Cartography M.Sc.

# Tracing the Evolution of Digital Cartography in Cartography Textbooks

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# Outline

1. Background
2. Research Objectives
3. Methodology
4. Results
5. Conclusion and Outlook

1. Background
    1. Digital Cartography as a Discipline
    2. Comparing Text in Books
    3. Content Analysis
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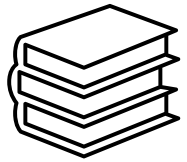
# Digital Cartography as a Discipline


The 1984 ICA Meeting in Perth *(Source: International Cartographic Association)*

"the fast-growing sub-discipline concerned with the use of information technology in the making and use of maps" (Visvalingam, 1990).

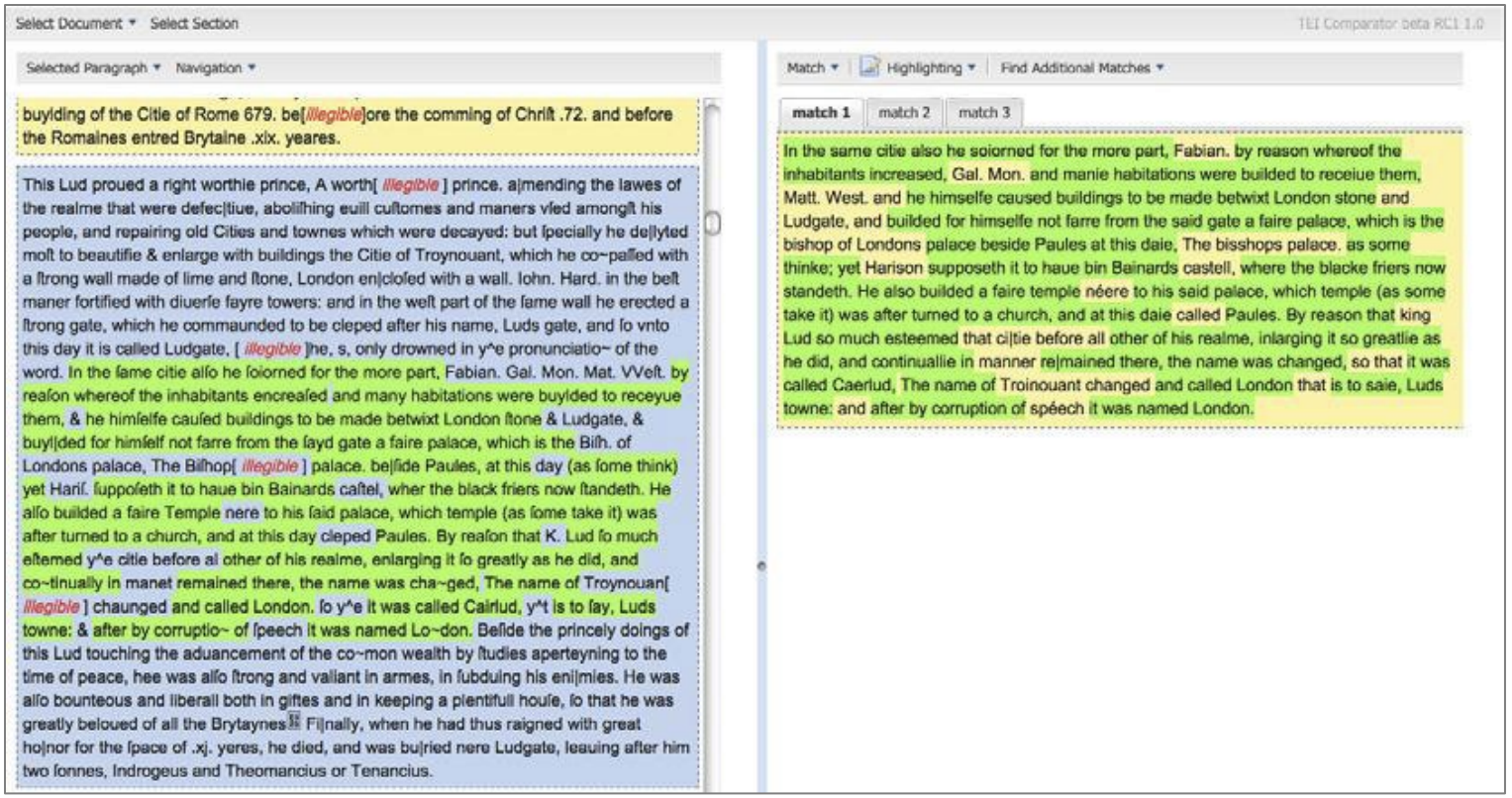


# Comparing Text in Books

| 1830 Edition | 1837 Edition | 1840 Edition |
|---|---|---|
| | 1 NEPHI 13:40 (32:10) | |
| | | + |
| the Lamb of God is the [___] Eternal Father and the Saviour | the Lamb of God is the Son of the eternal Father, and the Savior | the Lamb of God is the Son of the eternal [J] Father, and the Savior |

Comparison of three editions of the *Book of Mormon*
*(Source: Larson, 1974)*

# Comparing Text in Books



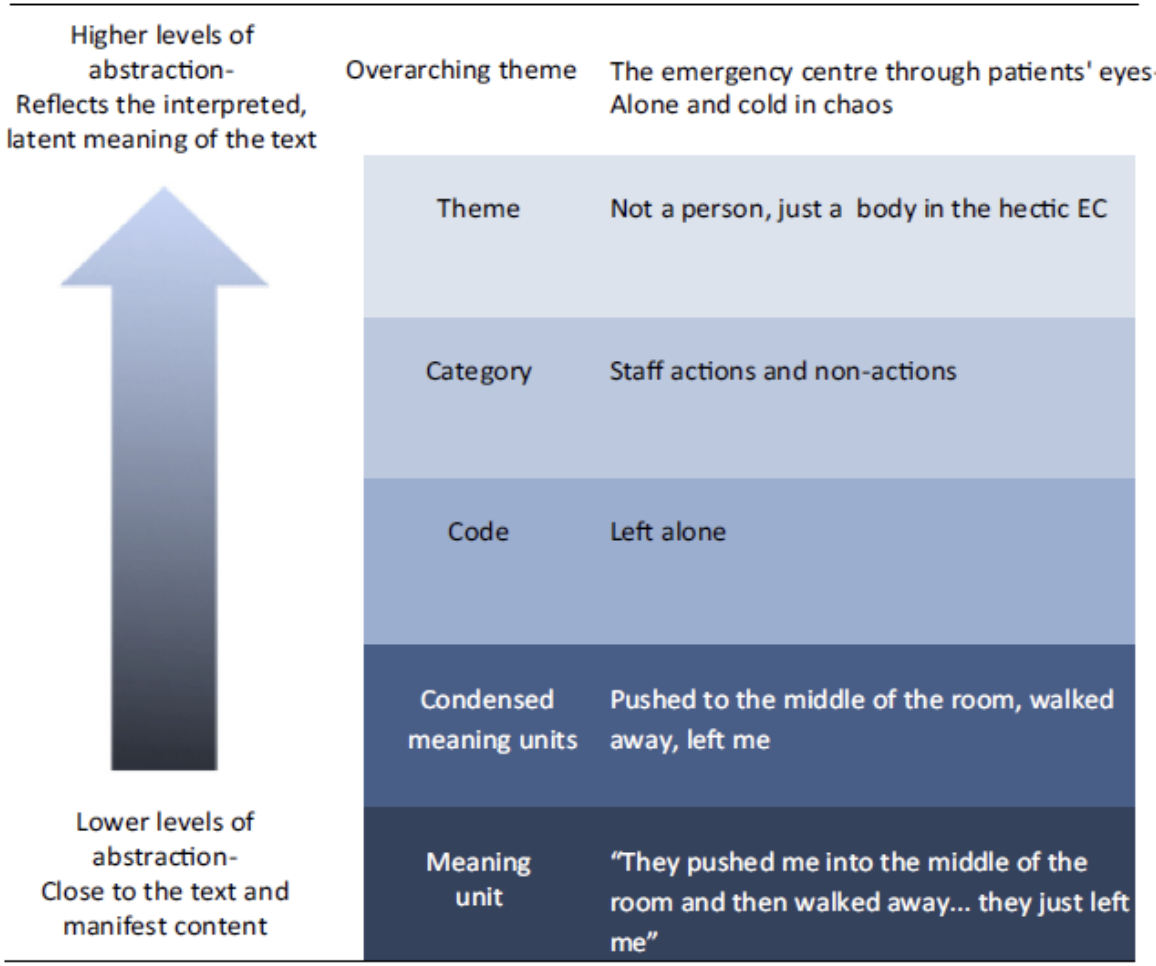

Text comparison engine (TEI-Comparator) displaying a match between two editions of text *(Source: Cummings & Mittelbach, 2010)*

# Content Analysis

“A research technique for making replicable and valid inferences from texts, pictures, audio, video, and other sources to examine patterns in communication”

(Bryman & Bell, 2011; Krippendorff, 2018).

# Content Analysis




*(Source: Erlingsson & Brysiewicz, 2017)*

# Content Analysis

| Projection Name | Pre-Computer Era | Mainframe Computer Era | Desktop Computer Era | Internet Era |
|---|---|---|---|---|
| Azimuthal equidistant | ■ | ■ | ■ | ■ |
| Lambert azimuthal equidistant | ■ | ■ | ■ | ■ |
| Mercator | ■ | ■ | ■ | ■ |
| Sinusoidal | ■ | ■ | ■ | ■ |
| Albers equal area conic | ■ | | ■ | ■ |
| Lambert conformal conic | ■ | | ■ | ■ |
| Orthographic | ■ | ■ | | ■ |
| Bonne | ■ | ■ | | |
| Polyconic | ■ | ■ | | |
| Stereographic | ■ | | | ■ |

*(Source: Kessler, 2018)*

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# Research Objectives

1. Analysing the changes related to digital cartography found in different editions of cartography textbooks.

2. Identifying in which ways the increased relevance of digital technologies has been reflected in cartography textbooks.

3. Exploring how content analysis can be used as a tool for mapping changes in textbooks and understanding the evolution of a theme.

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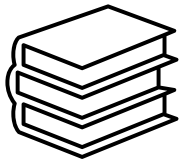
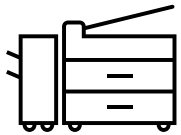
# Data Collection & Transformation



## Textbook selection and acquisition

- Slocum et al.'s *Thematic Cartography and (Geo)Visualization*
- Kraak & Ormeling's *Cartography: Visualization of (Geo)Spatial Data*



## Book Digitisation

## OCR and Layout Clean-Up

## Text File generation

# Content Analysis

## Analysis of Table of Contents and Prefaces

**Contents**



**Preface**

**PREMISES AND OBJECTIVES**

This book has been written to assist in cartographic education and intends, as a first objective, to provide an overview of the role that maps will play both today and in the near future in the world of geospatial data handling. It shows the background against which the provision and visualization of geospatial information takes place. It provides awareness of the Web both as a spatial data source and as a means for distributing the results of visualizing this spatial information. To realize that first objective, the nature of geospatial data is described as well as the characteristics of maps and the ways in which they can be put to use. A development stimulated by the Web was the increased use of spatial data infrastructures, for sharing national and global geodata with the professional and general public. The development of the Internet has boosted the possibilities for interaction and for querying the databases behind the maps presented there. The number of databases available via the Web has increased dramatically and so has the ability to interact with them (query, process, etc.) online. Maps have acquired an important interface function in this new cyberspace geo-information distribution environment. If mapmaking with GIS (geographical information system) mainly involved geo-professionals, the World Wide Web potentially allows everyone to have access to this new medium to create maps.

But not everyone is aware of the intricacies of map design and of the characteristics of the various map types and their limitations. That is where our second objective comes up: teaching map design. What types of geovisualization are appropriate, and how do we translate the numbers collected through censuses or the data measured by sensors into images that allow us to draw sensible conclusions? The answers are shared out over topographic, statistical (or thematic) and temporal maps. For all three categories of maps, we intend to provide sufficient relevant knowledge of cartography and geovisualization concepts and techniques to those accessing the World Wide Web for the production and use of effective visualizations of geospatial information.

Showing the manner in which maps function, either independently or combined in atlases, and can be analysed and interpreted, either in stand-alone or in geo-information environments, is the third main objective of this book. Since the position of the Web has strengthened and stabilized itself, it also stimulated a more integrative approach to problem-solving with geo-information (GIScience (geographical information science)). Since the World Wide Web is highly interactive, and since it allows one to integrate data files, and to link distributed databases, this makes maps suitable instruments for exploring these databases.

# Content Analysis

## Analysis of Table of Contents and Prefaces

# Content Analysis

## Chapter-by-Chapter Comparison & Change Documentation

The introduction of on-screen maps and their corresponding databases resulted in a split between these functions. To cartographers it brought the availability of database technology and computer graphics techniques that resulted in new and alternative presentation options such as three-dimensional and animated maps. In a GIS environment, geospatial analysis often begins with maps; maps support judging intermediate analysis results, as well as presenting final results. In other words, maps play a major role in the process of geospatial analysis.
They have acquired an additional role with the advent of geospatial data infrastructures (GDI). These new infrastructures for accessing geospatial data are being developed all over the world in order to allow access to the geospatial datafiles created and maintained in order to monitor the population, resources and environment. Access to the data needed requires complex querying procedures that are simplified when using maps to pinpoint the areas and themes for which data are needed (Figure 1.1).

| | A | B | C | D |
|---|---|---|---|---|
| 1 | **CHAPTER 1 Geographic information systems and maps** | | | |
| 2 | **Kraak_1** | **Kraak_2** | **Kraak_3** | **Kraak_4** |
| 3 | | | | The ever more detailed satellite imagery available, the increasing number of sensor networks and new |
| 4 | | | The rise of Internet brought the next revolution in mapping. Access to interactive maps is no longer | |
| 5 | | They have acquired an additional role with the advent of geospatial data infrastructures (GDI). These new | | |
| 6 | | Possibilities for interaction are boosted by the advent of the Internet and its potential for querying the | | |
| 7 | | Currently GIS is used in virtually all disciplines that require geospatial data to execute their tasks or solve | | |
| 8 | | The potential for analysis is already greatly enhanced by the possibilities of applying GIS processing on the | | |
| 9 | 1.5 The relation between GIS and cartography | 1.5 The relation between GDI and cartography (whole new) | 1.5 The spatial data infrastructure and maps | |
| 10 | | Companies and government departments at different levels (municipal, provincial/county, state, or national) | | |
| 11 | | In order to enable data users to find out whether data sets from different information systems can be | | |
| 12 | | A next step is the development of distributed geospatial warehouses, central repositories where not | | |
| 13 | GIS and cartography Many of the concepts and functions of GIS were first conceived by cartographers. | | | |
| 14 | | | In Europe the GDI implementation is guided by the EU INSPIRE initiative which, based on legislation, will | |

# Content Analysis

## Coding the Documented Changes

“This approach is also used by volunteers who want to update map data for humanitarian purposes after disasters such as hurricanes, flooding or earthquakes. The volunteers use recent satellite imagery to, for instance, indicate where the damage is most severe, and the new maps, often part of the OpenStreetMap, can be used to restore the basic infrastructure”

(Kraak & Ormeling, 2020).

**Codes:** *web, remote sensing, participation*

# Author Interviews

**Section I**

Below are the points that I would like to hear your opinion about.
They are general and open questions concerning your book.

1. What made you decide to write this textbook in the first place?
2. What kind of materials did you have available before starting to write the book?
3. What was the key motivation for each later edition to be published?
4. What was the writing process like when examining and updating the contents?
5. Have you recognised any changes in the cartographic teaching environment that the rapid growth of digital technologies has brought?
6. How has the relationship between cartography and the digital technology evolved throughout the editions of the book?

**Section II**

Below are the updates in the book that I would like to contextualise why they were added or deleted. Unlike the ones above, I do not expect a lot of discussion about these, and the answers can be succinct (e.g., "because the website was deprecated"). It is also okay if you cannot recall the reasons.

7. [Deleted in the second ed.]
   Why were two examples 'TOP10vector' from the Netherlands and 'ATKIS' from Germany deleted?
8. [Added in the third ed.]
   Why did you newly introduce the subchapter "Geographical Names"?
9. [Deleted in the third ed.]
   Why was the website 'Odden's Bookmarks' deleted?
10. What was the motivation to start providing hyperlinks of web resources in the textbook since the third edition?
11. Were there any criteria about which hyperlinks to add and which to leave out in the textbook?

# Text Mining

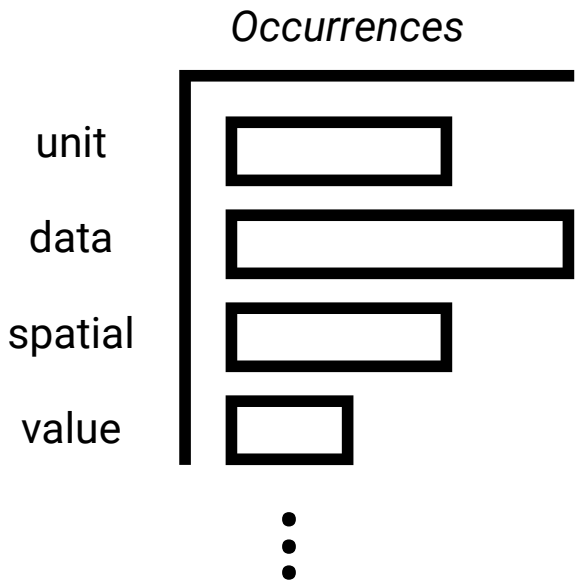
“In a manner analogous to data mining, text mining seeks to extract useful information from data sources through the identification and exploration of interesting patterns”

(Feldman & Sanger, 2006).

# Text Mining

- Word frequency

In section 2.1, we showed how we might combine the optimal classification approach with a spatial constraint. We utilized two criteria to accomplish this: (1) minimizing the difference between data values in classes (i.e., minimizing the tabular error, a nonspatial constraint), and (2) simplifying the map pattern by defining class limits such that contiguous enumeration units fall in the same class (a spatial constraint). Marc Armstrong and his colleagues (2003) have argued that we should consider a broader set of criteria when classifying data, including minimizing the tabular error, minimizing the difference between classes for contiguous enumeration units (i.e., minimizing the boundary error), maximizing the overall spatial autocorrelation in the resulting classed map, and equalizing the area in each class (which is often useful when we wish to compare choropleth maps). Note that the latter three of these are all spatial constraints.



# Text Mining

- Word frequency
- Bigram Analysis

"~~In~~ German, ~~the~~ at sign ~~was~~ referred ~~to~~ ~~as~~ spider monkey."

german at | at sign | sign refer | refer spider | spider monkey

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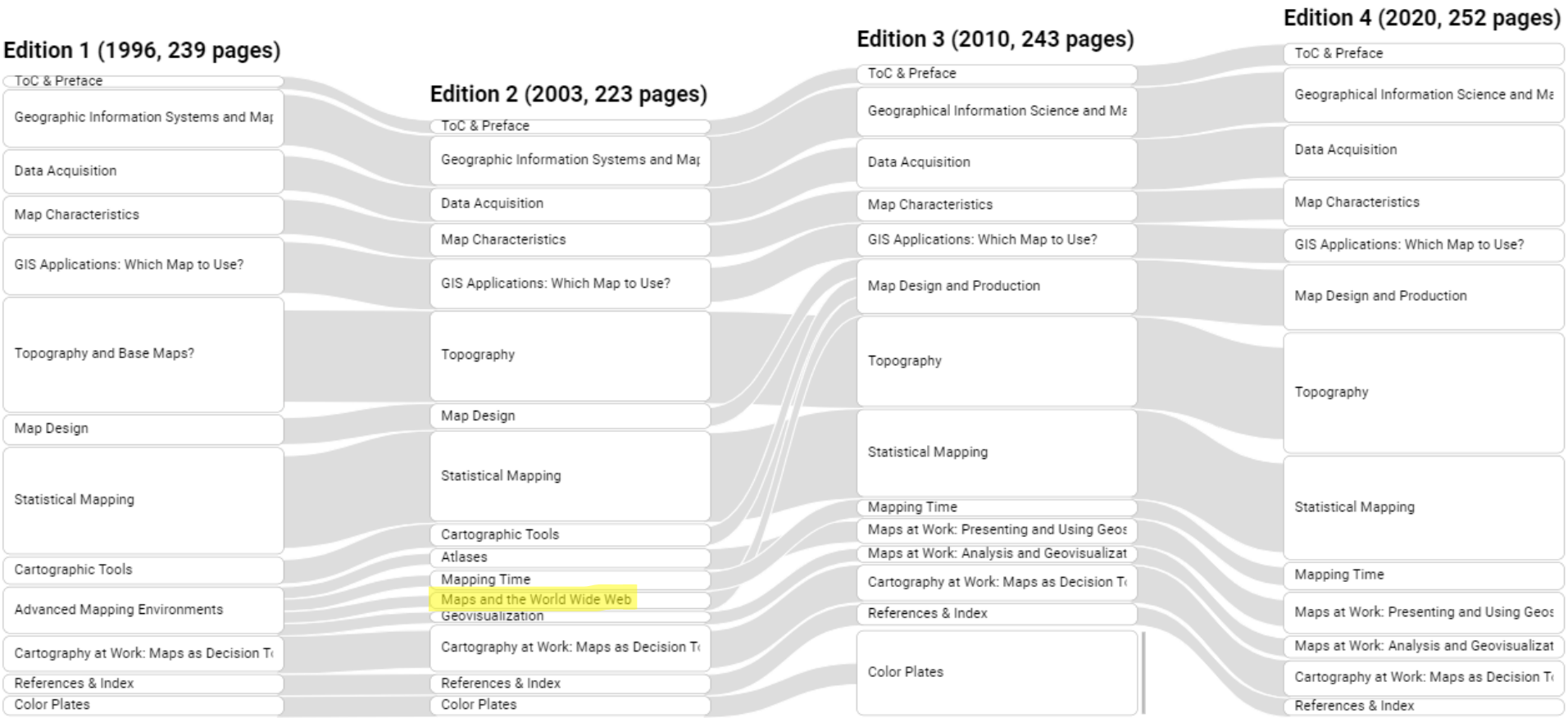
# Evolution of the Overall Structure

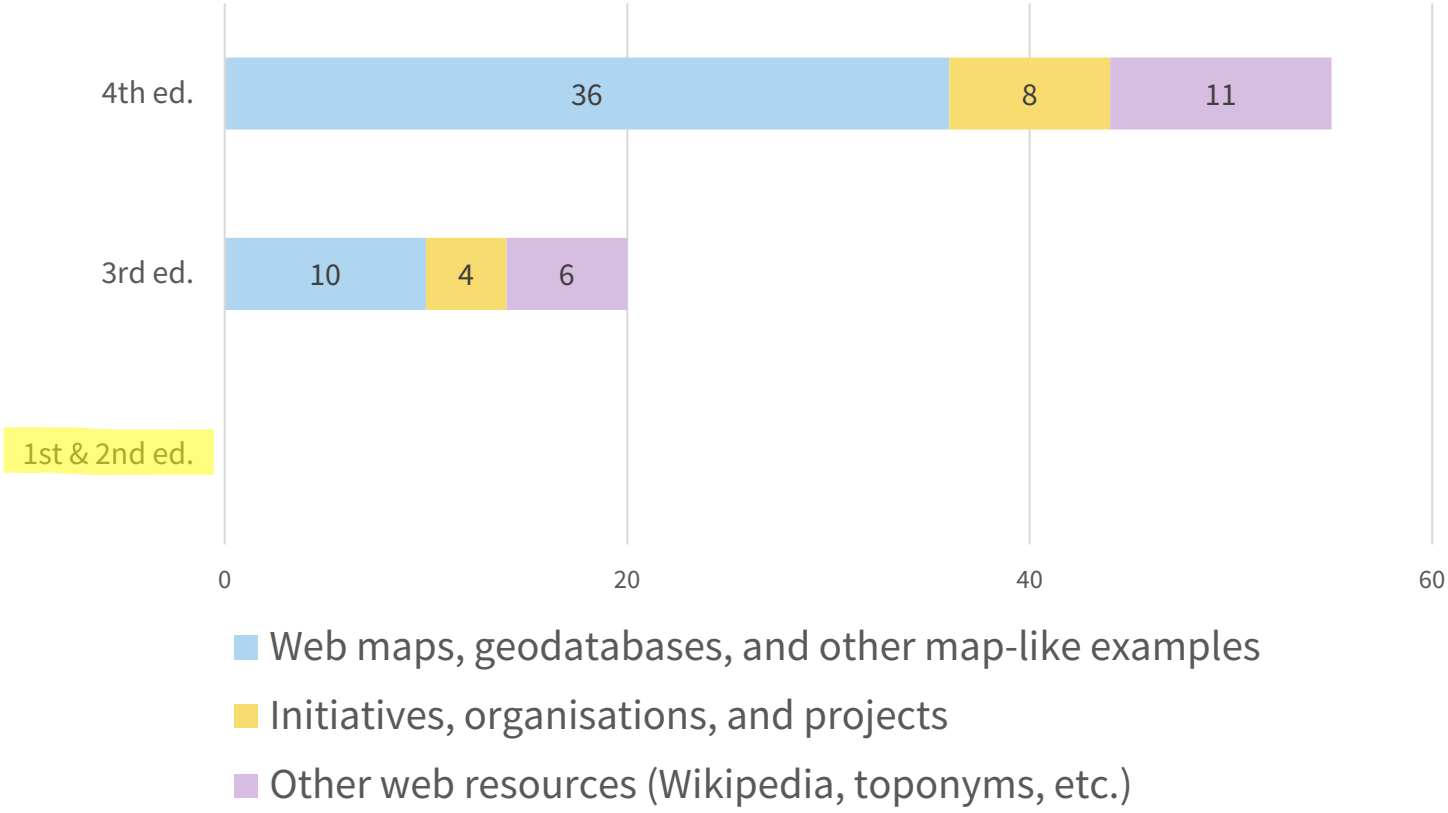


# Codes Found & Categories Formed

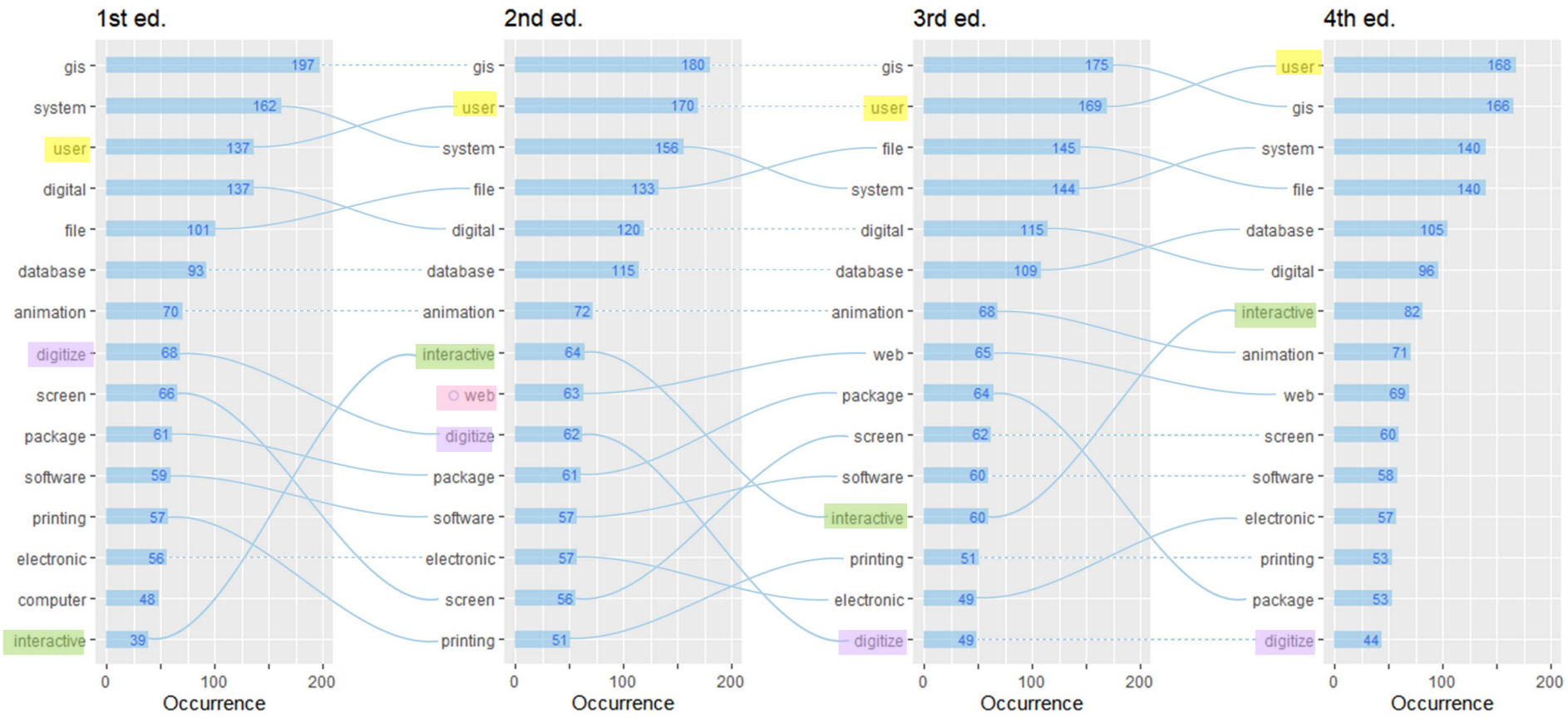
| | | | |
|---|---|---|---|
| Copyright | Education | Generalisation | Animation |
| Definition | Web | Hardware | Atlas |
| GDI | File Format | Software | Database |
| International | GIS | Multimedia | Visualisation |
| Toponym | Remote Sensing | Participation | Design |
| | | Printing | User |

- GDI and Geodatabases
- Electronic Atlases
- Animation, Multimedia, and Web Mapping
- Map Production
- Remote Sensing Technologies and Applications
- Semantics and Policies

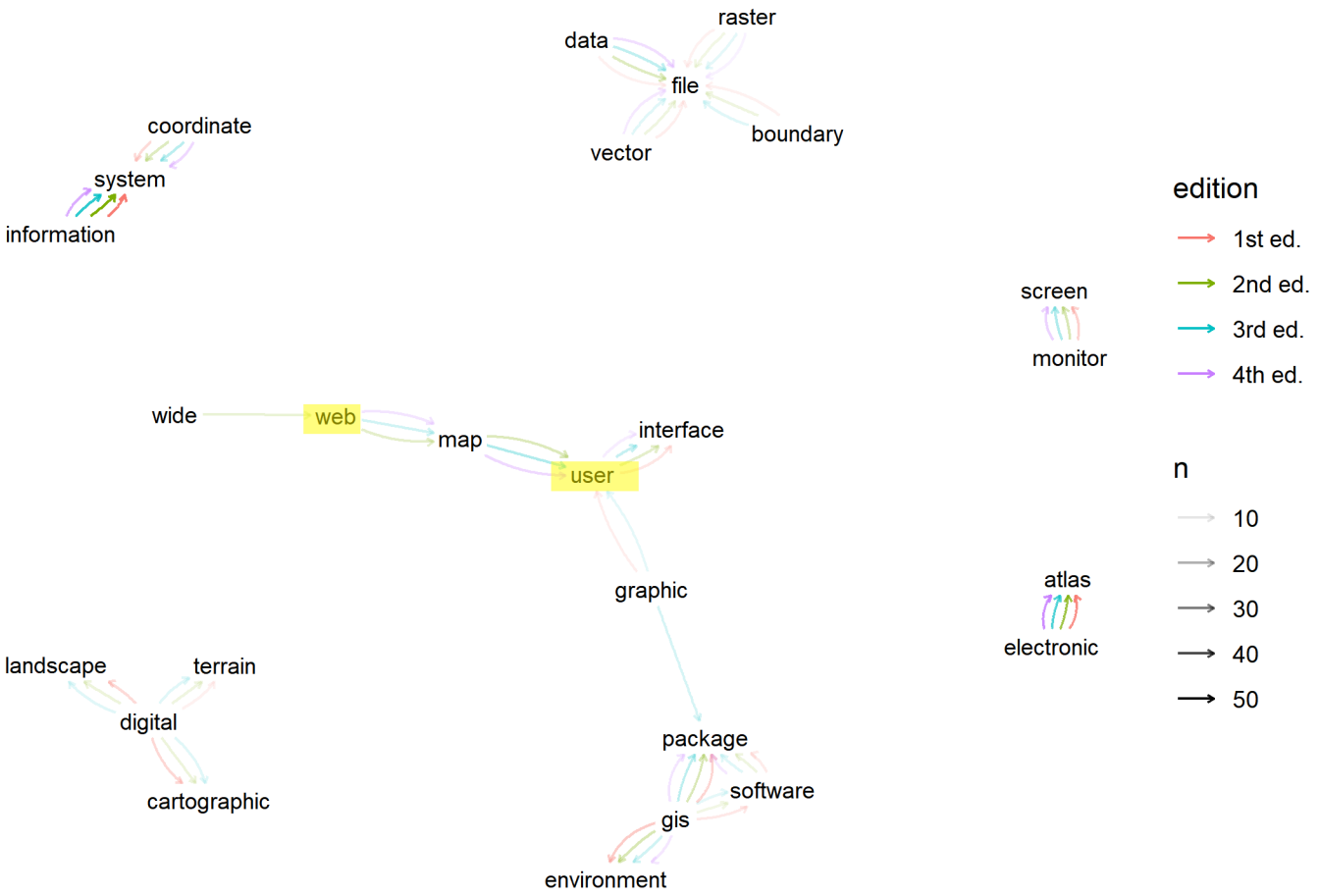
# Evolution of Web Resources



# Occurrence of Digital Keywords



# Bigram Analysis of Digital Keywords



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# Conclusion

- The strongest current observed in both textbooks is the emergence and proliferation of computer-based GIS and the web and their influence.
- The number of hyperlinks included in textbooks has constantly increased.
- Words related to web mapping are significantly used more often with the progress of editions.

# Suggestions for Future Research

- Identifying the optimal intersection of the dataset size between content analysis and text mining.
- Exploring novel ways to exhibit the changes in textual data.
- Integrating the non-textual content (i.e., diagrams, maps) to the analysis.

# Thank you for your attention.

Please feel free to ask questions
and give comments regarding the project.