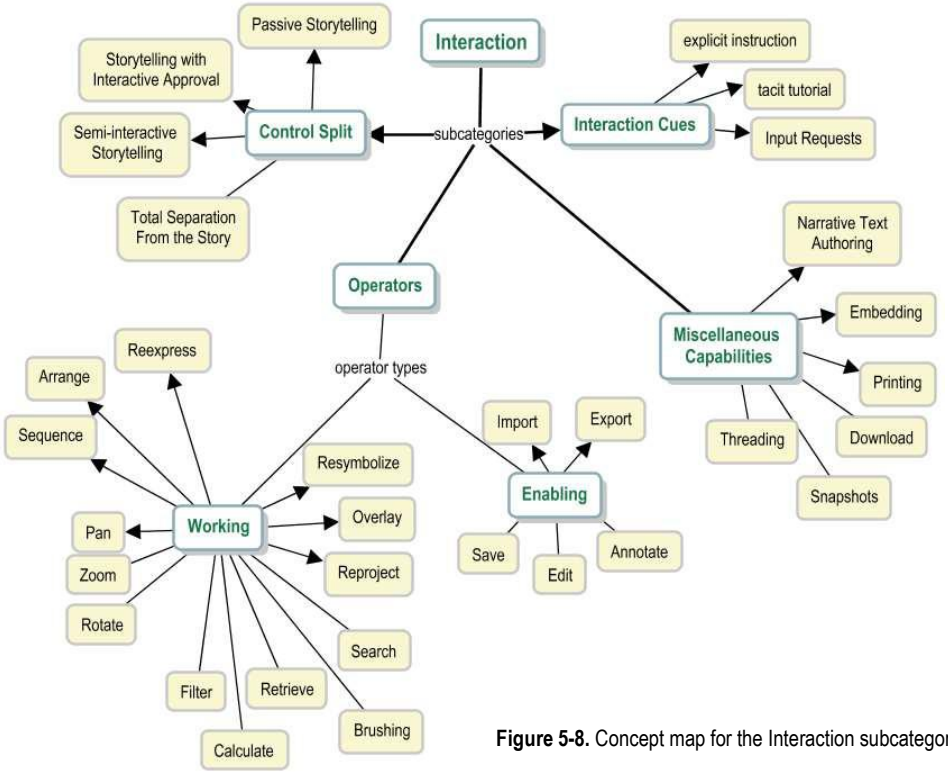


Figure 5-8. Concept map for the Interaction subcategory of Visual Narrative Tactics.

5.2. Rhetoric Devices

5.2.1. Information Access Rhetoric

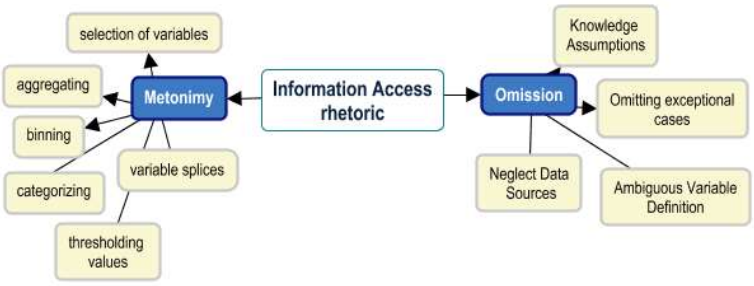


Figure 5-9. Information access rhetoric concept map.

5.2.2. Mapping Rhetoric

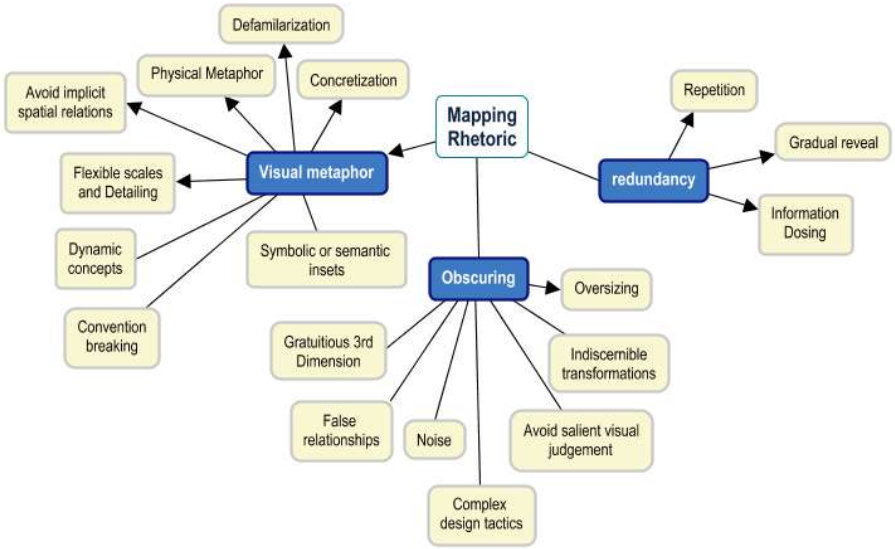


Figure 5-10. Concept map containing the mapping rhetoric techniques.

Table 5-2. Techniques in the mapping category of rhetoric devices. Definitions were adapted to suit the context of Story Maps.

5.2.3. Linguistic Rhetoric

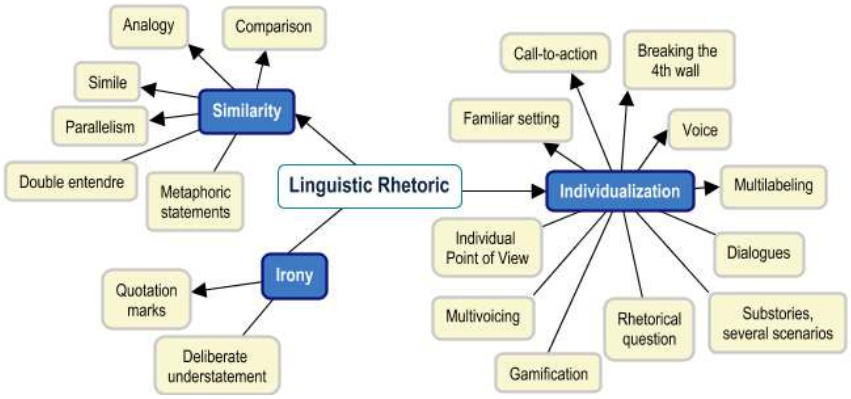


Figure 5-11. Concept map showing the types and techniques in the Linguistic Rhetoric category.

Table 5-3. Techniques and definitions in the individualization subcategory of Linguistic Rhetoric.

5.2.4. Provenance Rhetoric

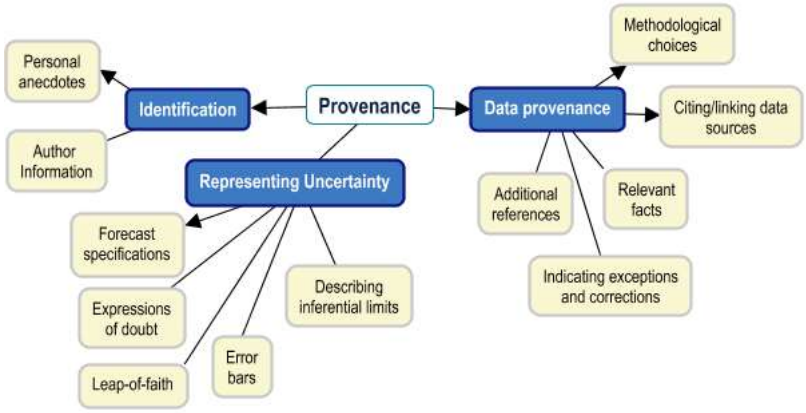


Figure 5-12. Concept map of the Provenance rhetoric category.

5.2.5. Procedural Rhetoric

Table 5-4. Techniques for anchoring, the main and only subcategory of procedural rhetoric.

5.3. Synthesis

6. RESULTS AND DISCUSSION

6.1. Cartographic Characteristics

	Planimetric	Oblique	Unclear/Other
Conventional	37	1	
Non-Conventional	4	11	
Unclear/Other	1	1	6

Table 6-1. Cross tabulation between Projection Types and Orientation.

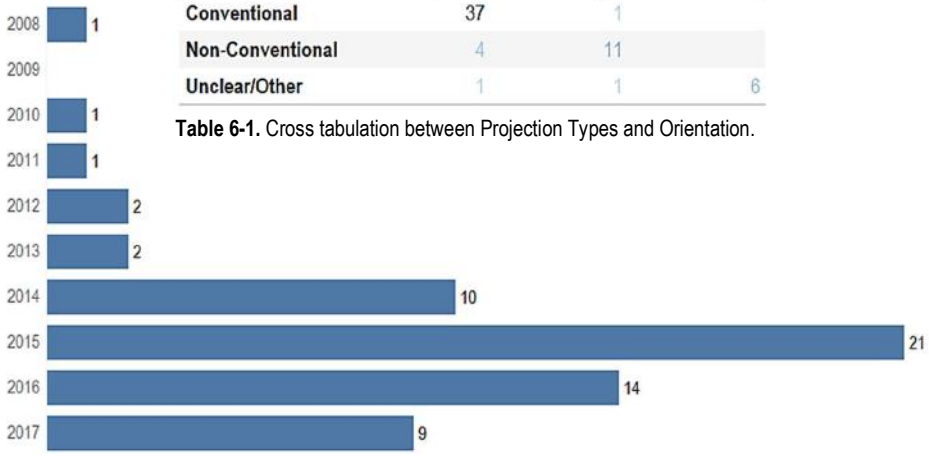


Figure 6-1. Unsorted histogram of the distribution of maps across year of creation.

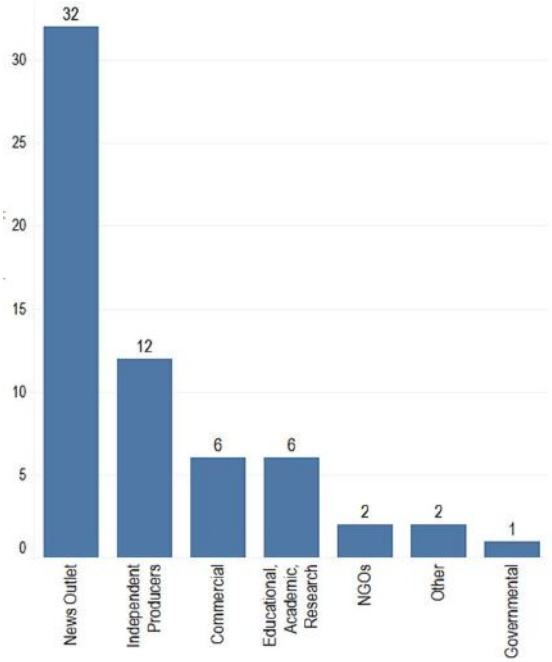


Figure 6-2. Sorted histogram showing the distribution of maps across producer type.

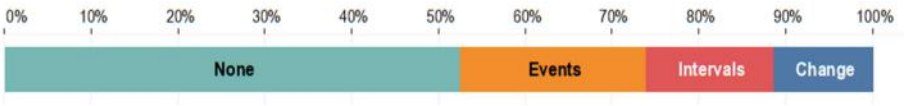


Figure 6-3. Proportion of the sample with different types of explicit temporal symbolization.

6.2. General Visual Story Characteristics

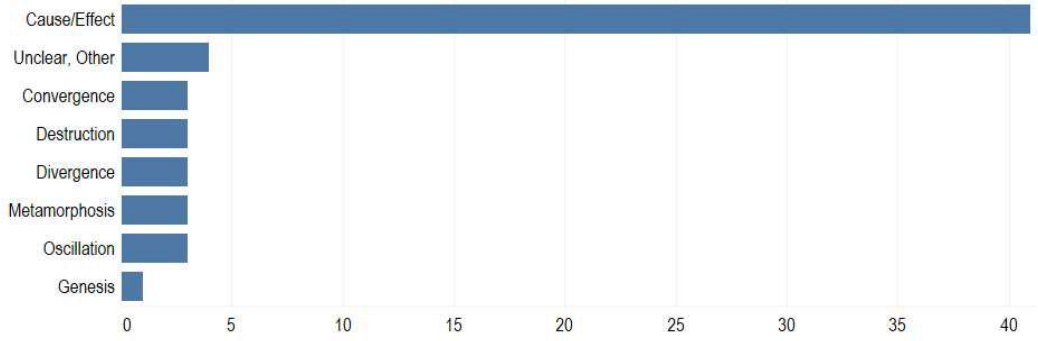


Figure 6-4. Distribution of maps across the different plot structures proposed by Phillips (2012).

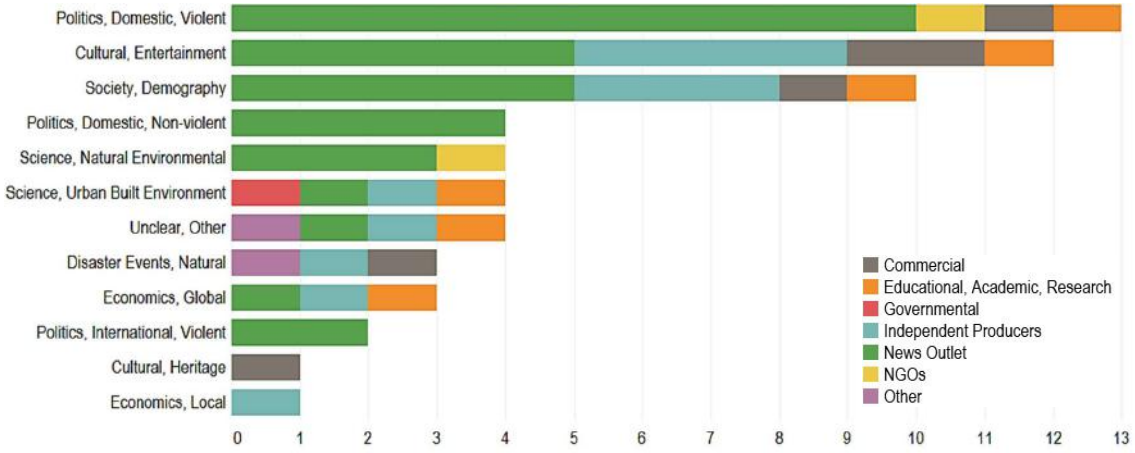


Figure 6-5. Frequency of story themes per producer type. Themes extracted from (Vujaković, 2014).

Rhetorical Style	
Understated	44
Authoritative	15
Other	2

Table 6-2. Frequencies of map types classified according to the Muehlenhaus' (2012) taxonomy of rhetoric styles.

6.3. Visual Narrative Tactics

Figure 6-6.
Reordered Matrix of VNTs. Groups G1-G3 are the only map groups identified by sets of characteristics a, b, and c.

6.3.1. Main Design Alternatives

6.3.1.1. Conceptual Design

Content Schema	Dynamic Slidesho..	Longform Infograp..	Multimedia Visual ..	Narrated Animatio..	Personalized Stor..	Stationary Story Ma..
Drill-Down				2	3	9
Hourglass	2	2	5	3	2	
Inverted Pyramid	5	8	5	2	2	1
Martini	1			3	1	
Pyramid	2					
Unclear/Other					3	

Table 6-3. Frequency table of content schemas found in genres. Empty cells indicate no map with both characteristics was found.

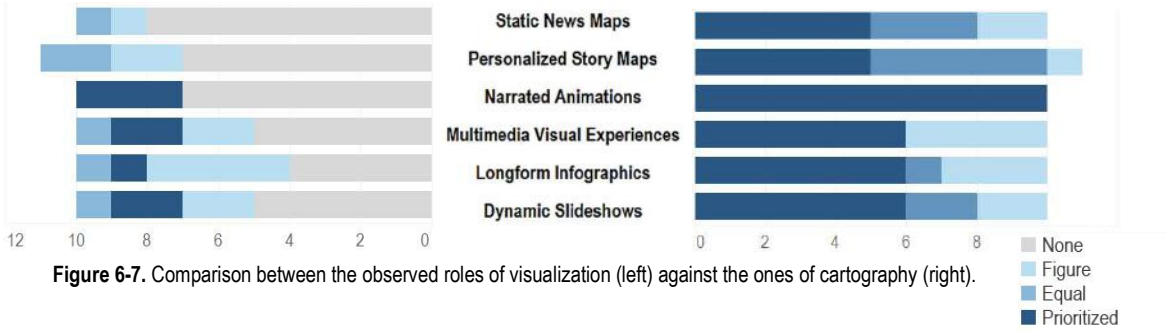


Figure 6-7. Comparison between the observed roles of visualization (left) against the ones of cartography (right).

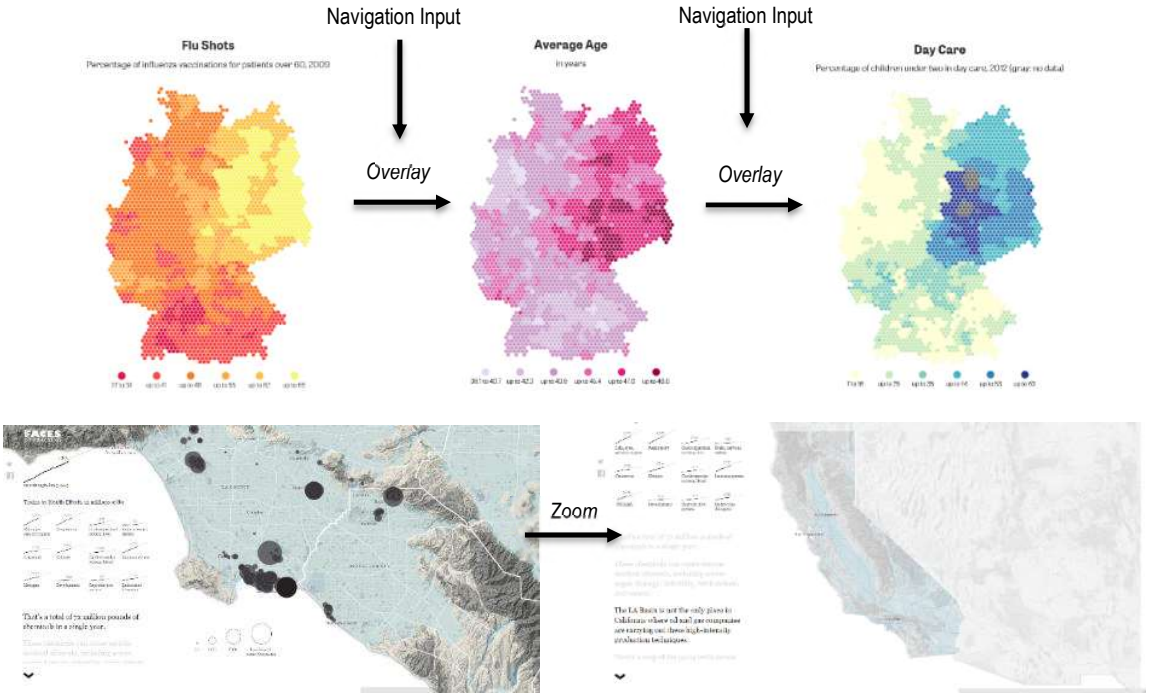


Figure 6-8. From top to bottom: Scrolling triggers the overlay operator in Zeit Online's "A Nation Divided" (Zeit Online, 2014). Below, scrolling also acts as an interactive interface for the Zoom operator in Flagg, Craig, & Bruno's (2014) "California is Getting Fracked".

Figure 6-9. "Britain's Royal Navy in the First World War" (Brohan,2012). The visual platform is maintained as the animation runs.

6.3.1.2. Input Type

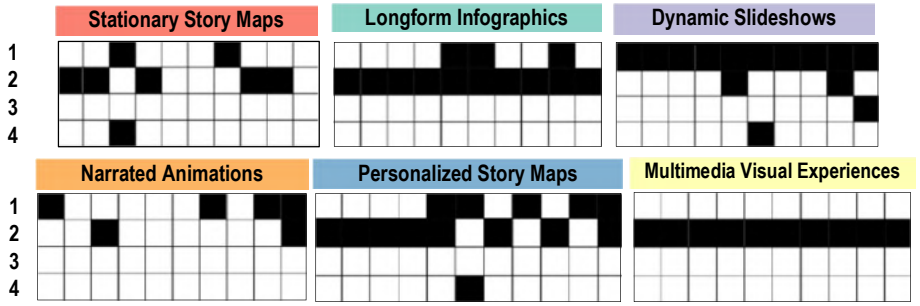


Figure 6-10. Symbolized binary tables depicting the existence of distinct types of navigation input across the map sample. Sample members have been grouped by genre, and numbering represents: (1) next/previous buttons, (2) scrolling, (3) swiping, and (4) sliders.

Figure 6-11. On the left, a Static News Map advances its content using section buttons only (populate, 2015). A play button stars a fully animated map depicting people movement across the globe in Elkanodata & Ticketbis (2015).

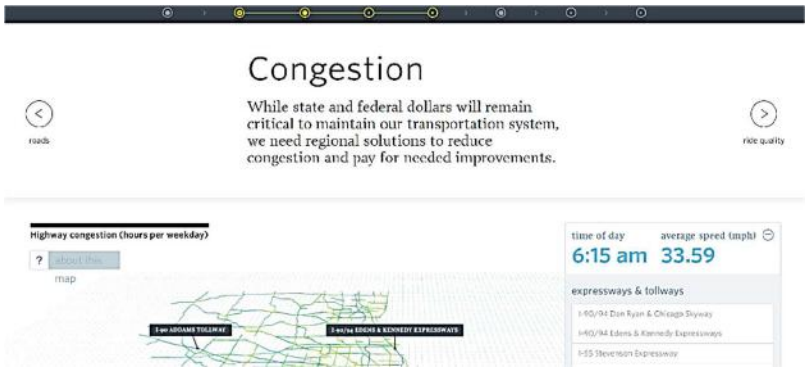


Figure 6-12. Navigation buttons, scrolling and a direct form of navigation have been incorporated into a single cartographic interface in (Chicago Metropolitan Agency for Planning [CMAP], 2014).

6.3.1.3. Navigation Indicators and Controls

Figure 6-13. Implicit forms of controlling and indicating navigation. Obtained and adapted from Smart (2012) (left), and Andrews, Watkins, and Ward (2015).

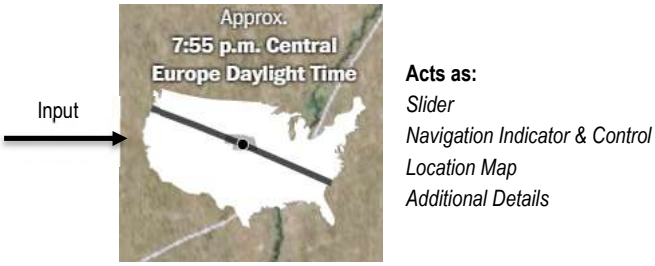


Figure 6-14. A navigation indicator serving multiple functions, implemented in "Travel the path of the solar Eclipse" (Karklis et al., 2017)

6.3.2. Navigation Feedback and Transition Guidance

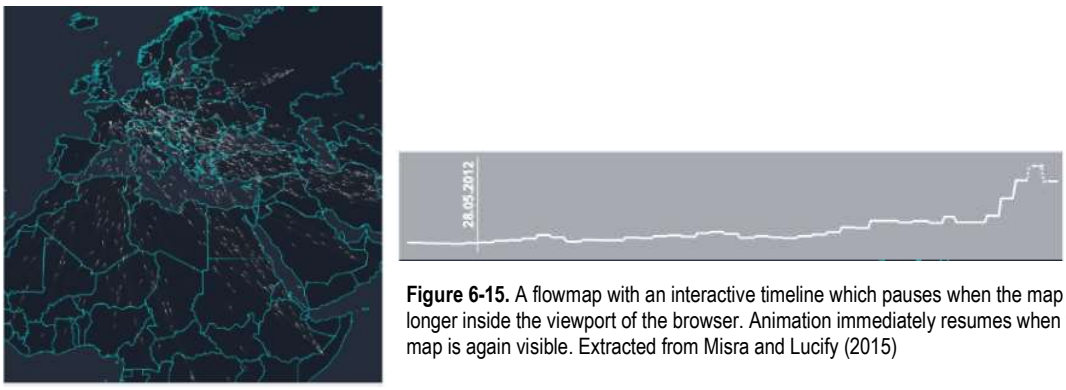


Figure 6-15. A flowmap with an interactive timeline which pauses when the map is no longer inside the viewport of the browser. Animation immediately resumes when the map is again visible. Extracted from Misra and Lucify (2015)

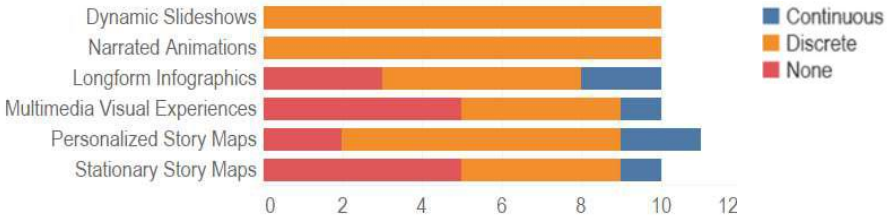


Figure 6-16. Distribution of levels of control across storytelling genre.

6.3.2.1. Editing

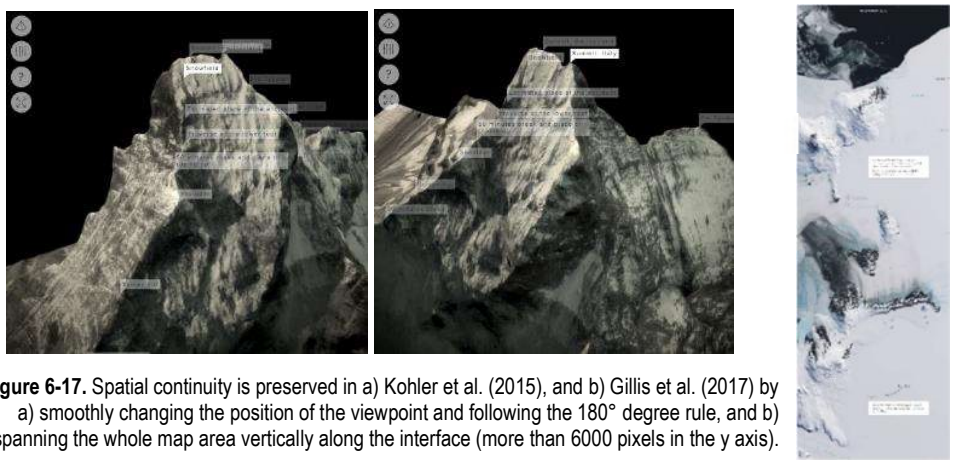


Figure 6-17. Spatial continuity is preserved in a) Kohler et al. (2015), and b) Gillis et al. (2017) by a) smoothly changing the position of the viewpoint and following the 180° degree rule, and b) spanning the whole map area vertically along the interface (more than 6000 pixels in the y axis).

6.3.3. Communication of Narrative and Information

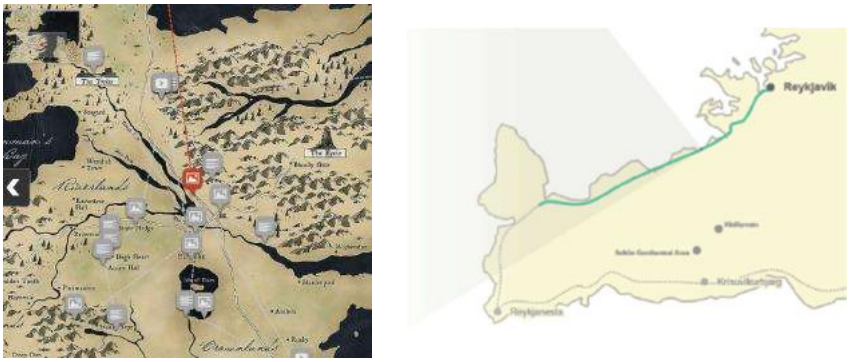


Figure 6-18. Trajectories are highlighted as the user generates input in Northwestern University KnightLab [NUK] (2014), and Bebber (2015).

6.3.4. Emphasis

6.3.5. Linking

Figure 6-19. On top: objects are linked by color and as text hyperlinks in "Election 2015: Where to vote tactically to get the prime minister you want" (Nardelli & Gutiérrez, 2015). Bottom: linking through symbol in "1812" (Nedkova et al., 2017).

6.3.6. Interaction

6.3.6.1. Control Split

Genre	Interactive Approval	Passive Storytelling	Semi-Interactive	Total separation
Static News Maps				10
Longform Infographics		5	5	
Dynamic Slideshows	2	5	3	
Narrated Animations		1	7	2
Personalized Story Maps		2	6	3
Multimedia Visual Experiences		4	5	1

Table 6-4. Distribution of genres across levels of control split

Figure 6-20. Different approaches to splitting control. On the left, an interactive map is placed at the beginning of the narrative in Quoctrung and White (2016). On the right, narration begins after other forms of user input.
Urban Big Data Centre & Economic and Social Research Council [UBDC & ESRC], (2016), top. Google, (2015), bottom.

6.3.6.2. Operators

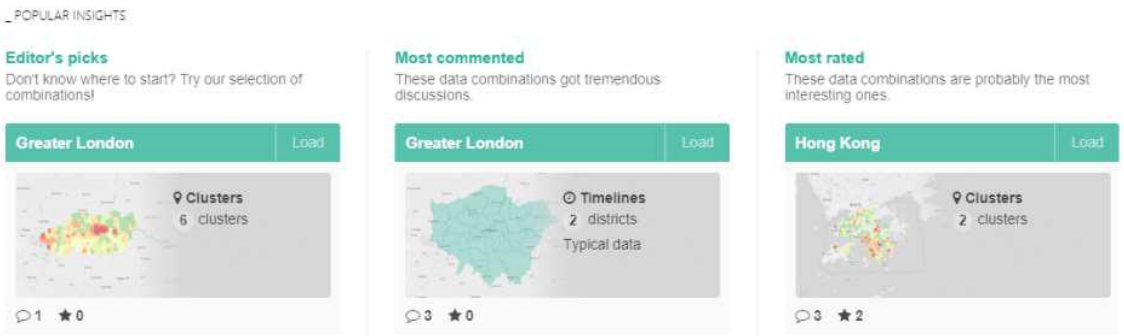


Figure 6-21. An example of snapshots generated via the save and annotate operators in a cartographic interface. Extracted from Ratti et al. (2014).

6.3.6.3. Miscellaneous Capabilities

6.3.6.4. Interaction Cues

6.3.7. Summary

6.4. Rhetoric Devices

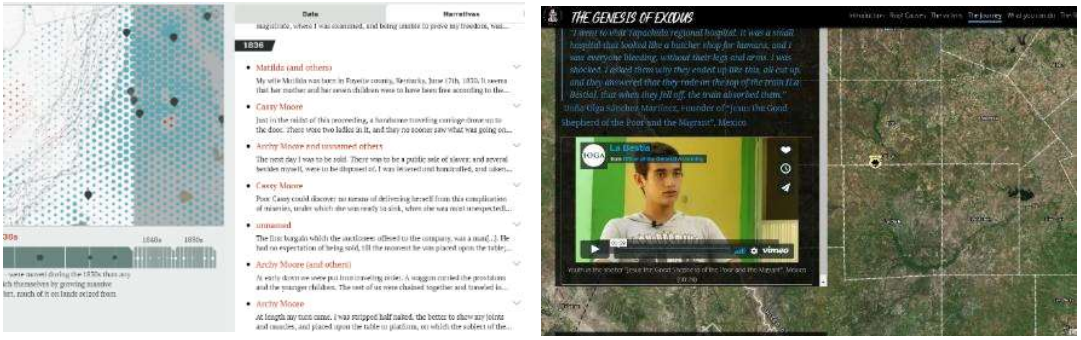
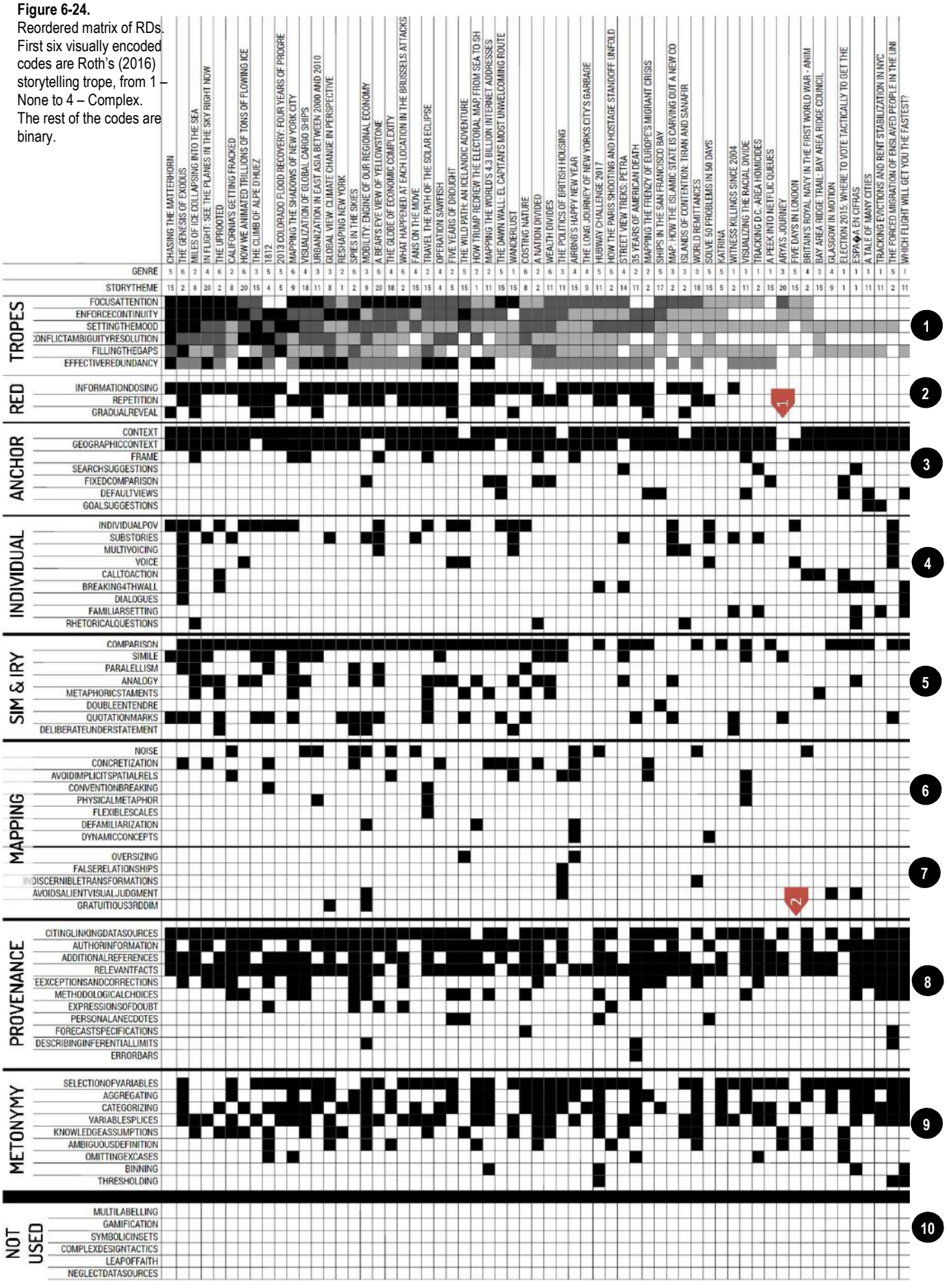


Figure 6-22. On the left map, substories are shown just in plain text. On the right a substory is depicted with media.

Figure 6-23. Destroyed and repaired roads are symbolized while showing an aerial picture of a message left by affected locals in Fischer (2017).

Figure 6-24.
Reordered matrix of RDs. First six visually encoded codes are Roth's (2016) storytelling trope, from 1 – None to 4 – Complex. The rest of the codes are binary.



6.4.1. Procedural Rhetoric

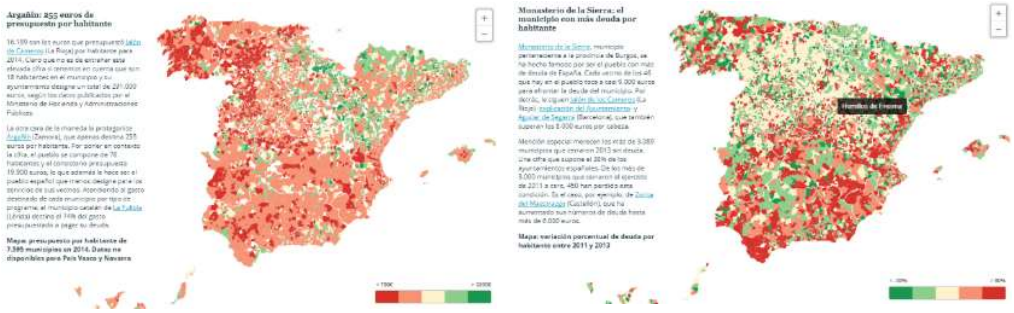


Figure 6-25. A divergent color scheme continually shows lower values in red color, then inverts the color scheme to show the same type of difference. Extracted from populate (2015).

6.4.2. Mapping Rhetoric

Figure 6-26. Comparison between a Static Map of the 2017 Total Eclipse (National Aeronautics and Space Administration, 2017) on the left, and a Longform Infographic depicting the same phenomenon dynamically (Karklis et al., 2017) on the right.

Figure 6-27. Distance encodes the disparity between racial make-up between neighboring tracts. Extracted from Vallandingham (2011).

Figure 6-28. "A World of Belonging on Airbnb". Extracted from Airbnb (2015).

6.4.3. Provenance Rhetoric

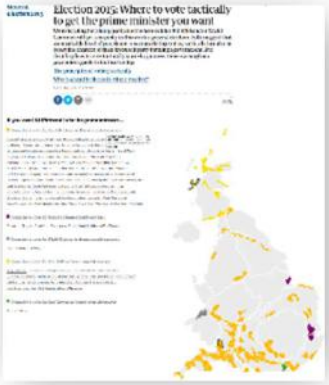


Figure 6-29. a) Authors narrate their own experiences in "Five Days in London" (Webadvantage, 2017), b) No documentation is provided in Nardelli and Gutiérrez (2015).

6.5. Conclusions and Summary

Figure 6-30. Fischer's (2017) "2013 Colorado Flood Recovery: Four Years of Progress". A genesis plot was identified by the end of the narrative.

6.6. Reintegrating Concepts and Reexplaining the Story Map

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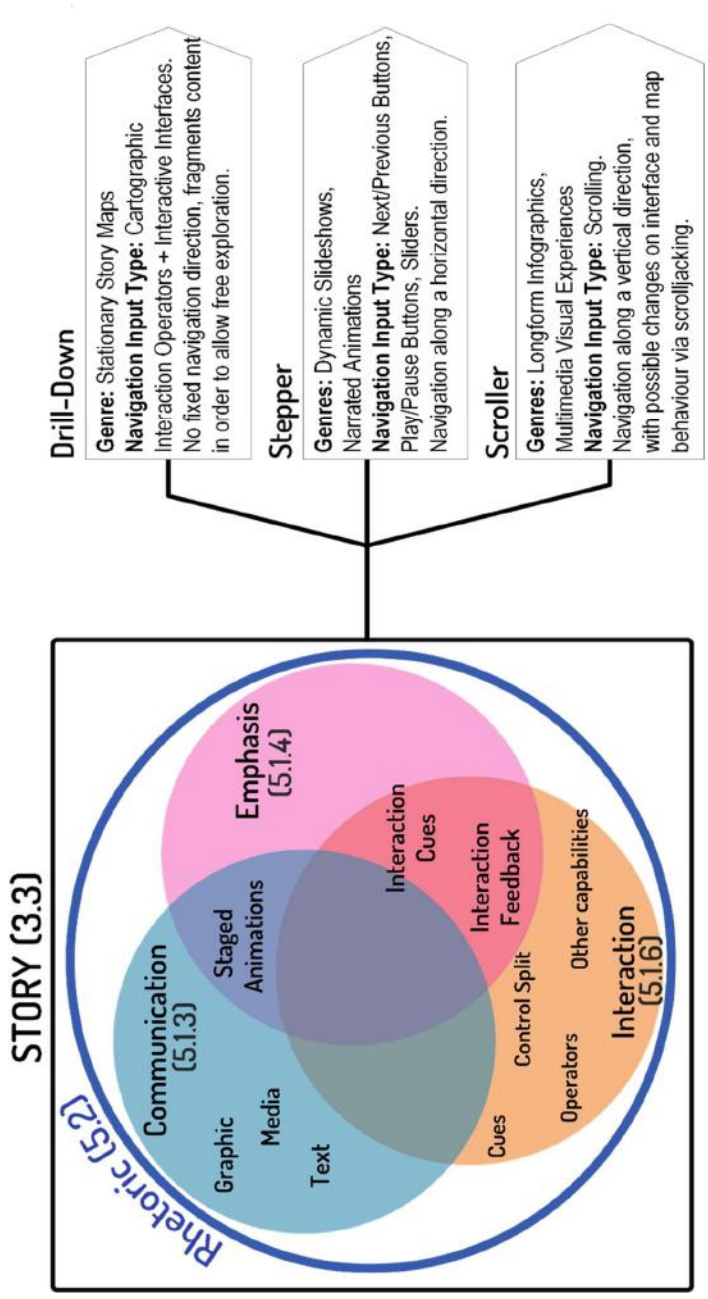

Figure 6-31. Integrated conceptualization of the Story Map. Numbering after concepts refer to section numbers.

7. CONCLUSIONS

7.1. Conclusions

7.2. Limitations

7.3. Future Work

LIST OF REFERENCES

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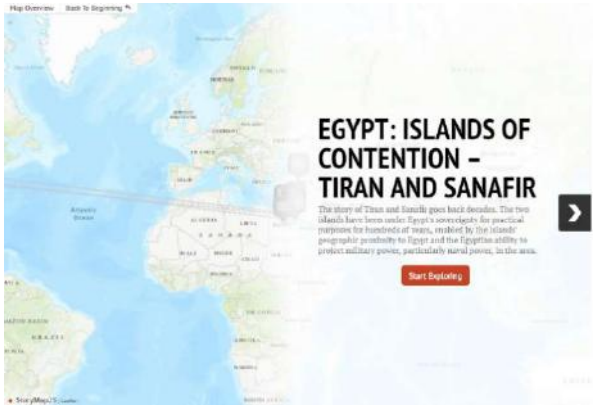
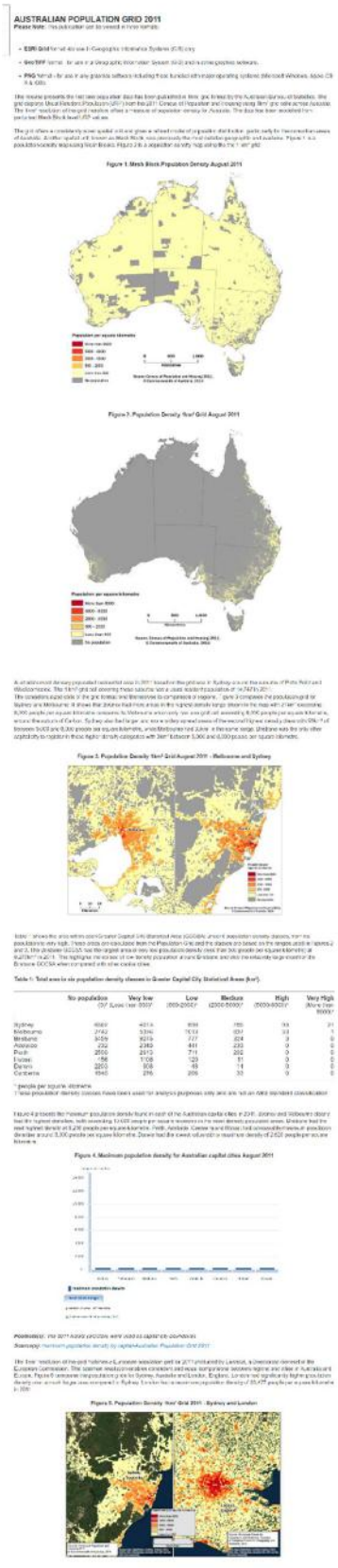
APPENDIX A

Static News Map

Dynamic Slideshow

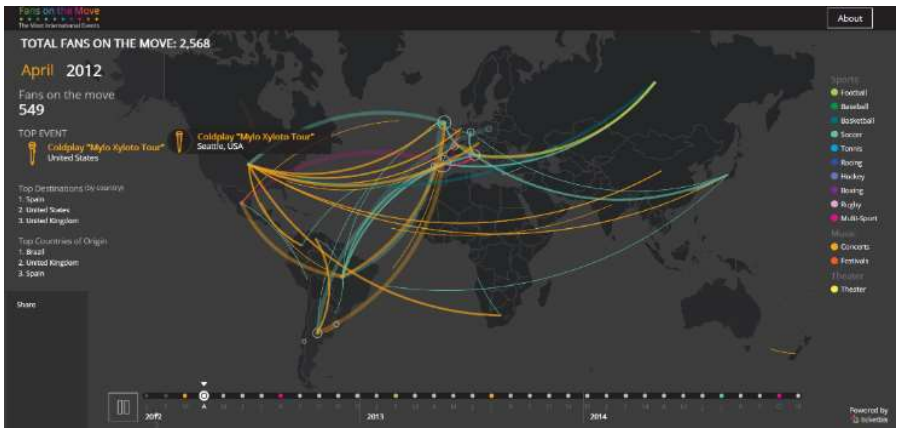


Longform Infographic

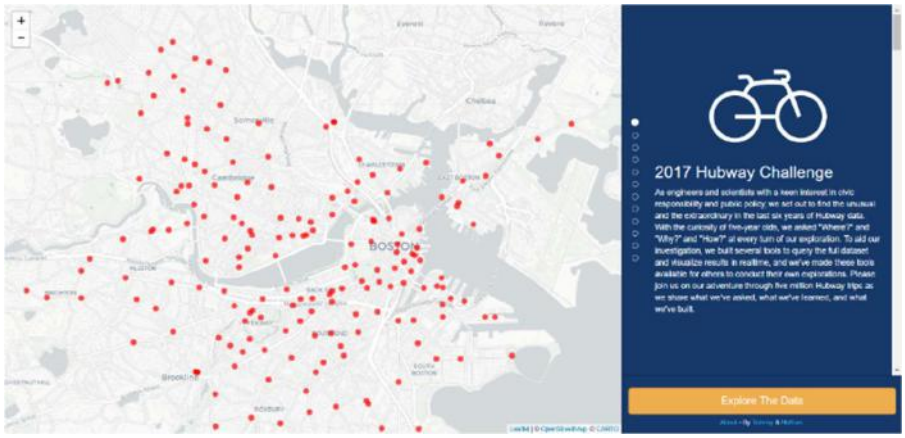


Multimedia Visual Experience

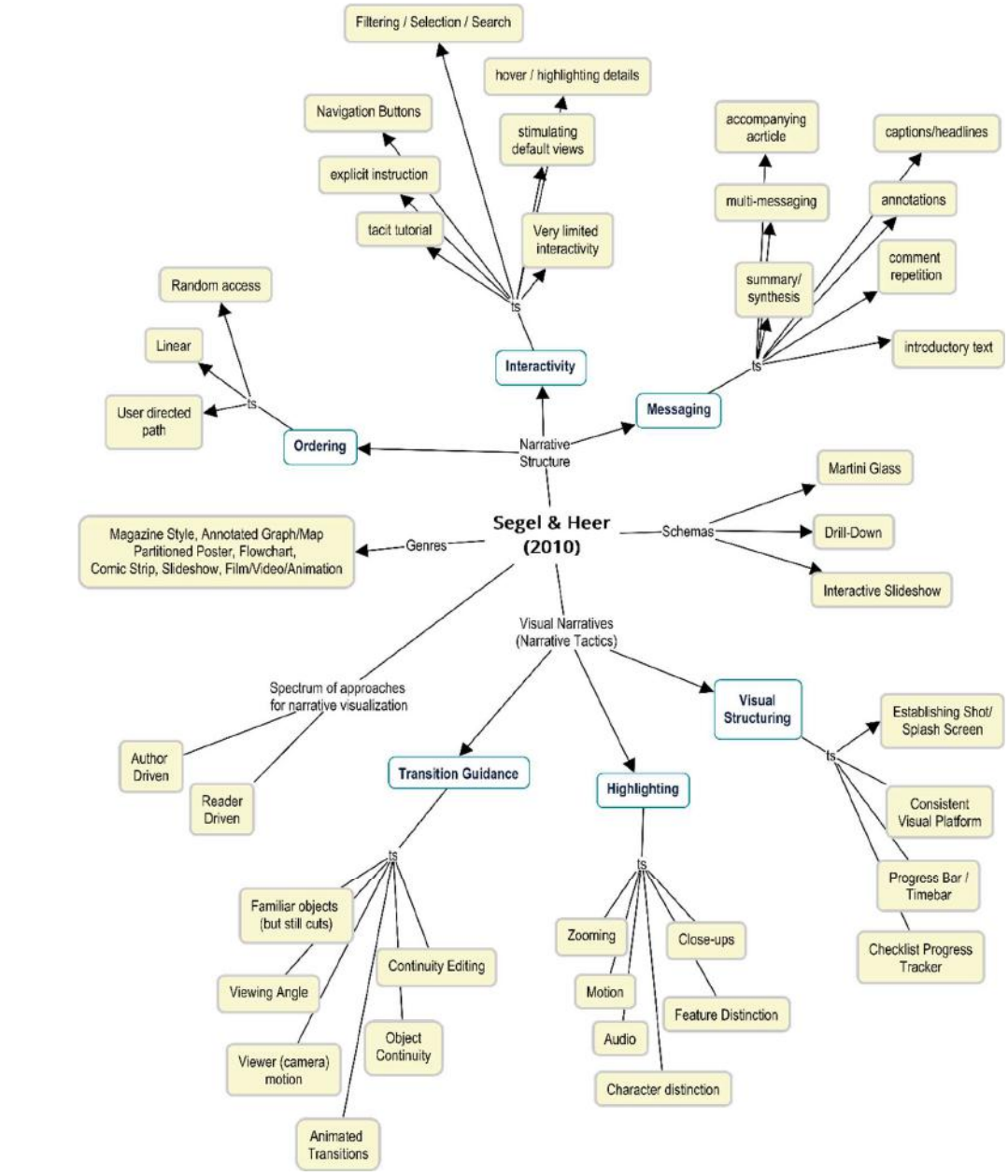
Narrated Animation



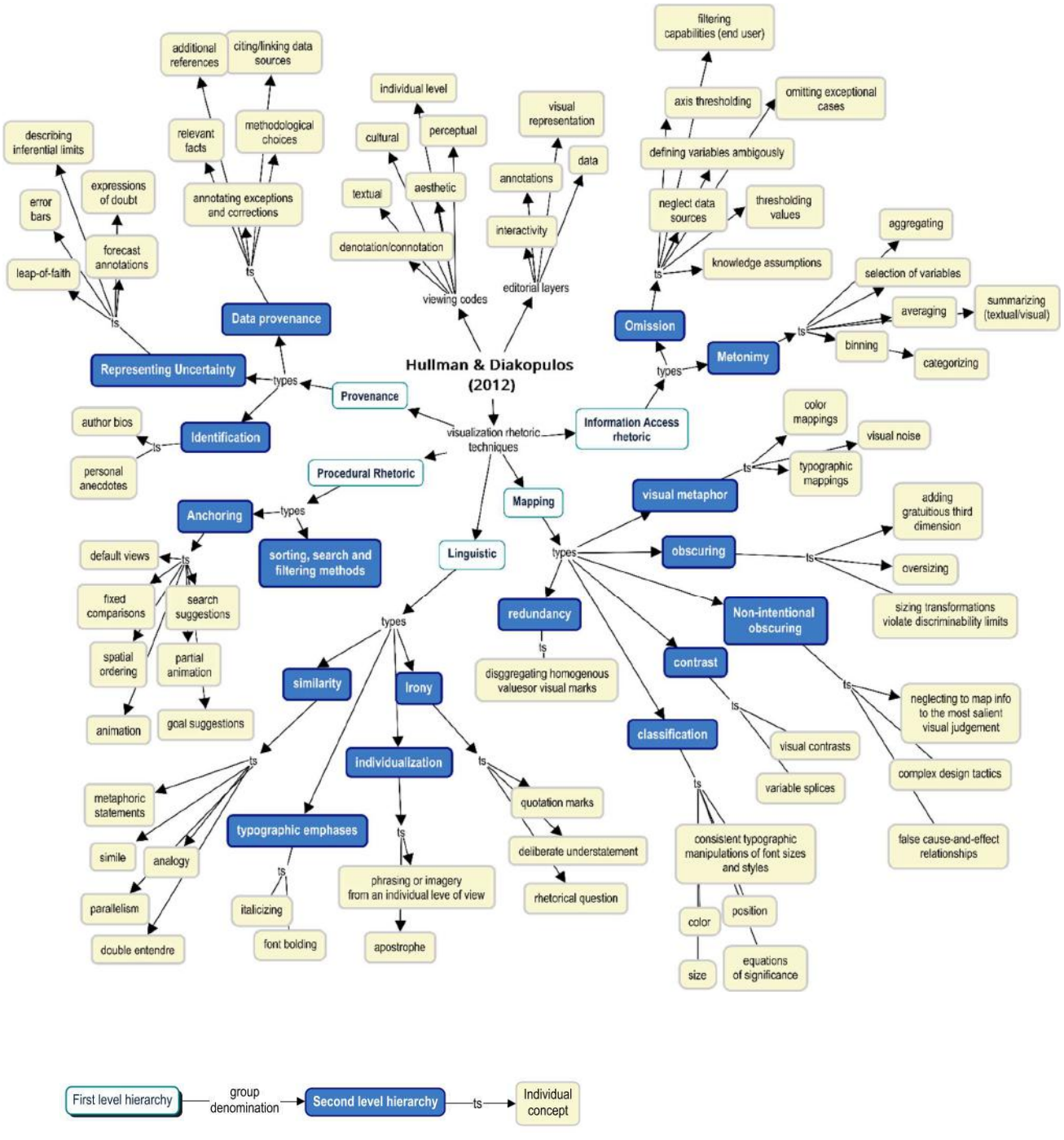
Personalized Story Map

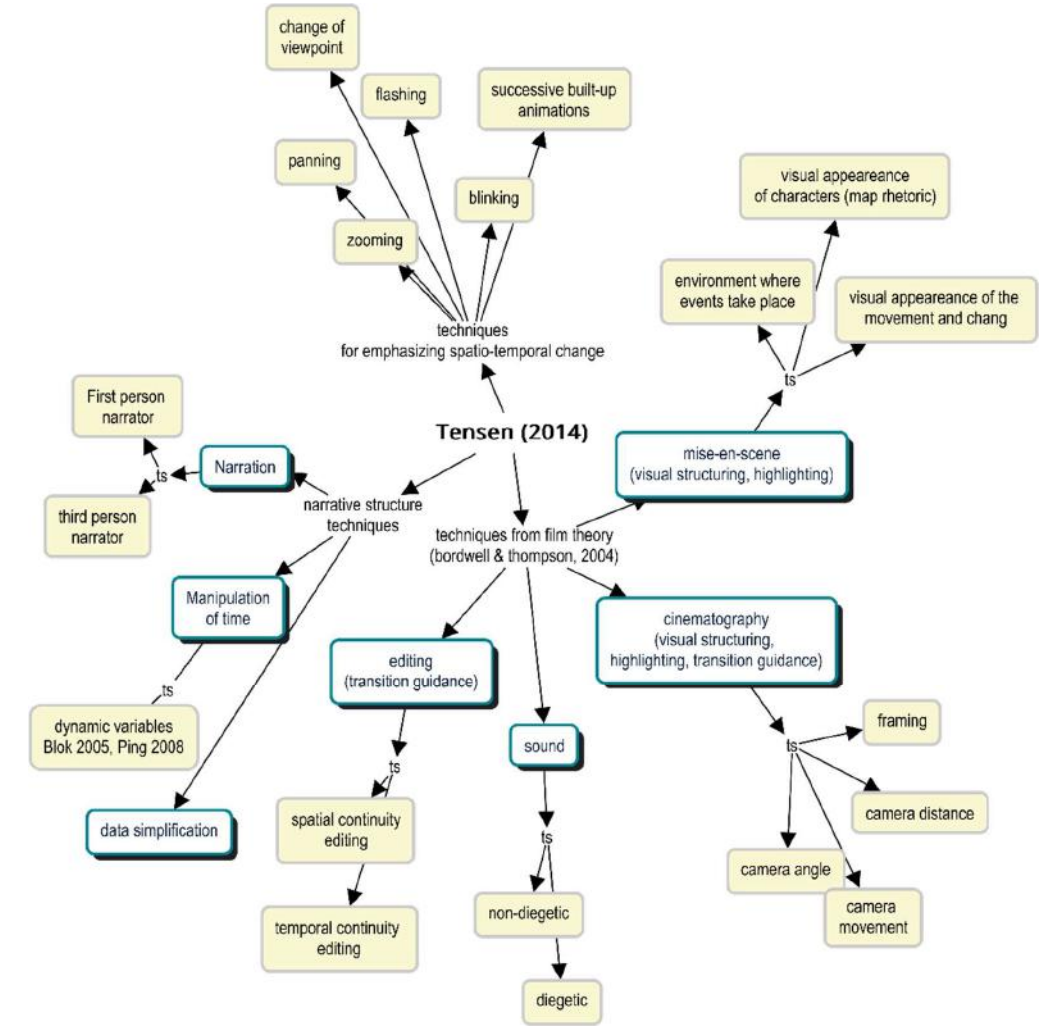


APPENDIX B – MULTI-LEVEL HIERARCHY CONCEPT DIAGRAMS



ts


Hullman & Diakopulos (2012)
visualization rhetoric techniques
Provenance
Data provenance
Representing Uncertainty
types
ts
viewing codes
editorial layers
Information Access rhetoric
Omission
Metonimy
Identification
Procedural Rhetoric
Anchoring
sorting, search and filtering methods
Linguistic
Mapping
visual metaphor
obscuring
Non-intentional obscuring
redundancy
contrast
classification
similarity
Irony
individualization
typographic emphases
additional references
citing/linking data sources
relevant facts
methodological choices
annotating exceptions and corrections
describing inferential limits
expressions of doubt
error bars
forecast annotations
leap-of-faith
individual level
cultural
perceptual
textual
aesthetic
denotation/connotation
visual representation
annotations
data
interactivity
filtering capabilities (end user)
axis thresholding
omitting exceptional cases
defining variables ambigously
neglect data sources
thresholding values
knowledge assumptions
aggregating
selection of variables
averaging
summarizing (textual/visual)
binning
categorizing
author bios
personal anecdotes
default views
fixed comparisons
search suggestions
spatial ordering
partial animation
animation
goal suggestions
color mappings
visual noise
typographic mappings
adding gratuitious third dimension
oversizing
sizing transformations violate discriminability limits
disggregating homogenous valuesor visual marks
visual contrasts
variable splices
neglecting to map info to the most salient visual judgement
complex design tactics
false cause-and-effect relationships
consistent typographic manipulations of font sizes and styles
color
position
size
equations of significance
metaphoric statements
simile
analogy
parallelism
double entendre
italicizing
font bolding
phrasing or imagery from an individual leve of view
apostrophe
quotation marks
deliberate understatement
rhetorical question
First level hierarchy
group denomination
Second level hierarchy
ts
Individual concept


change of viewpoint
flashing
successive built-up animations
panning
blinking
zooming
techniques for emphasizing spatio-temporal change
visual appeareance of characters (map rhetoric)
environment where events take place
visual appeareance of the movement and chang
ts
Tensen (2014)
First person narrator
ts
Narration
third person narrator
narrative structure techniques
mise-en-scene (visual structuring, highlighting)
techniques from film theory (bordwell & thompson, 2004)
Manipulation of time
ts
dynamic variables Blok 2005, Ping 2008
data simplification
editing (transition guidance)
ts
spatial continuity editing
temporal continuity editing
sound
ts
non-diegetic
diegetic
cinematography (visual structuring, highlighting, transition guidance)
ts
framing
camera distance
camera angle
camera movement
First level hierarchy
group denomination
Second level hierarchy
ts
Individual concept

ts

APPENDIX C – QUANTITATIVE CONTENT ANALYSIS CODES

C	*Categorical Code*	Category. From Roth, (2016)
O	*Ordinal Code*	Code. From Roth, (2016)
B	*Binary Code*	High-level concept.
S	*Scalar*	Low-level concept

	METADATA			
			Producer	
			Producer Type	
			Year	
S			***Number of Maps***	
	MEDIUM			
O	Size			The size of the map relative to the available space, using the most prominent dimension.
		1	***Small***	Less than or equal to one-quarter
		2	***Intermediate***	Between small and large
		3	***Large***	More than or equal to half, but not full bleed
		4	***Full***	Full bleed on vertical or horizontal axis
	TECHNOLOGY			
O	Multiscale			The inclusion of multiple levels of information detail, typically activated when changing map scales.
		1	***One***	One level of detail
		2	***Limited***	2 levels of information detail
		3	***Comprehensive***	3+ levels of information detail
C	Real-Time			The way in which information updates are made to the map content.
		1	***None***	No updates
		2	***Updates, Manual***	Updated manually by cartographer
		3	***Updates, Automated***	Updated automatically using data-feed
C	Social Media			The way in which readers/users can contribute to the map.
		1	***None***	No social functionality
		2	***Social, no-VGI***	Social component (e.g., discussion board, share on Twitter/FB), but no VGI
		3	***Social, VGI***	Social component, including VGI (i.e., add information to the map, typically given the user's location)
C	Animation			The additional enablements for dynamic cartography provided by the online, digital medium.
		1	***None***	No animation; static
		2	***Passive Animation***	System controlled animation, no user control
		3	***Active Animation***	User-controlled animation of the map
C	**Function of Animation**			The purpose of using animation on the interface and its content
		1	***Navigation Feedback***	Dynamics are activated only to provide input response
		2	***Advancing the story***	Interface or map dynamics are meaningful to the story (in time and/or space)
		3	***Both***	
		4	***Other***	
	PROJECTION			
C	Class			The shape of the developable surface onto which the reference globe is projected, and the resulting distorted map shape
		1	***Cylindrical***	Cylindrical developable surface, resulting in a rectangular map shape
		2	***Conic***	Conic developable surface, resulting in a semi-circular map shape
		3	***Planar***	Planar developable surface, resulting in a circular map shape
		4	***Compromise***	Projection determined by a mathematical function (identifiable on small scale only)
		5	***Unclear***	Unclear class, including illustrated maps that were not projected digitally and large-scale maps with minimal projection distortion
C	Orientation			The rotation of the map relative to the Earth's axis of rotation
		1	***Conventional***	North is 'up'
		2	***Non-conventional***	North is not 'up'
C	Perspective			The angle at which the reference globe is projected to the developable surface.
		1	***Planimetric***	Projected 'top-down', at nadir
		2	***Oblique***	Not projected at nadir, including illustrated maps with an intentional 3-dimensional perspective
O	Scale/Extent			The relationship between distance measurements on the map and the Earth, impacting the geographic extent of the map.
		1	***Municipal***	Large scale; extent of a metropolitan area or more local
		2	***Regional***	Intermediate scale; extent of region within a country (e.g., single or multiple admin1 units, such as states or provinces), or single inland lake or river basin
		3	***Country/Sea***	Intermediate scale; extent from a single country (admin0) to set of adjacent countries, or a single non-oceanic sea

	4	***Continental/Oceanic***	Small scale; extent of entire continent or ocean
	5	***World***	Small scale; extent of single hemisphere to entire globe
	CONTENT		
O	**Information Density**		The relative amount of geographic information depicted in the map.
	1	***None***	No real geographic information are communicated, with the map instead used as an illustration or abstract art
	2	***Light***	Few depicted geographic features
	3	***Intermediate***	Between information light and dense
	4	***Dense***	Many depicted geographic features
O	Visual Hierarchy		The degree to which map features contrast from their surroundings, resulting in a coherent visual hierarchy (does not include labels)
	1	***None***	No contrast differences, and thus no discernable visual hierarchy
	2	***Simple***	1-2 discernable contrast variation(s), resulting in a simple visual hierarchy
	3	***Intermediate***	Between limited and extensive visual hierarchy
	4	***Complex***	Many discernable contrast variations, resulting in a complex visual hierarchy
C	Basemap Type		The context information included beneath the primary symbolization for context. (NOTE: Check all for interactive maps, but indicate the default for the cluster analysis)
	1	***None/Abstract***	No basemap used for context
	2	***Vector Map***	Only vectors used for basemap context
	3	***Imagery***	Aerial photography or satellite imagery
	4	***Terrain***	Contours, hillshade, or shaded relief
	5	***Combination***	Overlay of multiple basemaps
	SYMBOLIZATION		
O	**Attribute Symbolization**		The number of attributes symbolized in the map.
	1	***None***	No attribute information (only spatial and/or temporal)
	2	***One***	1 attribute depicted
	3	***Two***	2 attributes depicted
	4	***Many***	3+ attributes depicted
C	**Temporal Symbolization**		The type of temporal information symbolized in the map.
	1	***None***	No temporal information (only spatial and/or attribute)
	2	***Events***	Specific timestamps depicted
	3	***Intervals***	Time ranges depicted
	4	***Change***	Change between events or intervals depicted
C	**Thematic Map Type**		The mapping technique used to symbolize attribute or temporal information. (NOTE: Check all for interactive maps, but indicate the default for the cluster analysis)
	1	***None***	Reference map; spatial information depicted only
	2	***Proportional Symbol***	Point representation; resized by value
	3	***Dot Density***	Point representation; density determined by value
	4	***Iconic Point Symbol***	Point representation; shape/icon by value
	5	***Isoline***	Line representation; line location depicting value
	6	***Flow Map***	Line representation; colored, shaded, or sized by value
	7	***Choropleth***	Area representation; colored, shaded, or textured by value
	8	***Cartogram***	Area representation; resized by value
	9	***Value-by-alpha***	Area representation; transparency determined by value
	10	***Surface***	Area representation; colored or shaded between isolines for value
	11	***Prism***	Area representation; prospective height for value
	12	***Combination***	2+ thematic maps used in single map (NOTE: We will need to create a copy for cluster analysis that makes this mutually exclusive)
	13	***Other***	Non-traditional, innovated mapping technique used to depict attribute or temporal information
	COMPOSITION		
C	Layout		The arrangement of map and non-map elements.
	1	***Isolated***	The map itself is the only component of the page
	2	***Fragmented***	Map and non-map components separated visually into different frames
	3	***Fluid, Uneven***	Map and non-map components share a frame; map unemphasized in optical center
	4	***Fluid, Balanced***	Map and non-map components share a frame; map emphasized in optical center
C	Aspect Ratio		The ratio of the vertical to horizontal axes of the space dedicated to the map.
	1	***Portrait***	More vertical than horizontal
	2	***Landscape***	More horizontal than vertical
	3	***Square***	Equal dimensions, including non-square frames whose major and minor axes are difficult to determine
C	Map Title		The location of the map title in the page, using the most prominent if multiple map headings.
	1	***None***	No map title
	2	***Caption***	Included as caption
	3	***Legend Only***	Included in legend
	4	***Subheading***	Subheading separate from main heading of story
	5	***Main Heading***	Main heading of story
C	Map Legend		The type of symbols or symbol classes described in the legend.
	1	***None***	No map legend
	2	***Nominal***	Symbols/symbol classes described nominally

	3	***Ordinal***	Symbols/symbol classes described ordinally
	4	***Numerical***	Symbols/symbol classes described numerically
	5	***Combination***	Combination of nominal, ordinal, and numerical symbol/symbol class descriptions
C	**Indication of Scale**		The indication of scale included for the map.
	1	***None***	No indication of scale
	2	***Scale Bar Representative***	Visual description, providing benchmark example
	3	***Fraction***	Mathematical description, maintain measurement unit
	4	***Verbal Statement***	Verbal description, changing measurement unit
C	**Indication of North**		The indication of north included for the map.
	1	***None***	No indication of north
	2	***North Arrow***	Visual compass icon
	3	***Graticulate***	Visual imposition of geographic or another coordinate system
C	Context Maps		The contextual maps embedded within the map depiction explicitly supplementing the given map (i.e., not a sequence of maps in a single story).
	1	***None***	No context maps.
	2	***Inset Map***	Map showing a portion of mapped extent at a large scale.
	3	***Location Map***	Map showing area surrounding mapped extent for identification.
	VISUAL STORY STRUCTURE		
C	**Story Theme**		The primary topic or theme serving as the content of the story.
	1	***Politics, Domestic, Non-violent***	Government, legislation, electoral, parties, non-violent protests, non-violent strikes
	2	***Politics, Domestic, Violent***	Riots, terrorism, civil conflict, civil war, coupes
	3	***Politics, International, Non-violent***	International relations, negotiations, agreements (non-trade)
	4	***Politics, International, Violent***	Military conflict, war, defense issues, territorial disputes, forced relocation
	5	***Disaster Events, Natural***	Earthquakes, weather-related events (floods, hurricanes, avalanches, tornados), epidemics, etc.
	6	***Disaster Events, Human***	Accidents, explosions, fires, industrial disasters, etc.
	7	***Science, Medical***	Biomedical research, disease prevention and intervention, public health
	8	***Science, Natural Environmental***	Environmental problems, environmental impacts, climate change, pollution, conservation and preservation
	9	***Science, Urban Built Environment***	Transportation, development and planning, civil engineering
	10	***Science, Non-urban Built Environment***	Agriculture, fisheries, logging, land use, resource management
	11	***Society, Demography***	Demographics, social trends, housing, employment, education
	12	***Society, Public Safety***	Crime, courts, judicial activity, policing, missing persons
	13	***Society, Human Rights***	Famine, representation, equality
	14	***Cultural, Heritage***	History, geography, archaeology, the arts and humanities
	15	***Cultural, Entertainment***	Travel, tourism, recreation, sport
	16	***Cultural, Human Interest***	Celebrity, scandals (non-political), VIPs, gossip
	17	***Economics, Local***	Microeconomics, business, finance, industry, commerce
	18	***Economics, Global***	Macroeconomics, trade agreements, international monetary issues, foreign aid, economic development, NGOs
	19	***Economics, Advertisement***	Advertisement, political message, brochure
	20	***Unclear, Other***	The story topic is unclear or different from other stories
C	Rhetorical Style		The aesthetic, emotional, or artistic style evoked to enhance and inform the visual story.
	1	***Authoritative***	The style of scientific visualization. Scientific, official, and magisterial
	2	***Understated***	Minimalist, they appear to just present facts. Extremely judicious in the use of data
	3	***Propagandist***	Almost exclusively created to quickly and succinctly communicate certain policies, agendas, ideology or jingoist messages
	4	***Sensationalist***	Attempt to overwhelm one's senses with a barrage of, often irrelevant, data and visualizations
	5	***Other***	No identified rhetorical style
C	Plot Structure		The sequence or progression of events in the story, focusing on the relationships and changes of characters or conditions.
	1	***Cause/Effect***	Impact of input characters/conditions on different, output characters/conditions
	2	***Genesis***	Creation or development of new characters/conditions
	3	***Emergence***	New characters/conditions emerge, often unpredictably, due to other processes
	4	***Metamorphosis***	Wholesale reorganization, rearrangement, or modification of characters/conditions
	5	***Destruction***	Loss, disappearance, degradation of characters/conditions
	6	***Convergence***	Convergence of different paths towards similar output characters/conditions
	7	***Divergence***	Divergence of similar input characters/conditions on different paths
	8	***Oscillation***	Cyclical or recurring changes or transitions in characters/conditions
	9	***Unclear, Other***	The plot structure is unclear or different from other stories

	VISUAL STORY CONTENT		
O	**Narrative text (excluding introduction/summary/synthesis/conclusion)**		The amount of text included in the story.
	1	***None***	No story text beyond labeling and map elements
	2	***Light***	1 paragraph or less
	3	***Intermediate***	Between text light and dense
	4	***Dense***	1 page or more (5+ paragraphs for websites)
O	Maps		The number of unique maps included in the story, not counting inset or locator maps that are embedded in other maps
	1	***One***	1 map
	2	***Two, Unordered***	2 maps, no explicit order for reading
	3	***Two, Ordered***	2 maps, explicit order for reading
	4	***Many, Unordered***	3+, no explicit order for reading
	5	***Many, Ordered***	3+, explicit order for reading
O	Visualizations (Static)		The number of non-map information graphics included in the story, not including maps.
	1	***None***	No information graphics included.
	2	***One***	1 infographic
	3	***Two***	2 infographics
	4	***Many***	3+ infographics
O	Visualizations (Interactive)		The number of non-map interactive information graphics included in the story, not including maps.
	1	***None***	No information graphics included.
	2	***One***	1 infographic
	3	***Two***	2 infographics
	4	***Many***	3+ infographics
O	Images		The number of images included in the story, not including the basemap.
	1	***None***	No pictures or images, not including the basemap
	2	***One***	1 image
	3	***Two***	2 images
	4	***Many***	3+ images
O	Audio Narration		The number of audio narrations included in the story.
	1	***None***	No embedded audio narration, not including audio feedback provided through the map
	2	***One***	1 narration
	3	***Two***	2 narrations
	4	***Many***	3+ narrations
O	Sound		Non-narrative audio accompanying the animation
	1	***None***	No sound whatsoever
	2	***Diegetic***	Takes place within the narrative; the scene or stage the user is located. May also allude to user interaction
	3	***Non-diegetic***	Used for creating an atmosphere, background and context. Is not visually relatable to anything in the stage the user is located.
	4	***Diegetic and non-diegetic***	Both types of sound are employed.
O	**Video Narrations/Demonstrations**		The number of video narrations/demonstrations included in the story
	1	***None***	No embedded video narration/demonstration
	2	***One***	1 narration/demonstration
	3	***Two***	2 narrations/demonstrations
	4	***Many***	3+ narrations/demonstrations
	VISUAL STORYTELLING TROPES		A visual device, motif, or effect used to advance and reinforce the story.
O	**Setting the Mood (i.e., Introduction)**		The use of visuals and text to introduce the setting, the primary characters or places in the story, and the overall problem context.
	1	***None***	No attention to setting the mood
	2	***Simple***	Minimal introduction beyond the title
	3	***Intermediate***	Between a simple and complex introduction
	4	***Complex***	Great attention to giving an introduction
O	**Conflict/Ambiguity Resolution (i.e., Conclusion)**		The use of visuals and text to come to a conclusion, redefining the setting, giving closure to the established characters or places in the story, and summarizing the overall problem context/message.
	1	***None***	No attention to conflict/ambiguity resolution
	2	***Simple***	Minimal conclusion or summary beyond the map elements
	3	***Intermediate***	Between a simple and complex conclusion/summary
	4	***Complex***	Great attention to giving a conclusion or summary
O	**Enforce Continuity (i.e., Linear Storytelling)**		The use of visuals and text to unify disparate pieces of information through a linear structure.
	1	***None***	No attention to enforcing continuity
	2	***Simple***	Minimal logical flow in the story
	3	***Intermediate***	Intermediate logical flow and cohesion

		4	***Complex***	Complex logical flow and cohesion
O	**Focus Attention (i.e., Accenting)**			The use of visuals and text to emphasize the important details that the reader cannot miss.
		1	***None***	No attention to accenting
		2	***Simple***	1 form of accenting used
		3	***Intermediate***	2 forms of accenting used
		4	***Complex***	3+ forms of accenting used
O	**Effective Redundancy (i.e., Motifs)**			The use of visuals and text to repeat important details essential to the message, often through use of motifs or recurring visual elements in the story.
		1	***None***	No noticeable, recurring visual motifs (i.e., styling, color, type across story elements)
		2	***Simple***	1 recurring visual motif used
		3	***Intermediate***	2 recurring visual motifs used
		4	***Complex***	3+ recurring visual motifs used
O	**Filling the Gaps (i.e., Situating the Reader)**			The use of visuals and text to enable the audience to draw from their own experiences, opinions, values, often through customizing the map to their situated context.
		1	***None***	No noticeable consideration of filling the gaps
		2	***Simple***	At least one, static allusion to considering the reader's situated context
		3	***Intermediate***	Between simple and complex filling of the gaps
		4	***Complex***	Explicit, typically interactive ways to adjust the map to the reader's situated context
	Main Design Alternatives			
	Story Map Conceptual Design			The underlying major the decisions which determine the visual, informational and semantic structure of the Story Map as a whole
C	Genre			
		1	***Static News Maps***	Linearity enforced by layout, highlighting and annotation on the map
		2	***Longform Infographics***	Linearity enforced through the browser window's scroll functionality
		3	***Dynamic Slideshows***	Linearity enforced by clicking or swiping through panels presented individually
		4	***Narrated Animations***	Linearity enforced by the narration and advancement of time in the animation
		5	***Personalized Story Maps***	Linearity enforced by the user
		6	***Multimedia Visual Experiences***	Linearity enforced through the layout and hyperlinking of text, images and graphics
C	Content Schema			Logic structures which dictate how the most important content of the story is logically sequenced
		1	***Inverted Pyramid***	States the most important piece of information in the headline, then follow that with the next most important in the opening, and then continue adding information of a lesser importance
		2	***Pyramid***	Opposite of the Inverted Pyramid
		3	***Hourglass***	Provide a review, next present the arguments and at the end give conclusions so readers are engaged at the beginning and at the end, whilst realizing how pieces fit together
		4	***Martini***	Presents a single-path author-driven narrative. When completed, it opens up to a reader-driven stage where the user is free to interact with the data.
		5	***Slideshow***	Typical slideshow format incorporating interaction mid-narrative within one slide. Slides often function as in the martini glass structure.
		6	***Drill-Down***	Presents a general theme, allowing the user to choose among particular instances to reveal additional details
		7	***Unclear/Other***	
C	Visual Platform			The type of viewport alongside is visuals on which the information contained in the story is navigated and visualized.
		1	***Consistent***	a single graphic (map or visualization) with no major changes is kept, and the information is successively displayed on it as users navigate
		2	***Variable***	Multiple and different graphics, animations, and content are displayed as users navigate.
O	**Role of Visualization**			The relative proportion a visualization has with respect to other forms of story material
		1	***None***	No visualizations
		2	***Equal***	Visualizations and other content types have comparatively the same size
		3	***Figure***	Visualizations are smaller in size, probably used for reference only
		4	***Prioritized***	Visualizations occupy most of the screen space
O	**Role of Cartography**			The relative proportion maps have with respect to other forms of story material
		1	***Equal***	Maps and other content types have comparatively the same size
		2	***Figure***	Maps are smaller in size, probably used for reference only
		3	***Prioritized***	Maps occupy most of the screen space
	Navigation Input			
B	Input Type			The type of input used for advancing the story
			Next/Prev Buttons	
			Scrolling	
			Swiping	
			Slider	
B	Navigation Indicators			Graphic (potentially interactive) widgets which indicate the reader's position in the story. Regardless of the type (time, section, area, etc.)
			Progress Bar	

			Timeline	
			Section Buttons	
			Menu Selection	
			Breadcrumbs	
			Geographic Map	
			Checklist/Progress	
			Trackers	
			Visualization	
	Navigation Feedback & Transition Guidance			**The kind of feedback users get as response to the basic interaction with the interface, as well as the behaviour and properties visualized objects show for indicating continuity and guiding the reader**
C	Level of Control			Determines the way animations are triggered as readers continually produce input
		0	***None***	No feedback apart from the normal or change in scene
		1	***Discrete***	the user generates input and the animation plays automatically and for an extended period of time
		2	***Continuous***	animation advances at the same pace as the user input, or even synchronously through its keyframes
		3	***Mixed***	Both types of levels of control exist in the interface
B	Animation On			Graphic elements on which the input has an animation effect
			Text	
			Visualization	
			Cartography	
			Widgets	
B	Change of Viewpoint			The behaviour of the viewer "camera" along the XYZ axes
			Angle	Camera angle changes without changing position
			Distance	Distance to the object or the map changes
			Position (same distance)	Position of the camera with respect to the object or map changes
B	Object Motion			The behaviour of the object(s) in the view along the XYZ axes
			Rotation	The object/map moves in its own XYZ axes
			Distance	The object changes its distance with respect to the camera
			Position (same distance)	The object/map changes its position with respect to the camera
B	Editing			Refining techniques which allow readers' keep track of movement, scenes changes or temporal changes in animations
			Object Continuity Editing	Can a particular object can be tracked/traced?
			Spatial Continuity Editing	Does the animation follow the 30/180 degree rule or provides establishing shots between transitions?
			Temporal Continuity Editing	Is it possible to identify where the animation ended (spatially/temporally) when a transition occurs?
	Communication of Narrative and Information			**Visuals devices that assist and facilitate narrative**
B	Advancement of the story			Text and graphics which convey information and indicate an order or sequence. Some of them provide additional information to a visualization/map.
			Establishing Shot/Splash Screen	A landing/introductory page containing an overview, titles, subtitles for the topic about to be introduced. Usually contains media or indicates loading content.
			Introductory text	A brief piece of text introducing the theme of the story
			Visual summary	Summary of the maps/visualizations/graphics within the narrative
			Captions/Headlines	Text indicating the content of maps/visualizations/subsections.
			Labels	Text over objects showing some of their attributes
			Annotations	Text over/connected to objects containing additional information
			Flowchart arrows	Directional lines which indicate a reading order
			Ribbons	(Directional) lines potentially indicating a reading order or route. May have changing symbologies.
			Small multiples	A series of graphs or maps with the same scale used for easy comparison
			Sequential insets/maps	A series of maps having different scales, data and extents used for advancing and explaining the story
			Synthesis/Conclusion	A section or element containing text or visual which tie the end of the narrative back to beginning, giving a summary of everything which has been viewed, a conclusion, or final message.
			Accompanying Article	Articles related to the main content but nor directly included in the narrative. Usually of optional access
			External exploratory Maps/Visualizations	Link to a separate exploratory map or visualization to distinctly separate open exploration from the story itself
B	**Emphasis (Focus Attention)**			**Visual techniques for emphasizing features, or groups of features in the map/visualization/text. Could be used either for non-temporal aspects of phenomena or spatio-temporal change**
			Typographic emphases	Font is formatted to stand out from the rest and represent meaning, other than importance or hierarchy
			Call-outs	Dialogue-like bubbles connected to objects
			Dynamic Zooming	Detailing of geographic areas for emphasis with animation in between
			Zooming/Close-ups	Detailing of geographic areas for emphasis. No animation in between, usually insets.

		Highlighting	Use of distinct symbologies to emphasis object(s). From changing colors to complex visual hierarchies
		Annotation	Use of annotations for emphasis in addition to provide additional information
		Masking	Changing symbology of surrounding objects/areas in order to prioritize the view of object(s)
		Audio	Sound or audio narration refers directly to certain objects
		Object motion	Object(s) relative change of its location/size/shape in coordinate space
		Dynamic Panning	Recentering the map dynamically to express change
		Panning	Recentering the map via scene changes, small multiples or successive insets
		Successive built-up animations	The sequencing of a series of data pieces onto each other to emphasize the difference between an initial state to a new one
		Viewpoint change	Similar to navigation feedback, but this viewpoint change is intended to emphasize the subsequent changes in the narrative.
		Blinking	Use of different techniques for emphasis (usually highlighting) intermittently on an object to attract attention.
		Flashing	Use of visual effects to locate/highlight objects. Unlike blinking, this lasts for a short period of time.
		Fast forward	Accelerating animation playback
		Slow motion	Decelerating animation playback
B	Linking		**How the maps and interface maintains consistency and connectivity between its features. This linking does not belong to a cartographic operator**
		Linking through animation	Through animation, the reader can trace the movement of objects from position to position
		Linking through color	Use of color to link data between a visualization/map/text
		Linking through typography	Use of different font styles to link the data
		Linking through symbol	Use of symbols (outside the cartography) for connecting data pieces
		Linking through reference	Textual references point to specific features or media within the narrative
		Linking through hyperlinks	Hyperlinking text and objects (outside the visualization or map areas) to to features within the visualizations or cartography.
	Interaction		**The degree that the user can manipulate the map.**
B	**Interaction Working Operators**		The kind of functionality provided to manipulate the map.
		Reexpress	Change the displayed map type
		Sequence	Change the currently viewed map from a set of maps
		Overlay	Change displayed feature types (overlay) or basemap type (underlay)
		Reproject	Change the projection parameters
		Resymbolize	Change design parameters without changing the map type (e.g., color scheme, classification, scaling ratio)
		Zoom	Change map scale
		Pan	Change map centering
		Rotate	Change map orientation
		Filter	Remove map features from within a feature type based on user-defined conditions
		Search	Add or highlight a map feature of interest
		Retrieve	Request details about a map feature of interest
		Arrange	Change map layout. Manipulate the layout of views in a coordinated visualization
		Calculate	Derive new information about a map feature of interest
		Brushing/Linking	Connecting and synchronizing linked views and features
B	**Interaction Enabling Operators**		
		Import	Load a dataset or previously generated map
		Export	Extract a generated map or underlying geographic information for future use
		Save	Store the generated map, geographic information, or system status
		Edit	Manipulate the underlying geographic information
		Annotate	Add graphic markings and textual notes
O	Interactivity		
	1	***None***	No digital interaction
	2	***Low Interaction***	1-2 interaction operators implemented (e.g., pan and zoom, search and retrieve, overlay and retrieve) in online map
	3	***Intermediate Interaction***	Between low and high interaction with online map
	4	***High Interaction***	5+ interaction operators implemented (i.e., beyond the slippy map prototype of pan, zoom, overlay, retrieve) in online map
B	**Other interactive capabilities**		
		Story threading	The capability of the platform to support participation via comment and observation threads (much like a blog). This may be enabled via social media functionalities.
		Narrative text authoring	The possibilities of adding comments and annotations on visualizations for further study and analysis
		Snapshots	It is possible to save a visualization state, for further analysis and use
		Embedding of cartography or visualizations in websites	Embedded cartography or visualizations can be shared via a hyperlink, and being displayed in other website
B	Interactive Cues		How the interface prompts/shows the user how to interact and use maps and visualizations
		Explicit Instruction	The use of the interactive interfaces/operators is explicitly shown to the user
		Tacit Tutorial	The use of the interactive interfaces/operators is implicitly shown to the user. E.g. animation

		Input Requests	Users are addressed and requested for specific input (through an interface style)
C	Splitting Control		Where in the spectrum of author-driven or reader-driven approaches the map is located. These are more descriptive and might be independent of the content schemas
	1	***Passive storytelling***	prohibits the interaction on the consumer's part; the author fully controls all domains
	2	***Storytelling with interactive approval***	passive storytelling pauses at certain points and lets spect-actors take temporary control. They can change the visualization's view, representation, and even content. Once they're satisfied with this interactive exploration, storytelling continues as originally intended.
	3	***Semi-interactive storytelling***	consumers can take control not just for an interim excursion but for an entire section of the story
	4	***Total separation from the story***	consumers can completely detach from the story and engage in interactive visualization with total freedom.
	Information Access Rhetoric		
B	Metonymy		Manipulate part-whole relationships within the data, serve simplification as well
		Selection of variables	Involves creating a subset of a larger dataset to present a simplified visual presentation of chosen features
		Aggregating	Mathematical or statistical operations which can be used for the description of potentially large numbers of samples
		Categorizing	Classification or grouping of values before other operations/visualization
		Binning	Partitioning of numerical datasets into subsets with specific ranges
		Thresholding Values	Assignation of a value beyond/below which data behaves differently or can be classified differently
		Variable splices	Combination of variables to describe features in the map which can potentially not be related to each other/relevant for the story
B	Omission		Strategies that may be motivated by the desire for simplification or outright disregard
		Ambiguous variable definition	Mentioned or mapped variables are not explained clearly
		Knowledge assumptions	No provision of information necessary for understanding other concepts
		Omitting exceptional cases	Presence of outliers in the information, or "exceptions to the rule" are not considered
		Neglect data sources	Avoiding citation and crediting for data sources or sponsors
	Procedural Rhetoric		
B	Anchoring		Direct attention of the user in a way the presented information helps convey a message
		Context	The situational status in which the events or phenomena take place is described
		Geographic context	Information about the geographical space in which events or phenomena takes place
		Search suggestions	prompting the user to examine particular parts of the data rather than explore freely
		Default Views	provide an initial point of interpretation anchored to a default visual configuration
		Fixed comparisons	present some information by default so that users can contrast this information with other values in the visualization.
		Goal suggestions	prompts the user to execute a series of steps that will reach an intended result
		Frame	Map aesthetics and graphics are modified in such a way they visually allude to the involved situation. It can potentially trigger certain emotions on readers
	Linguistic		
B	Similarity		Are based on the comparison between to entities motivated by similarities between them.
		Comparison	The depiction of two or more objects with the purpose of indicating the differences and contrasts between them
		Simile	resembles analogy and parallelism but the goal tends to be for effect and emphasis of a similarity relationship between objects
		Double entendre	hinges on a linguistic or visual similarity alone that is used to unite two ideas or entities.
		Analogy	a comparison is made in order to provide insight into the lesser known of two entities
		Parallelism	involves expressing two linguistic statements or visual features to show that they are equal in importance.
		Metaphoric statements	equate two ideas or values by labelling or directly asserting that one is the other
B	Individualization		
		Familiar Setting	Sets a point in the story related to the location or characteristics of the user
		Breaking the 4th wall	Subject unexpectedly addresses the viewer. To make a direct connection with viewer; to demonstrate the artificiality of the presentation; to challenge the objectivity of the observation. To make it clear that this is one interpretation. Surprise, so attention-getting.
		Call to Action	The reader is addressed, but it is invited to take part, participate for a cause or execute actions related to the topic at hand
		Voice	The characters' own narration advances the story
		Individual point of view	Narrative depicts several scenarios on the topic from involved people's own point of view.
		Multilabelling	Labeling features/locations differently according to distinct languages, endonyms or past names
		Multivoicing	The story is advanced with more than one narrator's words.
		Dialogues	The verbal interaction between multiple narrators advances the story
		Gamification	The implementation of interaction interfaces and operators, in a similar way videogames do
		Substories with several scenarios	The individual points of view are furthered by allocating exclusive subsections for their elaboration (within the main page)
		Rhetorical question	provokes the audience to ask themselves the question. It can set the context for a subsequent exploration of the reasons behind the answer
B	Irony		Set up a discordance between meanings and an alternative implied meaning

		Quotation marks	phrases or words are enclosed within quotation marks to indicate they may be false, unimportant, contradictory, etc.
		Deliberate understatement	The wording in a phrase has been modified to belittle the element it refers to, despite it is obviously relevant, or not to be disregarded
	Mapping rhetoric (Visual representation)		
B	Visual metaphor		Techniques that change the way the data/information is visualized i.e. the strategies taken for using alternative forms of visual representation, independent of the numerical aspect itself and rather related to the semantic properties of the data
		Concretization	The visual depiction of data is similar to the real object it represents
		Defamiliarization	Presenting something familiar in a novel, unexpected way. This challenges expectations, and encourages reading the map in new ways. Defamiliarization can be used to highlight and ques- tion implicit assumptions, and to force thinking differently about a well-known fact.
		Physical metaphor (e.g Multi directional labelling)	Use of the space itself and the relative position of objects for the representation of additional meanings. E.g Up= positive, down = negative
		Convention Breaking	Establishing a graphical convention and then break it, causing surprise
		Avoid implicit spatial relations	Position of objects with respect to each other represents additional meanings, and their spatio-temporal change is depicted in unexpected ways.
		Dynamic concepts	Use of symbols to represent subjective information (e.g. emotion), as well as the same symbol two represent different concepts
		Flexible Scales and Detailing	Varying scales of contiguous areas in a non-conjoined way to vary detail and show only what's relevant on each of them. Offers a more flexible way to vary scale and orientation, introducing spatial distortion
		Symbolic or semantic insets	Included insets represent subjective meanings, and have other purposes apart from spatiotemporal comparison
B	Obscuring		Methods for introducing noise, ambiguity and complexity into a visual representation.
		Gratuitous 3rd dimension	Unneeded 3rd dimension has been added to the map, causing interpretation to be difficult or ambiguous
		Oversizing	Objects have been overscaled, potentially with purposes of emphasis and disregard of other features
		Indiscernible transformations	New symbolization product of data transformations is difficult to detect, read and interpret
		Avoid salient visual judgement	Data has been visually represented either with the wrong visual variables, or using symbolization which is difficult to read or interpret
		False relationships	A relationship between two or more objects which is potentially artificial has been defined
		Complex design tactics	Overly intricate maps and visualization that require longer time to understand, or may even be impossible to read
		Noise	Visual effects, graphics or text which interfere with the reading or interaction with the map
B	Redundancy		Approaches which take advantage of the density or importance of the information to distribute it either repetitively or partitioned into pieces through the map interface.
		Repetition	Repetition of identical objects, or the disaggregation of values with little variance or similar functions or relationships between them are used for emphasis and reinforcing parts of the story
		Gradual reveal	Delays the disclosure and depiction of an important piece of information using graphics, text, animation or audio.
		Information Dosing	Reduces complexity by packaging the content into immediately understandable chunks of information
	Provenance rhetoric		Strategies that authors can take to increase the reliability of their creations, they can be seen as part of the most important ethical considerations in the visualization domain.
B	Data provenance		Consists of the inclusion of metadata and additional information which users can use for further investigation, replication and reference. It is also related to the proper crediting sources and facilitators deserve.
		Citing/linking data sources	Authors acknowledge and cite their data sources
		Methodological choices	Specifications about the methods and techniques used for the creation of the map/data processing are included
		Additional references	References to further reading or related content not particularly essential to the story is provided
		Relevant facts	Key information related to the data or any other component within the narrative is specified.
		Indicating exceptions and corrections	Further updates, modifications as well as acknowledging the exclusion of information are indicated.
B	Identification		Information regarding the authors/creators of the narrative as a whole
		Author information	The author provides contact or personal information
		Personal anecdotes	The author states comments, opinions or experiences directly.
B	**Representing Uncertainty**		Provision of details on the existent and possible limitations of the reliability of the underlying data which the visualizations and maps are supported on
		Expressions of doubt	Limited reliability on the results/information/assumptions is clearly shown with expressions which indicate so
		Describing inferential limits	Descriptions about the limitations of predictions
		Forecast specifications	Specification of data which is a prediction, rather than real data
		Error bars	Graphic representation of existent inaccuracies in the data
		Leap-of-faith	Information product of an obviously unreliable forecast/prediction is indicated

APPENDIX D – MAP SAMPLE

	Map Title	Author
Static News Maps (Stationary Story Maps)	Witness Killings Since 2004	Thompson and Lu (2015)
	Tracking D.C.-Area Homicides	Park, Mellnik, Pezon, and Lu (2017)
	A Peek into Netflix Queues	Bloch, Cox, Craven McGinty, and Quealy (2010)
	Tracking Evictions and Rent Stabilization In NYC	Wei, Groeger, Podkul, and Schwencke (2016)
	España en Cifras	populate (2015)
	Wanderlust	Roberts (2008)
	A Tale of Many Cities	Ratti et al. (2014)
	Which Flight Will Get You There Fastest?	King and Silve (2015)
	Election 2015: Where to Vote Tactically to Get the Prime Minister You Want	Nardelli and Gutiérrez (2015)
	Visualizing the Racial Divide	Vallandingham (2011)
Longform Infographics	Mapping the World's 4.3 Billion Internet Addresses	Cameron and Scola (2015)
	Mapping the Frenzy of Europe's Migrant Crisis	Misra and Lucify (2015)
	Miles of Ice Collapsing into The Sea	Gillis et al. (2017)
	35 Years of American Death	Koeze (2015)
	Reshaping New York	Fessenden et al. (2013)
	Travel the Path of The Solar Eclipse	Karklis et al. (2017)
	Five Years of Drought	Nelson (2016)
	How Trump Redrew the Electoral Map, From Sea to Shining Sea	Gamio and Keating (2016)
	A Nation Divided	Zeit Online (2014)
	California's Getting Fracked	Flagg, Craig, and Bruno (2014)
Dynamic Slideshows	The Politics of British Housing	Burn-Murdoch, Pearson, Allen, and Pickard (2014)
	Global View: Climate Change in Perspective	Bruns, Strausfield, Cousins, Sears Nick, and Harding (2014)
	How the Islamic State Is Carving Out A New Country	Sharma, Karklis, and Thorp (2014)
	Arya's Journey	Northwestern University Knightlab (2014)
	Bay Area Ridge Trail: Bay Area Ridge Council	National Geographic Maps (2014)
	Urbanization in East Asia Between 2000 And 2010	Bremer and Ranzijn (2015)
	Islands of Contention: Tiran And Sanafir	Al Jazeera (2017)
	The Climb of Alpe d'Huez	Mason, Griggs, and Ostlere (2015)
	Mobility: Engine of Our Regional Economy	Chicago Metropolitan Agency for Planning (2014)
	World Remittances	Bauer, Boyandin, and Stalder (2013)

Narrated Animations	Operation Sawfish	Stahl et al. (2015)
	Airbnb's Happy New Year	Airbnb (2015)
	Britain's Royal Navy in The First World War	Brohan (2012)
	Visualization of Global Cargo Ships	Kiln and UCL (2015)
	Glasgow In Motion	Urban Big Data Centre and Economic and Social Research Council (2016)
	The Long Journey Of New York City's Garbage	Galka (2016)
	The Globe of Economic Complexity	Cornec and Vuillemot (2015)
	Fans on The Move	Elkanodata and Ticketbis (2015)
	In Flight: See the Planes in The Sky Right Now	Kiln (2014)
	Street View Treks: Petra	Google (2015)
Personalized Story Maps	The Dawn Wall: El Capitan's Most Unwelcoming Route	Andrews, Watkins, and Ward (2015)
	The Wild Path: An Icelandic Adventure	Bebber (2015)
	Katrina	esri (2015)
	Ships in The San Francisco Bay	Kronick (2016)
	Five Days in London	Webadvantage (2017)
	Hubway Challenge 2017	Perkins & Leung (2017)
	The Forced Migration of Enslaved People in The United States 1810 - 1860	Nelson et al. (2016)
	Chasing the Matterhorn	Kohler et al. (2015)
	Solve 50 Problems In 50 Days	Smart (2012)
	2013 Colorado Flood Recovery: Four Years of Progress	Fischer (2017)
	1812: When Napoleon Ventured East	Nedkova et al. (2017)
Multimedia Visual Experiences	The Genesis of Exodus	Presbyterian Church (U.S.A.) Office of General Assembly & World Mission (2017)
	How We Animated Trillions of Tons of Flowing Ice	Watkins (2017)
	How the Paris Shooting and Hostage Standoff Unfolded	Curtin, Juan, and Bentley (2015)
	What Happened at Each Location in The Brussels Attacks	Yourish et al. (2016)
	Spies in the Skies	Aldhous and Seife (2016)
	Mapping the Shadows Of New York City	Quoctrung and White (2016)
	Wealth Divides	Esri (2016b)
	Costing Nature	Medaglia (2015)
	A Bear's Eye View of Yellowstone	Hello Monday et al. (2016)
	The Uprooted	Esri (2016a)