



TECHNISCHE
UNIVERSITÄT
WIEN

MASTERARBEIT

How Maps have been used: Towards a Typology of Map Functions

zur Erlangung des akademischen Grades

Master of Science

im Rahmen des Studiums

Internationales Masterstudium Cartography

eingereicht von

Julia Schiller

Matrikelnummer 12141454

ausgeführt am Institut für Geodäsie und Geoinformation
der Fakultät für Mathematik und Geoinformation der Technischen Universität Wien

Betreuung

Betreuer/in: Univ. Prof. Dr. Dr. h.c. Georg Gartner

Mitwirkung: Barend Köppen, drs

Wien, 07.09.2023

A handwritten signature in black ink, appearing to be 'JS', is written over a horizontal line.

(Unterschrift Verfasser/in)

(Unterschrift Betreuer/in)



TECHNISCHE
UNIVERSITÄT
WIEN

MASTER THESIS

How Maps have been used: Towards a Typology of Map Functions

for obtaining the academic degree

Master of Science

in the degree programme

International Masterstudium in Cartography

submitted by

Julia Schiller

Matriculation number 12141454

completed at the Institute for Geodesy and Geoinformation from the
faculty of Mathematics and Geoinformation at the Vienna University of Technology

Supervision

Supervisor: Univ. Prof. Dr. Dr. h.c. Georg Gartner

Reviewer: Barend Köbben, drs

Vienna, 07.09.2023

A handwritten signature in black ink, appearing to be 'JS', written over a horizontal line.

(Signature of the author)

A solid horizontal line intended for the supervisor's signature.

(Signature of the supervisor)



Cartography M.Sc.

Master thesis

How Maps have been used: Towards a Typology of Map Functions

Julia Schiller



2023

Statement of Authorship

Herewith I declare that I am the sole author of the submitted Master's thesis entitled:

"How Maps have been used: Towards a Typology of Map Functions"

I have fully referenced the ideas and work of others, whether published or unpublished.
Literal or analogous citations are clearly marked as such.

Sömmerda, 07.09.2023



Julia Schiller

Acknowledgements

First of all, I would like to thank Prof. Gartner for supervising my thesis and for trusting me to conduct it remotely. Additionally, I would like to thank Mr. Mocnik for his valuable thoughts at the beginning of the thesis semester, as well as Mr. Körben for taking over the Reviewer position and for providing me with new ideas regarding my chosen topic. Further, I would like to thank the coordinators of the different universities, especially Juliane Cron, who were continuously supportive.

Moreover, I would like to thank all my friends and family who were kind and took the time to support me on this journey. Without you this would not have been possible.

Abstract

Defining map functions was already attempted 30 years ago (Freitag, 1993). Various researches try to modernize or adapt findings (Caquard, 2009; Fairbairn et al., 2021). This thesis is exploring map functions in regard to political context, as a connection between map content and political events is suspected (Barnett & Casper, 2001; Friedmann, 2013). For this purpose, political ideologies of five eras, Medieval, Renaissance, Realism, Futurism, and contemporary, are analyzed and their influence on four fundamental map types, General Reference, Topographic, Navigational, and Thematic, is assessed. Furthermore, two user questionnaires are conducted in which participants are presented with 25 maps for which they first describe and then select map functions in respect to their political context. In the course of this, it turns out that with a difference of 1.7 percentage points, male and female user groups show the greatest difference in map function selection. In addition, the participants of the questionnaires are able to describe the political ideologies of the different epochs after viewing the corresponding maps, proving that political events indeed influence map content. In addition, the *Top-Down vs. Bottom-Up Typology of Map Functions* is presented, which is derived from the results of the questionnaires. The major difference between the two is the assumption that functions are either imposed on (Top-Down) or perceived by the individual, depending on their personal background and circumstances (Bottom-Up). Moreover, the hypothesis is made that this typology is applicable to more domains of map functions than only those of political context.

Keywords: map functions, typology of map functions, epochs, political context

Contents

Abstract	III
Contents	IV
List of Figures	VI
List of Tables	VII
1 Introduction	1
1.1 Motivation and Problem Statement	1
1.2 Research Identification	7
1.3 Thesis Outline	7
2 Theoretical Background	9
2.1 Communication	9
2.2 Cartographic Communication	11
2.3 Political Communication	13
2.4 Political Ideologies	14
2.4.1 Middle Ages	15
2.4.2 Renaissance	15
2.4.3 Realism	16
2.4.4 Futurism	16
2.4.5 Contemporary	17
2.5 Map Types	17
2.6 Related Work	21
3 Methodology	24
3.1 Map Selection	24
3.1.1 Europe	24
3.1.2 Maps selected	25
3.2 User Study	25
3.2.1 Target Audience	26
3.2.2 First Questionnaire	26
3.2.3 Second Questionnaire	27
3.2.4 Evaluation	28
4 Results	31
4.1 Cartography throughout Epochs	31
4.1.1 Maps in the Middle Ages	31
4.1.2 Maps in the Renaissance	32
4.1.3 Maps in the Realism	32
4.1.4 Maps in the Futurism	33
4.1.5 Maps in the Contemporary Age	33

4.2	Evaluation User Questionnaires	34
4.2.1	Concluded Functions	34
4.2.2	Function Choices of different User Groups	36
4.2.3	Functions and Map Types	37
4.2.4	Functions and Epochs	39
4.2.5	Identifying Political Trends	39
4.2.6	Gratitude for Maps	40
5	Discussion	42
5.1	Used Map Types	42
5.2	Biases	43
5.3	Shortcomings	43
5.4	Research Objectives and Questions	45
5.5	Map Functions	50
6	Conclusion	53
6.1	Limitations	55
6.2	Implications for further Research	55
	Bibliography	57
	Appendix 1: Maps	63
	Appendix 2: Questionnaire 1	64
	Appendix 3: Answers Questionnaire 1	65
	Appendix 4: Questionnaire 2	66
	Appendix 5: Answers Questionnaire 2	67
	Appendix 6: Evaluation Questionnaires	68
	Appendix 7: Evaluation Questionnaires - Percentages	69

List of Figures

Fig. 1: [Illustration about the 2023 pension reform of France] (Derenne, 2023)...	3
Fig. 2: La mobilisation contre la réforme des retraites. En nombre de manifestants le 19 janvier 2023 (VISACTU, 2023a).	4
Fig. 3: La mobilisation contre la réforme des retraites. En nombre de manifestants le 6 juin 2023 (VISACTU, 2023b).....	4
Fig. 4: Connections that influence map functions. Image by the author.	5
Fig. 5: Digital interactive and modifiable World Map showing country as well as European Union boundaries (Map Chart, n.d.).	18
Fig. 6: Topographic Map of Weimar, Germany, 1944 (Deutsches Reich / Reichsamt für Landesaufnahme, 1944).	19
Fig. 7: Map of the world showing the extent of the British Empire in 1886. British territories colored in red (Crane, 1886).....	19
Fig. 8: Nautical chart of the southern part of the North Sea, at a scale of 1:754,400 (United Kingdom Hydrographic Office, 1920).	20
Fig. 9: Cadastral Map of Bingham Canyon in 1962 (Salt Lake County, 1962). ...	20
Fig. 10: Extracted Map Functions from Questionnaire 1: Top-Down vs. Bottom-Up Typology of Map Functions. Image by the author.....	36
Fig. 11: The Top-Down vs. Bottom-Up Typology of Map Functions in regard to Freitag's (1993) proposal. Image by the author.....	51

List of Tables

Tab. 1: Map functions assigned to the epochs in which they have the largest percentage share in relation to all epochs.	48
Tab. 2: Map functions assigned to the epochs in which they have the smallest percentage share in relation to all epochs.	48
Tab. 3: Map functions assigned to the map types in which they have the largest percentage share in relation to all types.	49
Tab. 4: Map functions assigned to the map types in which they have the smallest percentage share in relation to all types.	50

1 Introduction

1.1 Motivation and Problem Statement

According to Jerry Brotton, who is a professor in London, UK, for Renaissance studies, “we always get the map that our age deserves” (Friedmann, 2013). But what does this mean and how can it be investigated? Maps have been around for a long time. One of the oldest known is the *Babylonian Map of the World*, dated around 550 BC (Bagrow & Skelton, 2010). It is known to a high extent what it displays but it is not clearly identified for what purpose it was created, nor how people at the time benefited from it (Horowitz, 1988). Applying these aspects to Brotton's proposal leads to questions and uncertainties about the motivations, intentions, and functions of particularly early maps whose origins remain either undocumented or undiscovered. While the motivations and intentions of map-making itself are easier to assume, functions tend to leave gaps in scientific knowledge, which increase the older a map is (Bagrow & Skelton, 2010).

Fundamental map functions are classified into six categories, with none being more or less important than the others: orientation, presentation or information, research, planning, jurisdiction, and propaganda and advertisement (Witt, 1979). Freitag proposed a different kind of classification in 1993: cognitive, communicative, decision support, and social. Unlike Witt, who describes what maps and their functions are useful for by themselves, he places them in the context of everyday human experience. In 1995 Krygier suggested that map functions are more diverse than one might initially think. He creates a new way of thinking by stating that they can be divided into art and science, but that both are not as dissimilar as it may appear and should rather be seen as a whole within the discipline of cartography. In recent years, there are even more attempts to specify map functions more precisely and to adapt them to the constantly changing modern age, by adding the function of communication within geospatial information. More precisely, map readers must at all times be able to excerpt a minimum of one entity associated with a specific framework. However, even with the best intentions and the most sophisticated use of symbols and colors, a map can contain functions that were not meant to be communicated (Fairbairn et al. 2021). Consequently, the question arises as to which fundamental circumstances might be present in our environment in order to allow non-intended map functions in the first place.

“Human social environments encompass the immediate physical surroundings, social relationships, and cultural milieus [...]” (Barnett & Casper, 2001, p. 465). Meaning, we are at all times, whether intentionally or unintentionally, consciously or unconsciously, children of our social environment. It is shaped by, but not limited to, “power relations; government; [...] cultural practices; [...] the arts; [...] and beliefs about place and community” (Barnett & Casper, 2001, p. 465). Therefore, returning to

Brotton's statement (Friedmann, 2013), the meaning of it becomes even clearer. Maps are a reflection of their time and are simultaneously a representation of the social environment their creators experience. Especially political and cultural circumstances shape the way of thinking and behaving, now and in the past. As a result, all our experiences mold our minds, conversations, way of working, and the things we create, thus also maps. Merging these thoughts with the findings of Barnett & Casper (2001), it appears that map content, whether intentionally or unintentionally, is always influenced by a cultural-political context. Regardless of whether the map was created for political purposes or not.

Culture is defined as "the characteristic features of everyday existence [...] shared by people in a place or time" (Merriam-Webster, n.d.d). Hence, people living on different continents do have the same everyday experiences regarding, for example, the fact that every country has a head of state, but can have different ones in terms of how the head of state operates and guides their nation (Lipsy, 2020). A head of state is "the highest representative of a sovereign state" (Munro, 2023). Meaning, this person usually plays an important role in decision making of the current reigning political party (Munro, 2023). Examples for political parties are *Democrats* and *Republicans*. The former pursues a general and evenly distributed standard of well-being for all inhabitants of a nation through a high level of government regulation. In contrast, the latter is more concerned with letting society regulate itself and insists on traditional values, such as having great military power, rather than being well regarded internationally for other things (Britannica, T. Editors of Encyclopaedia, 2022). Thus, decisions that influence the handling of political topics are based on a party's politics (Millard, 2004). More precisely, politics are "the art or science concerned with guiding or influencing governmental policy" (Merriam-Webster, n.d.g). Consequently, however, the question arises as to when something is considered to be political and when it is not. According to Merriam-Webster (n.d.f) something is political, if it is "[...] of or relating to government, a government, or the conduct of government". Having multiple possible political parties, it is important to note that decisions always depend on the context of their values (Britannica, T. Editors of Encyclopaedia, 2022). Context itself is defined as "the interrelated conditions in which something exists or occurs" (Merriam-Webster, n.d.c). Combining the words *cultural*, *political* and *context*, one can derive that cultural-political context indicates that anything within a region or specific time period is being directly or indirectly influenced by their social environment and politics. An example of this are the protests against the pension reform in France of 2023. According to it, the retirement age should be raised from 62 to 64 years - the context. Many citizens of the country do not agree with this and are protesting against it. In terms of working culture, the French have had to work two years less so far and are therefore resentful - cultural and social parts (Norddeutscher Rundfunk, 2023). Due to the lack of understanding for this political decision, important businesses in the country are also on strike. Public transport, garbage collection, gas stations, and elementary school staff are just a selection. This is argued with the fact that citizens are not only angered because of the pension reform. Wages and health care, in

particular, could be improved in rural regions. According to unionists, this anger has existed for a long time and the protests and strikes are a way of showing that politicians are not paying attention to the wishes of their citizens. The desire for change is reinforced by the fact that in some places up to 800,000 demonstrators are expected daily (Borutta, 2023). Thus, it is given that the uprisings of France are caused by the current social and political circumstances, the cultural-political context.

Political events can be represented in the form of art (see Fig. 1), with art being “the conscious use of skill and creative imagination” (Merriam-Webster, n.d.a). In Fig. 1 the author uses satire to show that the French citizens do not agree with the decision of their government on the pension reform, even though the latter might want to advertise it as having the best interest of its population in mind.

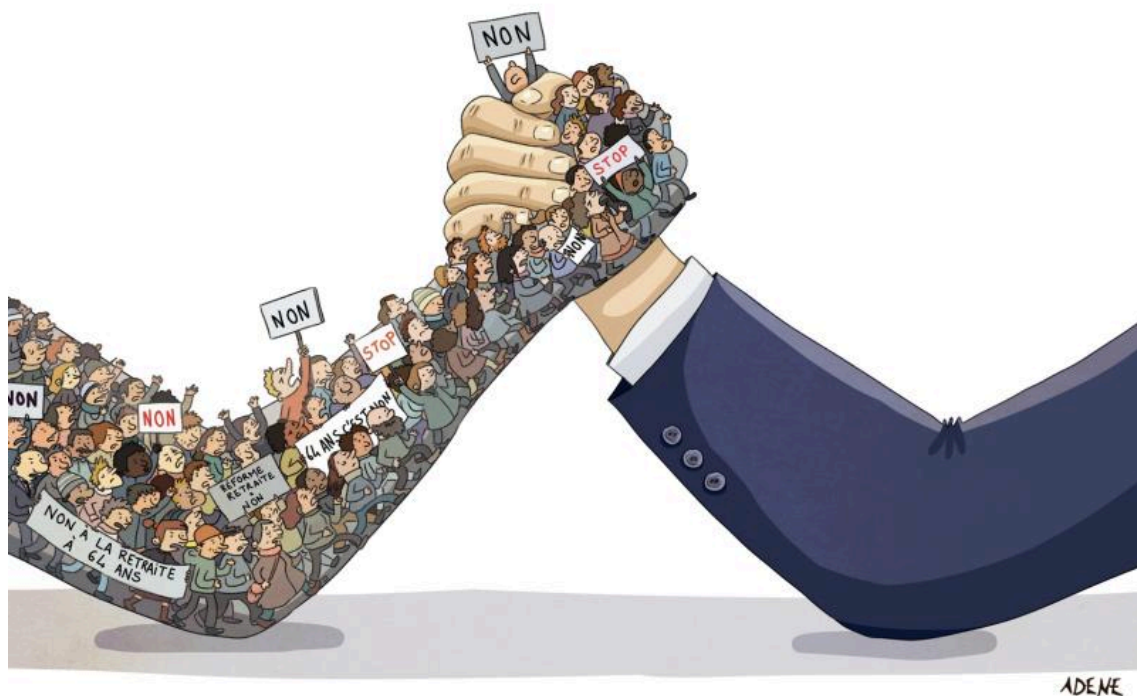


Fig. 1: [Illustration about the 2023 pension reform of France] (Derenne, 2023).

However, illustrations are not the only form of art that can address or contain political issues. Cartography incorporates art, because it is “the art and science of graphically representing a geographical area, usually on a flat surface such as a map” (Britannica, T. Editors of Encyclopaedia, 2023a). Further, a map is defined as a “graphic representation [...] of an area of the Earth or of any other celestial body” (Fuechsel, 2023). Example maps addressing political topics are Fig. 2 and Fig. 3. An unordered slideshow portrays the hotspots and numbers of demonstrators and police officers during the protests in France regarding the pension reform of 2023. When hovering above the colored circles, rounded numbers of each group at a specific location are displayed.

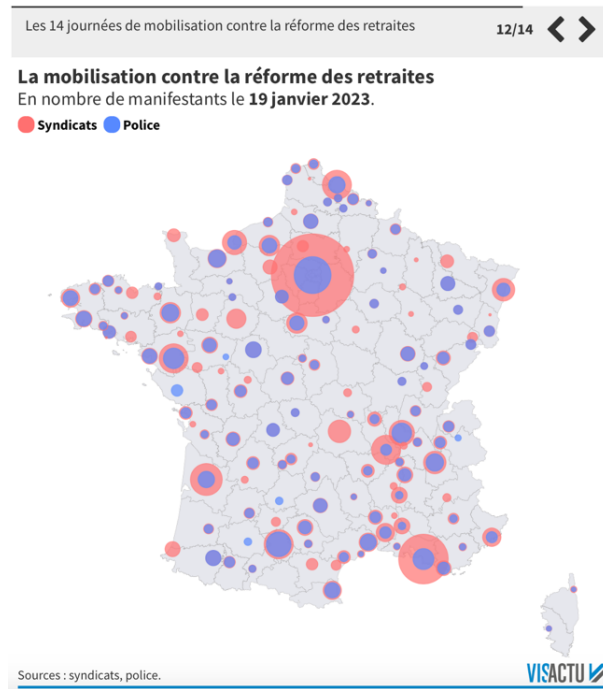


Fig. 2: La mobilisation contre la réforme des retraites. En nombre de manifestants le 19 janvier 2023 (VISACTU, 2023a).

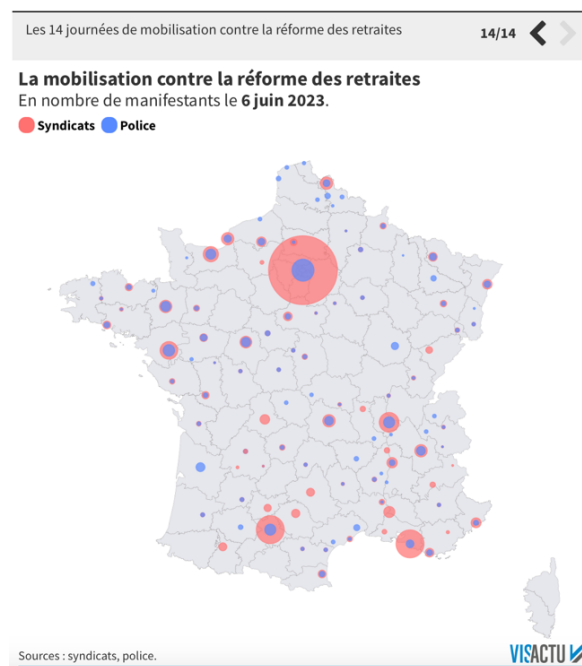


Fig. 3: La mobilisation contre la réforme des retraites. En nombre de manifestants le 6 juin 2023 (VISACTU, 2023b).

Taking into account Witt's (1979) map function categories, the only direct link to political map functions can be found in the implementation of propaganda (Bar-Gal,

2003). Though information and planning can also be considered, it is necessary to think a bit more outside the box. For instance, information becomes political when it is part of an open-data strategy devised by the government (Huijboom & Van den Broek, 2011). Regarding planning, McClamroch et al. (2001) hint that beneficial planning cannot occur in the absence of politics. Planning involves four phases: gathering and understanding information, selecting core objectives, drafting tactics for each one, and developing concepts to achieve each objective. Thereby, if any of these planning functions is found, it can be considered political. Along with politics comes ideology (Gerring, 1997). It is defined as “a manner or the content of thinking characteristic of an individual, group, or culture” (Merriam-Webster, n.d.e) and can also be found within art. Wartofsky (1980) implies that politics, ideology and art are bound together, with politics heavily influencing the existence of art itself. Hence the question emerges as to what extent it is possible to incorporate politics into art, particularly maps, and what functions result from this (Fig. 4).

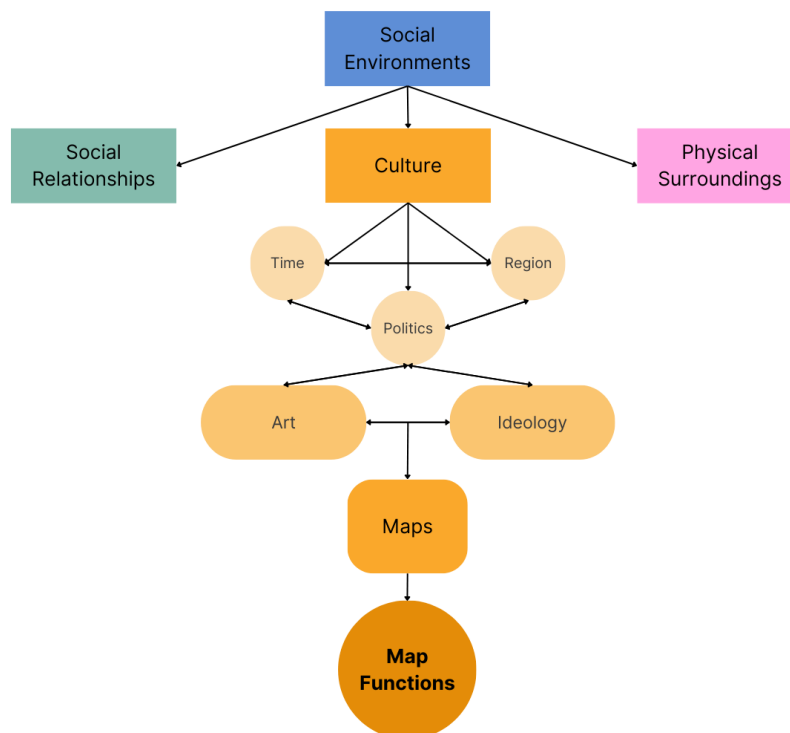


Fig. 4: Connections that influence map functions. Image by the author.

While there has been some research done on map functions (Bagrow & Skelton, 2010; Fairbairn et al., 2021; Krygier, 1995; Witt, 1979), deeper investigations into the nature of them, their many different facets and origins have yet to be done. Especially map functions in respect to their political context are of interest, because we are constantly surrounded by a rapidly changing world, where political situations can change our lives in the blink of an eye, with the outbreak of war between Russia and Ukraine as an example (Vorbrugg & Bluwstein, 2022). Hence, functions of maps created in this time

of war could be shaped due to these happenings. However, a 21st century map design would not be comparable to that of the 15th century, because art from different periods throughout history does naturally not look the same (Wölfflin, 1950). However, within the same epochs, similarities are found and the artwork changes approximately simultaneously (Ialongo, 2016).

As this research is conducted in the field of theoretical cartography, it is not aimed at developing new techniques for map creation, nor at improving a map for different needs in user-perception. Instead, it strives at generating a typology of map functions, in respect to their political context. This will be achieved by systematically analyzing four different types of maps: *General Reference*, *Topographic*, *Navigational*, and *Thematic*. Here, the latter is further subdivided into city maps and those with an obvious political motivation, representing a political theme. All map types are examined across five diverse time periods: the Middle Ages, Renaissance, Realism, Futurism, and the contemporary Digital Age. Thereby, the lack of knowledge of this field of research within theoretical cartography can be reduced and previous comprehensions can potentially be modernized. Moreover, by filtering out political characteristics of several time periods throughout history, as well as the comparison of to what extent maps complement their epoch, the understanding of influences on map-making can be deepened. This thesis aims at explicitly finding out which purposes a map serves, what motivations or intentions a mapmaker could have had while creating it and which aim it should fulfill. All, while taking into account the political context of the time a map was created. Further, assumptions about map functions for the future can be made, due to the inclusion of contemporary maps.

Learning about map functions is the key element to comprehending why maps were invented in the first place and why they continue to exist today. Other aspects of cartography depend on these findings: the use of different symbolism, colors, fonts, level of detail, and much more. Only by understanding the intended functionality can the true reasons for choosing one of these many choices be discovered. By combining the findings of this work into a typology of map functions, in respect to political context, it will subsequently be easier to understand a map's purpose and to further apply findings to other cartographic themes, such as general communicative map functions. Instead of having to study many scientific articles and comparing different opinions and putting much time and effort into deciding on the most fitting umbrella term to describe the function of the analyzed map, this work will provide a wide range of functional terms to quickly and efficiently achieve the desired result. Since previous studies have tended to focus on a few generic terms to describe map functions (Fairbairn et al., 2021; Krygier, 1995; Witt, 1979), this typology is expected to be of significant scientific advancement. Instead of having to assign an answer to two or more categories and being even more uncertain afterwards than before, because one is not sure whether the map in question covers all characteristics of this generic term or not, a definite answer to a definite question can be given with the help of this work. Thus, the research audience will most likely not be the average map user, but rather academics who question the intentions and motivations of map production and want

to understand the reasons and ulterior motives behind it and be able to determine them in a quick and efficient way. Additionally, this research aims to further solidify gratitude for maps alongside with the benefits they bring.

1.2 Research Identification

This thesis is conducted following two research objectives (ROs).

- RO1** Identifying broad political trends in different time periods in history in Europe and today and determining if these features are reflected in according maps.
- RO2** Identifying map functions, in respect to their political context, of several map types in different time periods of history in Europe and today and across various user groups.

To meet these objectives, the following research questions (RQs) must be answered.

- RQ1** What broad political trends have existed in different time periods in history in Europe and today, and how have they manifested themselves?
 - RQ1.1 Did political characteristics of a specific time period influence the content of according maps?
 - RQ1.2 Are map users able to correctly identify the political trends of an epoch from them?
- RQ2** Which map functions, in respect to their political context, can be found in different user groups?
 - RQ2.1 Is there a difference in map functions in different time periods of history in Europe and today?
 - RQ2.2 Is there a difference in map functions between different map types?

1.3 Thesis Outline

This thesis consists of five chapters: Introduction, Theoretical Background, Methods, Results, Discussion, and Conclusion. After this Introduction, where the most essential vocabulary is identified, an overview of already existing approaches to defining map functions is given. Additionally, the research objectives and questions that are to be

met and answered are explained. With the theoretical background following in the second part, it includes the concept of the four main map types used within this research. Further, the reasoning as to why only maps of a specific cultural background are used when looking at past epochs, apart from having a broad range for the ones from today's digital age, is given. Plus, an overview of the five epochs that are subject of this study is given, containing political trends of each. With a summary of related work, the second chapter is finished. Third is the Methods part. It introduces the overall methodological approach of this thesis, along with the analysis of cartography throughout different eras. This contains objective similarities and differences between map types in the same and other time periods. Further, both user study questionnaire frameworks are outlined. In the fourth chapter, Results, the user study questionnaire answers are evaluated. Thereafter, in Chapter 5, Discussion, these results are compared and discussed in regard to literature. The last part recapitulates the key findings of this thesis, identifies key limitations of the research and points to other areas in the field of theoretical cartography, with potential research in the future.

2 Theoretical Background

This chapter reviews different communication, the various time periods that are examined, as well as the according political ideology trends. Then, contents of the five epochs are demonstrated. Moreover, map types used within this thesis are discussed. Last, references to previous research that addresses similar topics are presented.

2.1 Communication

Communication is “a process by which information is exchanged between individuals through a common system of symbols, signs, or behavior” (Merriam-Webster, n.d.b). It occurs inevitably anytime there is social interaction (Luhmann, 1992). Further, with communication come goals that communicators want to achieve through it. The main one being to prevent misunderstanding between parties, although misinterpretations do not guarantee that objectives cannot be achieved. In fact, the detection of misunderstandings can be established as the very first goal. Additional ones, among others, are the control over communication and its content, as well as finding someone who can help keep it going (Goldreich et al., 2011). Consequently, all goals of communication can be summarized into one main proposition: ensuring effective, successful, and non-terminating communication.

Faerch and Kasper (1984) suggest that communication is based on two different strategies, both of which are problem-solving oriented: speech production and reception. Meaning, communication always has or is itself a goal, with the second being to become more coherent. In speech production strategies there are two possible outcomes: reduction or achievement. The former is characterized by formal or functional reduction. Hence, either rephrasing the statement or dismissing the subject matter as a whole. Opposed to this is achievement, which is divided into noncooperative and cooperative approaches and “Unlike reduction strategies [...] serve[s] to preserve the language user’s original communicative goal.” (p. 49). Noncooperative ones can be indicated by the speaker paraphrasing unfamiliar vocabulary. Cooperative by involving all conversational participants in finding a solution for the communication during the communication process. According to Kasper (1984), receptive communication strategies include certain key requirements concerning the receiver party. For instance, recipients must have knowledge about the context of the communication topic. When trying to understand what has been received, either top-down or bottom-up approaches are applied. The former tends to dismiss new information and focus on what was said in the beginning. In the further course of the conversation, indications on other subjects are linked to it and the underlying message of the communication is most probably discovered. Bottom-up on the other hand can be unsuccessful when trying to link different information

together, without a foundation being laid out about how different topics are connected.

However, not everyone shares this opinion of comprehension of the communication receiver as part of communication itself. Luhmann (1992) believes that it is not living beings that communicate in these interactions, but solely communication itself that does it within three stages: information, utterance and understanding or misunderstanding. These cannot operate independently. They exist only in communication and continuously throughout the cycle of their own. But, he proceeds to draw a clear line between communication and reception. If during a conversation someone absorbs conversational information, this person does not have to disclose their reaction to it. Therefore, the communication of the reception would not occur. Only by communicating again is it possible to communicate to a counterpart the reception of what has been received and whether it has been understood. Hence, the stage of understanding or misunderstanding and reception are two separate theoretical concepts. The former is rather the understanding or misunderstanding of the utterance that is to be communicated, while the latter is the information that a counterpart draws from the communication. With this reasoning comes the interpretation that communication does not always have and also is itself not necessarily a goal. Nevertheless, if communication is targeting a goal, it can be cautiously indicated based on implications and vocabulary used.

Goldreich et al. (2011) discuss the principle of targeting a goal within communication. For this purpose, they define three possible communication participants: the user, the server, and the world. The user initiates the communication, while the server receives it. The world represents the impact of the actions of the former two and is the decisive instance to determine whether or not a goal has been realized. Their first approach involves the user first expressing their intended meaning during communication and then adjusting or revising it as the conversation progresses, depending on the world's reaction. Next, the authors proceed to the concept of probabilistic and non-deterministic strategies. Accordingly, for a goal that is fulfilled via the latter, a referee must also be included in the model. Thus, the world is now the environment in which communication is practiced and the referee is the determiner of whether it was effective or not. In contrast, the probabilistic strategy is rather complex. Here, the communication that the referee classifies as goal-oriented is related to parts of the event that have already occurred. The user therefore sends goal-directed messages only after, for example, the topic has already been changed. Nonetheless, the user is still hopeful that its intended goal has been reached, even though it now no longer serves any meaningful function. Goldreich et al. also describe different types of goals in communication and divide them into compact, multi-session, and repetitive ones. The former is measured according to efficiency. Hence, the faster a goal is reached, the better. However, it must again be distinguished whether the referee makes this decision of achievement or whether the reactions of the world already prove it. Multi-session goals consist of several subordinate objectives that need to be achieved one after the other within a certain time frame. As

repetitive are those classified, which are approached throughout with the same communicative approach. Furthermore, the authors describe that in the course of verbal communication, for example through feedback, it is possible to perceive whether the intended goal is achievable or not.

Applying these findings to the reading and interpretation of maps, it is evident that in very few cases is it possible to have the goal or function explained by the designer personally. Instead, it is necessary to be satisfied with what can be seen and to hope that all components of a map have been chosen thoughtfully enough to allow the intentions to be unmistakably revealed. As a result, map users depend on another form of communication, with non-verbal communication coming first to mind. But, this second type consists of facial and body expressions, without spoken language (Hall et al., 2019). Others also identify components of non-verbal communication as “[...] paralinguage: voice qualities, speech nonfluencies [...]; skin sensitivity to touch or temperature [...] [or] use of artifacts, such as dress and cosmetics.” (Duncan, 1969, p.118). Accordingly, it is clear that cartographic communication does not conform with the kinds of methods that are commonly used or known when thinking of conventional communication.

2.2 Cartographic Communication

In 1992 Koussoulakou and Kraak proposed that animations and thus interactive maps are an excellent tool for cartographic communication. They describe three possible cases of visualization, each with one or more different possible applications, depending on the map display: geographic, thematic and temporal. Geographic elements can be displayed as planes on both static and animated maps, while thematic ones are best as visual variables. Temporal features, on the other hand, have more flexibility. On a single static map, they too are best represented as visual variables. On several contiguous ones they can be represented by spatial deduction and on animated ones by memory deduction. They discovered this on the basis of a user study. Furthermore, according to their findings, map users do not simply take a map as a given, but think about its contents and ask themselves what they mean. Moreover, in the user study they asked questions about the information displayed in the maps and were in all cases able to report more correct answers than incorrect ones.

Cartwright (2009) believes that cartographic communication is something where the essence of it can either convey more artistic, technological or scientific components. Depending on the chosen main characteristic, map users can interpret contents in one or the other direction. Thus, the map creator actively shapes how information is received. Several options are available for this. Nevertheless, they all have one thing in common: the creator must adapt to the state-of-the-art technology that prevails at the time a map is created. Consequently, in the end, there are always

limits to the design and therefore the communication of the desired information. At the dawn of the age of computers, Cartwright found that map users were far too quickly satisfied with the simple first attempts of this new invention. It was apparently not possible to show detailed information. Consequently, those who only looked at it superficially could see and understand the shallow functions, but there were no real considerations involved. Maps published on the early web gradually received the addition of being interactive, with layers being able to be turned on and off. Thus, the usability function was increased and communication was limited to what individual users found important or useful. Still, when paper maps were displayed on a computer, communication of the information they contained could also be degraded due to low screen resolutions. Regardless of how a map is displayed, the best communication technique is described by the author as using written words. This allows describing accurately everything that can be seen, which ensures the correct transmission of the presented material. Another communication tool is the display of naturalistic scenery. In addition, induced sounds and diverse map materials can lead to better communication. Especially if these materials are allowed to be touched. The latter two techniques are especially helpful for visually impaired people, who are more often excluded from information communication when using purely visual map design. It can be concluded that, according to Cartwright, successful communication consists of the most realistic possible map design, in which the important contents are also presented in written form. As a result, misunderstandings are much harder to occur.

Guelke (1977) advocates that cartographic communication should not be approached from a technological perspective. Based on this, anything shown on a map could be considered both disturbing, superfluous, or distracting, as well as informative. Like on a remote control there are often used operating buttons, such as the ones for turning the volume up and down, as well as those one does not use on a regular basis. Hence, from the very beginning, it is necessary to think about what content a map should communicate in the end. Each symbol, each color, each component of a map needs a meaning. But just as no color has the same meaning for every potential user group, it is not easy to say which components are necessary to ensure that everyone interprets a map correctly. For this, the author proposes a possible solution, which is context. He gives the example of a topographic map. This type was created and considered at the beginning of its invention by and for someone with a military background. Contextually, traditional content such as elevations or forests signify an easier or more demanding path or potential protection, respectively. Other groups, like scientists, would potentially add more specific information, such as wind directions. What is not displayed cannot be the meaning of a map and is therefore not communicated. To what extent the contents are true to nature, however, is subject to the judgment of the creator. It is therefore the reality, or context, which is presented. Not the reality or context that a reader might prefer to interpret or misinterpret into it. But, in order to ensure successful communication of its information, Guelke believes that it must be ensured that cartographers themselves

are confident about what is being portrayed and that they have done everything in their power to clearly transmit the message.

Peterson (1987) is addressing the question of how *mental images* connect to cartographic communication. It turns out that the more familiar a map user is with the content, for instance, the more often he has seen it, the easier and quicker differences can be detected. Consequently, icons are much more memorable than words, but not necessarily for communicating information. He concludes that primarily spatial information is communicated in maps. Explanatory texts or striking colors might be perceived, but they are not what is reflected in the mental image of the user. As a consequence, they are not a good choice for communicating information. Maps are primarily intended to pass on location-based information. This is implemented by arranging the most important reference landmarks of reality as symbols on the map.

Several insights can be established after considering all these various approaches to what cartographic communication looks like. On one hand, it can be seen that both static and animated maps communicate their content with different display methods in such a way that the majority of users can correctly answer specific content questions. On the other hand, there remains a residual proportion that has selected the wrong ones. Unfortunately, the size of this proportion is not specifically indicated, making it difficult to draw conclusions about the gaps in comprehension (Koussoulakou & Kraak, 1992). Cartwright (2009) argues that cartographic communication is helped by using not only visuals, but also other senses. For instance, sounds and touch can contribute greatly to accurate communication. Guelke (1977) distances himself from the technological approach instead and refers to a more personal level. In his opinion, knowledge about the context of map creation is important above all. Whereas Peterson (1987) aims at the fact that cartographic communication succeeds more easily if the map user is familiar with a topic. For him, the symbolism used is not that important. Even though these many approaches are available to explain cartographic communication, opinions differ, as usual, concerning how it is best accomplished. Therefore, it is always worthwhile to reflect on what information exactly should be communicated and who is the target group. In the end, those people that are supposed to and are interested in understanding what is trying to be communicating via a map, will do so.

2.3 Political Communication

Keeping in mind the political context of the research objectives, political communication also needs to be addressed. Although it may not look like it at first glance, it is very versatile and contains a lot of information regarding the political ideology that, as an example, a politician represents. Moreover, political communication is meant to sugar coat the audience and make them believe in something that would probably rarely ever be brought up again. This way, an

euphemistic impression can be portrayed. It is also beneficial to follow what the majority of the audience wants to hear. Thus, no new proposals should be created, but instead communicate what has long been demanded by the most people and with which they can identify. Further, it is best to focus on one topic and present it in the most effective way possible. Too much content at once can cause political followers to lose interest (Iyengar & Simon, 2000).

Van Aelst et al. (2012) also find that the more personal a political issue is to the audience, the easier it is to communicate. Nowadays, this is more successful than it used to be. It could be due to the fact that politicians today are no longer perceived only as their job title. A model named *privatization* exists, which means that they are now also seen as a separate person with a private life. Seeing a politician as a human being who, in the best case, also represents one's own interests, is therefore very helpful in attracting communication attention.

Modern technology also plays a role in political communication. When people are able to hold a picture of politicians in their hands or see them on live television broadcasts, they feel closer connected to them. Besides, this is a way to upgrade the appearance or image that some may have in their minds. Instead of picturing an old man, it is suddenly a smiling young person who represents their interests, which automatically creates more interest in what that person has to say. Moreover, the more a citizen identifies with the visual representation of a politician, the more easily they will show interest. Of course, this also applies in the reverse case. In addition, it seems to be advantageous to demonstrate things one has done for the good of the population, such as military service, in order to attract attention (Schill, 2012).

Overall, political communication can be described as euphemistic and self-promoting. Raising one's own image is more important than presenting things as they actually are. Communicating the interests and opinions of citizens or saying what they want to hear can be considered a manipulation technique. It is also important for politicians to help their audience to identify with them to make them believe the things they say. Because of this, communication between politicians and the audience works quite well.

2.4 Political Ideologies

When analyzing politics, one is struck by the fact that ideologies change over time, albeit slowly, and across cultures (Mintrom & Norman, 2009). Though, one thing in common is the inequality in the balance of authority (Dumolyn, 2012). Nevertheless, citizens of a nation are aware that at least they are subject to the authority of politicians. Most often, the latter represent the opinions and concerns of their constituents, creating a political culture. As a result, it is possible that people cannot do everything they want, because there are laws or worldviews imposed from above that they have to abide by (Pateman, 1971). For this reason, it is important for this

thesis to determine which political ideologies, world views or thought processes prevailed in the epochs and environments from which the to be examined maps originate. Since the individual time periods naturally have many different political movements, it is not possible to present each one individually. Instead, those from Europe that are considered predominated are portrayed. Thus, a very broad overview is given, but it is by no means claimed that the overall political climate was only like this and in no case any different.

2.4.1 Middle Ages

The centuries from 500 to 1500 CE are referred to as the *Middle Ages* (Peters & Frassetto, n.d.). One of the most dominant approaches to understanding political ideology in this time is the ruling inequality in all aspects of life, especially in relation to power. Those who had power, hence primarily the nobility, shared values, views of right and wrong and what was appropriate behavior and what was not. In addition, visual stimuli, among others, were used to manipulate the "lower" population of the time. Many banners or other visualizations served accordingly for the purpose of what is now called *propaganda* (Dumolyn, 2012). Further, Acharya and Lee (2019) argue that the Middle Ages can also be considered to be pioneers regarding the expansion of governmental organizations. It is the age that set the foundation for everything that exists today. One of the examples that has changed over the centuries is the line of approved descendants of a noble house. These were primarily always male, especially in the Middle Ages. If, after the death of a superior, there was sometimes no undisputed male successor, his absence could occasionally cause serious power struggles. Since this was the case throughout Europe and not only in some countries, the authors assume that the political climate was thus also largely the same everywhere. Nevertheless, they add that one must exclude regions that were dominated by Muslims, since their distribution of power was different from that of Christians. In a concluding statement, Acharya and Lee once again clarify that the political climate of Europe in medieval times was predominantly the same. However, it is shown that the development of a country or region was more efficient, the clearer the succession of a ruling house was. Where this was not the case, frequent wars were not unusual.

2.4.2 Renaissance

The Age of the Renaissance presumably began in Italy in the 14th century and lasted until the 17th (Britannica, T. Editors of Encyclopaedia, 2023c). In this period, the separation of class society was even more concise than in medieval times. In addition, there are the struggles to accomplish the desire to secede from the Roman Empire as well as the church reformation led by Luther. It should be noted that he did not always

consider the radical approach of his followers as beneficial. Despite the efforts of the rebels, they could not overthrow the leading regime. Ultimately, the decision was to keep fighting and die, or to give up and accept their fate as before (Greenblatt, 1983). Even if the fundamental social and political structures remained the same, the Renaissance was nevertheless an era of exploration and progress. For instance, the rediscovery of America by Columbus and the modernization of astronomy took place during this period (Britannica, T. Editors of Encyclopaedia, 2023c).

2.4.3 Realism

Realism is the term used to describe the era from 1848 to 1890 (Weber, 2020). Following the French Revolution, international political changes occurred throughout Europe. Although at the beginning there were attempts to counteract this from reigning regimes, it did not work for long. In addition, large nations such as Germany and Russia repeatedly had to resolve disagreements. Furthermore, France and Great Britain, among others, were dissatisfied with their current territorial ownership and wanted to expand it without regard to other potentially indigenous nations. Wars followed, which rarely led to new cooperations and rather made neighboring countries even more discontented than before (Schroeder, 1986). Although international cooperation worked at the beginning of the century, especially in the fight against crime, it became increasingly difficult towards the end. There was a significant increase in nationalization. As the industrial revolution progressed, people became more possessive and less trusting of their neighboring countries and even neighboring regions (Pollard, 1973).

2.4.4 Futurism

The Futurism epoch began in 1909 and ended just before the end of the second world war in 1944 (Futurismus, n.d.). The first half of the 20th century is marked by heretofore unmatched human violence. During the First World War from 1914 to 1918, nearly eight million soldiers and five million civilians lost their lives, and up to five million had to flee their homes. In the Second World War from 1939 to 1945, the number of the latter was 40 million. An estimated 27 million civilians lost their lives during this period. Thus, it is given that the second war was even more brutal than the first. While civilians were able to live a relatively undisturbed life in the first world war, they were targeted by bombing raids in the second. Many nations appeared more than willing to go to war because of the political shifts toward nationalism of the decades before. Shifting the blame for a loss onto others was an attractive strategy to further fuel the propaganda for one's own goals (Kershaw, 2005). Müller (2009) believes that the reason for these brutalities was that people at the time actually considered war to be the sole solution to their difficulties. The fact that the people at that time were

exposed to extreme changes, the author considers as a possibility that they wanted to create a new world and thought that now was the right time to do it. Politicians seemingly embodied the change that was desired, which meant that propaganda quickly had an effect. While the exact manifestations varied from nation to nation, the underlying thought processes shared the same characteristics.

2.4.5 Contemporary

Many years after the world wars, in the current 21st century, technology is advancing in such a fast way that even aspects such as business, including international, are already taking place online. It is therefore not surprising that borders, figuratively speaking, are disappearing and the world is merging more and more. One can even go so far as to speak of a renewed industrial revolution. The European Union, for example, would like to expand the international digital market in particular in order to be able to make products and services available to all member states. Thus, an estimated 83% of all national companies could benefit from an expansion, as their market penetration would increase (Troitiño, 2022). Nonetheless, it cannot be expected that all countries will have exactly the same opinions and values. It is important to include all views and then find a solution that consists of compromises, with everyone agreeing in the end (Moravcsik, 2018). However, it is easier to reach agreements with nearby neighboring countries than with those that are further away. In addition, due to the widely democratic nature of global politics, a change of government can have serious repercussions, especially in international cooperation and the economy. For example, some of the groundwork laid by former U.S. President Obama was undone by his successor, Trump. Due to the latter's national vision, international relations deteriorated (Laffan, 2018).

Evidently, the world has passed through a wide variety of political stations since the Middle Ages. While from medieval times up to the end of the 19th century there were still distinct class societies. Plus, neighboring regions and even in the 20th century countries chose war more often than words to overcome conflicts. Nowadays, there is an increased focus on international cooperation. The reason for this can be attributed to the world wars, which brought losses and suffering not only in Europe but, as the name suggests, worldwide.

2.5 Map Types

At the beginning of the first chapter, it is frequently mentioned that different types of maps are examined in this thesis. How this selection comes about is explained in the following section.

According to the ICSM (Intergovernmental Committee on Surveying and Mapping) (n.d.f), maps are divided into five categories: General Reference, Topographical, Thematic, Navigation Charts, and Cadastral Maps and Plans. However, some opinions favor alternative typologies, such as Particular, Reference, Thematic, and Universal or General Maps (Wood & Krygier, 2009).

General Reference and Reference Maps fall within the same map type category. They are convenient both in terms of interpretation and comprehension. Characterized by simplistic coloring and symbolization, general reference maps usually show relief, roads or boundaries (ICSM, n.d.b; Wood & Krygier, 2009) (Fig. 5). Universal or General Maps show the world in its entire extent, whereas Particular ones focus on smaller regions (Wood & Krygier, 2009).



Fig. 5: Digital interactive and modifiable World Map showing country as well as European Union boundaries (Map Chart, n.d.).

Topographical Maps are not considered by Wood & Krygier (2009) as an own map type, but rather assigned to the class of Reference Maps. As claimed by the ICSM (n.d.e), Topographic Maps contain the same characteristics as General Reference Maps, with the critical addition of contour lines. Further, they most likely incorporate human environmental objects, such as buildings, and are subject to local guidelines regarding scale (Fig. 6).



Fig. 6: Topographic Map of Weimar, Germany, 1944 (Deutsches Reich / Reichsamt für Landesaufnahme, 1944).

Thematic Maps, on the other hand, can again be found in both classifications. They display statistical, physical or any other kind of informational data and tend to be created for one sole purpose only. Examples are geology, export/import and points of interest maps (ICSM, n.d.d; Wood & Krygier, 2009) (Fig. 7).



Fig. 7: Map of the world showing the extent of the British Empire in 1886. British territories colored in red (Crane, 1886).

Other map types, as defined by ICSM (n.d.a; n.d.c) are Navigation Charts and Cadastral Maps and Plans. While the former displays maritime areas of the earth (Fig. 8), the latter shows an overview of several or individual property boundaries (Fig. 9). Usually, both types of maps are generated by or on behalf of a government.

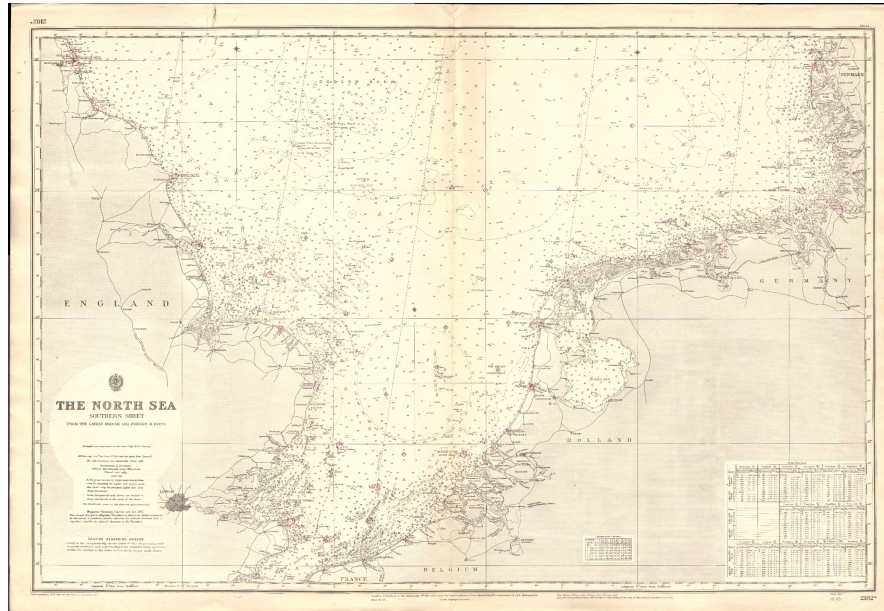


Fig. 8: Nautical chart of the southern part of the North Sea, at a scale of 1:754,400 (United Kingdom Hydrographic Office, 1920).

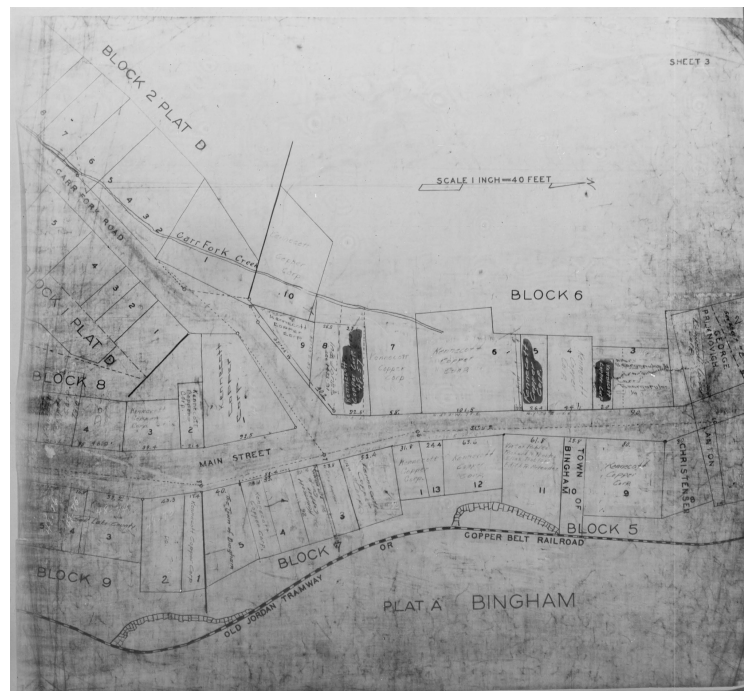


Fig. 9: Cadastral Map of Bingham Canyon in 1962 (Salt Lake County, 1962).

Hereafter, for the purpose of uniformity, the ICSM terms are used. In this thesis, the map types General Reference, Topographic, Navigational, and Thematic will be subjects of study.

2.6 Related Work

Ulrich Freitag might well be one of the most recognized German researchers in the fields of Geoinformation and Cartography (Ortag, 2003). In 1993 he published a set of map functions: cognitive, communicative, decision support, and social. However, despite this approach, which likely covers every area of human existence, he describes that maps were never created to serve only one particular function or intended use. Rather, they were designed to be accessible to the general public so that anyone, regardless of cultural background, age, and other things that differentiate people, could use them. In other words, a map could have all four of his proposed functions. On the one hand the cognitive one, which includes that spatial information about an area should be presented in the most effective way, but on the other hand the level of understanding of the used method of the end user must be taken into account. Next, the communication function, which reflects the information that needs to be provided to the user. It can have different origins, ranging from academic to ideological communication. For the decision support function, it is necessary to consider all possible decisions and actions a user could take after interpreting a map. For example, different navigation paths are possible, as well as the promotion of various items. The last thing to consider is the social function. It is important to regard which motivations for engaging in social settings or planning actions can be communicated by a map.

Even though Freitag's paper was issued three decades ago, it is still discussed in recent years (Fairbairn et al., 2021). This contrasts with the fact that knowledge has an ever decreasing lifespan. Theoretically, within five to ten years at the very latest after Freitag's publication, someone should have contradicted his approach. Reason behind this is that knowledge loses 50 percent of its present value in this time span (Helmrich & Leppelmeier, 2020). But, here this is not the case. Instead, as in Fairbairn et al. (2021), there are merely things that are added or re-specified. An example of this is their argumentation of the degree of common ground between Cartography and other fields of study. The question arises whether Cartography wishes to merely lend itself knowledge from elsewhere or to incorporate it into itself. Thus, the context of a map is not necessarily Cartography-based, but is nevertheless a part of it, as the knowledge is now behaving in an interdisciplinary way. After all these considerations, the authors conclude one essential function: that of geospatial information. Without it, there is no map. Secondly, they also consider the readability of a map to be a function, but only in the sense that the overall appearance of it must be pleasing to the user. However, this is a challenge, since different people may have different opinions, for example, on the choice of color. Accordingly, attention must be paid to ensure that

representations and stylistic components of a map are not ambiguous, but can be clearly understood. Fairbairn et al. conclude that a map, due to the different perceptions and backgrounds of the users, can have various functions. Even ones that may not have been intended by the creator, like the artistic function of it.

Krygier (1995) argues that maps provide functions not only for art, but also science and that these are more similar than some may believe. This is because cartographers are both artists and scientists. While the function of art concerns the aesthetic part of a map, the scientific one is to provide clarification. However, the art itself can also be anchored in the scientific part, and vice versa. Both parts of cartography have the same goal: to create an informative and understandable aesthetically pleasing map. The author believes that there should be no question as to what distinguishes art and science in cartography. Instead, it should be acknowledged that depending on the context, there may be different reasons for creating or studying a map. Both parts contribute their part to a successful end result. Trying to determine differences by any means leads to asking even more questions. Among other things, how art and science are defined, on which again there would be even more diverse opinions. Krygier suggests recognizing that the two are inevitably intertwined in the discipline of cartography. Therefore, it would be better to investigate how to apply both art in science and science in art in order to reflect on the visual dimensions of cartography.

Tsou (2011) discusses the need for a wide variety of map functions when different users engage with a map, specifically contemporary web maps. With the digital age constantly evolving, online maps must also continue to transform alongside their creators and users, adjusting and adapting to the wants and needs of the latter. The author describes two stages in the development of these digital representations: maps in the browser and ultimately the generation of maps on and with mobile devices. Therefore, not the artistic part of Cartography is the focus, but the usability for the end-user. Ergo, the user-centered design and the respective features and functions to create maps are the most important aspects to make Cartography work in modern settings. Examples include voice-controlled zooms, transitions of, among other things, imagery, or communal networking based on location. Hence, for Tsou, interactivity is the most important function. It should be used to simplify and improve the way humans engage with each other. In order to achieve this, the author proposes interdisciplinary cooperation with experts from other disciplines, such as sociologists.

Another variant of contemporary maps and their state-of-the-art functionalities is described by Caquard (2009). Listing nine examples at the very beginning of his research paper, including zooms, distinguishing shortest paths or even watching videos by using a digital map, the first thing he concludes that they all have in common is interactivity. Another unique characteristic is the possibility of presenting maps with real-time data, that ubiquitously update themselves and disclose more spatial information. More precisely, the author discusses maps that have been used in the cinematic context since the beginning of the 20th century. As they expand during a

movie from 1923 and reveal more and more information to the viewer, the creators create a tool that participates in the construction of a narrative of nationalism. Thus, political functions are essential for a map. Caquard also notes that elements of modern digital cartography were already being applied to cinematic maps about a hundred years ago, such as the animation of certain elements. This was long before the adoption of these techniques for the works of academic cartographers. In addition, he identifies the emotional component behind map functions during the next decade. This is evoked by sound, which can support or counteract a narrative at appropriate moments. Moreover, the narrative function is expressed, as maps are used as stylistic means for the value conception behind a story. However, it is not the individual who determines the scope and content of a map, but always a higher power. For instance, an organization such as the police. Accordingly, an institution of the government that is consequently politically biased.

It is evident that map functions are subject to constant change. While some authors build on previous proposals, others suggest entirely different arrangements. Being a theoretical topic, it is difficult if not impossible to claim that one opinion is more correct than the other. Perhaps the best that can be done is to find out what different user groups take away from a map, by means of questionnaires or surveys. It seems that this kind of approach is not yet commonly used for this issue, which is why it is conducted in this master thesis. By doing so, a new way of thinking is initiated, which can potentially bring new insights.

3 Methodology

This chapter outlines the methods used in this thesis. Starting with the map selection, it further deals with the reason why only maps from Europe were examined from the past epochs. After that, the selection is briefly presented. Furthermore, the target audience, approach and the evaluation process of the two user questionnaires are explained.

3.1 Map Selection

To reach the research objectives and to answer the research questions, a number of factors are crucial regarding the map selection. On the one hand, the maps should not be too similar, but on the other hand, neither should they be complete opposites. In order to ensure complete objectivity, all maps were chosen before any intense literature research and study of the topic began. Therefore, it was ensured that there was no influence on the selection to later be able to argue in one direction or another. Nevertheless, one thing was clear. All maps, except those of today's digital age, should be of European origin. The reason for this was the desire for comparability, within the limits of possibility, of political ideologies and epochs.

3.1.1 Europe

As section 2.4 demonstrates, the political situation throughout the various epochs in Europe was broadly comparable. Even if manifestations on the national level were sometimes more and sometimes less strongly embodied, the political atmosphere was nevertheless the same. Due to the fact that this is a master thesis, there are limits to the length and detail of the research. Given that Europe was more developed than some other continents in the time periods studied (Césaire, 2010), the inclusion of other political ideologies would exceed the scope of this work. Nevertheless, the question arises, what can be found out by only examining maps created by Europeans? As Tobler observed as early as 1970 “everything is related to everything else, but near things are more related than distant things.” (p. 236). Accordingly, the epochs studied were primarily present in Europe (Britannica, T. Editors of Encyclopaedia, 2023b; Britannica, T. Editors of Encyclopaedia, 2023c; White, 2023). One reason for this is that the Americas, for example, were only rediscovered by Columbus in 1492 (Flint, 2023). In other cultures, such as the Asian, other epochs were present (Muzio, 2002). Accordingly, the even greater question more likely to arise is as to why one should only roughly describe a wide variety of cultures in different ages

when one can also conduct a detailed work that can serve as the basis for further in depth research.

3.1.2 Maps selected

All maps selected can be viewed in Appendix 1. For each epoch, five different map types have been selected. These are *General Reference*, *Navigational*, *Topographic*, *Thematic - Political*, and *Thematic - City*. For the Middle Ages, in this order, there are maps from the 11th century, around 1335, 1456, 1450, and around 900. Two special cases are the Navigational and Topographic maps, as both are portolan charts:

[A] portolan chart, [is] also called harbour-finding chart, compass chart, or rhumb chart, navigational chart of the European Middle Ages [...]. The portolan charts were characterized by rhumb lines, lines that radiate from the centre in the direction of wind or compass points and that were used by pilots to lay courses from one harbour to another (Britannica, T. Editors of Encyclopaedia, 2009).

The Renaissance selection consists of maps from 1570, 1539, 1601, 1596, and 1585. They appear more detailed compared to those from the Middle Ages. Apparently, more attention was paid to details during their time of creation.

Maps from the Realism period are from 1859, 1857, 1888, 1886, and 1871. Here, it is noticeable that, in comparison to the Renaissance maps, they depict larger areas of the Earth. Only the thematic city map is limited to Berlin, which was predictable given its type.

The maps from the Futurism era date from 1925, 1920, 1944, 1914, and 1929. The increased use of grid lines for coordinates is striking. In previous epochs, this was most likely used in General Reference maps.

While up to now all maps came from European creators, those from the current 21st century are from a more international background. In addition, they all have an interactive function. Be it to just zoom in and out or to turn different layers on and off. This selection seems to be shaped to fit the individual preferences of a wide variety of users.

3.2 User Study

With the aim of gaining valuable insights into the perception of map functions throughout several time epochs in respect to their political context of different user groups, two online questionnaires were conducted in the course of this master thesis. They were published in a delayed manner, as the second was based on the first one. Participants were asked to answer predominantly open questions using their own

words in the first and were given a number of choices in the second questionnaire, which were drawn from the results of the first one. A total of 39 responses were submitted.

3.2.1 Target Audience

Concerning the target audience, two groups can be differentiated. The first one is what is called *experts* in the course of this study and the second one *non-experts*. They differ based on the self-assessment of their knowledge in the fields of cartography, geography, geoinformation and/or a similar discipline. Knowledge may have been substantiated, for example, through a degree or professional work experience. Consequently, experts are those who possess this level of expertise and non-experts are those who do not. Ideally, the percentage of experts and non-experts would be similar, as would the percentage of participants from different genders, age groups and cultural backgrounds.

After the evaluation of both questionnaires, a total of 39 responses can be counted. Among them, 20 are from men and 19 from women. Due to the time difference of their publishing, it cannot be excluded that one or more of the same persons participated in both. Thus, the number of responses does not necessarily indicate the number of participants. Since both questionnaires offered the possibility of anonymous participation, it is not possible to determine the exact participation rate.

Of the 20 responses from male participants eight consider themselves experts and 12 non-experts, whereas for females ten identify as experts and nine as non-experts. A total of four responses were submitted by participants older than 60 years old. The remaining 35 came from people aging between 20 to 40. Cultural backgrounds range from North America with one response, South America with two, Asia with three, and Europe with 23. Consequently, there is only enough diversity in knowledge level and gender to draw conclusions about differences in the perception of map function in respect to their political context.

3.2.2 First Questionnaire

The first questionnaire can be found in Appendix 2, with the respondents answers being in Appendix 3. In the beginning of said questionnaire, participants were asked to answer questions regarding the gender they identify most with, their age, on which continent they grew up and if they consider themselves as an expert or non-expert. After, they were shown one exemplary medieval topographic map, originating from 1465. Together with a sample answer for the request of them entering the in their opinion most fitting three keywords or short descriptions of map functions of this map, in respect to its political context, this first map served as a training map. By doing so, participants were supposed to gain a greater understanding of the response

requirements, because the question implied an open answer. Afterwards, they were shown a total of twelve maps. Two each from the Middle Ages, Renaissance and Realism and three each from the Futurism and Digital epoch. For all questions, respondents were encouraged to answer in a free associative manner. In addition, three supporting questions were given: *Which purpose does this map serve, in respect to its political context?*, *What motivations or intentions of a mapmaker can be found, in respect to its political context?* and *Which aim should it fulfill, in respect to its political context?*. Participants had to answer questions in regard to twelve maps

3.2.3 Second Questionnaire

The first questionnaire can be found in Appendix 4, with the respondents' answers being in Appendix 5. It again started with questions about the gender participants identify most with, their age, on which continent they grew up and if they consider themselves as an expert or non-expert. Then, participants were provided with another training map in the beginning, but this time a Thematic City map from today's Digital epoch. Here, there was an exemplary solution to the request: *Please pick the in your opinion most fitting three key words of the function of this map, in respect to its political context*. Deliberately, the question referred to three key words, but gave the possibility to select three to five, with the example answer having selected four. This way, participants were given the sense of being able to select any set of answers that they felt applied to the map in addition to any three main key words. Further, an empty text field allowed them to add any other map function of this map, in respect to its political context, that in their opinion was not represented in the selection options. Respondents were again encouraged to answer all questions in a free associative manner and given the same three supporting questions as in the first questionnaire. Maps presented in the second one included three each from the Middle Ages, Renaissance and Realism and two each from the Futurism and Digital epoch. In order to obtain the best possible results from the many impressions, an attention question was asked after five and ten maps. These were directed at getting the participants out of the trance of the many choices, in order for them to not randomly click on key words, but to choose them carefully. Thereby more truthful results were anticipated. Participants had to answer questions in regard to thirteen maps.

Additionally, participants were asked to answer questions about their personal familiarity with each epoch in general and art paintings or artists of the according time. After, they could provide those associations or artist names in empty text fields. In the end, respondents were given the chance to explain how they personally benefit from maps and why they are grateful for them.

3.2.4 Evaluation

First, the questionnaires were evaluated separately and secondly, they were assessed together. At first, the individual answers of Questionnaire 1 were used to derive the map functions that were later available for selection in Questionnaire 2. Then, the questionnaires were evaluated together, according to different topics, as well as on a percentage basis.

Starting with Questionnaire 1, the first step was to determine the distribution of participants between experts and non-experts, as well as by gender, age and origin. Since the map questions were open-ended, participants could answer anything that came to their minds. This led to statements such as "create enemy image," "vivid explanation of the situation," or as simple as "amusement" (see Appendix 6, Questionnaire 1, Map 1). These were first compiled for all maps in this first survey. After that, consideration was given to how to categorize them into tangible groups. For example, "create enemy image" and other answers indicating propaganda purposes were assigned to the group, and thus function, *Propaganda*. Attention was paid to the fact that the answers of this group all intentionally lead to believing in a certain thing, adopting an opinion and, if necessary, obtaining a negative opinion towards others, in this case countries. The second group, *Information*, to which "vivid explanation of the situation" was assigned contains answers that merely describe the content of the map, but do not interpret or personalize it. "Amusement," on the other hand, was assigned to a completely different type of map function, that of *Entertainment*. Replies that aim to amuse the map user or generally distract from the potentially negative content were assigned to this category. Gradually, all answers were assigned to a map function in this manner. In the meantime, it was also counted how often different user groups gave answers that could be assigned to one or another function. Expert answers are shown in blue, non-expert answers in yellow. Male and female answers are marked with M and F, respectively. If at least one expert and one non-expert gave the same answer, it is displayed in green. Since it was possible to write several keywords or short descriptions into the answer fields, the number of actual keywords for functions does not necessarily correspond to the number of people whose answer was placed in them. This is because doubled answers were written down only once to simplify the evaluation. It should be noted that this phase of assigning and considering the function keywords was approached objectively. Entirely original assignments and word groups were created, without reference to previous map function examples as described in Chapter 2.6. Thus, it is possible that another person would have chosen different terms or even different groupings.

The first evaluation of the second questionnaire was similar and can also be found in Appendix 6 below the evaluation of Questionnaire 1. Again, the number of participants per gender, where they came from and to which age group they belonged was listed. Answers from experts are again shown in blue, those from non-experts in yellow. In addition, like in Questionnaire 1, responses made by both in green. This time,

the exact number of answers per user group was not entered here, since they were directly added up in the Excel sheet of Appendix 7. Nevertheless, it was recorded which answers could be assigned to which user group. Questionnaire 2 provided a selection of the map functions created in Questionnaire 1. In addition, the participants were given the opportunity to describe further functions if they felt that these were not represented in the selection choice. Although this was occasionally used, it was always possible to assign the responses to an existing map function. The answers to the questions about personal knowledge of the different time periods and their art history were collected in tables. In doing so, the answers were taken from the questionnaire exactly as they can also be seen in Appendix 5. This new presentation served the purpose of providing a better overview of the self-assessment and the information provided. On the last page of Appendix 6, the answers to the last questions of Questionnaire 2 were collected in a bundle. Here, they were again divided into experts and non-experts using the already familiar colors. This additional presentation also served only to provide an overview and thus simplify the evaluation.

Upon completion of this, the percentage evaluation followed, which can be viewed in Appendix 7. Different approaches were chosen, but the two questionnaires were at all times evaluated together. First, it was determined how many of the 25 maps were selected by the different user groups for the various functions. Line 2 shows, for example, that the experts were able to assign information as a function 23 out of 25 times, or that they actively selected it. For the non-experts, this was the case 25 out of 25 times (see sheet General, Table 1). Afterwards all single answers were added up (see sheet General, Table 2). The addition was then checked again and corrected (see sheet General, Table 3). Next, it was calculated how many participants there were in total and per user group, as well as per each survey. In addition, the minimum and maximum number of all responses was calculated and can be seen in the rows *Min* and *Max*. For example, the minimum number was calculated for the *Together* column as follows: $23 \times 12 \times 1 + 16 \times 13 \times 3$. The $23 \times 12 \times 1$ represents the 23 participants from Questionnaire 1 who gave at least one answer for each of the 12 maps that could be assigned to a function. The $16 \times 13 \times 3$ represents the 16 participants from Questionnaire 2 who had to select at least three functions for each of the 13 maps. This results in a minimum total answer sum of 900 answers. The maximum number for the *Together* column is calculated as follows: $23 \times 12 \times 1 + 16 \times 13 \times 5$. The first part of the equation remains the same. In the second, the last number changes from three to five because participants could select up to five functions. Thus, the total is 1316. The *Real* column refers to the actual response total given per user group. Since it always lies between the minimum and maximum number, it is thus confirmed that no serious additional errors were made. *Real minus min* and *Max minus Real* were additionally calculated to get an overview of whether user groups tended to give more or fewer answers. The closer to the minimum end, the fewer responses per participant, the closer to the maximum, the more. The *Map Types* and *Epochs* sheets were given a similar approach. Thus, the first table in *Map Types* was assigned five columns with one map type each. For each map function it was now entered how often of the five

possible, for example General Reference maps, *Propaganda* could be assigned to or was selected as a function by the different user groups. The colors are arranged the same way as in Appendix 6. The same applies to the first table in the *Epochs* sheet, except that the columns there consist of the epochs. In both sheets, the second tables contain the total numbers which are identical to those of the third table of the *General* sheet.

For the percentage calculation, however, only the third table of the *General* and the second tables of the *Map Types* and *Epochs* sheets were used. These were much more concise due to the total numbers and could therefore provide more information about the distributions. The calculations were done as follows. In the *General%* sheet of Appendix 7, the individual totals of the total responses of each function were divided by the total sum of all responses per user group. This resulted in a percentage. Proving the accuracy of this percentage, all the individual percentages of the functions in each user group ended up at 100%. A similar procedure was applied to the *MapTypes%* and *Epochs%* sheets. In both cases the percentages were calculated the same. However, the individual map types or epochs were still required to be added together. In the end, those shares all amount to 100% as well.

Moreover, the last two questions of the second questionnaire were evaluated separately for experts and non-experts. The questions were *Do you personally benefit from maps?* and *Are you grateful that maps exist?* For this purpose, two lists were created, which are again marked in the colors blue, for experts, and yellow, for non-experts, and do not contain any further structure. The purpose of these questions was to determine how different user groups perceive maps and how they themselves benefit from them, described in their own words, rather than from people who create maps.

4 Results

This chapter first illustrates the results of the literature review in terms of political circumstances and the influence on maps of the five time periods studied. Then, the results of the two user questionnaires are presented in detail. This includes the map functions found, in respect to their political context, as well as the differentiation of these according to user groups. In addition, it is explained which functions are most prominent in which type of map and in which epoch.

4.1 Cartography throughout Epochs

In order to follow the research objectives, it is necessary to consider the political situation and the extent to which it influenced the content of maps. For this purpose, the map examples from Appendix 1 are considered. These were briefly explained in the previous chapter 3.1.2. The following subsections apply the findings of segments 2.4.1 to 2.4.5.

4.1.1 Maps in the Middle Ages

The maps of the Middle Ages, do not at first glance seem to be entirely consistent with the political sense of time, as described in chapter 2.4.1. Instead of battles and war, an overview of greater territory is found in all five categories. What is present, however, is the representation of rank. In the topographical map, it appears to be the gods watching over the inhabitants of the earth. This type of content is also found in the thematic political map. If you look very closely, in the lower left corner there are Adam and Eve in the Garden of Eden depicted in a circle. The earth is also shown within a circle in the center of the map. So it could be inferred that the Garden of Eden and the known world are either one, or the latter is an image of the former. The thematic city map shows three nobles and a knight in the foreground, as well as coats of arms in the upper left and right corners. The rest, the city, the fields, the ships, are all drawn smaller. Accordingly, one could conclude that the nobility is to be depicted here as the head of the illustrated empire. Moreover, the principle of propaganda could also be the reason for not depicting a bad image of the surroundings. Viewers should believe that everything is good and that they are protected by the upper powers. Therefore, they should not worry about war or other negative things. Thus, the maps could very well serve as a manipulation tool to instill an appreciation in people or to make them believe in something that doesn't even exist. In contrast, the General Reference map seems to merely represent knowledge about the environment. Likewise, the

Navigational map is probably designed more for the same purpose. Logically, a nautical map showing terrestrial wars does not match its reason for creation.

4.1.2 Maps in the Renaissance

The General Reference, Navigational and Topographic maps of the Renaissance seem to reflect the political state of their time. Thus, all three types depict ships exploring the world. In doing so, they discover both dangers and new areas of the globe that may be perceived as idyllic or reserved. In addition, the spirit of conquest shows itself, indicating exactly who rules where. The latter is most evident in the Topographic map, as the small island in the middle of the ocean is directly claimed and also populated by the nation that discovered it. The Thematic Political map also gives indications of this, although here the simple information of a history of occupation could also be in the emphasis. Because in the Renaissance, as described in chapter 2.4.2, fights took place primarily due to religious revolutions and the secession from Rome, this could also be represented here. The Roman fighters on the outside, with definite superior numbers, have surrounded the village or small town and intend to capture it. The Thematic City map, on the other hand, features a large coat of arms in the upper right corner, which stands out prominently in contrast to the other parts of the map. Here, just like in the Middle Ages, the class distinction can be recognized. The castle in the lower left part within the city walls seems to stand on a hill. Surrounded by gardens and trees, there is also direct access to the green meadow behind the city walls, as well as the river. All other houses are smaller and compressed, as well as deprived of nature. Thus, a difference in rank is noticeable. In addition, it is noteworthy on this map made of Chester that a legend adorns the lower right corner. The small letters are found between the houses of the city ring and probably describe the most important places. Although this kind of information was not found in the political literature research, it shows the progress of illustration that has taken place since medieval times.

4.1.3 Maps in the Realism

The different maps of the Realism epoch reflect varying parts of the political ideology as described in chapter 2.4.3. On the one hand, the General Reference map again places an increased emphasis on exploration. This can be identified by the additional illustrations. Moreover, the coherence of the different continents is shown in color. In the Navigational map, too, the focus is on exploration. Hence, the different landing options of the Auckland harbor, New Zealand, are illustrated in great detail. The Topographic map, unlike what was written in chapter 2.5, does not contain any symbols like houses or the like. Nevertheless, the colors are very concise, allowing differences in elevation to be easily identified, especially when including the legend.

Particularly the Thematic Political map reflects the spirit of conquest of the time. The depiction of the territories captured or occupied by Great Britain are color-coded. In addition, the white man is depicted in clearly more ostentatious clothing than the people with dissimilar skin color. Moreover, the latter are drawn in subordinate, rather servant, positions. Together with the garlands at the top, this map probably represents rather a glorification of colonialism. The true atrocities are concealed or overplayed. The most important thing is to show the British Empire as influential, important and powerful. This kind of nationalism can also be glimpsed in the Thematic City map of Berlin. Although this one also shows elements of amusement of the map reader, the glorification of the capital of the German Empire is in the spotlight as well. No bad elements can be found in this city, only good ones, and there is no need to go anywhere else as life is perfectly fine where one lives.

4.1.4 Maps in the Futurism

Surprisingly, maps of the Futurism epoch do not seem to incorporate the political happening of the world too much. In contrast to what is described in chapter 2.4.4, the maps appear almost peaceful and sterile. Only the Thematic Political map shows a cartoon whose content can be clearly assigned to either propaganda or entertainment. The apparently different positions of the countries of Europe in the First World War are depicted. It is important to note, however, that this is done from the point of view of a native of these countries. It is thus accordingly an influenced representation of perception. It is of course questionable to what extent wars could be represented in the other types of maps. Nevertheless, it has been shown in the examination of the previous epochs that especially through additional pictorial illustrations or certain coloring, a political image can certainly be created.

4.1.5 Maps in the Contemporary Age

Twenty-first century maps reflect the political spirit described in 2.4.5 very well. This is the case simply because of the digitization and accessibility of all types on the World Wide Web. There are maps whose layers can be set to one's personal liking, there is information and insight into sometimes distant cities and information for hiking vacations. Even the Thematic Political map seems to operate without any obvious influence on the reader. Only the true stories of families affected by the Holocaust are presented, but no evaluation is made. At the same time, this is the only map that is not available in English, making it potentially inaccessible to the majority of the world's population. It is therefore the least consistent with the principle of uniformity or accessibility by and for all.

4.2 Evaluation User Questionnaires

In this subchapter, the two user questionnaires are evaluated. First, a series of map functions, in respect to their political context, is derived from the first one. Afterwards, the user groups are analyzed to see if they show preferences for specific ones. More specific, they are divided between male, female, experts, non-experts, male experts, female experts, male non-experts, and female non-experts. The same is done for the different map types and epochs, with differentiation between either General Reference, Topographic, Navigational, Thematic Political, and Thematic City. As well as the Middle Ages, Renaissance, Realism, Futurism and Contemporary. Last but not least, it is examined to what extent map users were able to correctly identify the political trends of an epoch from the according maps. All results for subsections 4.2.2 to 4.2.4 can be reviewed in Appendix 7, those for 4.2.5 in Appendix 6.

4.2.1 Concluded Functions

As already described in Chapter 3.2.4, the map functions of the second questionnaire were derived from the answers of the participants of the first questionnaire. This will now be discussed in more detail. The divisions are always based on subjective judgment.

All extracted map functions, in respect to their political context, can be sorted into one of two categories. Either in Top-Down or in Bottom-Up. The former indicates that a certain function is "imposed" on the map reader by the creator and/or a higher authority. Whereas the latter implies that users interpret certain functions based on their personal circumstances. An according graph is visualized in Fig. 10 and is named *Top-Down vs. Bottom-Up Typology of Map Functions*.

Following the Top-Down arrows, three umbrella terms can be found. These are Evaluation, Imposition and Distracting. Evaluation functions further consist of Information and Generalization. What is presented has been evaluated by the map creator and then presented in the most informative way possible, so that a potential user understands the message. The degree of generalization of the map content was also evaluated in advance by the creator. Therefore, the first things a user potentially notices are all things that have been previously assessed by the creator/or other involving parties. Imposition includes Strategy, Ideology, War, Economy, and Government. It is highly probable that the map maker has already been required to include these functions by a superior or a client. Strategy, for example, can be fulfilled by depicting strategic military moves that resulted in the victory of a battle. The same is true for War. In the Thematic Political map of 1914, it is simply shown that a War going on. Ideology, War and Economy are things that are forced upon individuals unless they are in a federal government and making these decisions. They're things that nobody has any real control over. For example, the ideology of the government can be conservative. They entered a war. They have set the regulations for the economy. However, it

is possible to resist these forces and, for example, join another party, trade on the black market, or flee the war zone if possible. Government, the last subgroup, includes functions that cannot be escaped. For instance, a response from the first survey, about the function of OpenData, led to this one. OpenData is mostly introduced by federal governments to provide access to freely available and cost-free data for citizens (Bundesministerium des Innern, für Bau und Heimat, 2021). OpenData cannot be resisted, it cannot be slowed down or stopped. It just happens. The last subtype of Top-Down functions consists of Distracting ones. Propaganda can thus serve as a tool to adapt the view of a map reader to that of the client or creator. Yet, the fact that it works is not necessarily a given. Manipulation is similar, but involves actually changing the user's mindset to what the client or creator intends. Entertainment can potentially distract from the downsides of certain things. For example, the Thematic Political map from the Futurism epoch was received as entertaining by some questionnaire participants. The reason for this is the cartoonish illustration. Advertisement can also be distracting. The Thematic City map from the Realism time period depicts Berlin as the perfect city for all kinds of leisure activities and, above all, peaceful and joyful. In previous chapters of this thesis, it became evident that at the time of its creation, around 1871, Europe was not a peaceful place. Thus, it represents a distracting function of the citizens from the dark sides of the conflicts prevailing at the time and instead expresses how great life is.

Bottom-Up map functions consist of Evaluation, Personal, Particularity, and Feelings. In terms of Evaluation, in this case it is the Navigation and Travel functions. It is at the discretion of the map reader which route to take or whether to travel to a location or not. This cannot be definitively determined by the map creator. Personal Functions such as Religion and Self-Expression depend very much on the background of a map user. Thus, their interpretation can be rather diverse. If one is a member of a religion, the display of religious symbols can be perceived as positive. If one belongs to another or none at all, also potentially negatively. When or what can be considered Self-Expression is also different from one person to another. Therefore, pure symbolism, such as the depiction of ships on the Topographic map from the Renaissance, as well as the writing at the top of the Thematic Political map of Realism can be indicators to different individuals. Likewise, the same applies to the Particularity group. Just because some users see Art as a function in a map does not mean everyone does. People have different opinions, different perspectives, different backgrounds. It would be strange if everyone agreed on everything. Especially Interactivity is something that is concise in the maps of this century. Since this function is not available in the maps of the previous eras, it is something special. It is something that makes the current ones stand out from the previous ones. Nevertheless, this is again not the opinion of all questionnaire participants. Some, interestingly, chose interactivity as a feature even on older maps, even though they cannot be modified. Nevertheless, the users interacted with them and reflected upon them. This seems to also be a form of interactivity for some. Feelings also differ from person to person. Looking at a Navigational map gives some the impression of courage, perhaps to try a new route. Others gain a sense

of Justice through the mapping of true family stories of the Holocaust, as the stories of those affected have finally been sufficiently told and will not be forgotten. Others experience Choice by being able to design an interactive map according to their own wishes. Safety can be felt by having maritime dangers mapped in a Navigational map, or by knowing that a Topographic map displays all possible hiking trails so that people can always know or find their own location. The emotion Function includes everything from sadness, to joy or anger that can be felt after looking at a map. Ease, on the other hand, is the feeling of lightness of using something. This can be the case both with the interactive maps of the 21st century, as it is easy and intuitive to use them. On the other hand, it may also be the case with the Thematic City map of Futurism, as there the ease of life can be interpreted.

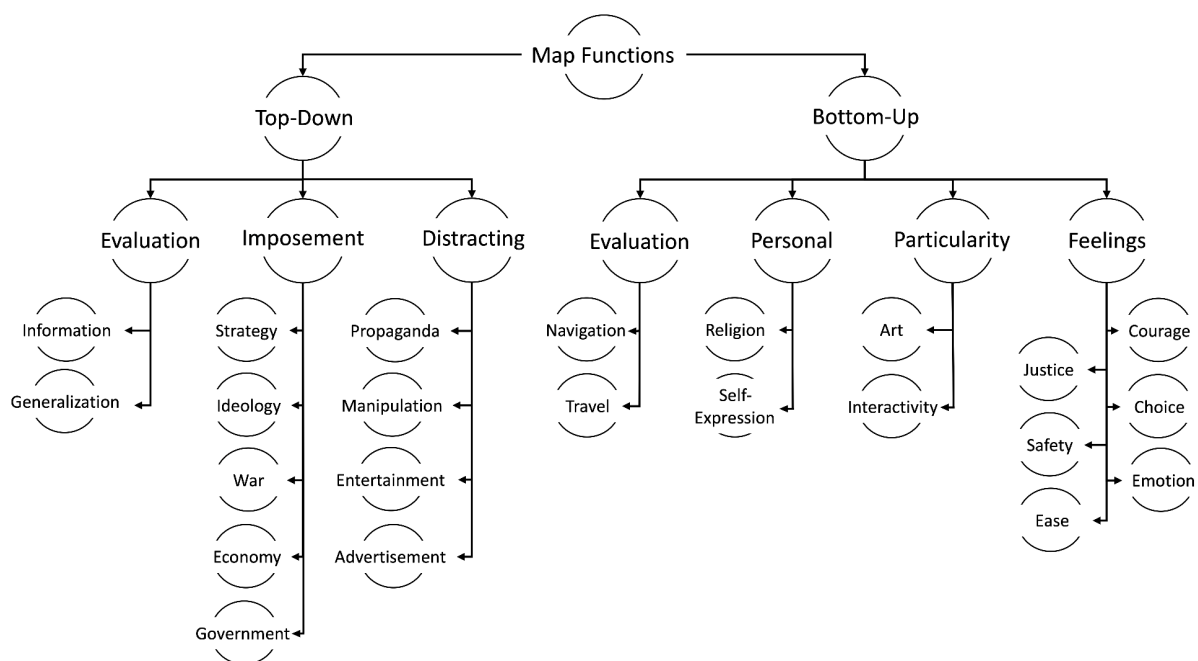


Fig. 10: Extracted Map Functions from Questionnaire 1: Top-Down vs. Bottom-Up Typology of Map Functions. Image by the author.

4.2.2 Function Choices of different User Groups

Of all 39 participants in the two questionnaires, 90.1% described or selected information. This is therefore the most frequently specified map function. Navigation follows in second place with 50.1% and Government in third with 36.4%. All other subdivided user groups, meaning male, female, experts, non-experts, male experts, female experts, male non-experts and female non-experts have also specified these three functions most frequently. The order also remains the same. The three least frequently considered functions for all user groups across all groups are Courage at 1.3%, Choice at 2.1%, and Ease at 2.4%. The male group, with 20 responses, has dissenting map functions at the bottom three with 0.4% Choice, 0.7% Ease, and Justice

at 1.4%. Courage is the only function that was not perceived by any male participants. Of the women, 1.3% described Courage, 1.7% both Ease and Choice, and 2% Justice as a map function, respectively selected in the second questionnaire. The largest percentage difference between these two user groups is found in the navigation function. This was perceived by men just about seven percentage points times more with 28,5%. The smallest difference is found in Generalization. This was used by women 0.2 percentage points times more with 5,2%.

Between experts and non-experts, only very minor differences can be found. While Courage occupies the last place for both with 0.5%, it is shared with Choice for non-experts. This latter and Ease share the second last place among experts, while Manipulation is in third last place. For non-experts, these places are occupied by Ease and Justice. In general, there is only one map function where there is a difference of more than one percentage point between these two user groups, which is Government. Experts considered this around 2.9 percentage points more.

Male experts perceived the functions Ease and Choice in only 0.4% of all cases. Manipulation and Justice in 0.8% and Safety, Emotion and Advertisement in 1.7% each. Courage was not selected by any male experts. Female Experts, on the other hand, Manipulation, Ease, Choice, and Courage at about 0.9%, Emotion at 1%, and Justice at 1.6%. For these two user groups, roughly half of the map functions differ by less or more than one percentage point. The greatest difference is in Navigation. Here, the male experts are ahead with 4.1 percentage points at 14,8%.

Male and female non-experts, on the other hand, differ slightly more. The third last place among the former is occupied by Ease with 0.3%, the second last by Justice with 0.6% and the third last by Advertisement with 0.9%. Among the female non-experts, Courage and Justice are in last place with 0.4%, Emotion, Manipulation, Ease, and Choice are in second last with 0.8%, and Generalization, Entertainment, and Advertisement are in third last place with 1.5%. It is again striking that only male non-experts did not perceive two card functions. These are Choice and Courage. The largest percentage point difference between these two user groups is again in Navigation with 2.9 percentage points, with male non-experts being slightly ahead at 7,1%.

4.2.3 Functions and Map Types

Information was most frequently perceived as a map function in the General Reference maps with 23.4%. The Thematic Political maps were the least popular, with only 15.1%. Therefore, the occurrence is relatively homogeneously distributed. For Government, the difference is clearly higher. At around 35%, the percentage of votes for Thematic City maps is at least 13.5 percentage points higher than for the other map types. Thematic Political maps bring up the rear with a share of 6.8%. With regard to the Navigation function, this map type again brings up the rear with again 6.8%. Here, the Navigational map is at least 13.6 percentage points ahead of the others, with

34.7%. Ideology is again fairly equal split, with a maximum of 25% from Thematic Political maps, compared to 14.3% for the Navigational ones. This represents just over a 10 percentage point difference. Economy, on the other hand, again hides wider margins. General Reference maps receive only 8.8% proportionally across all five map types. Navigational maps, on the other hand, 36.8%. The other three types are in between in ten percentage point increments. For Art, the focus is on the Thematic City maps, with a share of 31%. Navigational ones bring up the rear with 8.6%. With the Strategy function, the Thematic City maps are in the lead with 33.3%. The rest is evenly distributed between 14 and 20%, with Topographic maps having the least. Travel finds most agreement with the General Reference maps with 35.3%. Lowest with the Thematic City ones with 8.8%. The Thematic Political maps also bring up the rear here with 11.8%. Self-Expression also has an uneven distribution. General Reference and Navigational maps make up the bottom section with 3.1% and 6.3%, while Thematic City and Topographic ones are well above with 31.3% and 34.5%. A noticeable difference can be seen in the Safety map function. There, the share of Topographic maps is 63.9%. This function is least often assigned to Thematic Political maps with 2.8%. The other types are also all below 20%. Propaganda is most frequently found in the Thematic Political map type with 58.6%, and least frequently in the Navigational ones with only 3.5%. The others range homogeneously between twelve and 14%. Generalization peaks with 25% in the General Reference maps, with 6.3% in Thematic Political ones at the lowest. Entertainment is most prevalent in Thematic City maps with 36.4%, and least in those for Navigation with 4.6%. For Emotion, the two Thematic types share first place with 29.4% each. The Navigational category brings up the rear with 0%. The War Function distribution is again somewhat more homogeneous, with a maximum of 28.1% for the two Thematic maps and a minimum of 12.5% for Topographic ones. Religion, on the other hand, is again very heterogeneously distributed. Topographic and Thematic Political maps lead with 37.5% and 40% respectively, while General Reference and Navigational types bring up the rear with 5% and 2.5%. Thematic City maps are somewhat below the middle with 15%. In the case of Manipulation, however, the latter forms the upper edge with 35.7%, Navigational the lower with 0%. For interactivity, the general reference maps are clearly ahead with a share of 33.3%. Thematic City maps bring up the rear with 6.1%. The second most heterogeneous function is Advertisement. Thematic City maps have the largest share of 72.2%, while the General Reference type has the smallest share of 0%. Only two map types are eligible for Ease. General Reference and Thematic city type with 57.1% and 42.9% respectively. For the remaining three, this map function could not be determined. The situation is similar for Ease. Here, the General Reference type is ahead of the Navigational one with 66.7% and 33.3% respectively. Again, this function could not be found in the evaluation for the remaining three types. This is also the case for Courage. Again it is the General Reference with 33.3% and Navigational maps with 66.7% where this function was perceived by the questionnaire participants. With 100% of all shares for Thematic Political maps, Justice represents the most heterogeneous map function of this research in terms of map types.

4.2.4 Functions and Epochs

Information as a map function was mostly assigned to the present digital age with a share of 25.7% by the participants of the two questionnaires. This function occurs least in maps of the Middle Ages with 15.9%. Government is mostly found in the Renaissance with 26.2%, least in the Middle Ages with 13.6%. On the other hand, the last with 25.9% is the leader for the navigation function. Here, the Renaissance is the taillight with 14.3%. For Ideology, the percentages diverge a bit more. While it was assigned this function 32.1% of the time in the Middle Ages, Futurism was only assigned it 1.8% of the time. Economy is most represented in Realism with 29.4% and least in Renaissance with 11.8%. Art is much more heterogeneous. While this function was assigned to the maps of the Middle Ages with a 43.1% share, it is only the case for 1.7% in the digital era. For Strategy, Renaissance is at the top with 38.1%, and Contemporary again brings up the rear with 7.1%. Travel appears more homogeneous again. With a 25% share, this function occurs most frequently in Realism, least frequently in Futurism with 14.7%. Self-Expression, with 40.6%, was mostly assigned to Renaissance by the participants. In contrast, only 3.1% of the cases were assigned to Futurism. Safety is also most common in Renaissance with 30.6%, and least common in medieval times with 11.1%. Propaganda is again most frequent in the Renaissance with 38% and not at all in the Digital Era. Generalization presents itself more homogeneously. 28.1% share in Futurism compares to the lowest of 12.5% in the Middle Ages. Entertainment is found in 26.4% of all cases in the maps of Realism and only to 4.6% in the present age. For Emotion, the Renaissance takes the lead again with 29.4%, while Futurism takes the rear with 5.9%. The War function is even more heterogeneous. While it is found 50% of the time in the Renaissance, this is only the case for 3.1% in the digital era. Religion is even more strongly affected. With 77.5%, this function is clearly most strongly represented in the Middle Ages. The participants of the questionnaire did not assign it to the futuristic and digital eras. Manipulation occurs most in Realism with 50% and again not in the Futurism or Digital eras. Interactivity is found with 75.8% in the current age, and not at all in the maps of the Middle Ages. Advertisement is most represented in Realism with 44.4% share, and least in Futurism and Digital eras with 5.5%. Ease represents the top in the latter with 42.9%, and the bottom in Medievalism with 0%. Choice is only represented with 83.3% in the present era and with 16.7% in Realism. Courage was also assigned to only two eras by the questionnaire participants. This is Renaissance with 66.7% and Futurism with 33.3%. Justice has the most heterogeneous distribution with 90% share in the digital era and 10% in Realism.

4.2.5 Identifying Political Trends

Of the 16 participants of the second questionnaire, six indicated that they strongly disagree with the statement *I am familiar with the Middle Ages Epoch (ca. 500-1500*

AD). One reported disagreeing, eight are neutral to this, and one agreed. Nevertheless, those who were very negative to neutral about their knowledge gave many responses about their associations with this time period. Statements such as "beginning of a new era," "religious and easily manipulated, or "major population under protection and government of church installed and empowered leaders" are consistent with the findings as in paragraph 2.4.1.

For the Renaissance, the self-assessment looks a little more positive. Eight strongly disagree with the statement *I am familiar with the Renaissance Epoch (ca. 1400-1700 AD)*. Two disagree, two are neutral, and six agree. Again, a majority of the associations of the epoch agree with those in paragraph 2.4.2. For instance, descriptions include items such as "Kings/Nobility," "Invention of letterpress printing, capitalism," and "Architecture & Agriculture development."

The next statement *I am familiar with the Realism Epoch (ca. 1848-1890)* was marked *strongly disagree* by five people. Another five disagree, four are neutral, and two agree. The associations with this period are consistent with the findings in paragraph 2.4.3. Examples include "invasion," "industrialization" and "imperialism."

In the Futurism seven participants of the second questionnaire answer the statement *I am familiar with the Futurism Epoch (ca. 1909-1944)* with *strongly disagree*. Four disagree, two are neutral, two agree and one strongly agrees. Associations like "Modernization processes, war, relation to the past", "Justification of a new culture", and "World wars" also cover the findings as described in chapter 2.4.4.

For the digital age, the statement *I am familiar with the Futurism Epoch (21st century)* is rated *strongly disagree* by two participants. Two disagree, one is neutral, eight agree and three strongly agree. Exemplary associations are "information distribute fast worldwide", "Internet revolution" and "technological progress, coalition between governments" are also congruent with the findings from section 2.4.5.

4.2.6 Gratitude for Maps

Non-experts benefit from maps mostly in the context of navigation and localization. Especially in unknown areas they help them a lot to find their way around. In addition, they are grateful for the fact that one can organize better, especially when traveling. In addition, they enable life as it is known today, for example in the trade sector. Products from other countries would not be able to reach different destinations if there were no maps to guide the way.

Experts benefit from maps in other ways. They work with them and enjoy learning new things using them. For example, about different time periods and how people lived back then. Moreover, maps bring them a feeling of happiness. On the one hand to express themselves creatively, on the other hand to help other people with them. Furthermore, experts are grateful that maps exist, as they believe they are an important part of our environment and development. For example, one participant

wrote "Maps are the result of our need to understand and organize our world, they have evolved with our society adapting to its needs in every epoch".

5 Discussion

This chapter first considers matters that may be interpreted differently depending on the individual. Afterwards, biases and shortcomings of this master thesis are presented, and alternative solutions are suggested. Additionally, the Research Objectives and Questions of this thesis are discussed. Furthermore, the found map function typology is compared to relevant literature by discussing the different approaches.

5.1 Used Map Types

From the very start of the thinking process for this thesis, it was almost immediately apparent which types of maps would be included: General Reference, Topographic, Navigational and Thematic Political/City. They were supposed to be ones that were represented in all five epochs to the best of their ability. Still, distinguishing between the chosen ones is not always easy. What makes a Thematic Political map political in the first place? How is it different from a General Reference map, if both include additional illustrations? Most importantly, where does one draw the line between types, particularly in today's digital age? Especially when there is a zoom function and maps can be customized. The first question can be answered in such a way that a map is assigned to either the General Reference or Thematic Political type, depending on whether the additional illustrations seem to be fundamentally only informative and educational or have a political character themselves. For example, the General Reference and Thematic Political maps of the Realism epoch both essentially show an overview of the world's continents. The former, however, augments what is where with explanatory boundaries and illustrations, presumably so that map users can visualize the specific regions. In contrast, the latter clearly shows the territorial power of Great Britain with illustrations that are presumably intended to highlight class differences and the country's own power. Regarding the digital interactive maps of today, primary emphasis was focused on. The General Reference map shows the whole world in one overview. You can zoom in, but no layers hidden at smaller scales appear. There is only the hover effect, which shows the names of the countries. In the Navigational map the ports are in the foreground. At a smaller scale also the seemingly shortest routes between them appear. In the Topographic map, the specific characteristics are as described in Section 2.5. The Thematic Political map clearly deals with the political issue of the persecution of Jews during the Second World War and the Thematic City map is limited to the Helsinki region with the zoom level.

5.2 Biases

All of the different maps, 25 in total, were presented to the participants of the two user questionnaires. In the first twelve and in the second thirteen. As already mentioned in chapter 1.1, perception of happenings are based on individual contexts. Thus, people who live at the same time but may have grown up on different continents have different perceptions of events. Even if you grew up in the same country, but one person in the countryside and one in a big city, perceptions can be different. Accordingly, it must be taken into account that the participants of the questionnaires viewed or perceived the maps from different perspectives. Since much more participants with a European background took part, it is quite possible that the results have a bias due to this. In addition, there is another. Given that the questions of the first questionnaire were allowed and encouraged to be answered freely and intuitively in open text, they had to be sorted and grouped afterwards. This was done subjectively according to my understanding and conception of the answers. Accordingly, it is conceivable that another person would not be able to comprehend or would reject a line of reasoning for the arrangement. In addition, the comparison of the map contents with regard to the political situation of the time of creation and possibly overlaps of these is also subjectively evaluated. Those findings are only speculation. It is impossible to know exactly for what purposes or from what incident the maps were created. It may also be that the here listed interpretations are completely out of place. Still, unfortunately, there is no way to ask people from past eras if the interpretations are correct, let alone ask them to put the political situation in writing. On what it is necessary to rely, are the transferences, which were reviewed by, for example, historians. There, too, biases may have developed. Depending on whether someone was for or against an action, and accordingly may have chosen to downplay events or portray them as more horrific than they actually were. It is also possible that the sources used in chapters 2.4.1 to 2.4.5 omitted events that did not fit their research, but were nevertheless important events in history.

Nevertheless, I strongly believe that especially the political zeitgeist of the studied epochs are at least roughly reflected in all maps. This is demonstrated by the fact that, despite all the existing biases, overlaps of the political context and the maps created in the same artistic period can clearly be identified. For example, the presence of colonization or the representation of class distinctions established at the time.

5.3 Shortcomings

But, apart from the two biases, other problems of the user questionnaires also occurred. Sometimes there were spelling mistakes in the text response fields. As a result, the intentions of these answers were not clearly identifiable. In addition, one participant had proven difficulty recognizing political context in two maps. Even

though this was only stated twice, it cannot be ruled out that several participants felt this way. Possibly some answers were therefore rather forced, in order to be able to write down something at all. This is understandable, since most maps did not put political purposes into the foreground. Nevertheless, this was the intention and purpose of the study. To find out whether political functions can be recognized, although the map does not indicate it explicitly. For this reason, supporting questions were included with each map to facilitate responses. Nevertheless, it may be that the question about political context was too challenging for some participants for introductory work in this field. Presumably, a general question about potential map functions would have been better, without the additional requirement that they have to be political.

Additionally, not all of the hoped-for initial goals of this master's thesis could be achieved with the help of the questionnaires. It was planned to analyze map functions in respect to their political context not only by gender and expert status, but also by continental origin and age. Since there were only 39 participants in total, 33 of whom were from Europe and 35 of whom were between 20 and 40 years old, the other groups were comparatively unrepresentative. However, under different circumstances, the age analysis, in particular, could have succeeded. Two approaches are suggested. On the one hand, instead of four groups with ranges of 20 years, there could have been several smaller ones, such as those with ranges of five to ten years. On the other hand, it would have been possible to determine the age ranges after the end of the questionnaires. With this approach, the age could have been asked in them and divided into groups of approximately the same size during the evaluation process. This would have depended on how many participants took part of each age group. Certainly, it would have been easiest if there had been more participation for the user questionnaires. It was already assumed at the beginning of the study that there would not be too many, because the topic around Map Functions is very theoretical and perhaps everyone has enough interest in it. In addition, the division into two questionnaires with the approach of this research was necessary, but could also have been a reason for lack of participation. Although it would have been possible to take functions from the literature and distribute only one questionnaire, the idea was to explicitly create a new typology. This can only be done by looking at data from real users and drawing one's own conclusions. Not if one merely repeats the findings of other theorists. Furthermore, both questionnaires were quite time consuming for participants. In the first one, they had to think a lot and put their thoughts into their own words. During the second, they were able to choose between words for the map functions, but then still had to answer questions about their knowledge of the five eras studied and the according art. Plus, how they personally benefit from maps and why they are grateful for them. A questionnaire creator is more involved in the topic and thus everything seems logical. It is easy to forget that too many questions or too many impressions can quickly overwhelm participants. Due to the cookie settings, it also turned out that in the second questionnaire three people started it, but did not submit it. Perhaps because it seemed too long and overwhelming. Secondly, a test

questionnaire was conducted before the first one with five participants and it would probably have been appropriate to do this again for the second one. Consequently, for later research, it is essential to pay attention to the length of the questionnaires and to try to find even more suitable participants interested in the topic and, if necessary, to remind them more often to partake.

Further, it was assumed at the beginning of the thesis semester, that there would be enough time to compare at least exemplarily characteristic contents of art paintings with those of maps from the same time period. This was also the fundamental thought for dividing the eras primarily according to epochs where art was very different from one another (Britannica, T. Editors of Encyclopaedia, 2023b; Britannica, T. Editors of Encyclopaedia, 2023c). Unfortunately, due to lack of resources and the length requirement for this thesis, this was not feasible. A literature search was started. However, when beginning to compile the findings, it became apparent that the explanations and examples of art paintings would require considerably too much additional space. Therefore, this time, the focus was placed on the political context, its recognizability in the maps and the resulting functions. The decision was made that it was better to leave out one section instead of only being able to slightly address all. It seemed more reasonable to discuss the included parts in depth.

5.4 Research Objectives and Questions

R01 with the associated questions of RQ1 are able to be answered. All maps contain aspects that fit the political circumstances of their time. It is most apparent in some of them, especially the Thematic Political type. Moreover, it was possible for the participants of the questionnaires to reflect the political feeling on the basis of the maps shown. Of course, one could also argue that they are simply well acquainted with the different eras. However, this can mostly be refuted. Before the possibility to reflect associations to an epoch, they were asked with the help of a Likert scale how they themselves assess their knowledge about the time periods. Five levels were selectable: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. For the Middle Ages, only one person entered a positive self-assessment. Most, on the other hand, did so for the lowest and middle ranges. Associations from both experts and non-experts were also diligently added there. These associations coincide with the map contents and thus with the political sense of time. In the Renaissance, too, only four participants in the second questionnaire entered a positive self-assessment. Although most of the associations were entered by these individuals, matching ones were also found in other Likert scale levels. Accordingly, the question, if maps users are able to correctly identify the political trends of an epoch from them, can again be answered in the positive. Just because some are well informed about the Renaissance and write more about it does not mean that the others could not get a sense of the political events based on the maps. For the Realism era, two questionnaire

participants indicated a positive self-assessment regarding their knowledge. Here, the argument that was also made for the Renaissance applies again. In addition, in this case more associations were made in the negative ranges. Surprisingly, for the Futurism era, only two people stated that they were well acquainted with it, one very well. Especially since, at least in Germany, it is mandatory in the framework curricula of schools to deal with this period (Ministerium für Schule und Weiterbildung des Landes Nordrhein-Westfalen, 2011). Accordingly, it can be assumed that at least in the European countries, many of which were involved in the World Wars (Landeszentrale für politische Bildung Baden-Württemberg, 2022a; Landeszentrale für politische Bildung Baden-Württemberg, 2022b), this part of history is taught extensively in schools. Thirteen of the sixteen participants in the second questionnaire were from Europe. The question is why they did not give a more positive self-assessment. To seek an answer to this would be very speculative. Therefore, a suggestion for the future would be to ask in Likert scale questions why participants assess themselves in this way and not in a different way or how they have come into contact with an era so far. One could also think that the self-assessments turned out to be so negative because perhaps not all of them could relate to the term "Futurism". Nonetheless, this can be refuted, since the dates of the epochs were always included in the questions. In spite of all this, a tendency towards a positive answer to RQ1.2 can be seen. The majority of the described associations can be found in chapter 2.4.4 and also in the maps of Futurism. Only the Digital Today epoch of the 21st century sees more positive self-assessments, than negative ones. Eight participants state that they are well acquainted with today's era, three even very well. This is probably due to the fact that we live in this present time. Nevertheless, even in the negative self-assessments, the image of the political feeling described in chapter 2.4.5 can be recognized, and accordingly in the maps. It can be concluded that in all epochs, intentionally or unintentionally, the political events of their time are depicted in the associated maps. This to such an extent that people who are not familiar with the eras nevertheless are able to establish the right associations with them. Thus, this is the evidence that presumably every map in existence has a political context.

RO2 with the questions of RQ2 can also be answered. All map functions found can be reviewed in Fig. 10. They are divided into two main groups: Top-Down and Bottom-Up. Between the eight identified user groups, there are not many differences in terms of map functions in relation to their political context. The biggest percentage point jump is between the male and female groups. Here, there is a difference of just under seven percentage points between them, with the male group selecting or describing the Navigation function slightly more frequently with 28.5%. In relation to all functions, there is a percentage point difference of 1.7 between males and females, and 0.0 between experts and non-experts. Male and female experts differ by 0.95 and male and female non-experts by 0.75 percentage points. It can be concluded that experts and non-experts are not at all dissimilar in their opinions about map functions and that the biggest difference is to be found between the genders. While male respondents tended to distribute functions such as Information, Government,

Navigation, and Ideology more frequently, women were more likely to perceive Art, Travel, Self-Expression, and Courage. Accordingly, men tend to assign more Top-Down and women Bottom-Up functions in maps. Joel (2011) disagrees, in fact, that men's and women's brains are intrinsically very different. Instead, the author says it's more a combination of things from environmental factors, predisposition, development, and experiences one encounters over the course of a lifetime. Still, he brings up many studies that seem to find differences in brains between these two genders. With the results found in this thesis, Joel's thesis is only partially refuted. It is true that the preferences of men and women may be due to life experiences and differences in nature. However, it should not be excluded that the differences are also caused by different brain structures. However, it is not the intention of this research to investigate this neurological topic.

Likewise, differences between map functions can be recognized between the various eras. While Navigation, Religion, Ideology, and Art are most prominent in the Middle Ages, Propaganda, Government, Emotion, Strategy, Self-Expression, Safety, Courage, and War are most significant in the Renaissance. For Realism, Entertainment, Travel, Advertisement, Economy, Manipulation, and Generalization were proportionally recognized, and for the present age Information, Choice, Interactivity, Ease, and Justice. In Futurism, none of the map functions is most concise (Tab. 1). Information, Government, Interactivity, Ease, Safety, Generalization, Choice, Justice, and Courage occur least in the Middle Ages. In the Renaissance Navigation, Economy, Choice, and Justice and in Realism Courage. For Futurism, Emotion, Travel, Ideology, Religion, Self-Expression, Advertisement, Manipulation, Choice, and Justice are least concise, and for the present, Propaganda, Entertainment, Strategy, Religion, War, Advertisement, Manipulation, Art, and Courage (Tab. 2). Duplications occur when a function is represented equally often in percentage terms in at least two epochs. With respect to chapters 2.4.1 through 2.4.5 and the associated answers of the second questionnaire, some functions are not necessarily most associated with the time period or periods that one might first associate with them. Thus, all but Navigation make sense for the Middle Ages. Of course, navigation was needed in those times as well, but this was not the main focus according to the sources, unlike the Renaissance with Columbus' voyages of discovery and Realism, where much colonization took place. Although Religion can be assigned to the Middle Ages, it would also have been appropriate in the Renaissance due to the Church Reformation around Luther. The functions most proportionately assigned to Realism fit very well. As described before, during times of war it would not be out of place to distract the population from the bad and let them focus on the positive things in life. Even if the map functions mainly fit the assigned eras, it is still surprising why proportionally not for example Propaganda, War or Strategy were assigned to Futurism. After all, this epoch includes the two world wars. For the Digital Age, the functions seem to fit well again. An image of freedom, information and simplicity appears.

Middle Ages	Renaissance	Realism	Futurism	Digital
Navigation	Propaganda	Entertainment		Information
Religion	Government	Travel		Choice
Ideology	Emotion	Advertisement		Interactivity
Art	Strategy	Economy		Ease
	Self-Expression	Manipulation		Justice
	Safety	Generalization		
	Courage			
	War			

Tab. 1: Map functions assigned to the epochs in which they have the largest percentage share in relation to all epochs.

Middle Ages	Renaissance	Realism	Futurism	Digital
Information	Navigation	Courage	Emotion	Propaganda
Government	Economy		Travel	Entertainment
Interactivity	Choice		Ideology	Strategy
Ease	Justice		Religion	Religion
Safety			Self-Expression	War
Generalization			Advertisement	Advertisement
Choice			Manipulation	Manipulation
Justice			Choice	Art
Courage			Justice	Courage

Tab. 2: Map functions assigned to the epochs in which they have the smallest percentage share in relation to all epochs.

The proportionally most common functions of General Reference Maps are Information, Travel, Choice, Interactivity, and Ease. For Topographic Maps, they are Self-Representation and Generalization, and for Navigation Maps, Navigation, Economy, Security, and Courage. The Thematic Political ones are characterized by Propaganda, Religion, Emotion, Ideology, Justice, and War. Whereas the Thematic City maps are featured by Entertainment, Government, Emotion, Strategy, Advertising, Manipulation, Art, and War (Tab. 3). Self-Expression, Advertisement, Economy, Strategy, and Justice are the least common in the General Reference type. For the

Topographic maps, they are War, Choice, Ease, Justice, and Courage. The Navigational maps lack shares of the functions Propaganda, Entertainment, Emotion, Religion, Ideology, Manipulation, Art, Ease, and Justice. For Thematic Political, Information, Government, Navigation, Strategy, Security, Generalization, Choice, Ease, Courage are at the back of the list. For Thematic City, it is Travel, Ideology, Choice, Interactivity, Justice, and Courage (Tab. 4). Duplications again occur when a function is represented equally often in percentage terms in at least two different map types. The following remarks are based on chapter 2.5. Since map types do not have definite fixed components, the analysis of the found associations is difficult. General Reference maps, however, usually represent an overview of all continents. Therefore, the functions proportionally assigned to them most often seem to fit. It is easy to extract information from them, one can judge where one might travel and thus interact more with the map. The contents of Topographic maps go hand in hand with scales. Accordingly, the Generalization function is plausible here as well. Only Self-Expression encourages consideration. Since no justifications of the descriptions or choices of the map functions were requested in the questionnaires, we can only speculate here. Hiking has been shown to be a popular leisure activity (Vogt, 2009). Therefore, the latter function could stem from the fact that people associate Topographic maps with a sense of connectedness and corresponding representation of themselves. Due to the fact that Navigational maps are often commissioned by the government, it is striking that Government itself is not mentioned as a function. Thematic maps mostly follow one particular theme. In the case of the political and city subjects, the most frequently occurring functions appear in a comprehensible way.

General Reference	Topographic	Navigational	Thematic - Political	Thematic - City
Information	Self-Expression	Navigation	Propaganda	Entertainment
Travel	Generalization	Economy	Religion	Government
Choice		Safety	Emotion	Emotion
Interactivity		Courage	Ideology	Strategy
Ease			Justice	Advertisement
			War	Manipulation
				Art
				War

Tab. 3: Map functions assigned to the map types in which they have the largest percentage share in relation to all types.

General Reference	Topographic	Navigational	Thematic - Political	Thematic - City
Self-Expression	War	Propaganda	Information	Travel
Advertisement	Choice	Entertainment	Government	Ideology
Economy	Ease	Emotion	Navigation	Choice
Strategy	Justice	Religion	Strategy	Interactivity
Justice	Courage	Ideology	Safety	Justice
		Manipulation	Generalization	Courage
		Art	Choice	
		Ease	Ease	
		Justice	Courage	

Tab. 4: Map functions assigned to the map types in which they have the smallest percentage share in relation to all types.

As mentioned before, it is not possible to assign map functions to only one explicit map type. In fact, as found out by the questionnaires, it always depends on the person who uses it. For one individual, motivations and interpretations may be completely different from the next. Nevertheless, overall, the functions fit the types. Moreover, just because one did not receive the largest percentage for one type does not mean that it cannot be assigned to another one, albeit with a smaller percentage.

5.5 Map Functions

Fig. 10 shows the Top-Down vs. Bottom-Up Typology of Map Functions that is derived from the analysis of the answers provided by the first questionnaire. Now they are compared with those of Freitag (1993): cognitive, communicative, decision support, and social map functions (Fig. 11). The cognitive one includes that spatial information about an area should be presented in the most effective way, but on the other hand the level of understanding of the used method of the end user must be taken into account. With respect to the created Top-Down and Bottom-Up map function approach, there is only one function that can be assigned to this group, namely Generalization. It is the only one that directly influences the representation of spatial information. Next, the communication function reflects the information that needs to be provided to the user. It can have different origins, ranging from academic to ideological communication. Here, too, only functions of the top-down principle are considered. These are Information, Strategy, Ideology, War, Economy, and Government. All of these either communicate the general theme of a map or illustrate

a particular issue in more detail. For the function proposed by Freitag, decision support, it is necessary to consider all possible decisions and actions a user could take after interpreting a map. For example, different navigation paths are possible, as well as the promotion of various items. Both Top-Down and Bottom-Up branch functions are assigned here. They are Propaganda, Manipulation, Navigation, Travel, Art, and Interactivity. Through them, decisions are made, possibly inconclusive opinions are changed or consolidated, solutions could possibly be found with the help of interactivity and, for example, art elements could be determined. The last function to consider from Freitag is the social one. It is important to regard which motivations for engaging in social settings or planning actions can be communicated by a map. For the Top-Down vs. Bottom-Up Typology of Map Functions, these are Entertainment, Advertisement, Religion, Self-Expression, Courage, Justice, Choice, Safety, Emotion, and Ease. They all lead us to want to do something, buy something, perhaps present ourselves differently, or talk to other people about our impressions.

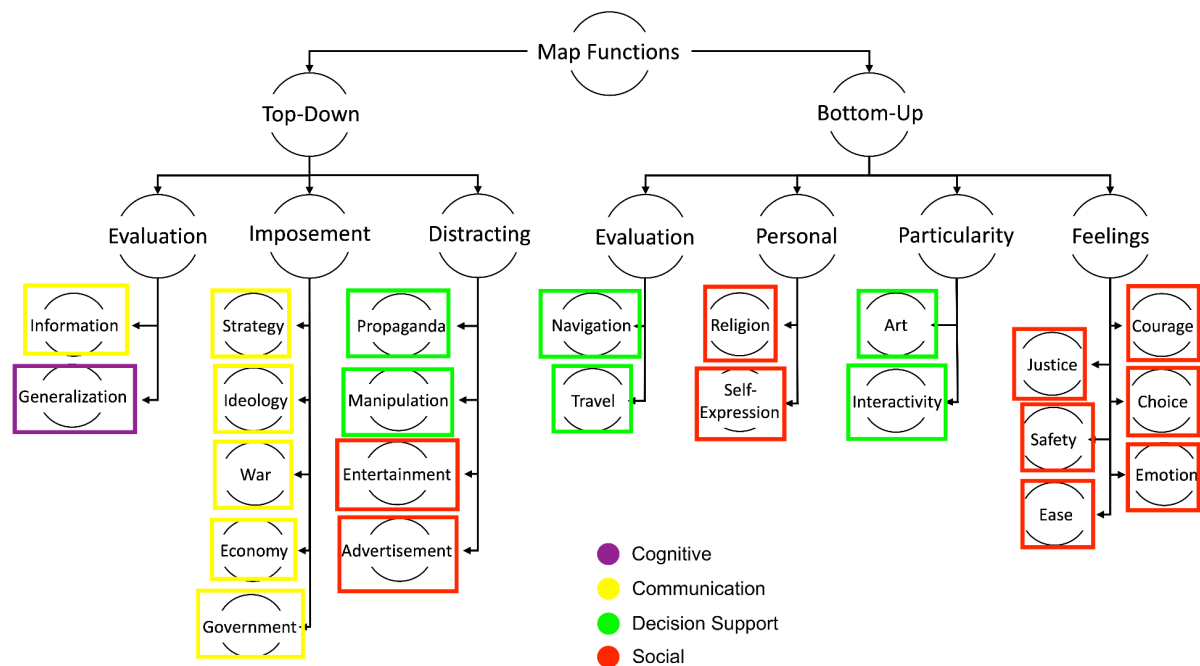


Fig. 11: The Top-Down vs. Bottom-Up Typology of Map Functions in regard to Freitag's (1993) proposal. Image by the author.

Accordingly, with some reflection, all of the derived functions of the two user questionnaires of the map function typology are relatable to those of Freitag. What is an important difference between the two approaches is that Freitag's proposal probably covers every area of human existence and how map functions are reflected in us and our behavior. The Top-Down vs. Bottom-Up Typology, on the other hand, distinguishes between functions that we cannot, or are unlikely to, escape, and that are, so to speak, forced upon us, and those that emanate from ourselves, for which our own background plays a more significant part. It is also interesting to note that

although the newly proposed typology was created in terms of map functions in respect to their political context, they nevertheless seem to apply to more than just politics. This is very clear from the comparison with Freitag's map functions, since his do not concern any particular context.

6 Conclusion

At the beginning of this thesis the following was written: According to Jerry Brotton, who is a professor in London, UK, for Renaissance studies, “we always get the map that our age deserves” (Friedmann, 2013). In the course of the research, this argument was investigated. For this purpose, five epochs, the Middle Ages, Renaissance, Realism, Futurism, and contemporary Digital Age were explored in terms of map functions in respect to their political context. It was necessary to have a context. How else could it have been possible to find out what an age deserves? Only by including a specific context can this question be answered with full satisfaction. In addition, the following concrete research questions were established:

RQ1 *What broad political trends have existed in different time periods in history in Europe and today, and how have they manifested themselves?*

This first question was necessary to understand the political context of the examined epochs. It turns out that from the Middle Ages to Futurism, largely uniform political ideologies prevailed in Europe. The current era was examined for global movements, as the world is far more connected than it was back then due to digitalization (see chapters 2.4.1 to 2.4.5).

RQ1.1 *Did political characteristics of a specific time period influence the content of according maps?*

During the next step, it was found that political context does in fact influence the content of maps at the time of their creation. Thus Jerry Brotton's argument would essentially already have been proven. But it deserved to be verified again using a different procedure.

RQ1.2 *Are map users able to correctly identify the political trends of an epoch from them?*

Once again, this question can be answered positively. It is apparent that user questionnaire participants largely gave negative answers to questions about their knowledge concerning the five epochs studied. Nevertheless, it was possible for them to establish correct associations with them and put them into wording. Accordingly, the political atmosphere of an era is recognizable in maps created at the same time, even after several hundred years. Consequently, the second approach also confirms Brotton's argument.

However, the question that remained was how exactly this context becomes visible in maps. For this purpose, questionnaire participants were asked to describe their associations with twelve maps in respect to their political context and to select from resulting functions for thirteen other maps which ones apply best.

RQ2 *Which map functions, in respect to their political context, can be found in different user groups?*

User groups do not distinguish themselves much in terms of map functions. There is no difference at all between all experts and non-experts with regard to all functions combined. Male and female non-experts have a difference of 0.75 percentage points, male and female experts of 0.95 percentage points. The biggest difference is between genders. Here the score is 1.7. Nevertheless, it is evident that male participants tend to perceive more Top-Down, while female participants tend to perceive more Bottom-Up map functions.

RQ2.1 *Is there a difference in map functions in different time periods of history in Europe and today?*

In a comparison of all epochs, the Middle Ages were most often assigned the function Religion, with 77.5%. For the Renaissance it is Courage with 66.7%, in Realism Manipulation is 50% and in the present age Justice with 90%. The Futurism era has proportionally not been assigned any function most often. However, the most frequently chosen one for this period is Courage with 33.3%.

RQ2.2 *Is there a difference in map functions between different map types?*

In comparison to all map types, the General Reference maps have most often been assigned the Choice function with 66.7% share. For the Topographic type it is Religion with 37.5%, for Navigational ones Safety is 63.9%. Thematic Political maps have Justice with 100% and the Thematic City type Advertisement with 72.2%.

Moreover, it is reasonable to assume that the created Top-Down vs. Bottom-Up Typology of Map Functions is applicable to other map contexts as well, not just the political one. With this very theoretical topic, it is also important to note that there is no real right and wrong answer to an extensive topic such as this. Just because one person interprets a map in one direction, the next may do so in the opposite. In addition, it is also possible, provided that one examines map functions in relation to a context, that some people may not be able to discern a function for that subject. This is neither right, nor is it wrong. The elaborated typology approach states that many map functions arise from personal background. Therefore, these answers are not to be left out of the interpretation. Instead, looking at the big picture, being grateful for maps and recognizing what they do for different user groups is more important. Be it a non-expert who wants to get from A to B by car or an expert who can express themselves artistically through them. Regardless of the ultimate function.

6.1 Limitations

No statistical analysis was performed as part of this research. It is therefore not possible to determine whether significant differences exist between the individual user groups, eras or map types in terms of functions. Rather, only the results of the former are distinguishable in percentage points. It was deliberately decided against an additional percentage point distinction of the epochs and map types, because there would have been so many values that in the end one would probably not understand what was actually found. Even as it is, there are a lot of percentage values. For the same reason, the statistical evaluation was omitted in order to facilitate the understanding of the results for as many people as possible. Thus, explanations of results are presented in tables or graphs, rather than in continuous text. Plus, it must be included that people interpret maps differently based on their background, or it may be that the cartographic communication (see Chapter 2.2) is not responsive to their character. Accordingly, the question arises as to how representative a statistical analysis would be without conducting face-to-face interviews to learn more about the background of the decisions.

Furthermore, it needs to be addressed again that just because it is suspected that the new typology is applicable to other map content contexts, this is not yet proven. This work serves only as a beginning of a new understanding of map functions. It may be that the collection will be expanded, shortened, or that parts are renamed. All this is an issue for the future.

6.2 Implications for further Research

As mentioned before, this work is only the starting point for further research in the topic of map functions in the broad field of Cartography. A first approach, under the condition that the epochs and the political context studied here are maintained, would be to additionally look at the art paintings of the individual time periods. Can the political circumstances also be recognized in them or are there other content characteristics? Are the contents of art paintings comparable to those of the maps? After all, art and maps are connected (Britannica, T. Editors of Encyclopaedia, 2023a). To put it into Cartwright's (2009) words "Art provides the 'public face' of cartography (and if we include the cartographer's passion when designing particular products, perhaps the soul as well)" (p. 9).

Moreover, it would be interesting to explore what about functions of maps that originate from the same time but from different parts of the world, in regard to political context. Are there any similarities? What are the differences? Continuing this thought, another possibility would be to extend both the research presented in this paper and the research just proposed to other contexts of everyday life. Thus, linguistic or social settings would also be of interest. However, the most important thing is to first

determine whether the Top-Down vs. Bottom-Up Typology of Map Functions approach proposed in this study is applicable to other contexts. The question remains whether one can identify an approach to map functions that is both time period appropriate and applicable to all maps across all of history.

Bibliography

- Acharya, A. & Lee, A. (2019). Path Dependence in European Development: Medieval Politics, Conflict, and State Building. *Comparative Political Studies*, 52(13–14), 2171–2206. doi: 10.1177/0010414019830716.
- Bagrow, L. & Skelton, R. A. (2010). *History of Cartography*. Transaction Publishers.
- Bar-Gal, Y. (2003). The Blue Box and JNF Propaganda Maps, 1930-1947. *Israel Studies*, 8(1), 1–19.
- Barnett, E. & Casper, M. (2001). A definition of “social environment”. *American Journal of Public Health*, 91(3), 465. doi: 10.2105/AJPH.91.3.465a.
- Borutta, J. (2023). “Es geht um etwas viel Größeres”. *tagesschau.de*. Retrieved August 18, 2023, from <https://www.tagesschau.de/ausland/frankreich-protesttag-101.html>.
- Britannica, T. Editors of Encyclopaedia. (2023a). cartography. *Encyclopedia Britannica*. Retrieved June 7, 2023 from <https://www.britannica.com/science/cartography>.
- Britannica, T. Editors of Encyclopaedia. (2022). How is the Democratic Party different from the Republican Party?. *Encyclopedia Britannica*. Retrieved August 17, 2023, from <https://www.britannica.com/question/How-is-the-Democratic-Party-different-from-the-Republican-Party>.
- Britannica, T. Editors of Encyclopaedia. (2009). portolan chart. *Encyclopedia Britannica*. Retrieved August 25, 2023, from <https://www.britannica.com/technology/portolan-chart>.
- Britannica, T. Editors of Encyclopaedia. (2023b). realism. *Encyclopedia Britannica*. Retrieved August 25, 2023, from <https://www.britannica.com/art/realism-art>.
- Britannica, T. Editors of Encyclopaedia. (2023c). Renaissance. *Encyclopedia Britannica*. Retrieved August 24, 2023, from <https://www.britannica.com/event/Renaissance>.
- Bundesministerium des Innern, für Bau und Heimat. (2021). Open-Data-Strategie der Bundesregierung. Retrieved August 30, 2023, from www.bmi.bund.de/SiteGlobals/Forms/suche/publikationssuche-formular.html.
- Caquard, S. (2009). Foreshadowing Contemporary Digital Cartography: A Historical Review of Cinematic Maps in Films. *The Cartographic Journal*, 46(1), 46–55. doi: 10.1179/000870409X415589.
- Cartwright, W. (2009). Art and Cartographic Communication. In *Cartography and Art* (pp. 9–22). Springer Berlin Heidelberg. doi: 10.1007/978-3-540-68569-2_2.
- Césaire, A. (2010). Culture and Colonization. *Social Text*, 28(2), 127–144. doi: 10.1215/01642472-2009-071.
- Crane, W. (1886). Imperial Federation [Map]. *The Graphic*. Retrieved April 29, 2023, from https://commons.wikimedia.org/wiki/File:British_empire_1886.jpg.

- Derenne, A. (2023). [Illustration about the 2023 pension reform of France]. Retrieved September 5, 2023, from <https://annederenneillustration.com/portfolio/3813/>.
- Deutsches Reich / Reichsamt für Landesaufnahme. (1944). *Weimar* [Map]. Retrieved May 28, 2023, from [https://ifl.wissensbank.com/cgi-bin/get-file/53616c7465645f5fb219ddde8b802d1b03d02226989390a427f6f23749fd a6a28485ea58d01f44bf0d030e54a44e7e8cbe05e375f99dac4d75562c23c52 0299e/MB5033\(1944\).jpg](https://ifl.wissensbank.com/cgi-bin/get-file/53616c7465645f5fb219ddde8b802d1b03d02226989390a427f6f23749fd a6a28485ea58d01f44bf0d030e54a44e7e8cbe05e375f99dac4d75562c23c52 0299e/MB5033(1944).jpg).
- Dumolyn, J. (2012). Political Communication and Political Power in the Middle Ages: A conceptual Journey. *EDAD MEDIA*, 13, 33–55.
- Duncan, S. (1969). Nonverbal communication. *Psychological Bulletin*, 72(2), 118–137. doi: 10.1037/h0027795.
- Faerch, C. & Kasper, G. (1984). Two Ways of Defining Communication Strategies. *Language Learning*, 34(1), 45–63. doi: 10.1111/j.1467-1770.1984.tb00995.x.
- Fairbairn, D., Gartner, G. & Peterson, M. P. (2021). Epistemological thoughts on the success of maps and the role of cartography. *International Journal of Cartography*, 7(3), 317–331. doi: 10.1080/23729333.2021.1972909.
- Flint, V. I. J. (2023). Christopher Columbus. *Encyclopedia Britannica*. Retrieved August 25, 2023, from <https://www.britannica.com/biography/Christopher-Columbus>.
- Freitag, U. (1993). Map Functions. *Cartographica: The International Journal for Geographic Information and Geovisualization*, 30(4), 1–6. doi: 10.3138/DQ3R-34T9-7227-51TX.
- Friedman, U. (2013). 12 Maps That Changed the World. Is there such a thing as a perfect map? *The Atlantic*. Retrieved April 5, 2023, from <https://www.theatlantic.com/international/archive/2013/12/12-maps-that-changed-the-world/282666/>.
- Fuechsel, C. F. (2023). map. *Encyclopedia Britannica*. Retrieved June 7, 2023, from <https://www.britannica.com/science/map>.
- Futurismus. (n.d.). *StudySmarter*. Retrieved August 24, from <https://www.studysmarter.de/schule/kunst/kunstgeschichte-epochen/futurismus/#:~:text=und%20Mobile%2DApp-,Definition%20des%20Futurismus,Deutsche%20%C3%BCbersetzt%20%22Zukunft%22%20bedeutet>.
- Gerring, J. (1997). Ideology: A Definitional Analysis. *Political Research Quarterly*, 50(4), 957–994. doi: 10.2307/448995.
- Goldreich, O., Juba, B., & Sudan, M. (2011). A theory of goal-oriented communication. *Proceedings of the 30th Annual ACM SIGACT-SIGOPS Symposium on Principles of Distributed Computing*, 299–300. doi: 10.1145/1993806.1993863.
- Greenblatt, S. (1983). Murdering Peasants: Status, Genre, and the Representation of Rebellion. *Representations*, 1, 1–29. doi: 10.2307/3043757.
- Guelke, L. (1977). Cartographic Communication And Geographic Understanding. *Cartographica: The International Journal for Geographic Information and Geovisualization*, 14(1), 129–145. doi: 10.3138/RM67-5034-1407-7573.

- Hall, J. A., Horgan, T. G., & Murphy, N. A. (2019). Nonverbal Communication. *Annual Review of Psychology*, 70(1), 271–294. doi: 10.1146/annurev-psych-010418-103145.
- Helmrich, R. & Leppelmeier, I. (2020). Sinkt die Halbwertszeit von Wissen? Theoretische Annahmen und empirische Befunde. *Bundesinstitut für Berufsbildung*.
- Horowitz, W. (1988). The Babylonian Map of the World. *Iraq*, 50, 147–165. doi: 10.2307/4200289.
- Huijboom, N. & Van den Broek, T. (2011). Open data: an international comparison of strategies. *European Journal of ePractice*, 12, 4–16.
- Ialongo, E. (2016). Futurism from foundation to world war: The art and politics of an avant-garde movement. *Journal of Modern Italian Studies*, 21(2), 306–323. doi: 10.1080/1354571X.2015.1134938.
- Intergovernmental Committee on Surveying and Mapping. (n.d.a). *Cadastral Maps and Plans*. Retrieved 12 June, 2023, from <https://www.icsm.gov.au/education/fundamentals-mapping/types-maps/cadastral-maps-and-plans>.
- Intergovernmental Committee on Surveying and Mapping. (n.d.b). *General Reference*. Retrieved 12 June, 2023, from <https://www.icsm.gov.au/education/fundamentals-mapping/types-maps/general-reference>.
- Intergovernmental Committee on Surveying and Mapping. (n.d.c). *Navigation Charts*. Retrieved 12 June, 2023, from <https://www.icsm.gov.au/education/fundamentals-mapping/types-maps/navigation-charts>.
- Intergovernmental Committee on Surveying and Mapping. (n.d.d). *Thematic Maps*. Retrieved 12 June, 2023, from <https://www.icsm.gov.au/education/fundamentals-mapping/types-maps/thematic-maps>.
- Intergovernmental Committee on Surveying and Mapping. (n.d.e). *Topographic Maps*. Retrieved 12 June, 2023, from <https://www.icsm.gov.au/education/fundamentals-mapping/types-maps/topographic-maps>.
- Intergovernmental Committee on Surveying and Mapping. (n.d.f). *Types of Maps*. Retrieved June 12, 2023, from <https://www.icsm.gov.au/education/fundamentals-mapping/types-maps>.
- Iyengar, S. & Simon, A. F. (2000). New Perspectives and Evidence on Political Communication and Campaign Effects. *Annual Review of Psychology*, 51(1), 149–169. doi: 10.1146/annurev.psych.51.1.149.
- Joel, D. (2011). Male or Female? Brains are Intersex. *Frontiers in Integrative Neuroscience*, 5. doi: 10.3389/fnint.2011.00057.
- Kasper, G. (1984). Pragmatic Comprehension in Learner-Native Speaker Discourse. *Language Learning*, 34(4), 1–20. doi: 10.1111/j.1467-1770.1984.tb00349.x.
- Kershaw, I. (2005). War and Political Violence in Twentieth-Century Europe. *Cambridge University Press*, 14(1), 107–123.
- Koussoulakou, A. & Kraak, M. J. (1992). Spatia-temporal maps and cartographic communication. *The Cartographic Journal*, 29(2), 101–108. doi: 10.1179/caj.1992.29.2.101.

- Krygier, J. B. (1995). Cartography as an art and a science? *The Cartographic Journal*, 32(1), 3–10. doi:10.1179/000870495787073762.
- Laffan, B. (2018). The Next European Century? Europe in Global Politics in the Twenty-First Century. *Journal of Contemporary European Research*, 14(4), 303–309. doi: 10.30950/jcer.v14i4.1037.
- Landeszentrale für politische Bildung Baden-Württemberg. (2022a). Der Erste Weltkrieg - Überblick. Retrieved September 1, 2023, from <https://www.lpb-bw.de/erster-weltkrieg-zusammenfassung>.
- Landeszentrale für politische Bildung Baden-Württemberg. (2022b). Der Zweite Weltkrieg. Retrieved September 1, 2023, from <https://www.lpb-bw.de/kriegsende-zweiter-weltkrieg>.
- Lipsky, P. Y. (2020). COVID-19 and the Politics of Crisis. *International Organization*, 74(S1), E98–E127. doi: 10.1017/S0020818320000375.
- Luhmann, N. (1992). What is Communication? *Communication Theory*, 2(3), 251–259. doi: 10.1111/j.1468-2885.1992.tb00042.x.
- Map Chart. (n.d.). *World Map: Simple* [Map]. Retrieved May 28, 2023, from <https://www.mapchart.net/world.html>.
- McClamroch, J., Byrd, J. J. & Sowell, S. L. (2001). Strategic Planning: Politics, Leadership, and Learning. *The Journal of Academic Librarianship*, 27(5), 372–378. doi: 10.1016/S0099-1333(01)00222-1.
- Merriam-Webster. (n.d.a). Art. In *Merriam-Webster.com dictionary*. Retrieved June 7, 2023, from <https://www.merriam-webster.com/dictionary/art>.
- Merriam-Webster. (n.d.b). Communication. In *Merriam-Webster.com dictionary*. Retrieved June 15, 2023, from <https://www.merriam-webster.com/dictionary/communication>.
- Merriam-Webster. (n.d.c). Context. In *Merriam-Webster.com dictionary*. Retrieved June 2, 2023, from <https://www.merriam-webster.com/dictionary/context>.
- Merriam-Webster. (n.d.d). Culture. In *Merriam-Webster.com dictionary*. Retrieved June 6, 2023, from <https://www.merriam-webster.com/dictionary/culture>.
- Merriam-Webster. (n.d.e). Ideology. In *Merriam-Webster.com dictionary*. Retrieved June 6, 2023, from <https://www.merriam-webster.com/dictionary/ideology>.
- Merriam-Webster. (n.d.f). Political. In *Merriam-Webster.com dictionary*. Retrieved June 2, 2023, from <https://www.merriam-webster.com/dictionary/political>.
- Merriam-Webster. (n.d.g). Politics. In *Merriam-Webster.com dictionary*. Retrieved June 2, 2023, from <https://www.merriam-webster.com/dictionary/politics>.
- Millard, F. (2004). Elections, Parties and Representation in Post-Communist Europe. *Palgrave Macmillan*. doi: 10.1057/9780230000865.
- Ministerium für Schule und Weiterbildung des Landes Nordrhein-Westfalen. (2011). Kernlehrplan für die Realschule in Nordrhein-Westfalen. Geschichte. Retrieved September 1, 2023, from https://www.schulentwicklung.nrw.de/lehrplaene/lehrplan/155/KLP_RS_GE.pdf.
- Mintrom, M. & Norman, P. (2009). Policy Entrepreneurship and Policy Change. *Policy Studies Journal*, 37(4), 649–667. doi: 10.1111/j.1541-0072.2009.00329.x.

- Moravcsik, A. (2018). Preferences, Power and Institutions in 21st-century Europe. *JCMS: Journal of Common Market Studies*, 56(7), 1–27. doi: 10.1111/jcms.12804.
- Munro, A. (2023). head of state. *Encyclopedia Britannica*. Retrieved August 17, 2023, from <https://www.britannica.com/topic/head-of-state>.
- Muzio, C. L. (2002). THE UMĀMAHEŚVARA IN CENTRAL ASIAN ART. *Rivista Degli Studi Orientali*, 76(1/4), 49–86.
- Müller, J.-W. (2009). The triumph of what (if anything)? Rethinking political ideologies and political institutions in twentieth-century Europe. *Journal of Political Ideologies*, 14(2), 211–226. doi: 10.1080/13569310902925857.
- Norddeutscher Rundfunk. (2023). Erneut Proteste auf Frankreichs Straßen. *tageschau.de*. Retrieved August 18, 2023, from <https://www.tagesschau.de/ausland/europa/frankreich-rentenreform-proteste-125.html>.
- Ortag, F. (2003). Honorary Fellowship for Ulrich Freitag. *International Cartographic Association*. Retrieved August 8, 2023, from <https://icaci.org/honorary-fellowship-for-ulrich-freitag/>.
- Peters, E. & Frassetto, M. (n.d.). The Middle Ages. *Encyclopedia Britannica*. Retrieved August 24, 2023, from <https://www.britannica.com/topic/history-of-Europe/The-Middle-Ages>.
- Peterson, M. P. (1987). The Mental Image in Cartographic Communication. *The Cartographic Journal*, 24(1), 35–41. doi: 10.1179/caj.1987.24.1.35.
- Pateman, C. (1971). Political Culture, Political Structure and Political Change. *British Journal of Political Science*, 1(3), 291–305. doi: 10.1017/s0007123400009133.
- Pollard, S. (1973). Industrialization and the European Economy. *The Economic History Review*, 26(4), 636. doi: 10.2307/2593702.
- Salt Lake County (1962). *Recorder-Plat Maps, Bingham Plat A, 1962-1963, Reel #09137, Record Series RC-052, Sheet 3* [Map]. Retrieved June 12, 2023, from https://commons.wikimedia.org/wiki/File:Sheet_3_from_Salt_Lake_County_Recorder_Plat_Maps,_Bingham_Plat_A,_1962-1963,_Reel_09137,_Record_Series_RC-052.jpg.
- Schill, D. (2012). The Visual Image and the Political Image: A Review of Visual Communication Research in the Field of Political Communication. *Review of Communication*, 12(2), 118–142. doi: 10.1080/15358593.2011.653504.
- Schroeder, P. W. (1986). The 19th-Century International System: Changes in the Structure. *World Politics*, 39(1), 1–26. doi: 10.2307/2010296.
- Tobler, W. R. (1970). A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography*, 46, 234–240. doi: 10.2307/143141.
- Troitiño, D. R. (2022). The European Union Facing the 21st Century: The Digital Revolution. *TalTech Journal of European Studies*, 12(1), 60–78. doi: 10.2478/bjes-2022-0003.

- Tsou, M.-H. (2011). Revisiting Web Cartography in the United States: The Rise of User-Centered Design. *Cartography and Geographic Information Science*, 38(3), 250–257. doi: 10.1559/15230406382250.
- United Kingdom Hydrographic Office. (1920). *Nautical chart of the southern part of the North Sea* [Map]. Retrieved April 30, 2023, from https://commons.wikimedia.org/wiki/File:Admiralty_Chart_No_2182a_North_Sea_southern_sheet,_Published_1920.jpg.
- Van Aelst, P., Sheaffer, T., & Stanyer, J. (2012). The personalization of mediated political communication: A review of concepts, operationalizations and key findings. *Journalism*, 13(2), 203–220. doi: 10.1177/1464884911427802.
- VISACTU. (2023a). La mobilisation contre la réforme des retraites. En nombre de manifestants le 19 janvier 2023. Retrieved August 18, 2023, from <https://www.sudouest.fr/economie/reforme-des-retraites/reforme-des-retraites-voici-la-carte-montrant-l-ampleur-des-sept-premieres-journees-de-mobilisation-14428373.php#article-comments>.
- VISACTU. (2023b). La mobilisation contre la réforme des retraites. En nombre de manifestants le 6 juin 2023. Retrieved August 18, 2023, from <https://www.sudouest.fr/economie/reforme-des-retraites/reforme-des-retraites-voici-la-carte-montrant-l-ampleur-des-sept-premieres-journees-de-mobilisation-14428373.php#article-comments>.
- Vogt, L. (2009). Wandern und Trekking als Freizeitaktivität und Marktsegment im Naturlandtourismus. Ein Überblick den Stand der Kenntnisse und ein Ausblick auf landschaftsplanerische Konsequenzen. *Naturschutz und Landschaftsplanung*, 41(8), 229–236.
- Vorbrugg, A. & Bluwstein, J. (2022). Making sense of (the Russian war in) Ukraine: On the politics of knowledge and expertise. *Political Geography*, 98. doi: 10.1016/j.polgeo.2022.102700.
- Wartofsky, M. W. (1980). Art, Artworlds, and Ideology. *The Journal of Aesthetics and Art Criticism*, 38(3), 239–247. doi: 10.2307/430124.
- Weber, E. (2020). Realismus: Epoche der schönen Wirklichkeit (1848–1890). *UNICUM*. Retrieved August 24, 2023, from <https://abi.unicum.de/epochen/realismus-epoche>.
- White, J. J. (2023). Futurism. *Encyclopedia Britannica*. Retrieved August 25, 2023, from <https://www.britannica.com/art/Futurism>.
- Witt, W. (1979). *Lexikon der Kartographie* (Band B). Deuticke Verlag, Wien.
- Wood, D., & Krygier, J. (2009). Map Types. *International Encyclopedia of Human Geography*, 339–343.
- Wölfflin, H. (1950). *Principles of Art History. The Problem of the Development of Style in Later Art*. Dover Publications.

Appendix 1: Maps

This appendix can be accessed at: Appendix 1.

Appendix 2: Questionnaire 1

This appendix can be accessed at: Appendix 2.

Appendix 3: Answers Questionnaire 1

This appendix can be accessed at: Appendix 3.

Appendix 4: Questionnaire 2

This appendix can be accessed at: Appendix 4.

Appendix 5: Answers Questionnaire 2

This appendix can be accessed at: Appendix 5.

Appendix 6: Evaluation Questionnaires

This appendix can be accessed at: Appendix 6.

Appendix 7: Evaluation Questionnaires - Percentages

This appendix can be accessed at: Appendix 7.