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STUDENTERRAPPORT

SENSE OF DIRECTION IN MAPS

CAN "LESS IS MORE" BE ENOUGH TO UNDERSTAND A FAMILIAR ENVIRONMENT THROUGH LANDMARK AND SURVEY KNOWLEDGE?

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Abstract:

This thesis researches whether or not it is possible to create a map only consisting of landmarks that still can be understood by users.

Through theories of geocommunication, cognitive maps and spatial learning, detection of landmarks, qualitative data analysis, it is tried to see if respondents could locate a non-visible landmark in three different maps. Data were collected with an online survey. There were produced maps for three different Danish cities.

It was found that in general was it possible for half of the respondents to successfully locate one of the non-visible landmarks in one type of map, in the second type of map a third could locate the non-visible landmark, whilst only one percentages could locate the non-visible landmark in the third type of map.

It is therefore concluded that in this case, less is not more. However, as a result of a pre-study of communication map with landmarks, alteration is suggested for later pre-studies.

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1 Introduction

Two friends step out from a hotel in a foreign city. One of them is recording the other on a video camera whilst saying “Do something funny!” followed by a more despairing “do something…”. The other responds: “I am, I’m ignoring you”. The first friend hands the other friend the video camera and folds out a map of the city. The map has small pop-up landmarks on it. The first friend starts talking to himself: “The hotel is here. No… Wait! No, we must go… no… I know!”. He lays the map down on the ground in front of him, looks seriously at his friend for this is indeed for a big deal, according to his own mind: “I’m going to have to go into the map”. He then places both his shoes on top of the map. He looks up and down, up and down – trying to relate the map image with his surroundings. The other friend thinks he is silly and mocks him. The first friend steps off the map, picks it up and now knowing the way to their destination, he tells his friend to follow.

This is a scene from the beloved American sitcom “Friends” (1994-2004), where Joey and Chandler are visiting London for attending the wedding where Ross says the wrong name at the altar. Joey has no sense of direction of the environment and therefore use a map to guide him to the wanted destination. He then uses a method of stepping into the map to orientate himself in relation to his surroundings, see figure 1.1.

Figure 1.1: Scene from “Friends” (1998) addressing sense of direction

A scene from the sitcom Friends. Source: Warner Brothers Televison, 1998

The “Friends”-series is a clear depiction of the late 1990’s which was a time before online maps and smart phone navigational applications were everyday items. Today, the use of these items nearly has no limits in communication of geographical information.

Many companies. municipalities, sport arenas (et cetera) communicate geographical information about the location to their facilities through an online map. The maps do often contain a lot of information because the location is shown with a topographical map or an aerial photo. These two types of base maps, topographical and aerial photo, contains many information which is presented to the map user which perhaps could be too much information. This in general cause a challenge to the cartography perspective, where instead of static and printed maps, today most maps are dynamic and online (Cartwright, 2013a). Therefore, there is a new issue in addressing how the cartographical element should be visualize in the online maps, which is highly available today. If people are traveling to an unknown destination, online route planners are frequently used to aid the wayfinding. In the late 1990’s and start 2000’s, online route planners were developed, and here one could print a route description which one could bring along the journey in the car or on foot. Today, the route planners for general wayfinding, but also specified transportation such as car, cycling, walk or public transportation, are accessible from smart phones applications. With limited efforts, one can retrieve a route from destination A to destination B in an unknown environment. Because of positions calculations are

Figure 1.2: Maps on Smart Phones

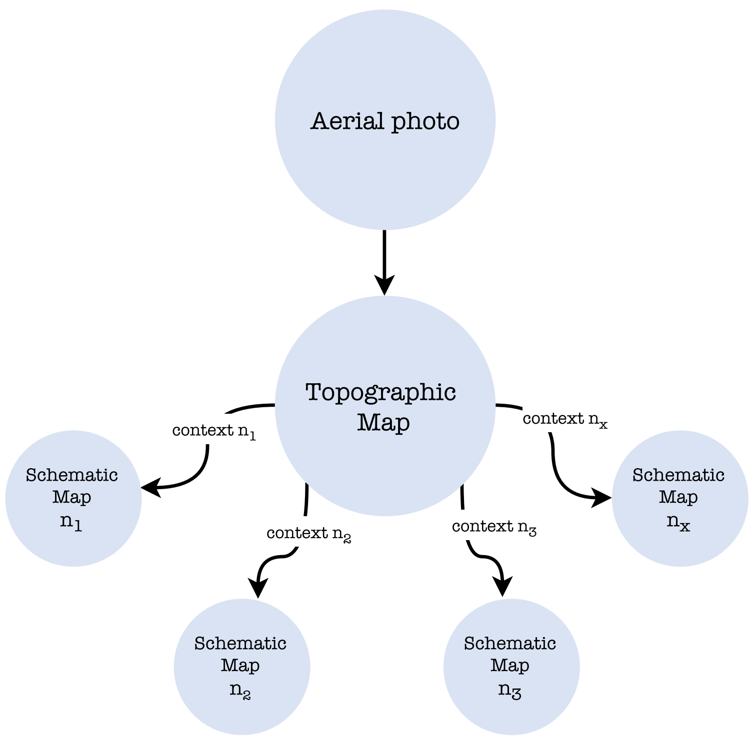
Maps today are often dynamic and accessible from a smart phone, and by that you presumably never get lost. (Purchased image).

available in route planners of smart phones, the present location is shown, one rarely gets lost. The online routing applications is for wayfinding therefore more convenient than analogue maps. In figure 1.2, a smart phone routing application is shown on top of a map. The smart phone shows the current location which is not featured in the analogue map beneath.

Arguably, the broad amount of information and the routing applications serves as a helping hand when unknown to the environment, but if one is familiar with the environment do one then need the excessive amount of information often displayed in online maps and in the smart phones applications to know the way through an environment? When navigating through a known environment, one rarely uses maps or navigational applications. People normally have a picture of how the environment is structured. If a map was to be proposed to a group of people with knowledge of the environment, could there then be less data in the map? The question is whether or not the people familiar with the environment can understand the map if it is only illustrated with limited amount of information.

In a study performed by Meilinger et al. (2007), they tested if less than standard data in a shopping mall plan could lead to better performance among the mall users. The main point of their research was to see how much data was actually necessary, and how much data was superfluous (Meilinger et al., 2007). In their general discussion, they propose a research of city maps, nonetheless they also point that in unfamiliar environment maps must communicate signs, or verbal directions is needed without a map (Meilinger et al., 2007). In Denmark, lots geodata are freely available for download and/or use. Some companies or municipalities develop their own maps with the free public geodata available, however, this can also result in an information-overfilled map. If there is so much geodata available when is it then necessary to stop with the information in the map? When do the map contain enough information to be understood? As a part of communicating through maps, the key element is to present enough data to reach a conclusion or make a decision (Brodersen, 2009).

Figure 1.3: Relationship between types of maps



The relation (one to many) between topographic maps and semantic maps. After Kippel, 2003.

In general, there is a relationship between different map types (Kippel, 2003), see figure 1.3. The most exact reproduction of the real world can be seen in the aerial photo. The aerial photo is a map created by photographing the earth from an airplane, and the taken photographs are then georeferenced and merged together. The topographical map is "normal" map, which compromises the vast information of the aerial photo to vectorized elements. Schematic maps are themed maps, only displaying a smaller amount information, often just the needed information to understand the map's purpose. As seen in figure 1.3, the relationship between the topographic map and the schematic maps is one-to-many. The schematic maps show a chosen fraction of the topographic map (Kippel, 2003).

In continuation hereof, the idea of testing how well people know a familiar environment through less data than normal is interesting. A way of seeing whether or not people understand a map is to limit the amount of information and then ask them to point to a non-visible location. If they understand the map, are familiar with the environment, it should be possible to do so. But then another question arises; which data themes should be displayed in the given schematic map to support the map users in their designation of a known location? According to Kriz (2013), not all maps and their graphics communicate the purpose efficiently, and Kriz continues that the capability to understand the graphics in the map is a key factor for a good communication. To then decide the data themes needed, the purpose of the map much be investigated. Several studies point that successful navigation through an environment depends on description or knowledge of landmarks (Duckham, Goodchild & Worboys, 2004; Sorrows & Hirtle, 1999; Rousell & Zipf, 2017; Raubal & Winter, 2002). Landmarks is closely linked to the mental maps constructed in our mind of the environment and help us navigate through the city (Rousell & Zipf, 2017). Landmarks are therefore a relevant focus if the goal is to limit the number of data in the map and see if people still are able to understand the environment through their knowledge of landmarks and their sense of direction. Even though many people today as mentioned use navigational apps on their mobile phones, they might unconsciously notice their surroundings and be able to point in which directions they came from, or in this case by able to point to landmarks based on the location of another landmark. Landmarks are both present for the understanding of the environment in familiar and unfamiliar environments (Allen, Siegel & Rosinski, 1978). This can also be seen in tourist maps which often highlights the attractions (landmarks) in one way or the other. The maps for tourists however needs a lot of information e.g. street names, area names, buildings, public transport information of how to get there, the addresses of the landmarks and perhaps even more, as pointed out by Meilinger et al. (2007), the information for an unfamiliar environment needs to be descriptive enough to navigate through. The reason for the need for a lot of information here is that the tourist does often not know the area, the landmarks or how the landmarks are distanced to each other, and therefore needs to be guided through more information of the map. If the tourists then were to ask locales for directions, the verbal directions of the persons familiar with the environment will often be based upon landmarks and the landmarks distances between each other. E.g.: "when you reach the church down this road you must turn left then you will reach the statue of interest". People in a familiar environment locate landmarks in relation to other landmarks – in the sense that they can place one landmark in distance to another when given wayfinding and navigational tasks (Rousell & Zipf, 2017). Therefore, there could be a possibility that people familiar with a city could locate a not shown landmark in a map only or primarily illustrated with landmarks.

A way to account for individual differences in how good people are to interpret a map of landmarks, is their sense of direction. Sense of direction is:

"*A person's ability to know without explicit guidance the direction in which they are or should be moving*" (Quote: Oxford University Press, 2017 – online dictionary).

In several studies, different self-report measurements have been used, such as the Santa Barbara Sense of Direction Scale (SBSOD). The SBSOD has been found highly reliable to give an indication of how good or poor people think their sense of direction are (Weisberg et al., 2014).

One's sense of direction is therefore a key factor when trying to navigate through an environment or understanding of a map. Thus, the SBSOD will give an indication of the individual differences when exploring how well people in a familiar environment are to locate structures in a map with less information.

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2 The Research Overview

As explained in the introduction, there is an interesting issue if people is able to understand an environment illustrated with less than “normal” data. Montello (2009) states that one of the main challenges in this field is to provide enough information to understand a map, and not more. To be able to address this matter, a research question is created. For this thesis, the research question will be answered through supporting hypotheses. When the hypotheses are validated or invalidated, they will constitute to a general answer of the research question. The research statement and hypotheses will form the basis for the analysis and discussion.

2.1 Research Statement

The research statement for this thesis is as following:

People can in a known environment locate non-visible landmarks in a map only consisting of landmarks and no routes

The research aim of this thesis is to investigate if it is possible for a person to locate a landmark in familiar environment with limited amount of data on the map. The information available on the map will be landmark features. The purpose is to make a feasibility study whether or not it could be of use to create more simpler maps when illustrating information to a local group of people. Thus, the intention is firstly to identify if people understand the simple maps and then secondly to see if there is any future in this kind of map design; could the less information serve a greater purpose when communicating a message through this type of map.

2.2 Hypotheses

The five following hypotheses are created to give a more comprehensive answer to the research question.

1. Respondents familiar to the environment can find the given locations

2. There is a correlation between how precisely the given location was found and their test score on Santa Barbara Sense of Direction Scale

3. There is a correlation between how precisely the given location was found and how easy the respondents thought the maps were to interpret

4. The rotated map is harder to understand than the non-rotated map

5. Respondents who live (or have lived) in the city give a more precise answer than the respondents that do not live in the city

2.3 Presentation of chapters

In *chapter three*, the relevant theories will be presented. In *chapter four*, the used methodology will be described. The results of the data collecting will be visible in *chapter five* divided into answer categories of five hypothetical statements as seen above. *Chapter six* will consist of a discussion of the results and a general discussion. *Chapter seven* will feature the conclusion of the thesis. The reference can be seen in *chapter eight*, while the appendix can be seen in *chapter nine*.

3 Theory

This chapter presents the used theory. The theory for answering the research question can be characterized as theory belonging to the fields of geography, psychology and statistics. The subject examined in this thesis, can be described as Cognitive GIScience, where all of the aforementioned fields influence and intertwine.

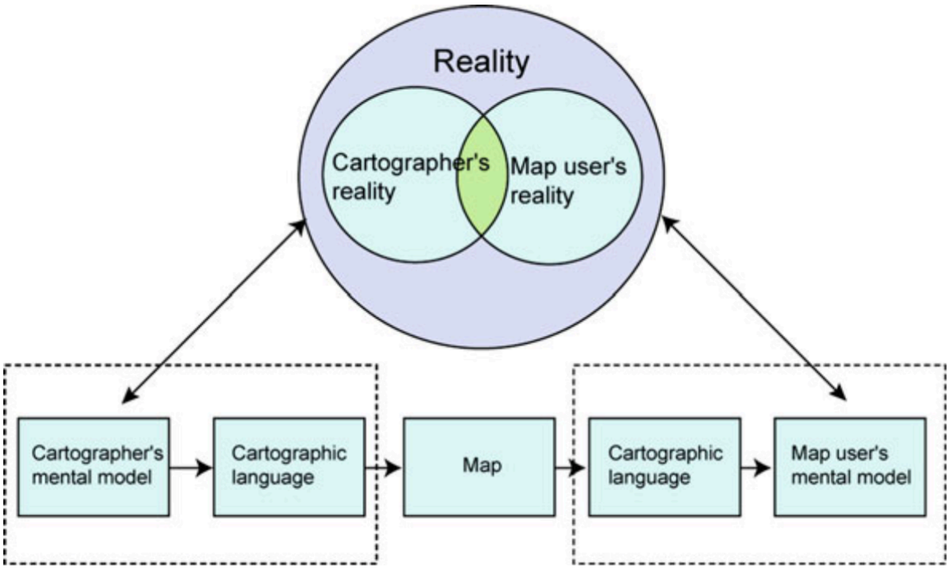
3.1 Geocommunicaton and Maps

Maps are a communicative media, where different informative messages can be distributed to the end user; the map user or map reader. Maps display and communicates spatial relationships, spatial patterns, and spatial distributions (Torguson, 2012). When designing a map, the sole purpose of the map must be predefined of the map designer (Brodersen, 1999; Cartwright, 2013b). The purpose can for example be to illustrate the road network, economic factors in a neighborhood or schools. The purpose of every single map produced is to communicate spatial knowledge (Torguson, 2012). but the cartographic design of the map has a prominent role in how the map user interpret the map (Kriz, 2013).

Cartwright (2013b) explains that the map proposer/cartographer often has observed, refined or re-defined the information before the map is presented to the map user. In addition, Brodersen (1999) defines two steps in developing a well-communicative map: 1) the role of the map proposer, and 2) the role of cartographer. Through these two steps, the map should undergo different alterations to perfectly communicate the purpose to the map user. The map proposer's role contains defining the purpose; why develop the map, defining the target group; who shall use the map, and defining the goal; how should the map appear for the map user (Brodersen, 1999). The cartographer's role is more design orientated – which information shall the map contain, how shall the information be filtered and organized, and finally, which graphical design shall the map have (Brodersen, 1999). The map proposer and cartographer must have an understanding and knowledge of the geographical means that needs to be transformed into a communicative media (Cartwright, 2013a). It is the map proposer's and the cartographer's role to find the needed elements of information which can lead to effective communication (Kitchin & Blades, 2002).

According to Brodersen (1999), these considerations that the map proposer and the cartographer make before producing a map result in a satisfactory map if the map user is involved in the process. A pre-study of whether the intentions and consideration of the map proposer and the cartographer communicates the wanted information to the map user is best accomplished if the map user is involved – and testing the map. However, in every map, the graphics and the amount of information is a key factor for the map user possibility to decode, interpret and thus, understand and use the map (Kriz, 2013). In figure 3.1 the communication of a reality is displayed. When designing a map of a reality, it is important that the map user's reality correspond with the cartographer's reality (Cartwright, 2013b; Brodersen, 1999). The pre-test could according to figure 3.1 be relevant to see if the shared reality of the map purpose is consistent – and with it, the interpretation.

Figure 3.1: Cartographer's reality and Map User's reality



Theoretical model of map design, production and consumption. The interrelation of the shared reality between the cartographer and map user is the key factor for good geocommunication. *Source: Cartwright, 2013b*

A way to help the map user to better interpretation and understanding is through generalization of the information and graphics. Not all graphics or information in the map communicates the map purpose efficiently (Kriz, 2013). By using an informational generalization, it is possible to limit the amount of information necessary to serve the purpose of the map (Brodersen, 1999). Graphical generalization can be seen in how to graphically exaggerate meaningful information or graphically oppress less important information in the map (Brodersen, 1999). The exaggerated or oppress information is determined by the purpose of the map (Cartwright, 2013b). Vaughan (2013) states that, the map user's attempt to perceive the map purpose depends on the ability to interpret the shown layers. Regarding this, the way to secure the map purpose to be communicated efficiently the map proposer and cartographer must enable the map user to recognize the presented reality in the map. A method of helping the map user is to create elements in the map, which the map user is familiar with (Kriz, 2013). Kriz (2013) argues that, the interpretation of the map is depended on the spatial knowledge of the map user – learned ability to translate the cartographic elements to reality.

The theories of geocommunication is relevant for this thesis because they debate how it is most efficiently to develop a map, which can be understood of the end user. The theories also highlight the different realities of the cartographer and the map user that might influence the map interpretation. The geocommunication leads towards the theories of cognitive geography. The theories of cognitive geography and cognitive maps will be presented in the following section.

3.2 Cognitive Maps

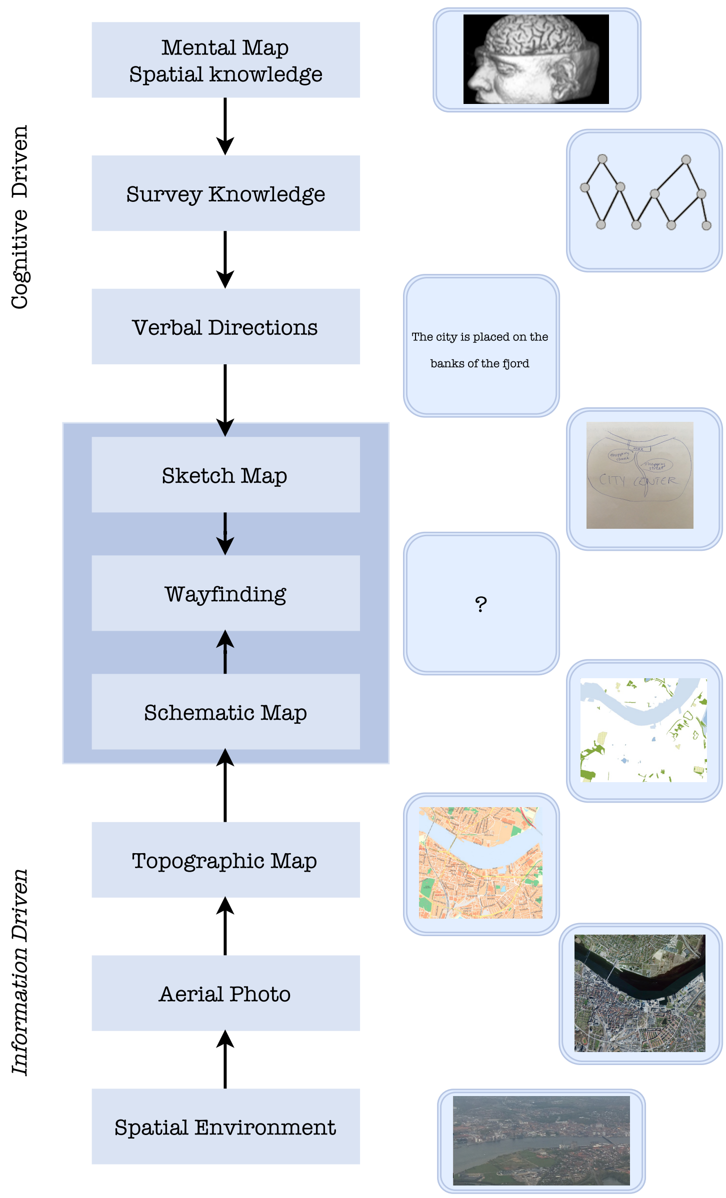
When trying to understand a map, the map user must recognize features (Kriz, 2013) to be able to do so one must have spatial knowledge of locations, patterns, connections, relationships (Torguson, 2012). and even cartographical design principles (Kriz, 2013). That being the case, the cognitive geography addresses how people learn, understand, remember, and perceive spatial information in different environments (Castree, Kitchin & Rogers, 2016a).

The cognitive maps are said to be the mental map of the given environment that people have in their minds (Castree, Kitchin & Rogers, 2016b). Both the mental maps and the actual developed maps are important, because they impact in peoples understanding of the world (Kriz, 2013). Kitchin & Blades states that, cognitive maps refer to individual's spatial knowledge. The spatial knowledge consists for example of one's ability to see environmental relationships and encoding information by filtering the important information from the excessive information available in the real world (Kitchin & Blades, 2002; Holloway & Hubbard, 2013).

Cognitive geography and cognitive mapping are often used in studies of the spatial memory (Wedell & Hutcheson, 2014). The cognitive map, or mental map, can be visualize in different ways. The mental map is the map inside one's head, whereas the sketch maps are hand-drawn maps produced from one's mental map (Ricther, Marin & Devanini, 2012; Castree, Kitchin & Rogers, 2016c). The sketch map can be seen as a tangible product of the mental map. The sketch maps are therefore an individual's understanding of the environment and demonstrates a high reliability in one's spatial knowledge. However, as stated by Neisser (1976), as summarized by Kitchin & Blades (2002), the individual interactions and needs will determine which features will be shown in a sketch map.

The cognitive mapping and spatial knowledge is prevailing when in need of finding one's way through an environment, or recognizing the environment. Cognitive geography is highly used when trying to describe wayfinding. This is due to the interest in mapping the different human understanding of an environment, and the interaction with, or behavior in, an environment (Montello, 2001; Kitchin & Blades, 2002; Weisberg et al., 2014; Kippel, 2003). In figure 3.2 after Kippel (2003) can the connection between information (data) and cognitive understanding of an environment, and two sides of the wayfinding be seen. The cognitive driven approach starts with one's mental map of a given environment. The spatial knowledge is translated into survey knowledge, which is one's general impression of interrelationships in the environment. With the mental map and survey knowledge, one is able to give verbal descriptions of an environment, which then can be used to create a sketch map of an environment. This steps results in one's ability to navigate through an environment without any aid. The Information driven approach is the geographical information science approach, where a map designer tries to limit the amount of information to a certain degree, which can support the navigation through the use of maps. Firstly, the map designer starts with a given spatial environment, in the figure a photograph taken from an airplane over Aalborg is shown. The next step for the designer is to see id navigation is able through an aerial photo, but as noted in the in intro duction, aerial photos are often information-filled images which can lead to misinterpretations. Then the topographical map is considered, but still this is an information-filled map, even though it is simpler than the aerial photo. In Kippel's model, he therefore highlights that schematic maps with only the needed information is leading to successful navigation through an environment. An example hereof, could be the normal car GPS, where an aerial photo rarely is used for the background feature. Sometimes a topographical map is used, but most often just the road network is highlighted as the needed information for the car-driver to reach his/her destination

Figure 3.2: From Mental Map and Spatial Environment to wayfinding.



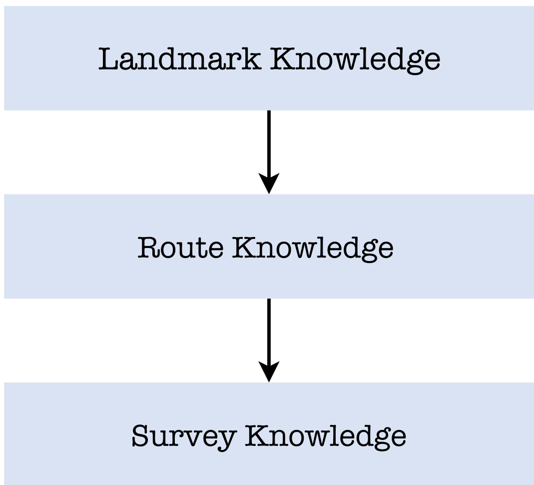
After Kippel, 2003.

The figure leads to an understanding of the different techniques that results in wayfinding. While one is the cognitive and individual aspect, the other is the map production and communicational aspect of the map proposer and cartographer. The cognitive element is relevant for this thesis because it effects the spatial understanding of maps and therefore, how well a pre-study of landmark-focused maps could be. But as mentioned in this section the spatial knowledge is acquired through learning and memory, wherefore the next section will focus upon the theory of spatial learning.

3.3 Spatial Learning

Since the 1950s and 1960s, the studies in cognitive geography and spatial learning have flourished, and cognitive GIScience has been included as well since the late 1990s (Montello, 2001; Montello, 2009). Montello (2009) states that only few modifications has been done to the methods of how geographical information is cognitively understood. One of the most acknowledged methods for theoretical understanding of the spatial learning processes were presented by Siegel & White in 1975 (Wiener, Büchner & Hölscher, 2009). Siegel & White presents a model of how the mental map is developed in one's mind and memory, see figure 3.3 (Allen, Siegel & Rosinski, 1978).

Figure 3.3: Spatial Knowledge

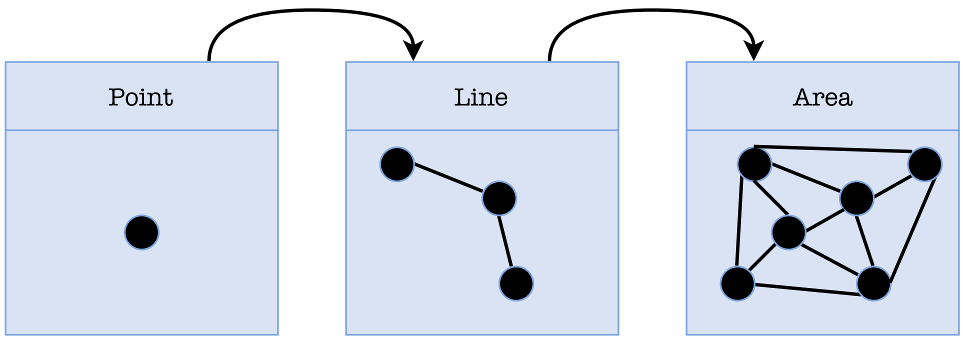


After Siegel & White (1975) as summarized by Montello (2001); Rousell & Zipf, (2017); Allen, Siegel & Rosinski (1978); Wiener, Büchner & Hölscher (2009).

Firstly, one notices the salience features in the environment, the landmarks (Montello, 2001; Rousell & Zipf, 2017). The registration of landmarks function as reference points in the environment and is labelled ***Landmark Knowledge*** (Allen, Siegel & Rosinski, 1978). Studies show that landmarks are important for the means of navigation (Dudchenko, 2010; Rousell & Zipf, 2017). Secondly, is ***Route Knowledge.*** Route knowledge is formed when linking one landmarks position and distance to another landmark (Allen, Siegel & Rosinski, 1978; Montello, 2001; Rousell & Zipf, 2017). This is often done when traveling from one landmark to another, by which means a route is created. Third and lastly is when one is able to create a general impression of the environment through routes and landmarks, it is called ***Survey Knowledge*** (Rousell & Zipf, 2017; Montello, 2001; Allen, Siegel & Rosinski, 1978). The survey knowledge can be seen as the overall understanding of different routes and landmark connections.

These three stages are often referenced in the literature of cognitive geography, and several contributors to the method have followed over the years. Golledge (1999), as summarized by Wiener, Büchner &Hölscher (2009), refers to the three stages as points, lines and areas. It is possible to follow Golledge if thinking visually, as illustrated in figure 3.4. Here the landmarks are distinctive reference points in the environment, which is connected by route lines, and the stage of area knowledge is when one has the ability to calculate new routes in between the already know routes and landmarks by the means of the understanding of the locations and distances.

Figure 3.4: Points, Lines, and Areas in Spatial Learning



after Golledge (1999) as summarized by Wiener, Büchner & Hölscher (2009).

3.3.1 Wayfinding through Spatial Knowledge

A more specific taxonomy for the different aspects of navigation where propound by Wiener, Büchner & Hölscher (2009). They combined several previous assumptions of wayfinding into one model, see figure 3.5. As seen in the model, the first division in navigational task is made between locomotion and wayfinding. The definition of locomotion has been described by Montello (2001); locomotion refers to how people avoid obstacles and other immediate surroundings (Wiener, Büchner & Hölscher, 2009; Montello, 2001). By these means, the locomotion can be said to the immediate reaction to the environment, The wayfinding on the other hand is in need of one's spatial knowledge as mentioned earlier.

Under wayfinding there is a further division: aided or unaided wayfinding. The aided wayfinding is occurring when signs leads to the destination or when a detailed map is depicted the way (Wiener, Büchner & Hölscher, 2009). When studying the cognitive wayfinding, the unaided wayfinding is more interesting than the aided. This is for the simple reason that the spatial knowledge of an environment is achieved through spatial learning – and the everyday navigation through a known environment often happens without aided wayfinding.

Figure 3.5: Taxonomy of Wayfinding

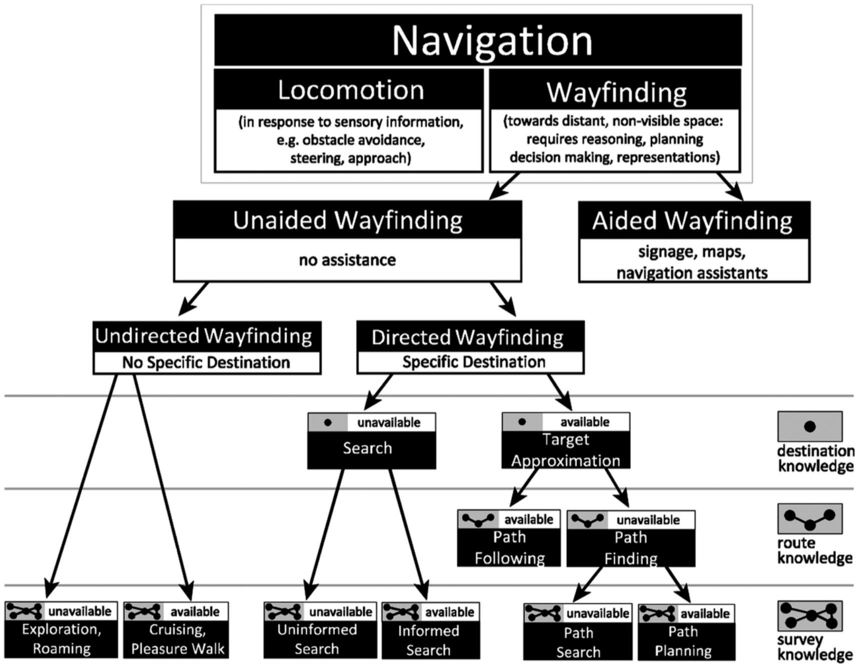


Figure XX wiener, Büchner & Hölscher, 2009.

The unaided wayfinding is divided into two categories; directed and undirected wayfinding. The undirected wayfinding is when strolling around in an environment without a final destination (Wiener, Büchner & Hölscher, 2009; Dudchenko, 2010). When having a destination to reach, the wayfinding becomes directed (Dudchenko, 2010). In this subdivision of the wayfinding, the directed wayfinding seems more interesting than the undirected wayfinding, because the spatial knowledge is needed to reach the destination in mind. However, Wiener, Büchner & Hölscher (2009) states that undirected wayfinding quickly can transform to directed wayfinding. Their example of this is, if strolling through a shopping street on a day off, one might not have a destined shop in mind when starting, but when one needs to find a cup of coffee, car or home the wayfinding becomes directed (Wiener, Büchner & Hölscher, 2009).

In the next phases of the model Wiener, Büchner & Hölscher (2009) elaborates the spatial learning method of Siegel and White. Under the directed wayfinding another split is described; search and target approximation. The target approximation is used when describing if the person has knowledge of destination, or landmark, and then knows a route to the destination (route knowledge). Nevertheless, if the person's survey knowledge of the environment is not strong, the target approximation can result in path search or planning (Dudchenko, 2010; Wiener, Büchner & Hölscher, 2009).

The search phase has two subcategories; uninformed search and informed search. Uniformed search emerges in wayfinding, when the destination is known, but one does not know the route to get there or know the environment (Wiener, Büchner & Hölscher, 2009; Dudchenko, 2010). An example of this could be tourists that have a goal to see a specific attraction in the city. The tourists might have started the day with a planned route to another attraction, followed by an undirected exploration of city. The tourists then want to see the specific attraction while out, or presumably in the area; they know the attraction is somewhere, but they do not know where it is, or how to get there. To fully get success from an uninformed search, one is perhaps in need for aided wayfinding – or if not successful with finding aid to reach the destination, one must then search and search.

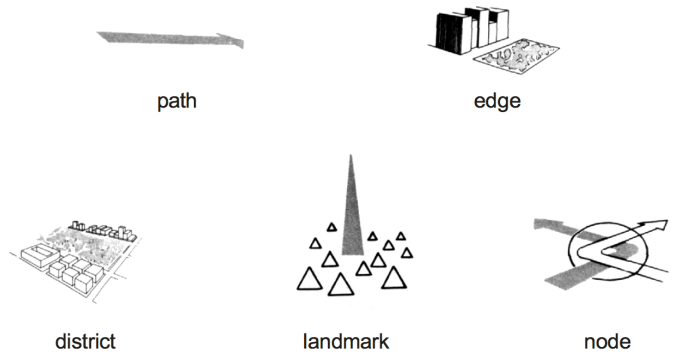
The informed search is present when one has at least a rough survey knowledge of the environment (Dudchenko, 2010). In the informed search, the landmarks' locations and distances is known but the knowledge of a direct path is always known (Wiener, Büchner & Hölscher, 2009). An example hereof could be that if one must find the way to a specific shoe in a shoe shop, the person knows where the shoe shops is located in relation to the other shops in the area, but the person still needs to find the way to specific shelf with the right shoe.

For this research, the informed search is significant. The informed search happens in a familiar environment with the knowledge of the locations and distances of landmarks, but there is no route in particular of assistance for guidance. By these means, with the informed search it might be possible to locate a non-visible landmark in a map. According to the model by Wiener, Büchner & Hölscher (2009), directed wayfinding needs landmark knowledge of some sort. Furthermore, both Dudchenko (2010) and Rousell & Zipf (2017) point that the most accurate navigation and wayfinding through an environment are found when landmarks are available for the traveler. In the next section of this chapter, a further look into the definition and specifications of a landmark will be presented.

3.4 Detection of Landmarks

As established in the earlier sections of this chapter, landmarks are used to organize one's spatial knowledge (Allen, Siegel & Rosinski, 1978; Farran et al., 2012; Kitchin, 1994; Richter & Winter; 2014; Duckham, Goodchild & Worboys, 2004). But what is the definition of a landmark? According to Stankiewicz & Kalia (2007), the definition of a landmark depends on the given purpose or person declaring an object a landmark. One of the first to notice the significance of landmarks in wayfinding perspectives, was Lynch (1960). Through his research, Lynch found five significant features of which people use when trying to describe a known environment (Lynch, 1960; Rousell & Zipf, 2017; Fenster, 2009). These five features were paths, districts, edges, nodes and landmarks, see figure 3.6, and where found by asking citizens to draw a sketch map of their environment (Lynch, 1960; Fenster, 2009; Kippel, 2003). Furthermore, Lynch stated that because of these five significant feature types people are able to remember and thereby, navigate through their city's environment (Lynch, 1960; Wedell & Hutcheson, 2014).

Figure 3.6: The five Lynchian features



After Kippel, 2003

In 1999, Sorrows & Hirtle proposed that landmarks could be divided and detected into three descriptive types. In their article “The Nature of Landmarks for Real and Electronic Spaces”, they described how landmarks become reference points in the mental map through the structure’s salience or the personal meaning of the structure to the individual (Sorrows & Hirtle, 1999). Landmarks can therefore be any distinctive structure in the environment because individuals might impose subjective significance to the place or feature (Stankiewicz & Kalia, 2007; Quesnot, 2017;). As noted by Lynch (1960), Sorrows & Hirtle (1999) also states that successful navigation depends on the landmarks in the environment (Sorrows & Hirtle, 1999; Stankiewicz & Kalia, 2007; Duckham, Goodchild & Worboys, 2004). However, by concluding that not only can the landmark be one of the five visual features as proposed by Lynch (1960), the landmark can be somehow categorized by using distinctions like structural, visual and cognitive (Sorrows & Hirtle, 1999). The differences in the three landmark types can be seen in figure 3.7.

Figure 3.7: The three distinctions of Landmarks

Structural	Visual	Cognitive
Its role or location, structure of space	Features of contrast with surroundings	Has a typical, or atypical, meaning
Highly accessible	Significant salience	It might be culturally or historically important
Prominent location in the environment	Particular memorable	Often personal
Certain spaces, intersections or aspects in the environment	Prominence of spatial location	Can be missed by those not familiar with the environment

After Sorrows & Hirtle, 1999

The visual landmarks are the features in the environment which color, shape, height, architecture or other predominant salience differs from the surroundings; the structural landmarks are features of space such as roads, intersections, infrastructural accessibility; and the cognitive landmarks are features with cultural, historical or personal meaning (Sorrows & Hirtle, 1999). It is further noted that a landmark not always just belong to one of the three types. A strong and powerful landmark in the meaning of memory and navigation often belongs to all three types, and is manifested in for example architecture, color, accessibility, historical value in the given environment (Rousell & Zipf, 2017; Sorrows & Hirtle, 1999).

This landmark theory will help selecting the right landmarks for the research of this thesis. The distinction between the different types will be used for handpicking the right landmarks for display. As noticed by Holloway & Hubbard (2013), numerous landmarks might result in an ignorance of landmarks that the individual do not have any personal spatial knowledge of. Alternatively, if limiting the landmarks to generally known landmarks, the individual might misinterpret the landmarks as of closer together due to their onsite knowledge compared with map interpretation (Siegler & Thompson, 2014). Thus, it is needed to try to illustrate the distances between the landmarks through the maps to limit the misinterpretation and still, not overfill the map with information.

3.5 Sense of Direction

In the introduction, the definition of sense of direction were presented as a person's ability to know where they are and where they should be going (Oxford University Press, 2017). Through the theories in this chapter, the theories of spatial knowledge and landmarks has been presented. One's sense of direction can through these theories be linked with the spatial knowledge (landmark knowledge, route knowledge and survey knowledge) where the goal is either navigating or orienting oneself (Hegarty et al, 2002). Sense of direction reflects the spatial orientation ability and how this ability helps maintaining the orientation through space (Kozlowski & Bryant, 1977).

It is found that people are more unlikely to lose orientation in a familiar environment (Kozlowski & Bryant, 1977; Golledge, 1992; Dudchenko, 2010; Hegarty et al., 2002). However, because spatial knowledge is a learned ability it is not certain that everyone possesses a comprehensive survey knowledge to support knowledge of one's orientation or whereabouts (Montello, 2001).

A self-report measurement was developed by Hegarty et al. (2002). called the Santa Barbara Sense of Direction Scale (SBSOD). The SBSOD-test is an ability test of how individuals perceive a spatial environment (Hegarty et al., 2002; Dik, 2007). As most ability tests, the SBSOD-test is able to show difference between people and measure maximal abilities due to self-rating (Dik, 2007). It is argued that the performance measurements in the SBSOD-tests is highly reliable and valid, because compared to other abilities the sense of direction is used all the time and individuals therefore have a good understanding of how well they perform this task (Dudchenko, 2010; Hegarty, 2002). The score from the SBSOD-test can be used for detecting and understanding the differences in spatial knowledge (Weisberg et al., 2014; Hegarty et al., 2002; Dik, 2007).

Figure 3.8: The 15 statements in the SBSOD-questionnaire

Santa Barbara Sense of Direction Scale

1. I am very good at giving directions
2. I have a poor memory for where I left things
3. I am very good at judging distances
4. My "sense of direction" is very good
5. I tend to think of my environment in terms of cardinal directions (N, S, E, W)
6. I easily get lost in a new city
7. I enjoy reading maps
8. I have trouble understanding directions
9. I am very good at reading maps
10. I don't remember routes very well while riding as a passenger in a car
11. I don't enjoy giving directions
12. It's not important to me to know where I am
13. I usually let someone else do the navigational planning for long trips
14. I can usually remember a new route after I have traveled it only once.
15. I don't have a very good "mental mep" of my environment

After Hegarty et al., 2002.

The SBSOD-test is a questionnaire consisting of 15 statements relating to one's spatial knowledge, which is featured a 7-point likert scale (Hegarty et al., 2002; Weisberg et al., 2014). The 15 questions can be seen in figure 3.8. After collecting the data, recalculations of some of the statements' points is performed resulting in a score measuring sense of direction of individuals (Hegarty et al., 2002; Weisberg et al., 2014). The closer the sense of direction score is to 7, the better sense of direction does the individual have (Hegarty et al., 2002).

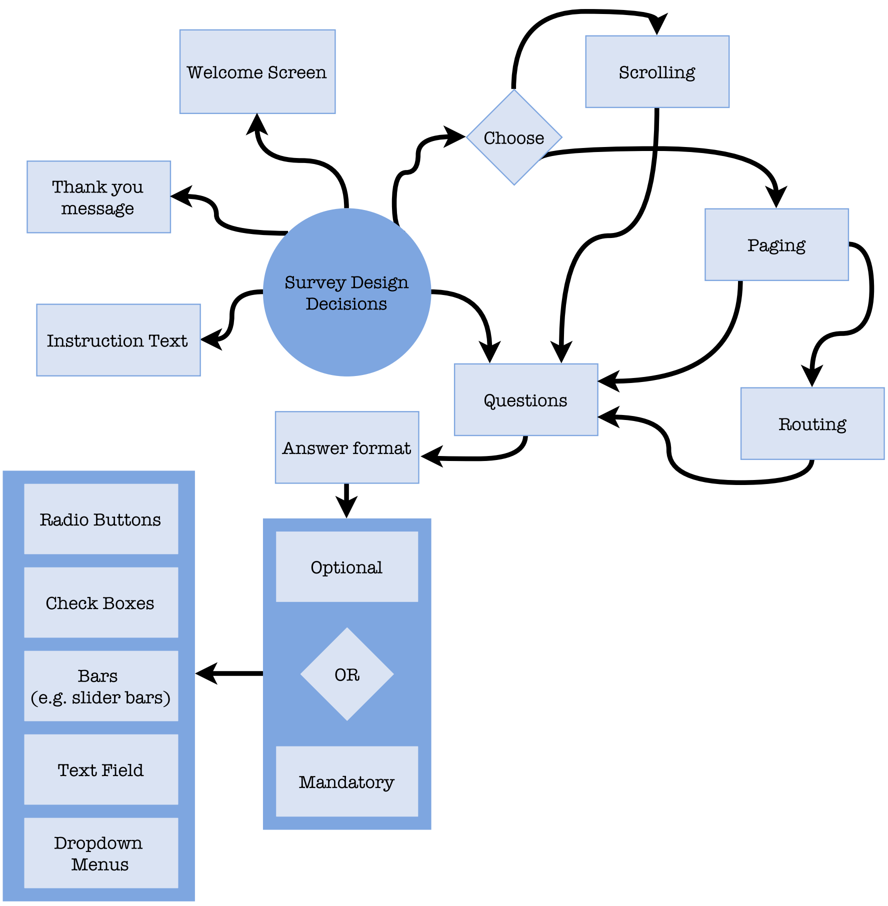
Since this thesis study the understanding of a map with limited amount of information for later use in geocommunication through maps, the possible individual difference in spatial knowledge must be taken into account. By these means, the acknowledged SBSOD-test is chosen.

3.4 Qualitative Data and Online Survey

When doing a pre-study of a map's communicative abilities it is evident to perform a test. Generally, statistics is concerning data collection, presentation and analyzing (Khan Academy, 2017). But where quantitative statistics is focused upon mathematical variability, the qualitative data analysis tries to display the dimensions of human understanding and experiences, thus not easily compromised into numbers (Khan Academy, 2017; Nigatu, 2009). Qualitative data can normally be classified into categories of a nominal or an ordinal variable (Glen, 2015; Ko, 2011). The nominal variables are labelled and countable as for example the number of male or females in a test, whereas the ordinal variables are countable and possible to rank as for example a likert-scale score (Ko, 2011). The qualitative data analysis identifies patterns, similarities, differences, and meanings through the principle that people differ in their understanding of the reality (Nigatu, 2009).

When assembling an online survey, several considerations regarding the survey design must be performed (Toepoel, 2017). From access control, to answer formats, to recruitment all the aspects of the questionnaire are often designed before the distribution of the online survey (Toepoel, 2017; Vehovar & Manfreda, 2017). This process is time consuming and often requires several tests before releases (Toepoel, 2017). In figure 3.9, some of the consideration is displayed. Toepoel (2017) states that every online survey must have a welcome screen to catch the respondents interest and will to complete the survey, and a thank you message to respondents at the end of the survey: to thank the respondents for taking the time to answer the questionnaire. Besides the questions and instructions test, the answer format is a key for optimizing the data collection. By creating

Figure 3.9: Online Survey Design Decisions



The figure presents some of the consideration of which the designer must decide for creating a functioning online survey. Figure created after Toepoel, 2017.

different answer possibilities, such as one answer, multiple answer, sliders, the answering becomes more intuitive for the respondent (Toepoel, 2017). Some argue whether it is best to use scrolling or paging trough the survey (Toepoel, 2017). Scrolling gives the respondents a complete overview of the questionnaire at hand, while the paging design move the respondent from page to page (Toepoel, 2017). The paging enables an interactivity in the questionnaire where a question can depend on the answer of previous questions (Vehovar & Manfreda, 2017).

Generating a sample for online surveys is mostly controlled sampling to a certain degree (Vehovar & Manfreda, 2017). Different methods can be used to distribute the survey, where the two major categories are list-based or non-list-based (Vahovar & Manfreda, 2017). When selecting the sample, it is most convenient to use a sample that can answer the questionnaire (Nigatu, 2009). The list-based surveys have an existing sample frame, for example trough a mailing list, and the non-list-based surveys are more randomly selected (Vehovar & Manfreda, 2017). Furthermore, the access to the survey should be considered. An online survey can be accessed through a general link, or a private link where only invited respondents can enter (Toepoel, 2017). Linked to the access, the benefits of having a non-defined-device survey might improve the number of answers with the possibility for the user to access the survey from a web browser on computer or smart phone (Vehovar & Manfreda, 2017).

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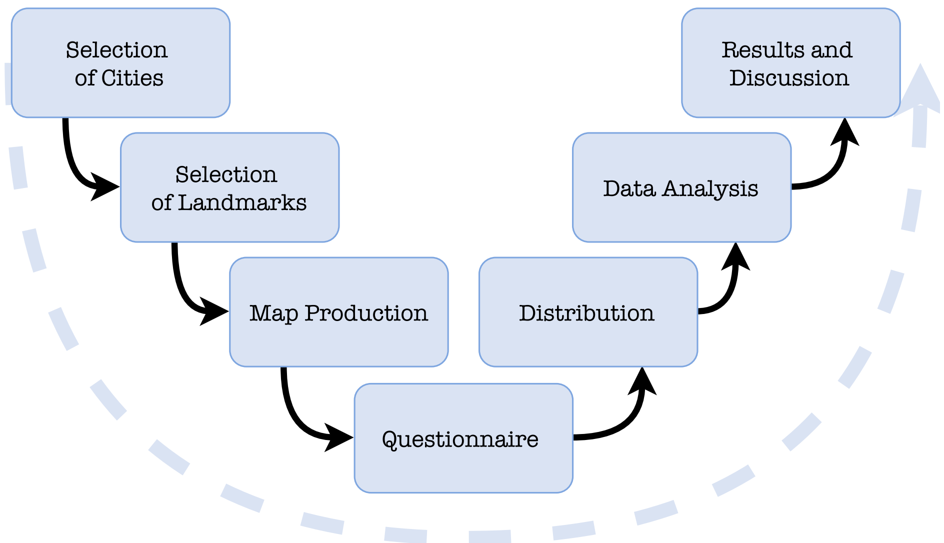
4 Methodology

In this chapter, the methodology of this thesis will be presented. The methodology consists of the considerations and the methods for designing the study map and the online survey and introduce the tools used for the analysis. Some of the described methods will be used to illustrate the methods in use. Figure 4.1 shows an overview of the used methodology chapter. Firstly, the selection of cities and landmarks will be described using the theory of spatial learning and landmarks. Secondly, the general map production of how the geographical data was collected, manipulated, visualized and communicated through the use of Geographical Information Software (QGIS). Then, the design of the questionnaire using the theories of online surveys, qualitative data and SBSOD. The phase of the questionnaire is linked with the distribution of the data, whereto the data collecting is connected as well. Lastly in this chapter, the used analyzing tools for the qualitative data analysis will shortly be describe.

Figure 4.1: Overview of the Methodology.



4.1 Selection of Places and Landmarks

Three Danish cities of different sizes and locations were selected for testing whether or not the maps are useful for communicational purposes, and how well people with familiarity with the city could locate. The three cities were Aalborg (population of 113.417), Roskilde (population of 50.393) and Copenhagen (population of 1.295.686) (Statistikbanken, 2017). Aalborg is a known for its former industry, but now brand itself as a city of knowledge and education. Furthermore, is Aalborg the fourth largest city in Denmark. Roskilde is a medieval city in which most of Danish royalty is buried in the cathedral. Copenhagen is the Danish capital and largest city area in Denmark.

The decision of which landmarks should be used, the three types of landmarks (structural, visual and cognitive) were considered with informational generalization in mind. With the notion that the strongest landmark belongs to all three types, it was however, decided to detect three general geodata features belonging to one of the landmark types for use in the map. Intentionally to see, if one type of these landmark types communicates better than the other, or if they all communicate equally effective. To do so, three maps for each city were developed; one illustrating structural landmarks; second map illustrating visual landmarks, and the third map illustrating cognitive landmarks. The maps are later mentioned as the structural map, the visual map and the cognitive map.

For the structural landmarks, it was chosen to use the road network of the three cities. As defined by Sorrows & Hirtle (1999), the structural landmark is defined through its accessibility and prominent location. These words can also be used to describe the road network in every city, and many may know the location of a street, where it intersects with other streets, or where it ends. Therefore, it is found that the road network is mostly a structural landmark.

For the visual landmarks, it was chosen to illustrate the city by four to five significant features, which in their salience, prominent location or historical meaning often is used as meeting points for people in the cities, or is well-established tourist attractions. A way to clarify the argument of, why visual landmarks often becomes meeting points is, that because of this prominent feature's salience, location or history it is a landmark most people of the city know and have a spatial relation to these landmarks. The selected landmark feature to represent the visual landmarks in the visual map can be seen in table 4.1.

For the cognitive landmarks, the position of grocery stores was chosen to be illustrated in the cognitive map. This is substantiated in the fact that people living in a city needs to shop groceries and there for often creates a navigational connection between the location of the different grocery stores. Grocery stores serve a typical meaning, but for non-locales who do not need to go shopping for groceries, the grocery stores might be missed. The reason for the omission of these grocery stores for non-locale can be linked with the statement that our perception of a new environment makes the brain filter unnecessary features out (Holloway & Hubbard, 2013).

Table 4.1: Chosen visual landmarks for map development (Continues)			
Aalborg	1	Cimbrer tyren	Statue of a bull Meeting point
	2	Jomfru Ane Gade	Street with clubs on both sides Meeting point
	3	Kennedy Arkaden	Central Buss station Small shopping center Cinema Meeting point
	4	Musikkens hus	Concert house by the fjord Architectural pearl of the city
	5	Budolfi	Church Next to shopping streets Meeting point

Roskilde	1	Roskilde Domkirke	Cathedral All Danish royalty buried here Meeting point Tourist attraction
	2	Vikingeskibs-museet	Viking ship museum by the fjord Tourist attraction
	3	Hestetorvet	Square with statue Meeting point In front of train station
	4	Folkeparken	Public park Popular among locals
Copenhagen	1	Vor Frue Domkirke	Cathedral ("Church of Our Lady") Meeting point
	2	Rundetårn	Round tower Meeting point Tourist attraction In shopping street
	3	Rosenborg Slot	Royal Castle Public park (Kongens have – the King's Garden) Tourist attraction
	4	Tycho Brahe Planetarium	Planetarium Tourist attraction

.

4.2 Map Production

After the cities and landmark feature were chosen, the map production was performed in the open source GI-software *QGIS*, the PostgreSQL database of *pgAdmin III*, and through online image-converting sites.

It was chosen to display the maps as static maps for the purpose of understanding and communication. For the reason that, this research deals with a pre-study of whether it is effective or not to produce a map with landmarks. Another reason for creating a static map is for the map user not to be confused be the ability to pan around in a web-based map.

Most of the data was downloaded from the free Danish geoportal *Kortforsyningen*. The used datasets contained buildings, roads, lakes and municipality borders. Other free geographical data used were the *Register of Danish Addresses (DAWA)*, which was used to create a new dataset for the thesis. By collecting the addresses of the grocery stores in the three cities, it was possible to link the addresses to a geographical point with the DAWA dataset, see figure 4.2.

The road network from Kortforsyningen was manipulated to only containing the roads in the cities and displayed through a single colored line, while the manipulated dataset of grocery stores was displayed in the cognitive map by classified points of the different grocery stores, where the colors of the points were tried to be illustrated according to the grocery stores logos, and labelled with the store name.

Figure 4.2: SQL code for linking the collected dataset of grocery stores with a geographical point from DAWA.

```sql
SELECT
  butikker.id, -- ID from shops collection
  butikker."Butik", -- name of shop
  butikker.husnummer, -- house number
  butikker.vejnavn,  -- street name
  butikker.postnummer,  -- postal code
  municipality1.id as aws_id -- address ID from DAWA, column named aws_id
INTO
  test.butikker_in_municipality1 -- new data file is created
FROM
  test.butikker,  -- collected data with addresses of the grocery stores
  test.municipality1  -- DAWA dataset with all the addresses in the municipality
WHERE
  butikker.vejnavn = municipality1.vejnavn AND
  butikker.postnummer = municipality1.postnr AND
  butikker.husnummer = municipality1.husnr;
  /* only use the data where:
  street names from the collected dataset is equal to the street names in DAWA;
  post number from the collected dataset is equal to the post number in DAWA;
  and the house number from the collected dataset is equal to the house number
  in DAWA. */
```

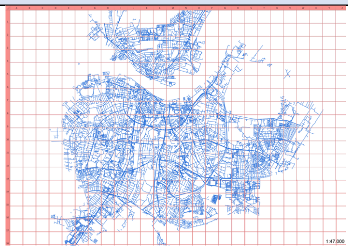
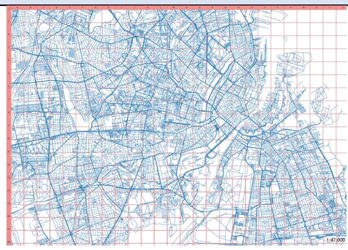
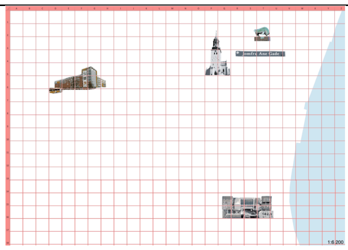
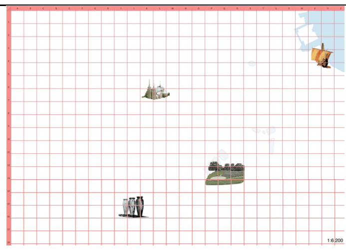
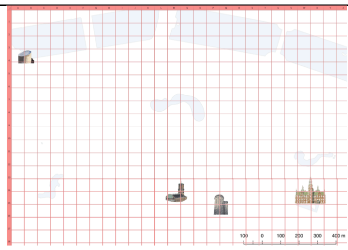
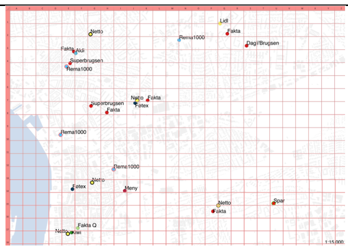
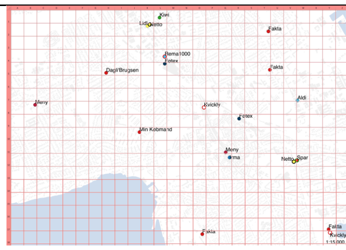
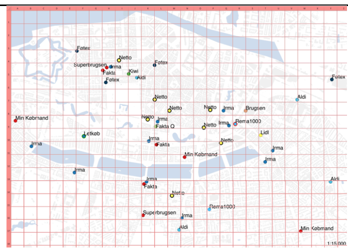
.

For the visual landmark map, pictures were found of the buildings/statues presented in table 4.1 and converted to SVG files. The transformation from image to usable vectorized image were a bit tricky; a guidebook of how it was managed can be seen in *appendix 9.1,* where also the reference of the images used are mentioned. To integrate the SVG-files onto the map, reference points of the specific locations were manually plotted into a new vector file by using an aerial photo. The reference points of the visual landmarks were then classified by name, and the SVG-images were used to illustrate the points.

For creating consistence between the three cities, it was decided to illustrate the different maps on the same geographical scale. Thus, the structural map for all three cities were 1:47.000 meters, the visual map for all three cities were 1:6.200 meters, and the cognitive maps were 1:15.000 meters. The different scales were chosen to support the understanding best possible representation of the limited data (Hirtle, 2011). Because road networks often are a larger network, the smaller geographical scale were here determined to be needed. For the cognitive map, a larger geographical scale was chosen. Considering the different distances between the grocery stores, this scale was found large enough to illustrate several shops and their relation. The visual map contains four to five specific landmarks in relation to each other, it was presumed that to help the spatial knowledge of the map users the scale must be even larger.

To peak the maps even further than not just only limiting the elements on the map, the visual map and the cognitive map were rotated. Hirtle (2011) noted that maps often are created with a preferred orientation: north is at the top of the map, but as of the theories of spatial learning – one learns where a landmark is located to others landmarks. Therefore, it is argued for this method, that because showing enough landmarks the map users understanding of the relations between landmarks in the familiar environment, the map does not need to be presented in the preferred orientation.

Figure 4.3: Overview of the developed maps

	Aalborg	Roskilde	Copenhagen
Strucural			
Visual			
Cognitive			

Maps created for the questionnaire. See appendix 9.2 for larger maps.

For assisting the map user of the pre-study, a grid was placed upon every map. The grid was equipped with letters from A-Z at the top, and numbers 1-18 to the left. Figure 4.3 show an overview of the developed map. Larger-sized maps can be seen in appendix 9.2. For the pre-study to be successful, a non-visible landmark should be found and placed in a grid the maps. The non-visible landmarks which should be located can be seen in figure 4.4.

Figure 4.4: The non-visible landmarks needed to be located

	Strutural	Visual	Cognitive
Aalborg	Gigantium	Springvandene ved Toldbod Plads	Aalborg Sygehus (syd)
København	Kastellet	Nørreport st. (Metro)	København Rådhus
Roskilde	Roskilde Domkirke	Roskilde Politistation	Sjællands Universitetshospital, Roskilde

'Gigantium' is a sport arena which facilitates indoor swimming, ice hockey, handball, concerts, flea markets, and much more. 'Kastellet' is a former citadel, but is today military area, memorial site, museum, and public park. 'Roskilde Domkirke' is as describe in figure XX, a cathedral and burial site for Danish royalty since medieval times. 'Springvandene ved Toldbod Plads' are iconic step-like fountains placed near the harbor front and shopping streets. 'Nørreport st. (Metro)* is one of the main public transport location in Copenhagen; from here you can travel almost in every direction, and furthermore, it is placed in the inner city at the end of a shopping street. 'Roskilde Politistation' is the police station of Roskilde; it is a rather new modern building in where e.g. renewal of passports is done. 'Aalborg Sygehus (Syd)' is one of two hospitals in Aalborg; on this, the accident and emergency department is located. 'København Rådhus' is the town hall of Copenhagen and the politician of Copenhagen municipality is working here; nonetheless, the square in front of the town hall is often used for demonstrations, concerts and flea markets. 'Sjællands Universitetshospital, Roskilde' is one of the main hospitals in the region, and it is strategically located close to the train station. .

4.3 Questionnaire

Through a questionnaire, the maps were presented to test people familiar with the environment. As one of the first steps of the design of the questionnaire, questions were developed to establish a more comprehensive qualitative analysis of the spatial understanding of maps, and how this affect a map only displaying generalization of landmarks. An overview of the questions presented can be seen in figure 4.5. Because the cities are located in Denmark, the questionnaire was presented in Danish.

It was chosen to use the online survey software ***Survey Xact*** developed by the engineering company Ramböll, Survey Xact enables possibilities to design the survey with tools like questions, text, paging, scrolling, different answer formats and routing, but also features different distribution options.

It was decided to use a combination of paging and scrolling. For the SBSOD there were used scrolling through the questions, whereas the maps and relating questions were presented through paging. Only one questionnaire was designed, but because of routing it was possible to design which question should depend on a specific answer of a previous question. Thereby, the answer of the question of which city of the three pre-selected would lead the respondent to the maps and question for this city.

Figure 4.5: Question line-up

Overview of Questionnaire
Age & Sex
SBSOD Self-Report Questions
Selection of City
Questions, E.G. Live or do not live in the city?
Find Landmark on Structural Map
Find Landmark on Visual Map
Find Landmark on Cognitive Map
Map Evaluating Questions

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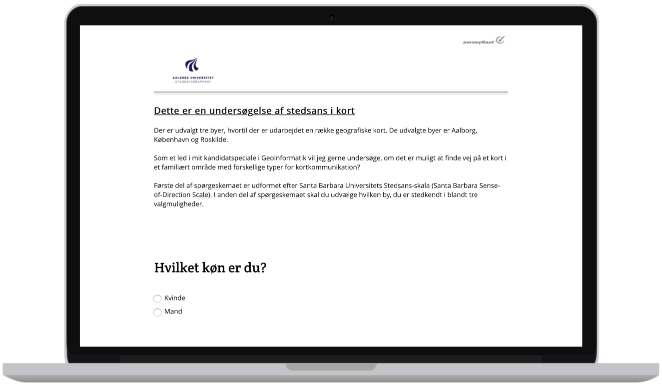
Figure 4.6: Welcome text in the Online Questionnaire



Own questionnaire presented by tools from the e-software Survey Xact.

During the questionnaire, the respondent was in total presented to 31 questions different questions. 15 of these were the SBSOD statements, while 6 of the questions concerned the maps. The ten other questions determined sex, age, city, living in the city or not, years of living or other relation to the city (depended on the answer of 'living in the city or not'), one self's estimation of navigational abilities in the given city (depended on the answer of 'city'), if one uses landmarks when navigating; and three assessments questions concerning, if the sense of direction was challenge with the maps, how the orientation of the maps was received, and lastly, rating of one's map interpretation skills after the maps. Most of the questions were mandatory with one possible answer, but it was possible to give multiple answers to the question of relation or none. Both radio buttons, checkboxes, dropdown menus and sliders were used as answer format. Four optional textboxes were also featured in the questionnaire. The first textbox where placed beneath the SBSOD statements, where the respondent could write his/hers e-mail to receive their SBSOD-score. The three other textboxes followed the maps, and it was possible for the respondent to write a comment to the given map.

It was chosen to keep the design colors of the questionnaire simple, using a white background, black text, balck/white page-turning-buttons and a small header containing the logo of Aalborg University (Student Report), see figure 4.6. A welcome-text was presented as the first. In this, the reason of the questionnaire was shortly presented and a brief overview of the questionnaire were provided. However, the welcome-text was not separated from the first to questions determining sex and age. Before every map, the landmark used were presented, the non-visible landmark needed to be located was mentioned, and rotation if different, were mentioned, see figure 4.7. The questionnaire finished with 'thank you'-messages, with an invitation to send an e-mail if curiosity or questions in general aroused.

The intention was that the questionnaire should be answered with a computer. However, Survey Xact also automatically adjusted the questionnaire to smart phones or tablet if it was viewed from one of these devices, as shown in figure 4.7.

Figure 4.7: Instructional text before map display on both computer and smart phone.

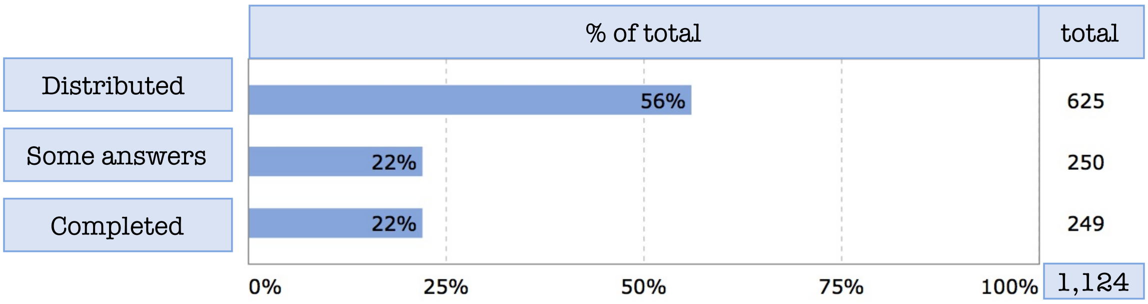
Own questionnaire presented by tools from the e-software Survey Xact.

The complete questionnaire in Danish can be seen in appendix 9.3. However, it should be noted, that the different answer formats or paging effects are not present.

4.4 Distribution and respondents

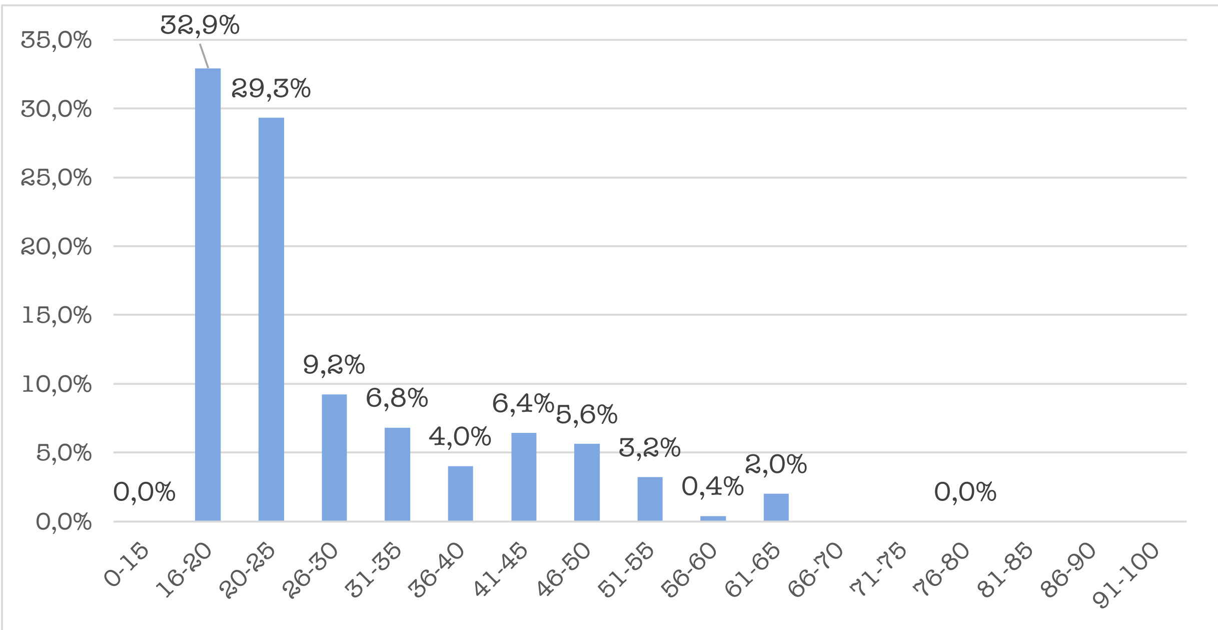
In total 249 respondents completed the questionnaire and serves as the data for the qualitative data analysis later performed, but it should be noted that this only constituted of 22 percentages of the total amount of people who were presented with the questionnaire, see figure 4.8. The questionnaire was online from the 1st of May until the 10th of May 2017.

Figure 4.8: An overview of all the respondents of the questionnaire



with element from the data analysis tool from the e-software Survey Xact.

Figure 4.9: Distribution of respondents' age



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For the data collection of the questionnaire it was chosen to make the respondents anonymous and let the respondents enter the questionnaire by using a general link. The link was then posted on Facebook where it was shared multiple times by people in the three different cities. The sharing on Facebook can be seen as a randomly selection of the survey sample, but it should be noted that the one's social network highly influence the answering of the questionnaire. To neutralize this, the link to the questionnaire was send to high schools in the area with an invitation to share this among their students. The effects of the social network sharing and the distribution to high school students are shown in the percentages-wise distribution of the respondents' age, see figure 4.9. Most of the main social network of use can be estimated to an age around 25, while the high school students often are between 15-21 years.

Duly noted, was the sampling from the different cities not alike, Complete answers from the city of Aalborg were 126 respondents; city of Roskilde were 83 respondents, and city of Copenhagen were 40 respondents.

4.5 Analyses and measures

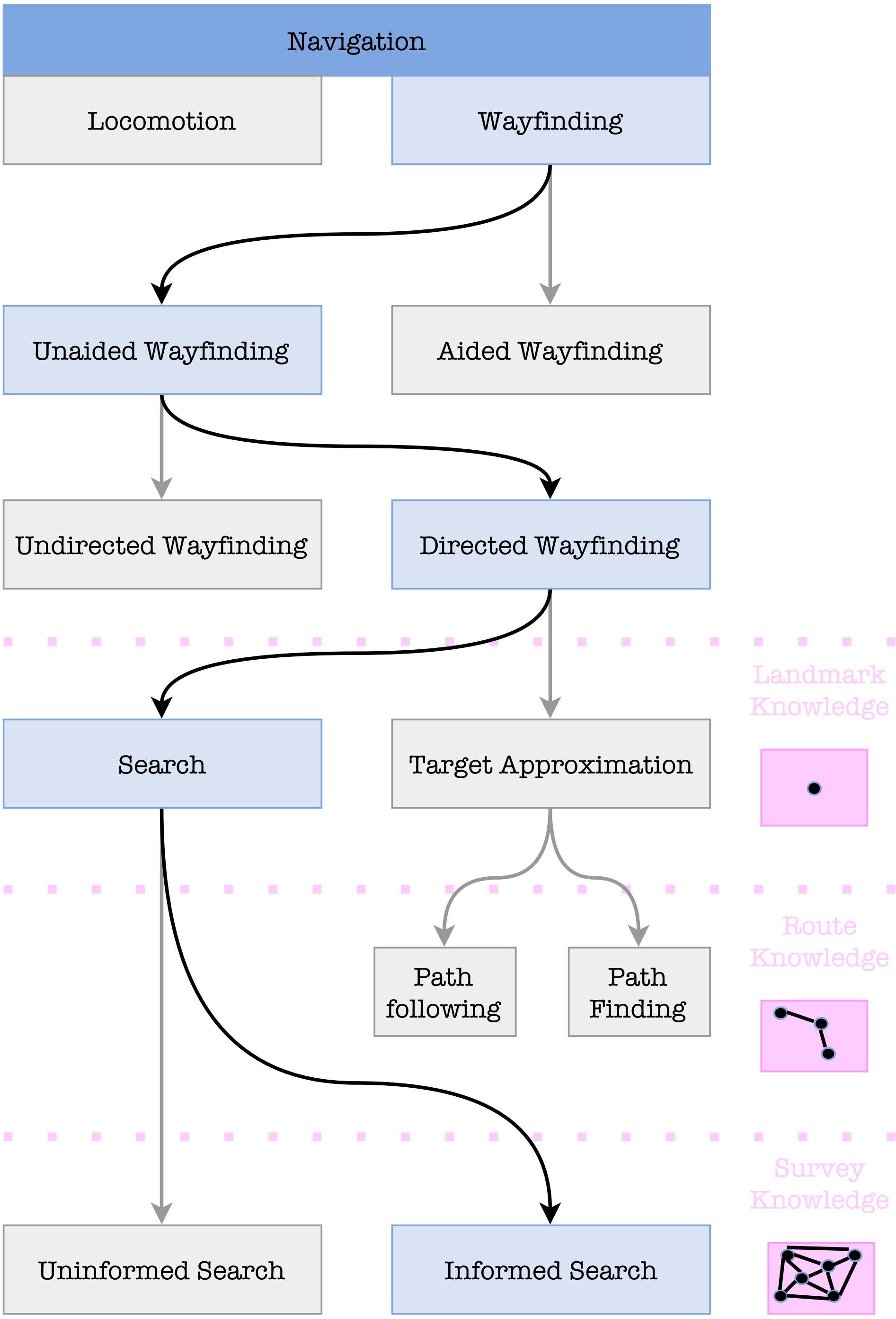
After data were collected through the questionnaire, recalculation and new variables must be performed. The complete dataset was imported to ***Microsoft Excel*** where the qualitative data analysis was performed.

For the calculation of the right SBSOD-score, recalculation of statement 1, 3, 4, 5, 7, 9, and 14 was performed according to Hegarty et al, (2002).

The complete dataset was divided into from which city the respondents had answered that they were familiar with. In the city-divided datasets, the grid answers of the non-visible landmarks were altered from a D and an 8 to D8. Next to the answer of the respondents, the true answer was typed. By performing a true/false test on whether or not the answered grid coordinate was consistent to the true answer. However, for some of the non-visible landmarks there were more than one true grid coordinate, as a result more than one true/false test were performed to that variable. To search for similarities or differences pivot tables were created with different variables.

As of qualitative data analysis, the purpose of the analysis was to detect trends, similarities and clear differences. The general assumption of the analyses was that through a person's spatial knowledge he/she could locate a non-visible landmark in the map. If the taxonomy by Wiener, Büchner & Hölscher (2009) is taken into consideration, the results should affect that the respondent through his/her navigational skills, is able to perform an informed search. Arguably, the limited amount of information on the map can be described as unaided wayfinding, because the aided wayfinding assists the navigator precisely to one's destination. This assumption is highlighted in figure 4.10.

Figure 4.10: The assumption of which the analysis is based upon



Highlighted the used perspective of the taxonomy by Wiener, Büchner & Hölscher. 2009.

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5 Results

In this chapter, the results of the research will be presented. Firstly, the hypotheses will be examined. Secondly, other interesting results of the research will be presented.

5.1 Hypotheses 1

The first hypothesis was: Respondents familiar to the environment can find the given location. The goal of this hypothetical question was to study if it was possible to use the limited number of landmarks as a communicative map and have the respondents point to a non-visible landmark. For being able to do this, the respondent should possess landmark and survey knowledge of the city, so the respondent could perform an informed search for the non-visible landmark.

5.1.1 Results

As explain in the methodology, only respondents with familiarity with one of the three cities were presented with the maps.

It was found that half of the respondents could place the non-visible landmark on the structural map. Almost a third could locate the non-visible landmark on the cognitive map, whilst only one percentages could locate the non-visible landmark on the visual map. See table 5.1. 19 percent of the respondents were able to both locate the non-visible in the structural map and in the cognitive map.

Table 5.1: Results of hypothesis 1, all respondents

Could place the non-visible landmark in...	Percentages
... the structural map	51 %
... the visual map	1 %
... the cognitive map	32.1 %
... all three maps	0.8 %
... the structural and cognitive map	19 %

If observing the results from the different cities, some differences are seen, see table 5.2. The successful identification of the non-visible landmark in the structural map differs from 49 % (Aalborg), 40 % (Roskilde), and 80 % (Copenhagen). In all three maps, approximately one third of the respondents located the right location for the non-visible landmark (33 %, 33 %, and 30 %). Whereas none respondents of Roskilde (0 %) located the right location for the visual map, one respondent of Aalborg (0.7 %) and two respondents from Copenhagen did (5 %). Because of the few respondents locating the landmark in the cognitive map, only two answered correctly in all three of the map; in Aalborg (0.7 %) and Copenhagen (2.5 %). For the location ability of the respondents in both the structural map and the cognitive map, it was found that Roskilde differed 10 percentages points from the next highest percentages score of Aalborg.

Table 5.2: Results of hypothesis 1 per city

Aalborg	
Could place the non-visible landmark in...	Percentages
... the structural map	49 %
... the visual map	0.7 %
... the cognitive map	33 %
... all three maps	0.7 %
... the structural and cognitive map	22 %

Roskilde	
Could place the non-visible landmark in...	Percentages
... the structural map	40 %
... the visual map	0 %
... the cognitive map	33 %
... all three maps	0 %
... the structural and cognitive map	12 %

Copenhagen	
Could place the non-visible landmark in...	Percentages
... the structural map	80 %
... the visual map	5 %
... the cognitive map	30 %
... all three maps	2.5 %
... the structural and cognitive map	25 %

.

Despite some differences, the total percentage calculation gives a better overall calculation of the location of the different non-visible landmarks. The general higher percentages for Copenhagen is arguably because of the smaller sampling size collected. Consequently, it was found that the most effective map communication occurred through the structural map, but still, the result of the structural map was approximately 50 %.

5.2 Hypotheses 2

The second hypothesis was: There is a correlation between how precisely the given location was found and their test score in Santa Barbara Sense of Direction Scale. Through this hypothetical question, it is wanted to see if the SBSOD-score of the respondents influences the ability to point to the correct location of the non-visible landmark. As mentioned in the theory (chapter 3.5), the SBSOD is capable to make a general impression of how the conceptual understanding of the environment is in the mind of the respondent. The possibility to connect the spatial knowledge to the result can therefore support a more comprehensive pre-study of the communication abilities of the created maps.

5.2.1 Results

None SBSOD-score of this study, reached below two points. One respondent was self-estimated to the highest score of seven points as the calculated score. However, the only three respondents who were able to locate the non-visible landmarks in all of the maps, had self-estimated themselves in the SBSOD to a result between 5.00-5.99 points, respectively with 5.73 and 5.93 points.

The SBSOD-score distribution of the three cities where both the non-visible landmark of structural and the cognitive map were located can be seen in table 5.3. Notably, most of the successful identifications of the non-visible landmarks were found by respondents with an SBSOD point between 5.00-5.99 points. The respondents between the intervals of 3.00-4.99 and 6.00-6.99 also were represented well in the identification in both the structural and cognitive map.

Table 5.3: SBSOD-score and respondents with the non-visible landmark correct in both the structural map and the cognitive map

SBSOD-score in intervals of 1	Aalborg	Roskilde	Copenhagen	TOTAL
2.00-2.99	0	1	0	1
3.00-3.99	4	5	0	9
4.00-4.99	6	1	3	10
5.00-5.99	12	2	5	19
6.00-6.99	5	1	2	8
7	1	0	0	1
Sum	28	10	10	48

For the structural maps, it was found that both Aalborg and Copenhagen peaked between 5.00-5.99, while Roskilde peaked in the successfulness identification of the non-visible landmark with respondents with a SBSOD-score between 4.00-4.99, see figure 5.1. The successful respondents in the cognitive maps peaked for all cities between 5.00-5.99, see figure 5.2. If the total respondents are studied, the respondents in the structural

Figure 5.1: SBSOD-score and the correct identification of the non-visible landmark in the structural map

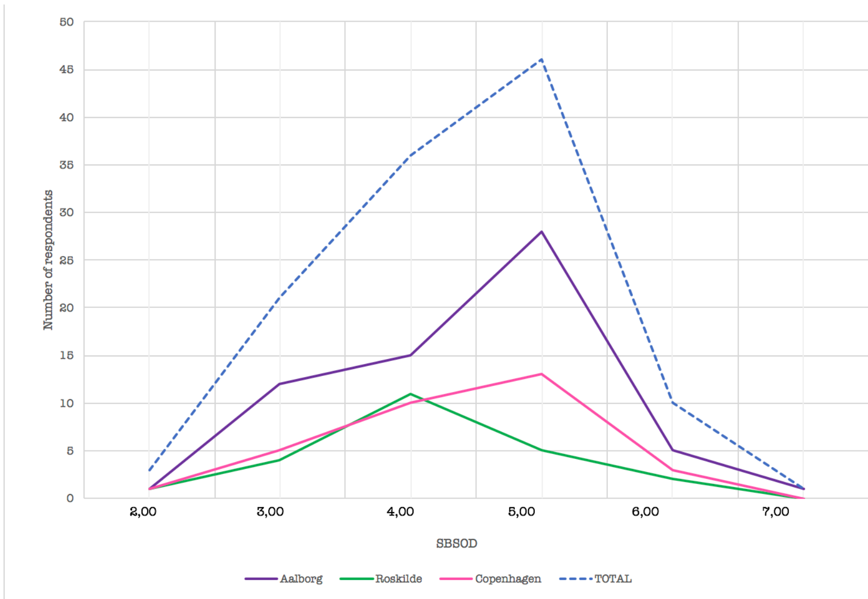

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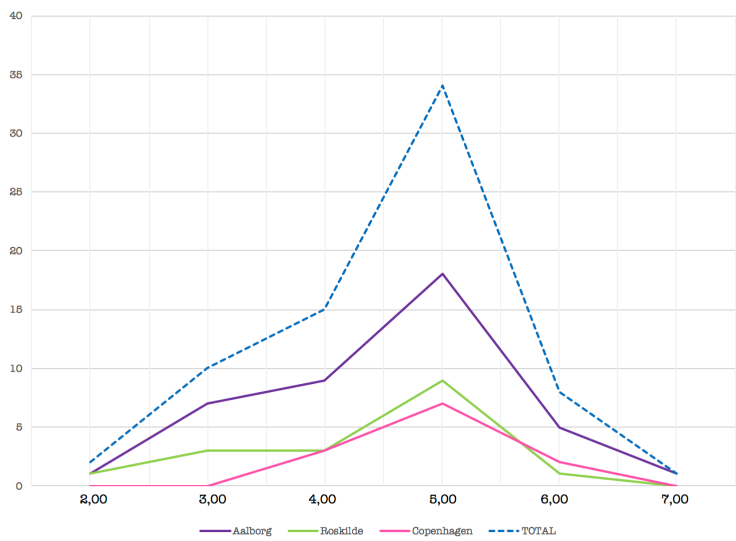
Figure 5.2: SBSOD-score and the correct identification of the non-visible landmark in the cognitive map



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5.3 Hypotheses 3

The third hypothesis was: There is a correlation between how precisely the given location was found and how easy the respondents thought the map were to interpret. After the respondents had given their estimation of the non-visible landmarks location, they were asked whether or not they found the map easy or hard to understand. With the results of the respondents' personal evaluation, this hypothetical question was analyzed.

5.3.1 Results

It was found that there was a correlation between the respondents' location of the non-visible landmark and how challenging they found the interpretation of the map. In figure 5.3 can a percentage-wise decrease in easy/correct answer be seen as the graph continues to very hard/correct answer. Conversely, the easy/wrong answer percentage-wise increase through the degree of difficulty. Even though, already established in previous

results, the non-visible landmarks in the cognitive maps were only found by three persons, it was interesting to see, how the respondents evaluated the maps. As of figure 5.4, the degree of difficulty is expressed through stacked columns. It was found that 84 % of all the respondents found the cognitive map hard or very hard to understand.

Figure 5.2: The distribution of correct and incorrect answers compared with the respondent's evaluation of degree of difficulty to interpret the map. Total

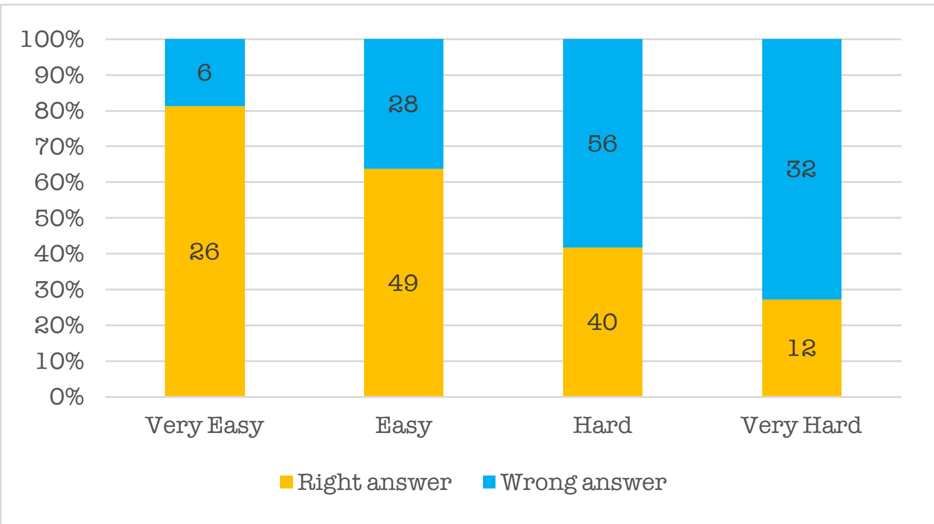


Figure 5.4: An overview of the distribution of correct and incorrect answers compared with the respondents' evaluation of degree of difficulty to interpret the visual map.

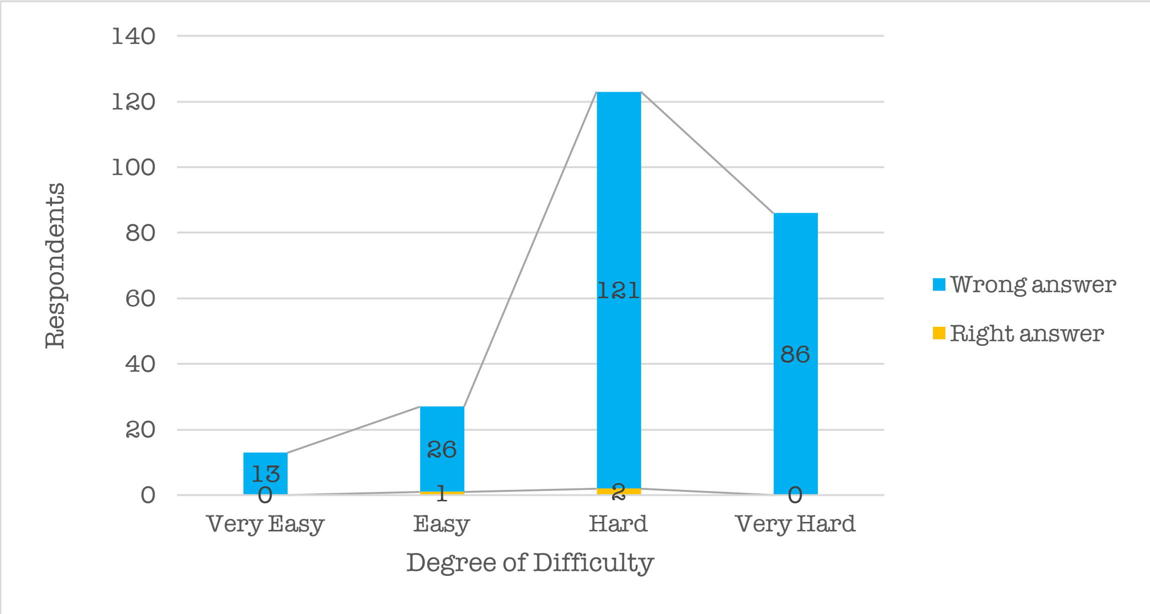


Figure 5.5: The distribution of correct and incorrect answers compared with the respondent's evaluation of degree of difficulty to interpret the cognitive map.

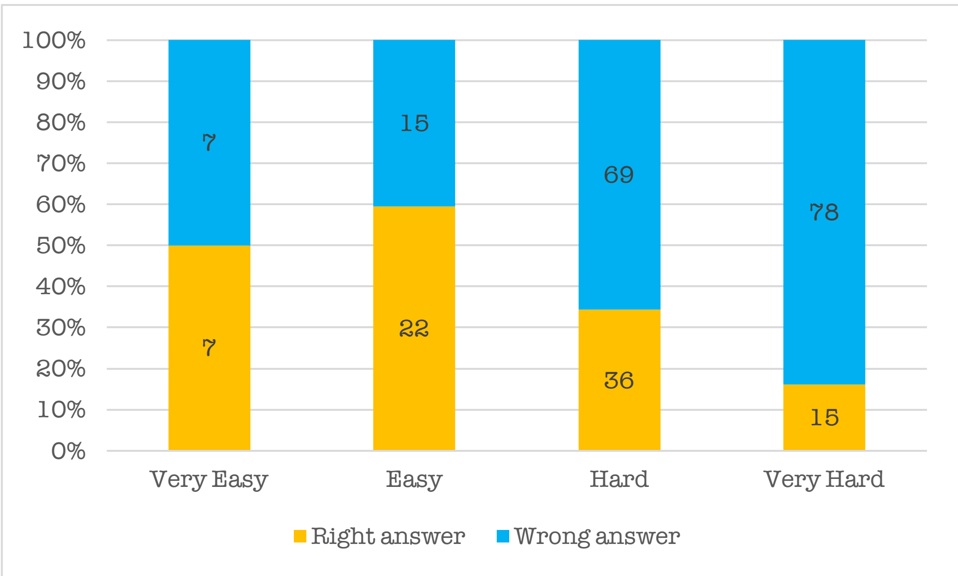
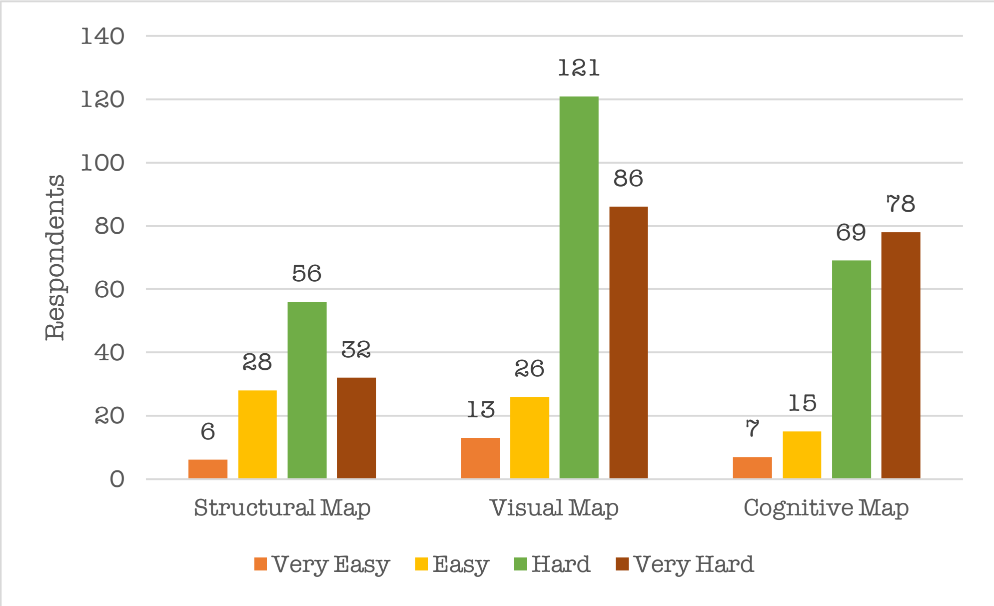


Figure 5.6: Total of respondents who did not identified the non-visible landmarks conception of map communication.



Like the structural map, the cognitive map shows an almost linear correlation through the percentage distribution of correct/incorrect answers, see figure 5.5. However, a 50-50 distribution is occurring in the very easy-evaluation. Thus, in the rest of the percentages-wise distribution while the correct answers decrease over the degree of difficulties from very easy to very hard, the incorrect answers likewise increase.

Of the respondents who did not identify the non-visible landmarks, 84-86 % evaluated the difficulty of the map to be hard or very hard in the visual and the cognitive map, see figure 5.6. 72 % the respondents with incorrect answers in the structural map found the hard or very hard to understand.

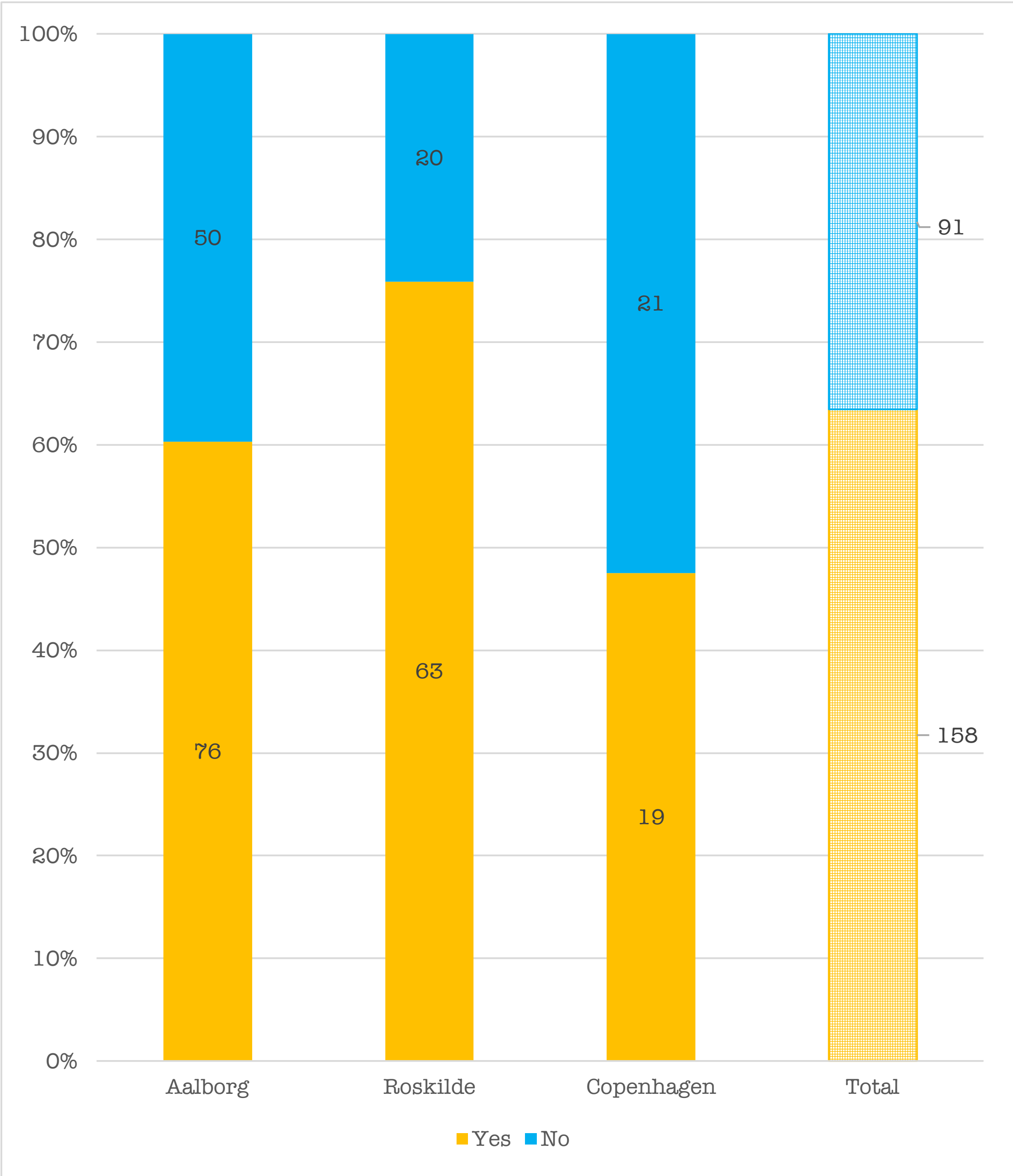
5.4 Hypotheses 4

The fourth hypothesis was: The rotated map is harder to understand than the non-rotated map. Through this hypothetical question, it was presumed that the not-normal orientation of the maps would cause some difficulties for the respondents. The informed search for the non-visible landmarks needed a good landmark and survey knowledge, to understand how the landmarks and the spatial relationship between those in the environment.

5.4.1 Results

It was found that in total, the respondents found it harder to locate the non-visible landmarks with an orientation differing from the normal geographical orientation (63 %), see figure 5.7. The number of respondents divided on the cities who did not found it hard to understand a map with a different orientation scale were estimated to be 40 % (Aalborg), 24 % (Roskilde), and 53 % (Copenhagen).

Figure 5.7: Result of whether the respondents found it hard to orientate themselves in the map with a different from normal geographical orientation.



5.5 Hypotheses 5

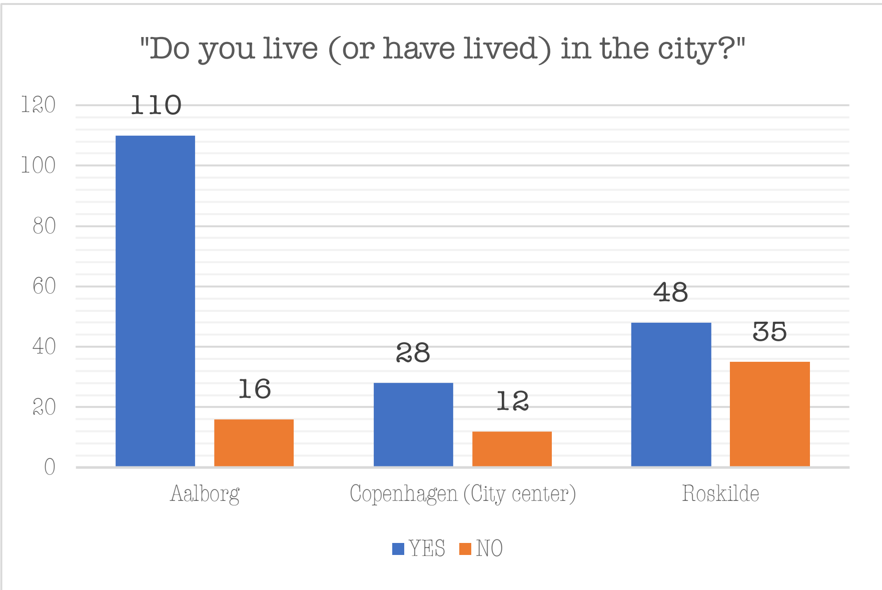
The fifth and last hypothesis was: Respondents who live in the city (or have lived in the city) give a more precise answer than the respondents that do not live in the city. This hypothetical question was asked with the assumption that people who live in the environment might have a better understanding (survey knowledge) of the cities compared to those respondents not living in the city.

5.5.1 Results

It was found that 13 % (Aalborg), 14 % (Roskilde), and 30 % (Copenhagen) of the respondents from the three cities did not actually live in the cities, see figure 5.8.

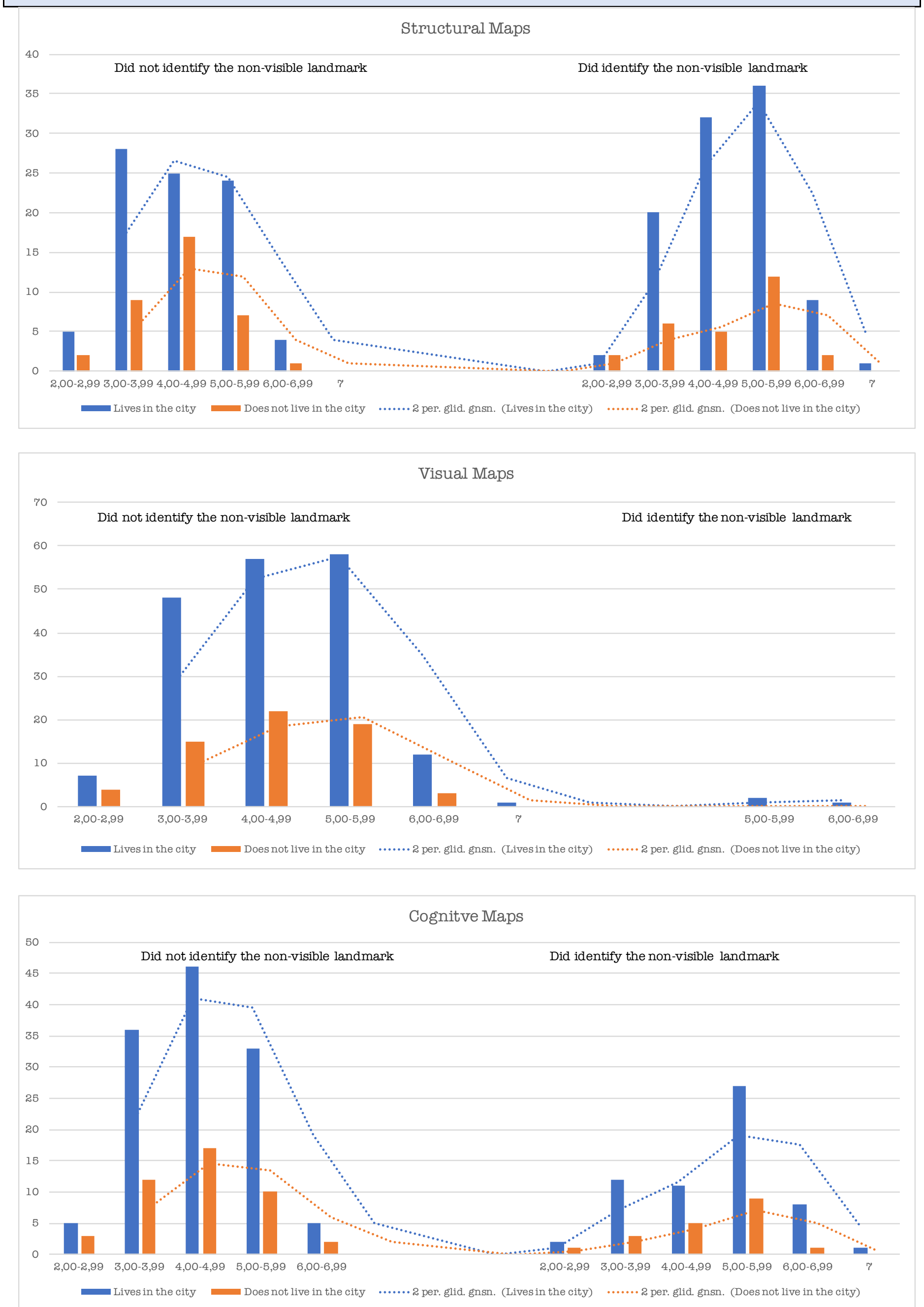
Figure 5.9 shows the correlation between the SBSOD-score and whether the respondent lives or do not live in the city. To the left, the respondents who did not identify the given non-visible landmark, and to the right, the respondents who did identify the given non-visible landmark. For the correct answer, the SBSOD-score of both the living and not-living peaked between the interval of 5.00-5.99 in the structural map and the cognitive

Figure 5.8: Distribution of respondents living or not living in the cities.



map. Whereas the incorrect answer for the structural map peaked between the interval of 3.00-3.99 for the respondents living in the city, and peaked in 4.00-4,99 for the respondents not living in the city. For the cognitive map, the most respondents who answered incorrect, could be placed between the SBSOD-score interval of 4.00-4.99 for both living and not-living in the city. Because of the small correct answers in the visual map, the graph displaying the visual map in figure 5.9, can also be used illustrate the total distribution of living and not-living respondents.

Figure 5.9: SBSOD-score distribution compared with whether or not the respondents live or do not live in one of the three cities.



6 Discussion

In this chapter, the results of the study will be discussed. The first part of the discussion will focus upon a discussion of results of the hypotheses. In continuation hereof, a discussion of method and data collection. The second part of the discussion will debate whether or not the results and maps is useful for development of the maps.

The goal of this thesis was to see, if it was possible for people to locate a non-visible landmark through a map only illustrated with landmarks. The general trend of the results was that the maps did not communicate as efficiently as hoped. Where the result differed across the different maps, the highest percentages of the total respondents who successfully locating a one of the non-visible landmark were 51 %. In successful map communication, not only half of the map user should be able to understand the map. Through the hypothetical statement, it was tried to see if the respondents differed or if their differences could influence the results. It was found that there to some degree was a correlation between the correct location of the non-visible landmark and the SBSOD-score. However, there was an uneven sampling between the three cities, which can have affected some of the results. If the data should had produce a more valid result, the sampling sizes for the three cities should have been even. The uneven sampling size is especially visible in the percentage-wise distribution of correct answers. In this result, Roskilde have a success rate at 40 % while Copenhagen has a success rate at 80 %. Not only are the percentages of success rate double for Copenhagen, the sampling size was also half the size of Roskilde.

The SBSOD-score showed to be represented in most of the intervals of 1. According to Hegarty et al. (2002) there should be a correlation between the higher SBSOD-score, the better the individual is to orientate oneself. This is partly shown in the results. There is a tendency, that in the successful respondents that the higher their SBSOD, the larger of the number of respondents. However, contradistinction to Hegarty et al. the results of this study shows that the SBSOD-score peaks in between the interval of 5.00-5.99, whereupon the curve descends. This can be explained through the number of respondents who self-reported themselves – if disregarding the success rate of location of the non-visible landmark, only 16 respondents are to find in the interval between 6.00-6.99, while both 4.00-4.99 and 5.00-5.99 consists of 79 respondents. Therefore, the percentages of the success rate therefore naturally show a decrease.

A better data analysis could be obtained by insuring the sampling sizes in the different cities and in the SBSOD-score results were the same. To reach an equaled sized sampling size in the cities, should be manageable, if the questionnaire were divided for the different cities, and closed when reach the required number of respondents. Nevertheless, if combined with the SBSOD-score, the SBSOD-score should be calculated immediately and not in the data analysis. If there both should be a limit on the sampling size of the cities and a required distribution among SBSOD-intervals, should the questionnaire then dismiss respondents placed in one of categories, if the interval already has reached the required number of respondents? Of course, there might be equally many persons belonging to the different intervals, but if a relevant analysis must be performed focusing on geocommunication, there might not be any reason for including in the sample. Conversely, the best geocommunication existing can be understood by everyone by these means, it could be necessary to include all the intervals. In either case, the collection of the respondents for this study, would have had benefitted for an equal sampling size in the three cities and in the intervals of the SBSOD-score.

By way of contrast to the SBSOD-scores, the self-evaluation results after the maps showed a correlation between correct location of the non-visible landmark and the degree of difficulty. It should be noted that there is a difference between SBSOD and an evaluation based on the impression of the shown map. For question of whether it had any influence if the respondent lived or did not live in city, the results of both scenarios in general followed each other. It was however noticed that there was a small correlation with the respondents living in the area and their SBSOD-score when the respondents failed locating the non-visible landmark in structural map. Here it was found that the lower SBSOD the more respondents living in the city failed to locate the landmark. Yet, the curve did not continue to include the SBSOD interval of 2.00-2.99. A reason for this, could as mentioned before be the sampling sized and the number of respondents in that interval.

More than 60 % of all the respondents found the rotated orientation of the maps to contribute to a harder interpretation of the maps. If taking into consideration that it was the visual and cognitive map which were rotated, it is found that the results for those two maps differs particularly. Thus, it is debatable if this is caused by the rotation. The success rate in the cognitive map is however just 33 %, but compared with the 1 % of the visual map, the difference in the success rate might be an indication that it is not the orientation which here influence the success rate.

A way to have improved the success rate in the results, could have been by either given more aids in the map, or created a more comprehensive series of maps. Conspicuously, the visual map did not have a high success rate among any of the respondents. This could indicate that the maps in general needed more information to be understood. Compared with the structural and the cognitive map, the visual map also differed in the amount of data. Whereas the structural map contained all of the streets in the city, and the cognitive map illustrated all the grocery stores and buildings in the shown area, the visual map only showed four to five pre-chosen landmarks. An improvement of the results might have occurred if the visual map also

Another way, would have been to include a topographical map into a series of maps. If the respondents firstly were presented with the maps of tested questionnaire, and then secondly were asked to find the same non-visible landmark in a topographical map with “normal” orientation, and lastly, presented with the first map with a different geographical orientation. This would give the respondents the ability to test their first impression of produced map, second step would give an aided search, which thirdly perhaps would recall their survey knowledge of the area. This could result in some very different answers from the first map to the third map, and the result of the third map might not support the study of whether or not a map with limited amount of information communicates sufficiently.

It can also be argued, that perhaps not all the respondents knew of the non-visible landmarks and their location, or perhaps there were a difference of spatial knowledge of the chosen landmarks for the same type of map across of the cities. For the structural map, the appearance of Kastellet (structural map) in Copenhagen is very salient in the road network. Gigantium (structural map) in Aalborg is also included in the road network, however, the site area of Gigantium is sorely smaller than Kastellet. Roskilde Domkirke (structural map) in Roskilde is even smaller than Gigantium. The site area and salience in for example in the road network might have had influenced the results. To create a greater comparability the non-visible landmarks needed might need to be of same character and size for the appointment in the maps wanted to be tested for communicativeness. Another factor influencing if is the landmark chosen, is known under another name than the official name. An instance of this is for example the fountains at Toldbod Plads (Aalborg). Many knows the fountains as the fountains near the harbor front or as the fountains at Nytorv. However, because of other fountains actually placed on Nytorv, the correct name was needed to be used for this study. To enhance the success rate, the tester could include a picture of the non-visible landmark could be added to the instruction text shown before the map to make sure that the respondent have the right understanding of which landmark that is referred to.

Concerning the data collection, the e-software of Survey Xact might have impacted the results. Intentionally, the maps were design to be at a fixed scale and size in the questionnaire and should only have been reached through a screen where the whole map could be seen. The intelligent feature Survey Xacts supplies is the conversion to the devices from which the questionnaire is accessed from. This resulted in, that when accessing the questionnaire from a smart phone or a tablet, not the whole map could be seen in window. Because it was not all shown, the respondents had to pan and scroll through the image to locate the non-visible landmark. This can have caused some inconvenience for the respondents and might have influenced their answers.

7 Conclusion

For the research of this thesis, it was wanted to study if people could locate a non-visible landmark in a map only illustrated with a few landmarks. The reason for this was the aim to see how much data actually was needed for a successful communication to occur. Today, there is almost no limit in the amount of available geographical data, and therefore, a need for establishing if "less is more", if schematic maps only with known landmark features should be preferred when seeing a map of a known environment.

It was found that the presented structural and cognitive landmarks as map illustration serve the map user better, but should reach a higher success rate if it should be produced as a communicative media. Whereas the proposed visual map is 99 % away from being approved as a useful map. Sorrows & Hirtle (1999) that the landmarks which belonged to all of the three categories was stronger reference point for navigational and survey purposes. Therefore, a combination of the three categories of landmark classification might communicate better than when trying to divide and illustrate the landmarks separately.

The results do not lead to a direct approval of any of the maps for communicative purposes, but it confirms the need to perform a pre-study before creating a map. In the case of these in three types of maps, it can be found that "less is more" does not fit. The informed search performed by the respondents are not successful for the maps to be approved as map for production or distribution. Hence, a new production of maps and a new pre-study is suggested.

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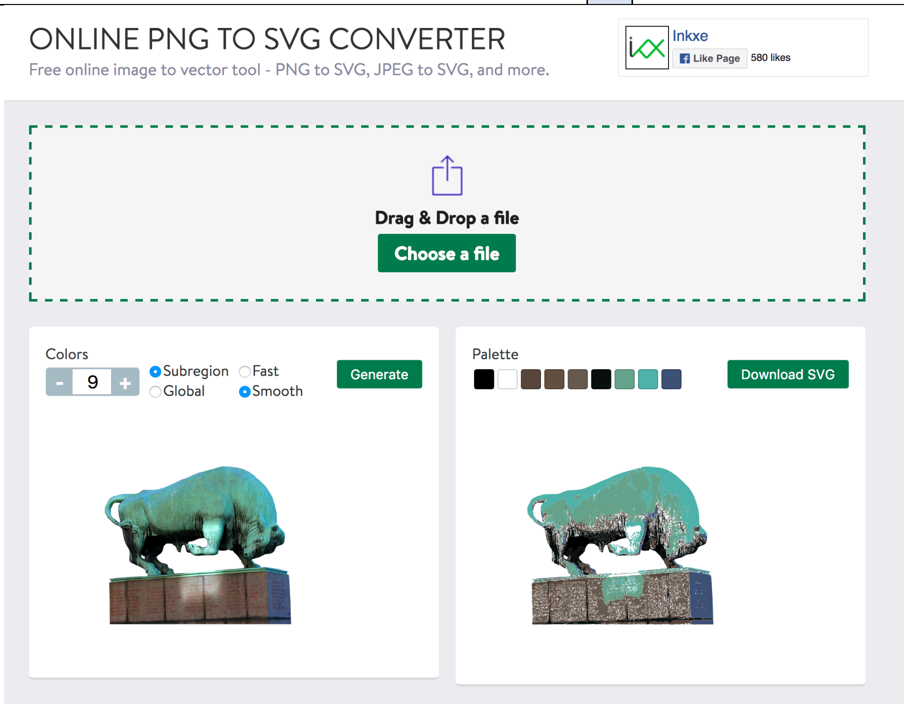
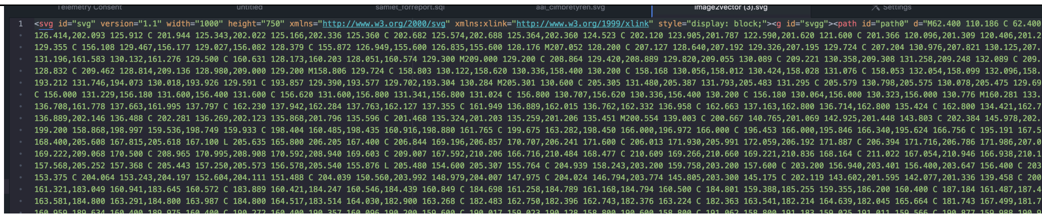
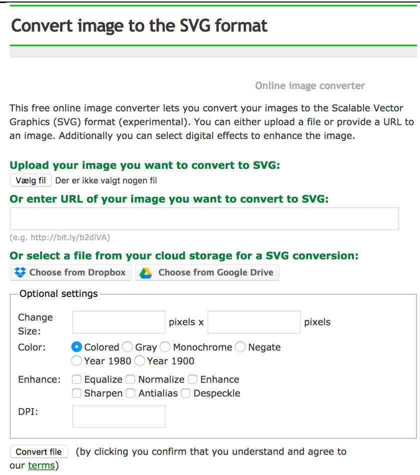
9 Appendix

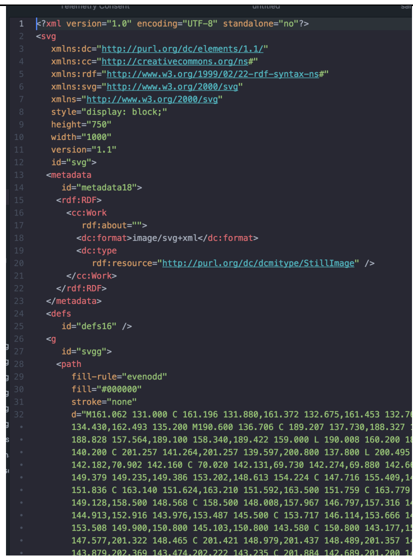
9.1 The creation of SVG-files for the visual map

Example of how a SVG icon was created			
1		2	
3			
4			

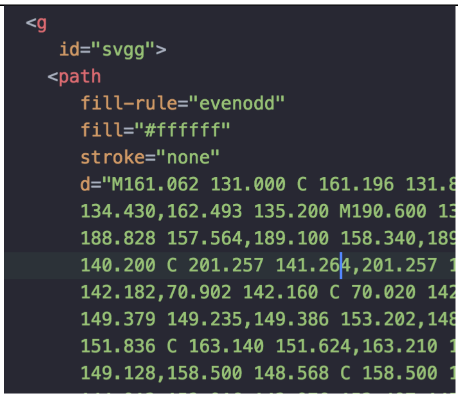
5



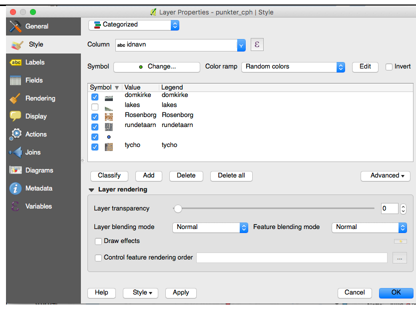
6



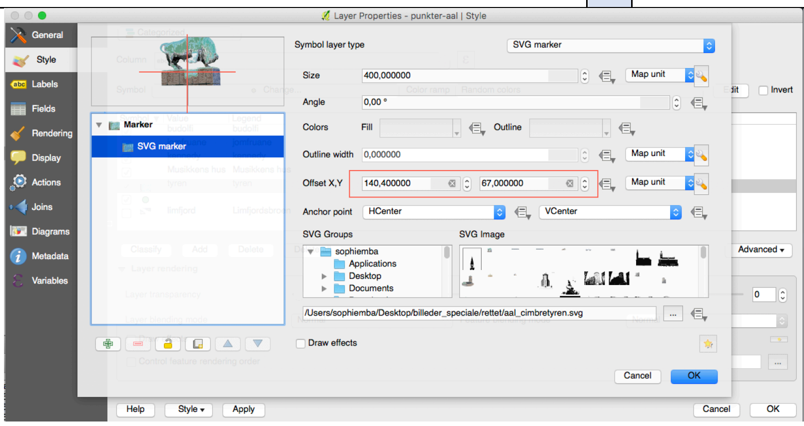
7



8



9



Step 1: An image of the given landmark is found on the web.

Step 2: The background of image is deleted using the program SketchBook.

Step 3: The website pngtosvg.com is used to convert the image file of png to a vector file (SVG). The advantages of this online converter is, that it is possible to control the number of colors used in the SVG file.

Step 4: The SVG file is opened in the program Atom. It is found that the SVG file is not ordered. Step 5: The already converted SVG-file is converted in another online SVG converter image.online-convert.com/convert-to-svg. Step 6: The second SVG file is opened in atom, where the code for the image now is orded. Step 7: The fill-color of white is located in the code. The white fill-color is the background, and because this is not wanted, it is deleted. Step 8: QGIS is opened and the points of the landmarks is classified by name. Step 9: The individual landmark's classification is opened, and altered to SVG. The created SVG file of the landmark are added. The size is manipulated. Furthermore, the SVG-landmark must be centered, which is altered through the offset XY-function.

9.1.1 References of the used pictures in the maps

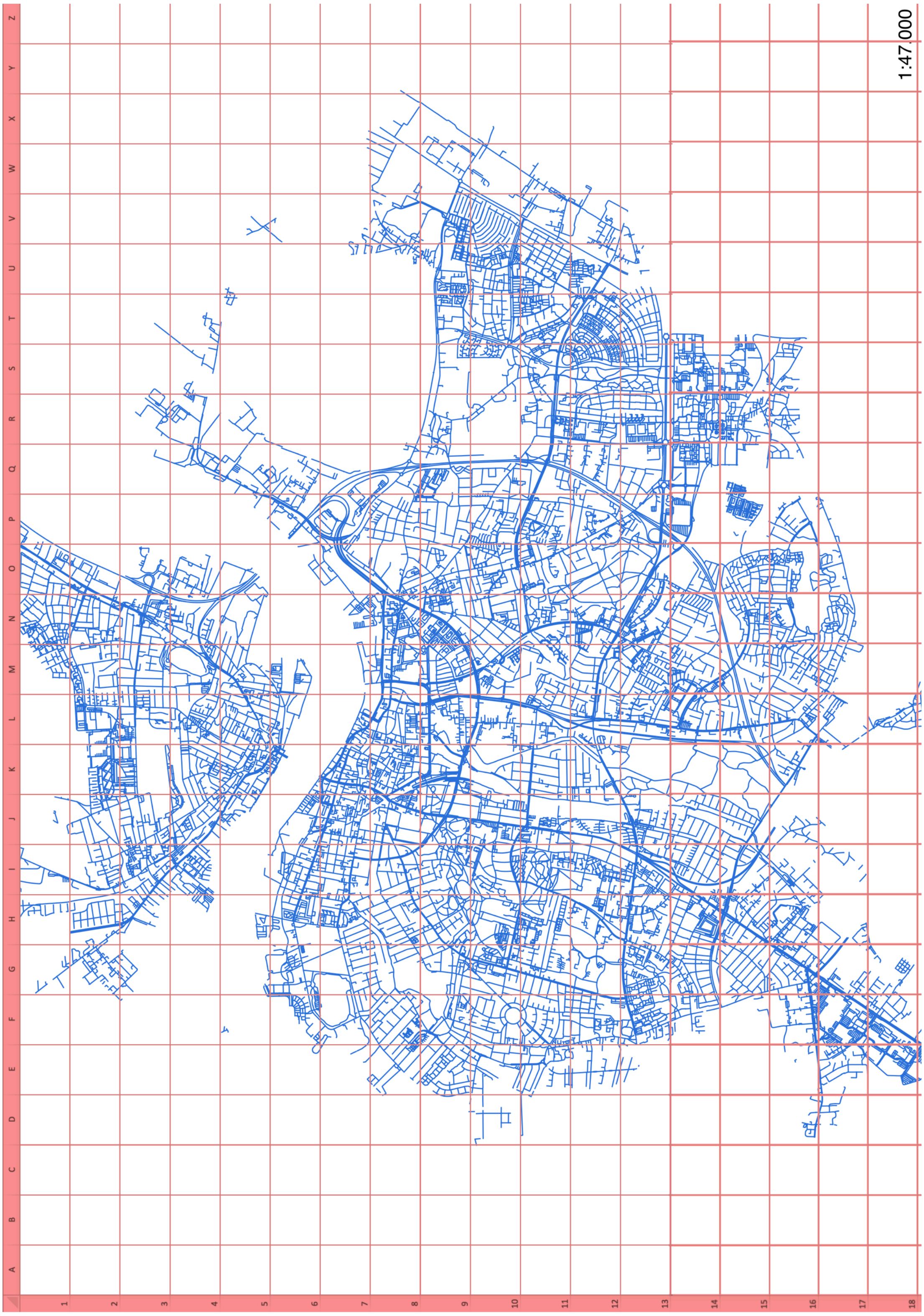
Cimbrer tyren	Picture available at: http://www.danmarkstur.no/jylland/nordjylland/aalborg/cimbrertyren.htm
Jomfru Ane gade	Picture available at: https://www.triposo.com/poi/N__1711228273
Kennedy Arkaden	Picture available at: https://nordjyske.dk/nyheder/pensionspenge-bag-koeb-af-kennedy-arkaden/dec56cae-de17-4d42-8b07-21429b062569
Musikkens hus	Picture available at: http://www.visitaalborg.dk/sites/default/files/styles/galleries_ratio/public/asp/visitaalborg/n_bygnings vaerker_bygninger_huse/1600_musikkens-hus/musikkens-hus-panorama.jpg?itok=QUnh410b
Budolfi	Picture available at: https://da.wikipedia.org/wiki/Budolfi_Kirke
Roskilde Domkirke	Picture available at: https://sonnerupgaard.dk/wp-content/uploads/2015/08/roskilde-domkirke5.jpg
Vikingeskibsmuseet	Picture available at: http://www.vikingeskibsmuseet.dk/nyheder/archive/

	2016/december/article/museets-venneforening-donerer-80000-kroner-til-bogudgivelse/
Hestetorvet	Picture available at: http://static.panoramio.com/photos/original/9928129.jpg
Folkeparken	Picture available at: http://www.opland.eu/renovering-af-amfiteatret-i-folkeparken/
Vor Frue Kirke	Picture available at: https://www.colourbox.com/image/image-4269289
Rundetårn	Picture available at: https://www.colourbox.com/image/copenhagen-round-tower-image-23508877
Rosenborg Slot	Picture available at: https://www.colourbox.com/image/rosenborg-castle-image-3494047
Tycho Brahe Planetarium	Picture available at: https://www.colourbox.com/image/tycho-brahe-planetarium-in-copenhagen-image-17388042

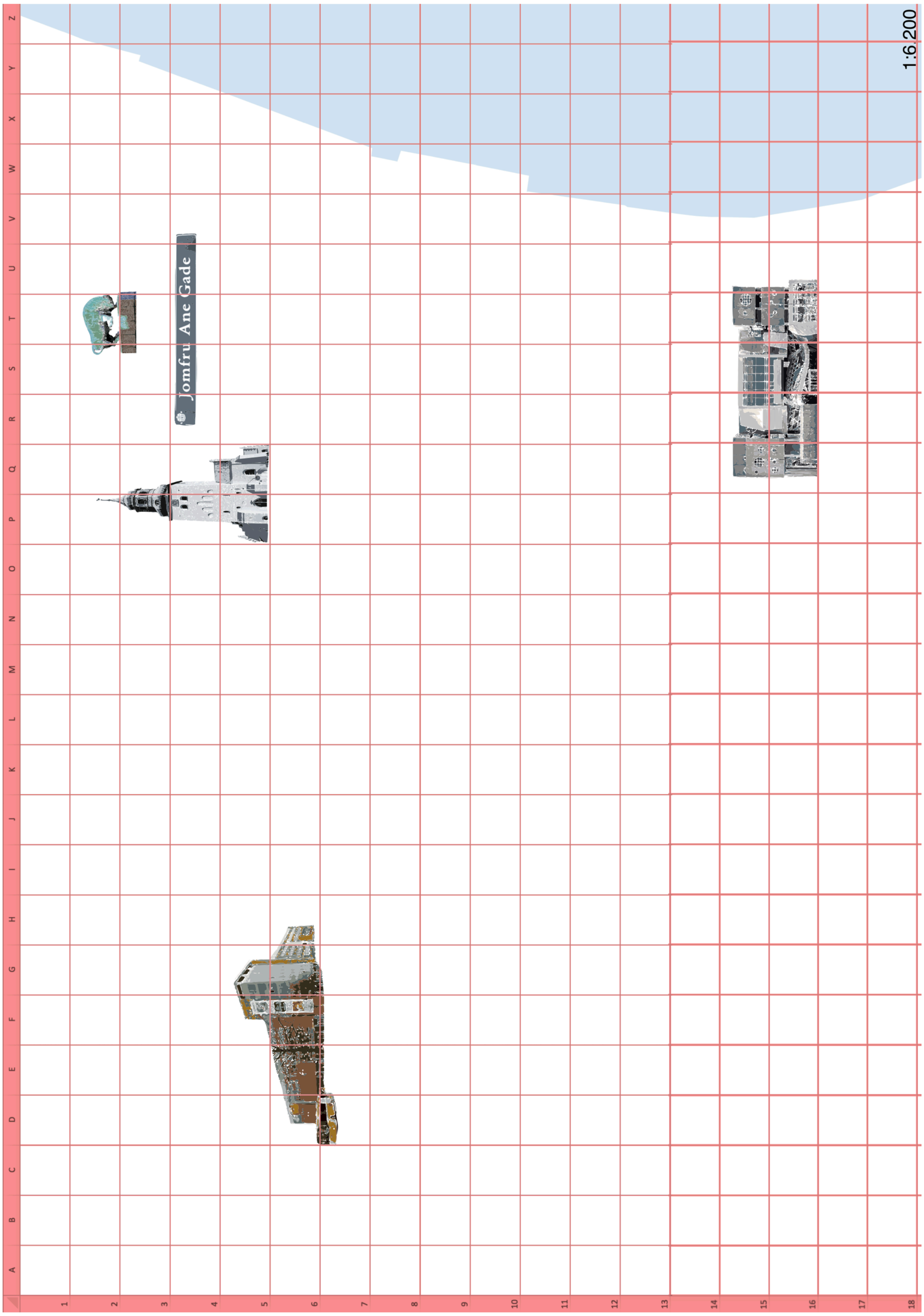
9.2 Produced Maps for Questionnaire

9.2.1 Aalborg

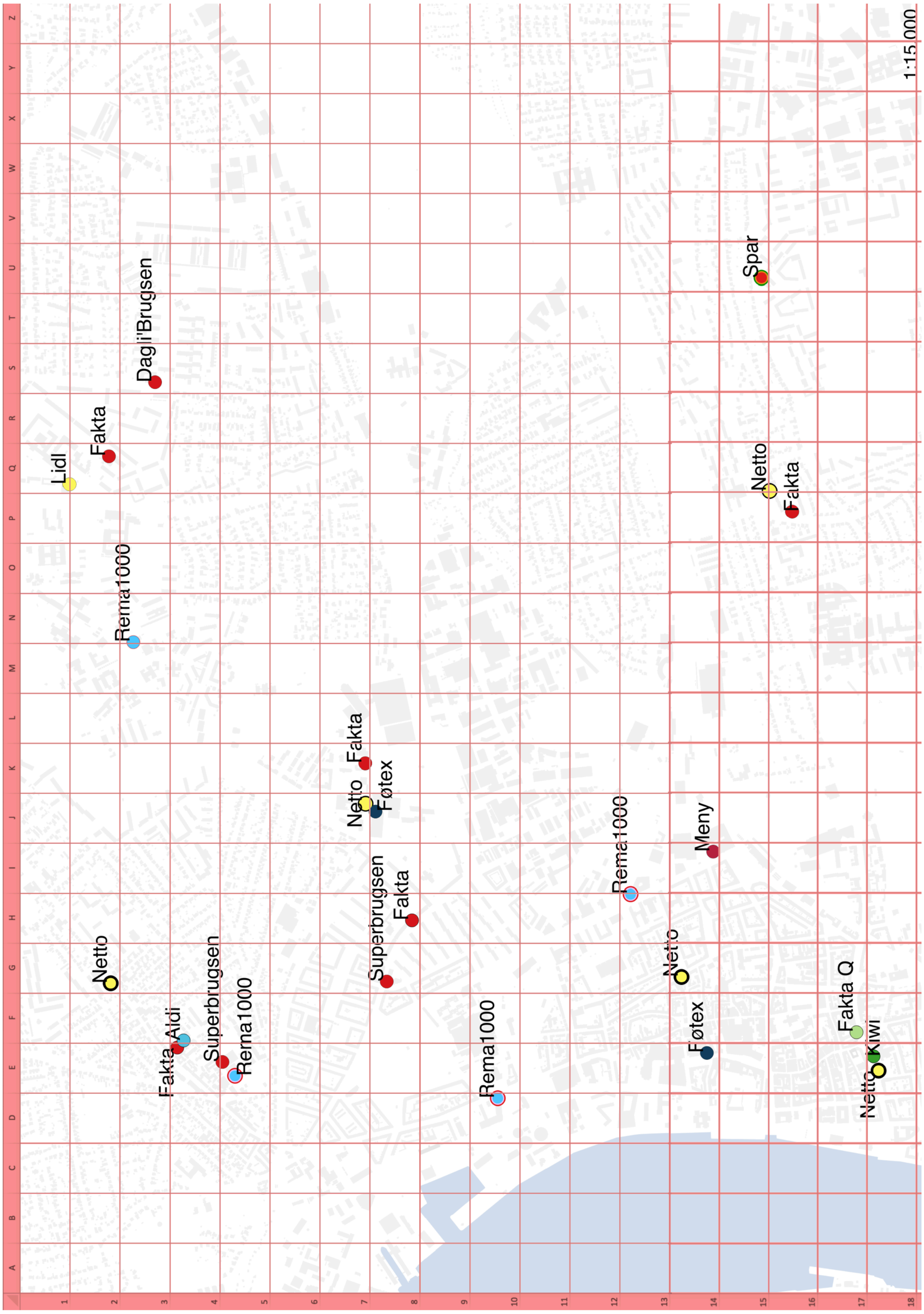
Structural map:



Visual map

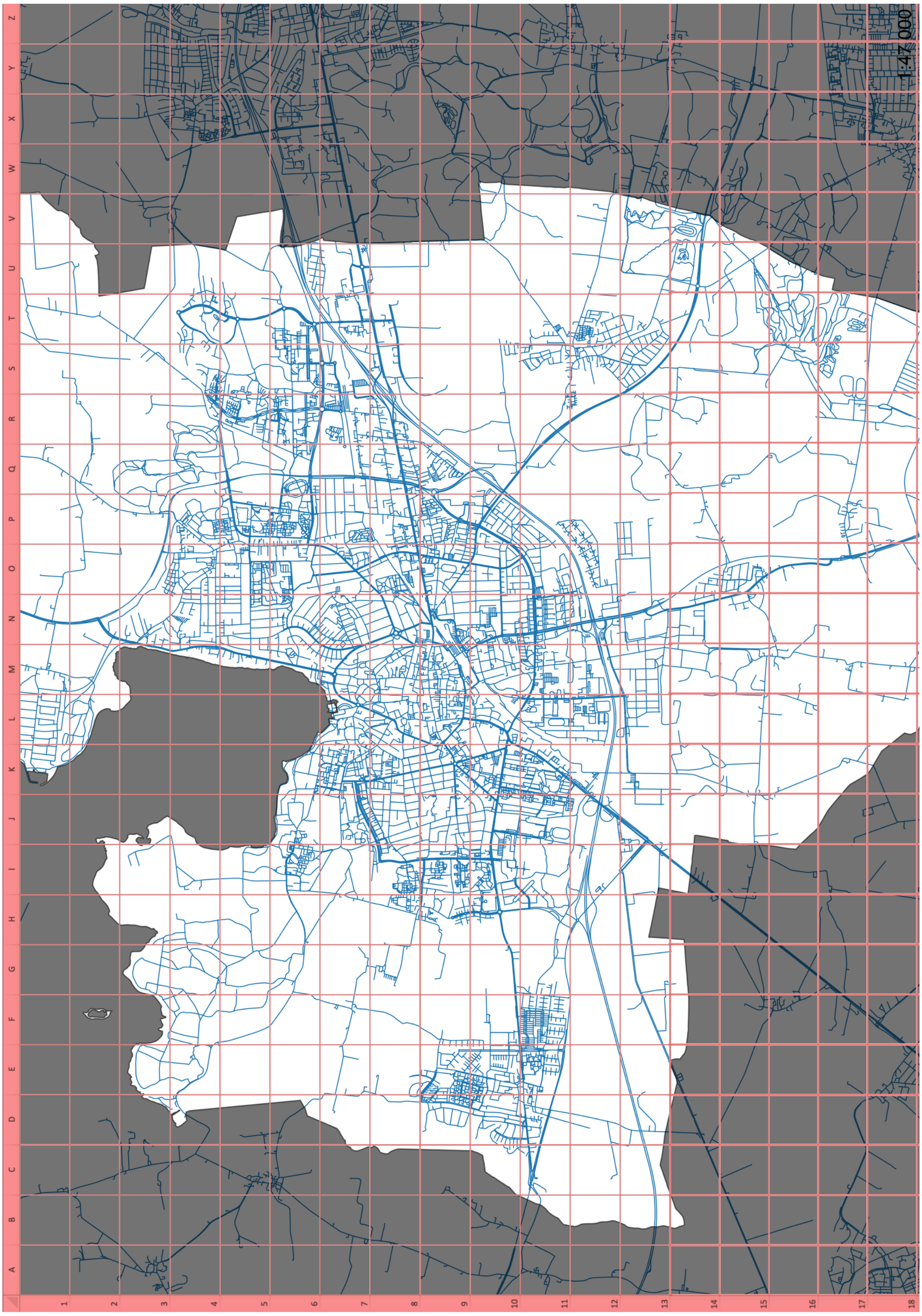


Cognitive map:

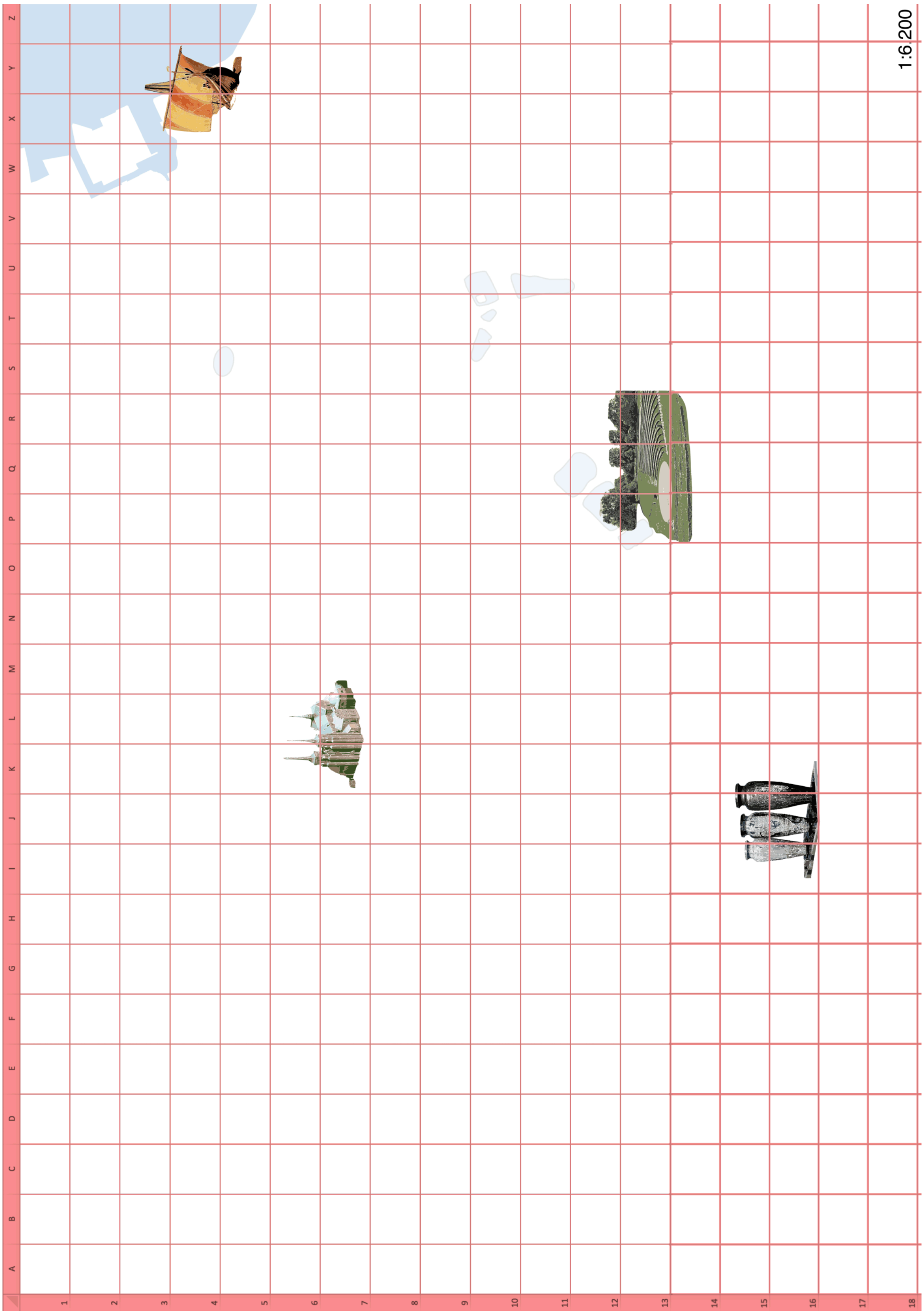


9.2.2 Roskilde

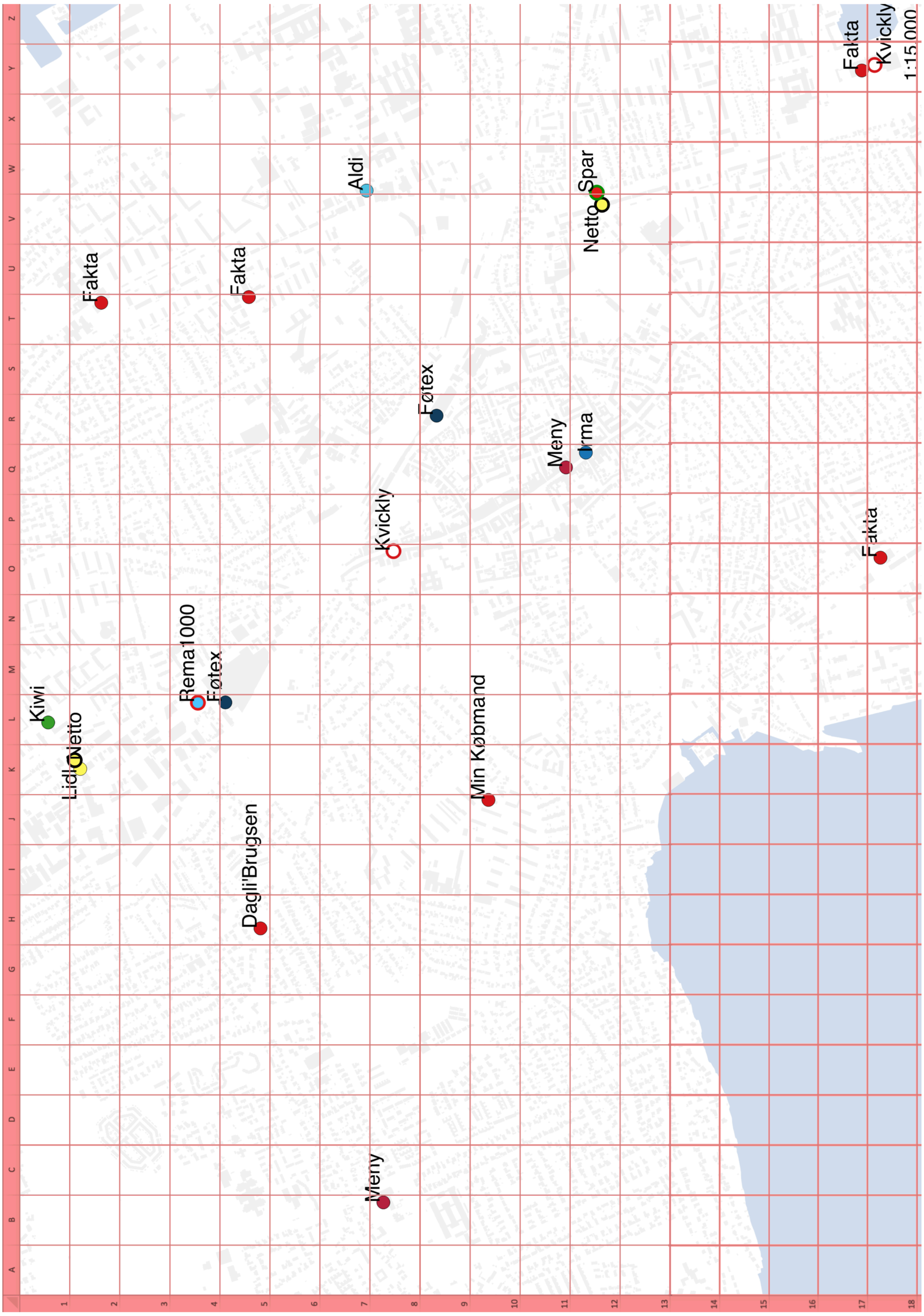
Structural map:



Visual map:



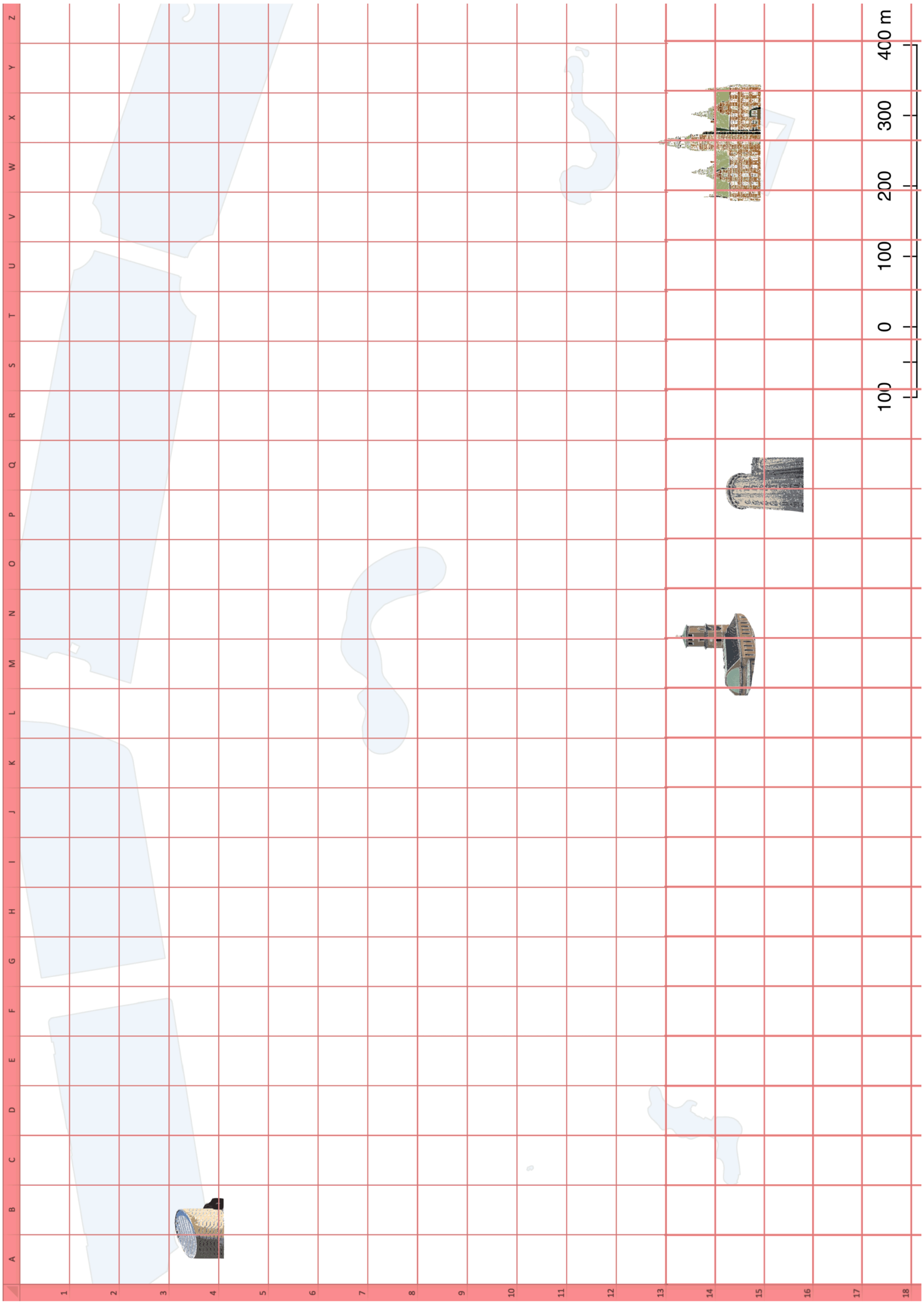
Cognitive map:



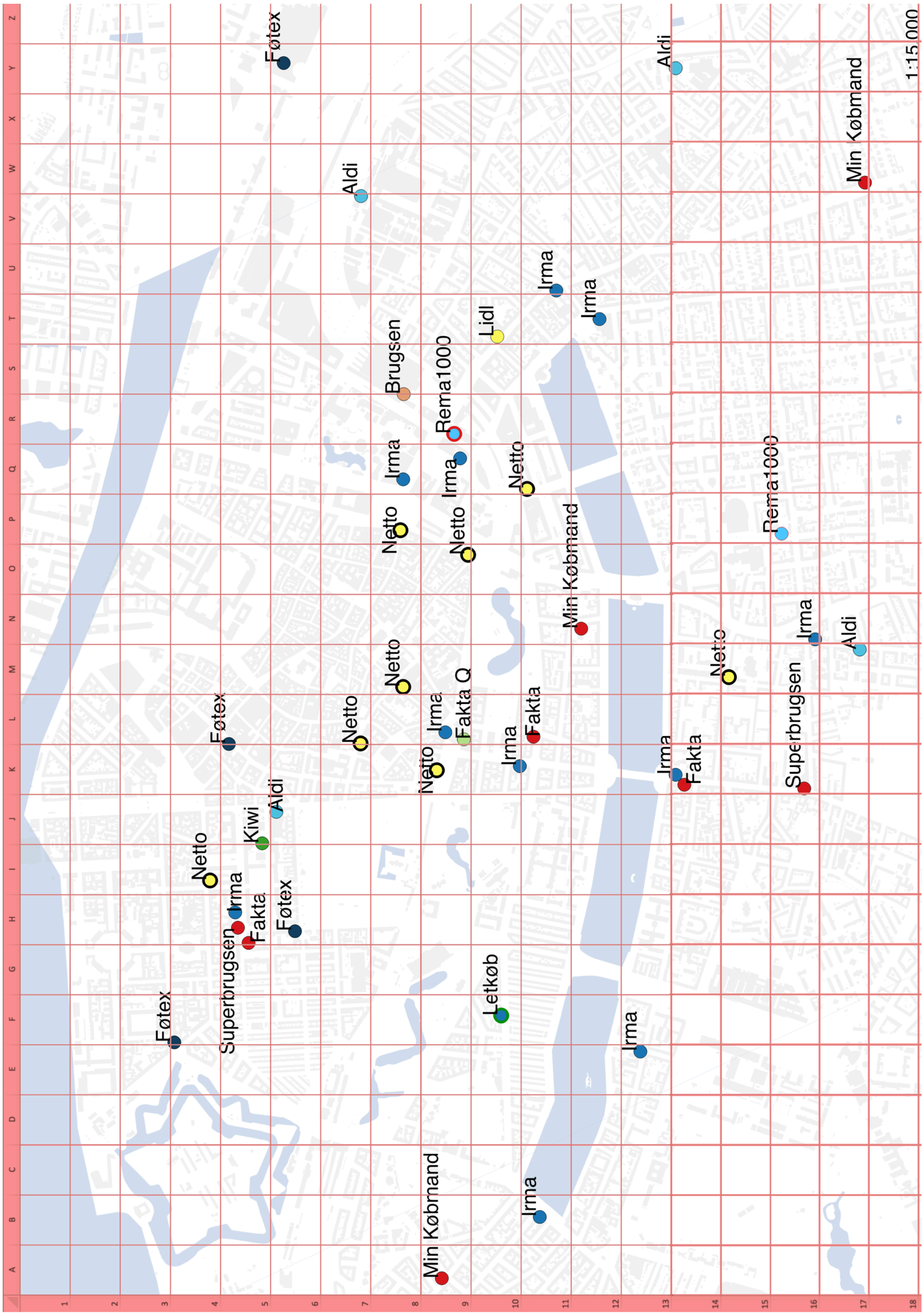
9.2.3 Copenhagen

Structural map:

Visual map:



Cognitive map:



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9.3 Complete questionnaire in Danish

Dette er en undersøgelse af stedsans i kort

Der er udvalgt tre byer, hvortil der er udarbejdet en række geografiske kort. De udvalgte byer er Aalborg, København og Roskilde.

Som et led i mit kandidatspeciale i GeoInformatik vil jeg gerne undersøge, om det er muligt at finde vej på et kort i et familiært område med forskellige typer for kortkommunikation?

Første del af spørgeskemaet er udformet efter Santa Barbara Universitets Stedsans-skala (Santa Barbara Sense-of-Direction Scale). I anden del af spørgeskemaet skal du udvælge hvilken by, du er stedkendt i blandt tre valgmuligheder.

Hvilket køn er du?

- ☐ Kvinde
- ☐ Mand

Hvor gammel er du?

- ☐ 0-15
- ☐ 16-20
- ☐ 20-25
- ☐ 26-30
- ☐ 31-35
- ☐ 36-40
- ☐ 41-45
- ☐ 46-50
- ☐ 51-55
- ☐ 56-60
- ☐ 61-65
- ☐ 66-70
- ☐ 71-75
- ☐ 76-80
- ☐ 81-85
- ☐ 86-90
- ☐ 91-100

Følgende spørgsmål indeholder udtagelser om dine stedslige og navigationsevner, -præferencer og -erfaring. Efter hvert udsagn skal du indikere, hvor enig eller uenig du er med udsagnet.

Jeg er meget god til at vise vej

- ☐ Meget enig 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7 Meget uenig

Jeg er dårlig til at huske, hvor jeg har efterladt ting

- ☐ Meget enig 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7 Meget uenig

Jeg er meget god til at bedømme afstande

- ☐ Meget enig 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5

- 6
- 7 Meget uenig

Min "stedsans" er meget god

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Når jeg skal finde vej, bruger jeg ofte verdenshjørnerne (Nord, Syd, Øst og Vest)

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Jeg farer hurtigt vildt i en ny by

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Jeg nyder at læse kort

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Jeg har problemer med at forstå rutebeskrivelser givet af andre

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Jeg er meget god til at læse kort

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Jeg husker ikke ruterne særlig godt, hvis jeg er passager i en bil

- Meget enig 1
- 2
- 3

- 4
- 5
- 6
- 7 Meget uenig

Jeg kan ikke lide at vise vej

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Det er ikke vigtigt for mig at vide, hvor jeg er

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Normalt lader jeg andre styrer ruteplanlægningen ved lange ture

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Jeg kan normalt huske en ny rute efter at have brugt den en enkelt gang

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Jeg har ikke et særlig godt "mentalt kort" over mit område

- Meget enig 1
- 2
- 3
- 4
- 5
- 6
- 7 Meget uenig

Dette var Stedsansskala'en fra Santa Barbara Universitet.
Hvis du er interesseret i at få resultatet fra denne, kan du tilføje din mail i nedenstående boks. Svar vil blive sendt ud i midten af juni.

E-mail:

Hvilken by ville du vurdere, at du er stedkendt i?

- Aalborg
- København (Indre by)
- Roskilde

Bor du eller har du boet i byen?

- Ja
- Nej

Hvor mange år har du boet i byen?

- 0-1 år
- 2-3 år
- 4-5 år
- 6-10 år
- 11-15 år
- 16-20 år
- 20 eller flere år

Har du en anden tilknytning til byen?

- Familie/venner
- Arbejde
- Uddannelse
- Andet

Hvor god er du til at navigere igennem Aalborg?

- Rigtig god
- God
- Mellem
- Halvskidt
- Dårlig

Hvor god er du til at navigere igennem København (Indre By)?

- Rigtig god
- God
- Mellem
- Halvskidt
- Dårlig

Hvor god er du til at navigere igennem Roskilde?

- Rigtig god
- God
- Mellem
- Halvskidt
- Dårlig

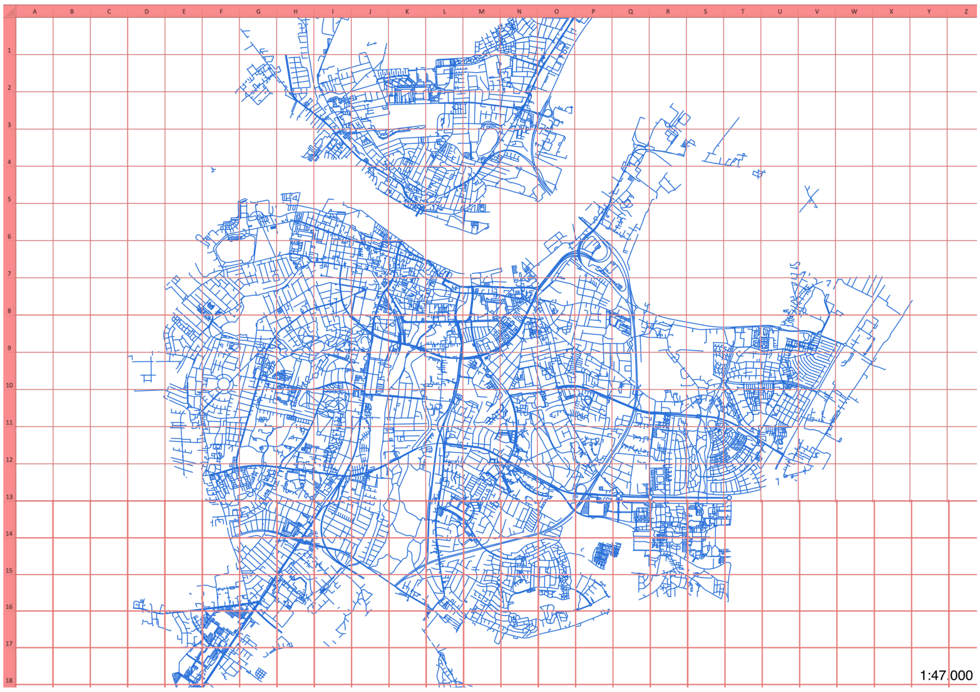
Bruger du bygninger, statuer, torve eller andet til at navigere efter?

- Altid
- Nogle gange
- Aldrig

På det følgende kort vil du få vist Aalborg kun illustreret ved vejnettet.

Kan du ud fra dette finde Gigantium?

Kortet vises med et kvadratnet (bogstaver i toppen og tal i venstre side). Når du har fundet det kvadrat, du vil placere Gigantium i, skal dette udfyldes nedenfor.



Vandret

- ❑A
- ❑B
- ❑C
- ❑D
- ❑E
- ❑F
- ❑G
- ❑H
- ❑I
- ❑J
- ❑K
- ❑L
- ❑M
- ❑N
- ❑O
- ❑P
- ❑Q
- ❑R
- ❑S
- ❑T
- ❑U
- ❑V
- ❑W
- ❑X
- ❑Y
- ❑Z

Lodret

- ❑1

- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10
- ☐ 11
- ☐ 12
- ☐ 13
- ☐ 14
- ☐ 15
- ☐ 16
- ☐ 17
- ☐ 18

Hvor nemt var kortet at aflæse?

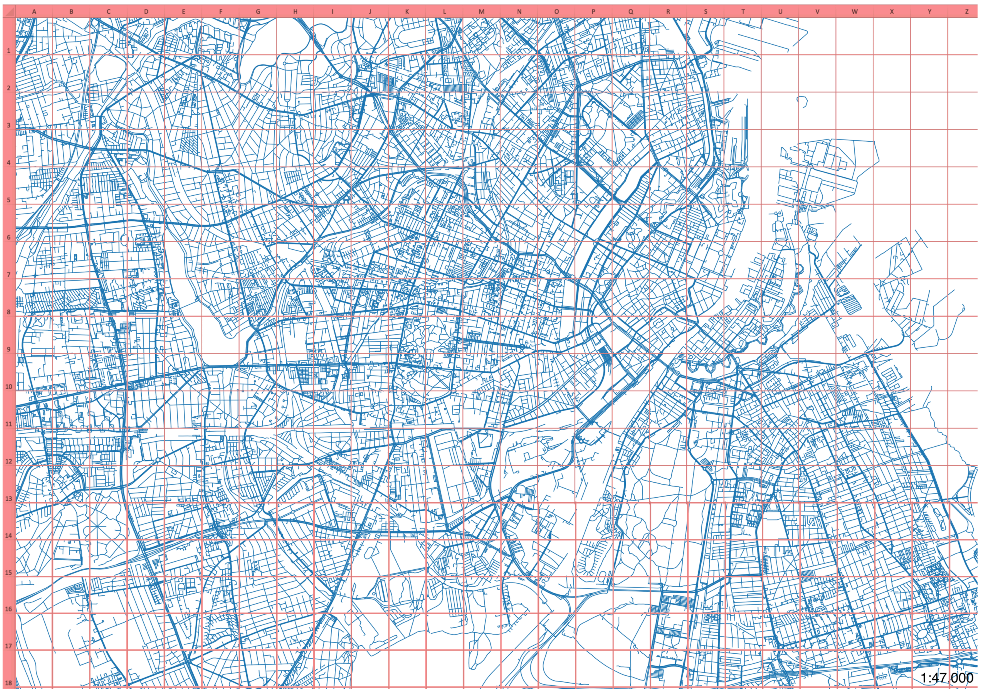
- ☐ Meget nemt
- ☐ Nemt
- ☐ Lidt svært
- ☐ Meget svært

Eventuelle kommentarer til kortet

På det følgende kort vil du få vist København kun illustreret ved vejnettet.

Kan du ud fra dette finde Kastellet?

Kortet vises med et kvadratnet (bogstaver i toppen og tal i venstre side). Når du har fundet det kvadrat, du vil placere Kastellet i, skal dette udfyldes nedenfor.



Vandret

☐ A
☐ B
☐ C
☐ D
☐ E
☐ F
☐ G
☐ H
☐ I
☐ J
☐ K
☐ L
☐ M
☐ N
☐ O
☐ P
☐ Q
☐ R
☐ S
☐ T
☐ U
☐ V
☐ W
☐ X
☐ Y
☐ Z

Lodret

☐ 1

- ❑2
- ❑3
- ❑4
- ❑5
- ❑6
- ❑7
- ❑8
- ❑9
- ❑10
- ❑11
- ❑12
- ❑13
- ❑14
- ❑15
- ❑16
- ❑17
- ❑18

Hvor nemt var kortet at aflæse?

- ❑Meget nemt
- ❑Nemt
- ❑Lidt svært
- ❑Meget svært

Eventuelle kommentarer til kortet

På det følgende kort vil du få vist Roskilde kun illustreret ved vejnettet.

Kan du ud fra dette finde Roskilde Domkirke?

Kortet vises med et kvadratnet (bogstaver i toppen og tal i venstre side). Når du har fundet det kvadrat, du vil placere Roskilde Domkirke i, skal dette udfyldes nedenfor.

Vandret

- ☐ A
- ☐ B
- ☐ C
- ☐ D
- ☐ E
- ☐ F
- ☐ G
- ☐ H
- ☐ I
- ☐ J
- ☐ K
- ☐ L
- ☐ M
- ☐ N
- ☐ O
- ☐ P
- ☐ Q
- ☐ R
- ☐ S
- ☐ T
- ☐ U
- ☐ V
- ☐ W
- ☐ X
- ☐ Y
- ☐ Z

Lodret

- ☐ 1

- ❑2
- ❑3
- ❑4
- ❑5
- ❑6
- ❑7
- ❑8
- ❑9
- ❑10
- ❑11
- ❑12
- ❑13
- ❑14
- ❑15
- ❑16
- ❑17
- ❑18

Hvor nemt var kortet at aflæse?

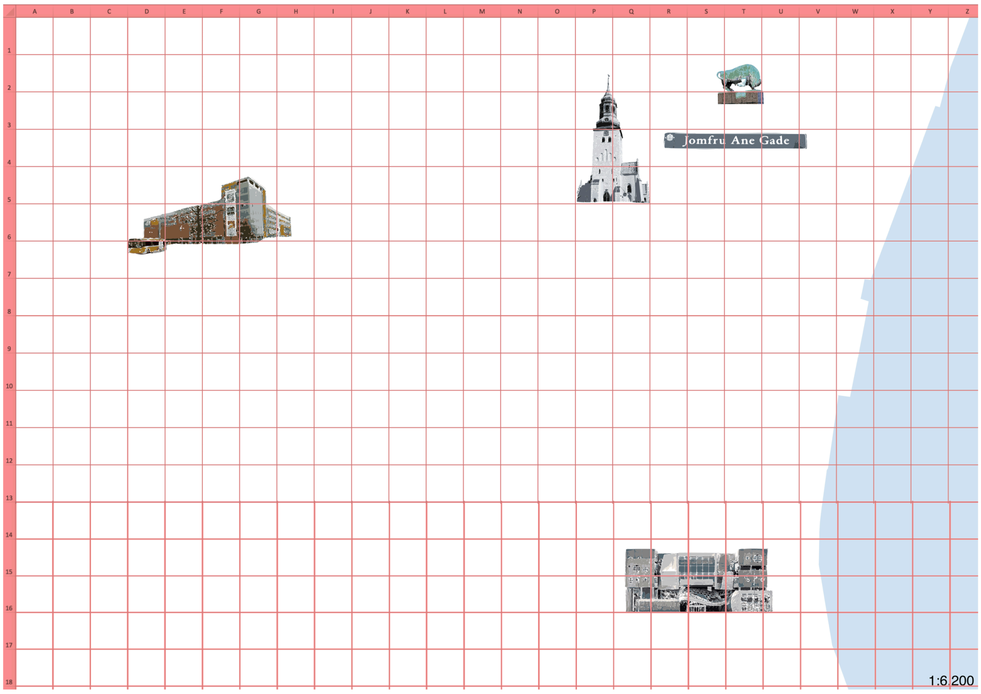
- ❑Meget nemt
- ❑Nemt
- ❑Lidt svært
- ❑Meget svært

Eventuelle kommentarer til kortet

På følgende kort vil du få vist et kort over Aalborg. På kortet kan du se udvalgte varetegn. Kortet er roteret.

Kan du finde Springvandene ved Toldbod Plads?

Kortet vises med et kvadratnet (bogstaver i toppen og tal i venstre side). Når du har fundet det kvadrat, du vil placere Springvandene ved Toldbod Plads i, skal dette udfyldes nedenfor.



Vandret

- ❑A
- ❑B
- ❑C
- ❑D
- ❑E
- ❑F
- ❑G
- ❑H
- ❑I
- ❑J
- ❑K
- ❑L
- ❑M
- ❑N
- ❑O
- ❑P
- ❑Q
- ❑R
- ❑S
- ❑T
- ❑U
- ❑V
- ❑W
- ❑X
- ❑Y
- ❑Z

Lodret

- ❑1

- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10
- ☐ 11
- ☐ 12
- ☐ 13
- ☐ 14
- ☐ 15
- ☐ 16
- ☐ 17
- ☐ 18

Hvor nemt var kortet at aflæse?

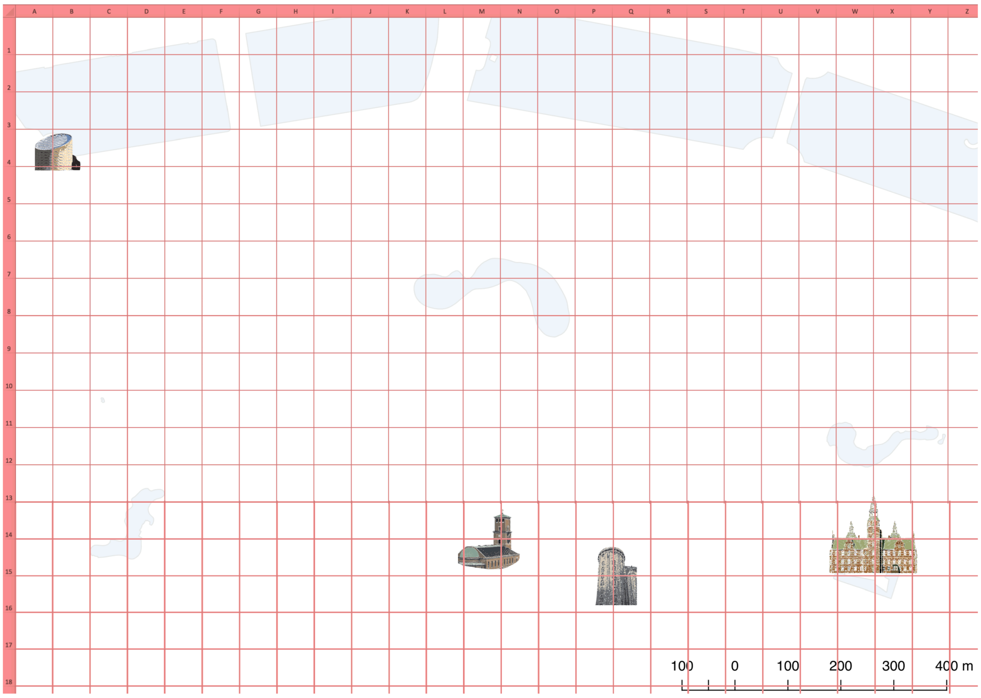
- ☐ Meget nemt
- ☐ Nemt
- ☐ Lidt svært
- ☐ Meget svært

Eventuelle kommentarer til kortet

På følgende kort vil du få vist et kort over København (Indre By). På kortet kan du se udvalgte varetegn. Kortet er endvidere roteret.

Kan du finde Nørreport Station (Metro)?

Kortet vises med et kvadratnet (bogstaver i toppen og tal i venstre side). Når du har fundet det kvadrat, du vil placere Nørreport Station (Metro) i, skal dette udfyldes nedenfor.



Vandret

- ☐ A
- ☐ B
- ☐ C
- ☐ D
- ☐ E
- ☐ F
- ☐ G
- ☐ H
- ☐ I
- ☐ J
- ☐ K
- ☐ L
- ☐ M
- ☐ N
- ☐ O
- ☐ P
- ☐ Q
- ☐ R
- ☐ S
- ☐ T
- ☐ U
- ☐ V
- ☐ W
- ☐ X
- ☐ Y
- ☐ Z

Lodret

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10
- ☐ 11
- ☐ 12
- ☐ 13
- ☐ 14
- ☐ 15
- ☐ 16
- ☐ 17
- ☐ 18

Hvor nemt var kortet at aflæse?

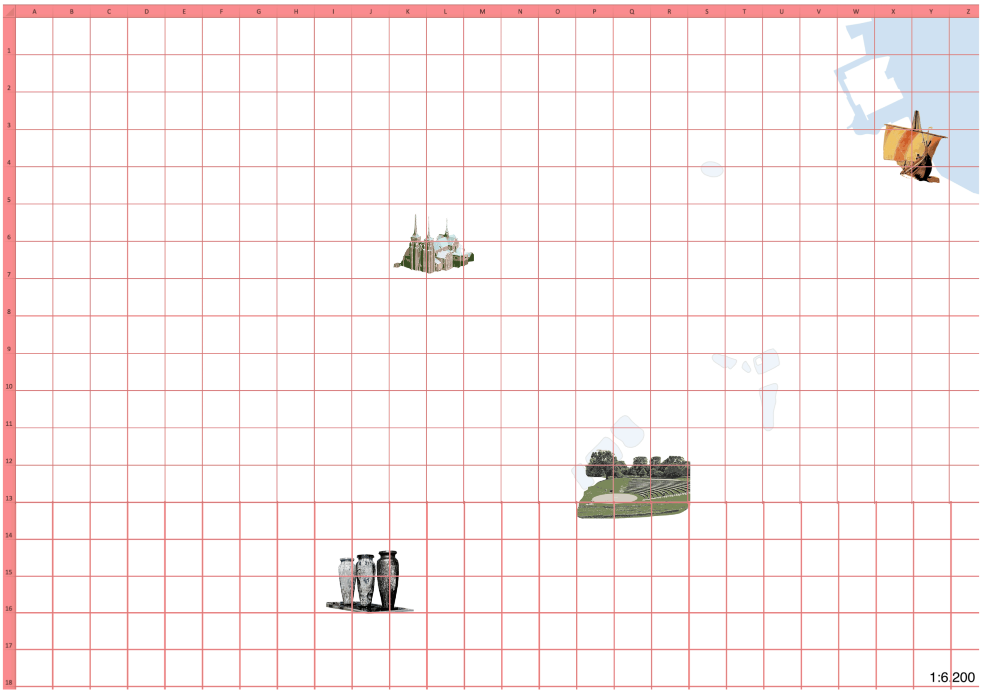
- ☐ Meget nemt
- ☐ Nemt
- ☐ Lidt svært
- ☐ Meget svært

Eventuelle kommentarer til kortet

På følgende kort vil du få vist et kort over Roskilde. På kortet kan du se udvalgte varetegn. Kortet er endvidere roteret.

Kan du finde Roskilde Politistation?

Kortet vises med et kvadratnet (bogstaver i toppen og tal i venstre side). Når du har fundet det kvadrat, du vil placere Roskilde Politistation i, skal dette udfyldes nedenfor.



Vandret

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Lodret

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Hvor nemt var kortet at aflæse?

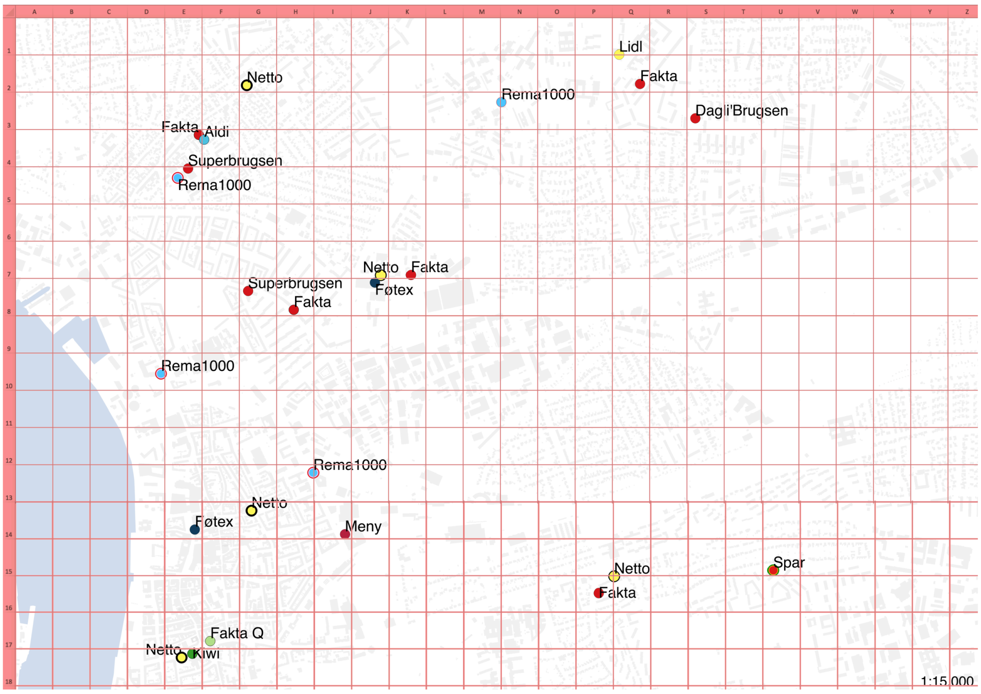
- ☐ Meget nemt
- ☐ Nemt
- ☐ Lidt svært
- ☐ Meget svært

Eventuelle kommentarer til kortet

På følgende kort vil du blive vist supermarkeder og svagt fremhævede bygninger i Aalborg. Kortet er roteret.

Kan du finde Aalborg Sygehus (Syd)?

Kortet vises med et kvadratnet (bogstaver i toppen og tal i venstre side). Når du har fundet det kvadrat, du vil placere Aalborg Sygehus (Syd) i, skal dette udfyldes nedenfor.



Vandret

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Lodret

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Hvor nemt var kortet at aflæse?

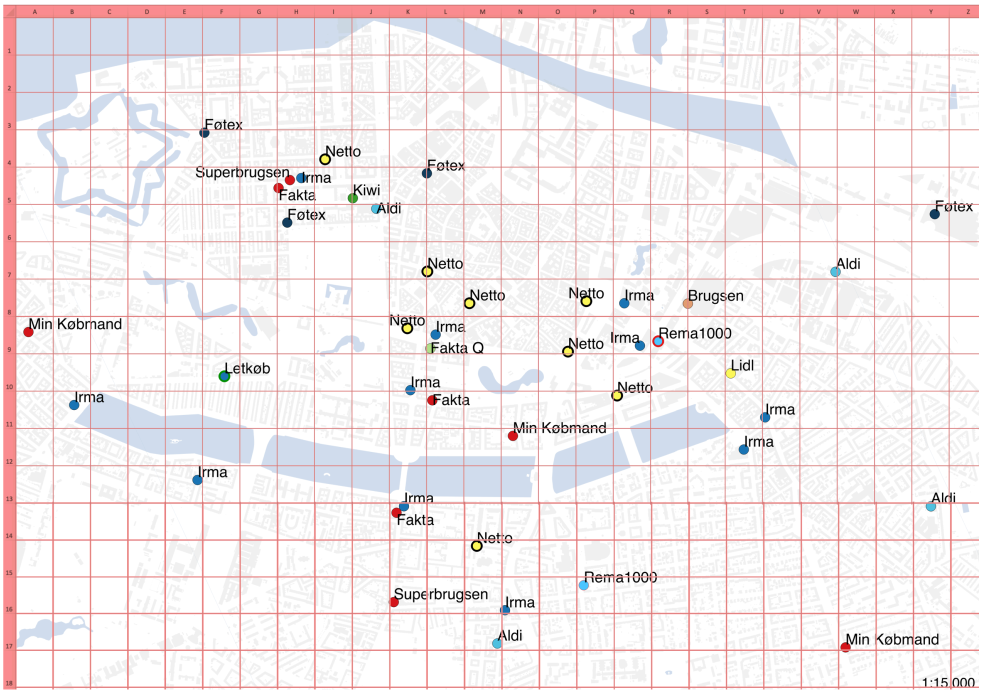
- ☐ Meget nemt
- ☐ Nemt
- ☐ Lidt svært
- ☐ Meget svært

Eventuelle kommentarer til kortet

På følgende kort vil du blive vist supermarkeder og svagt fremhævede bygninger i København (Indre By). Kortet er roteret.

Kan du finde Københavns Rådhus?

Kortet vises med et kvadratnet (bogstaver i toppen og tal i venstre side). Når du har fundet det kvadrat, du vil placere Københavns Rådhus i, skal dette udfyldes nedenfor.



Vandret

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Hvor nemt var kortet at aflæse?

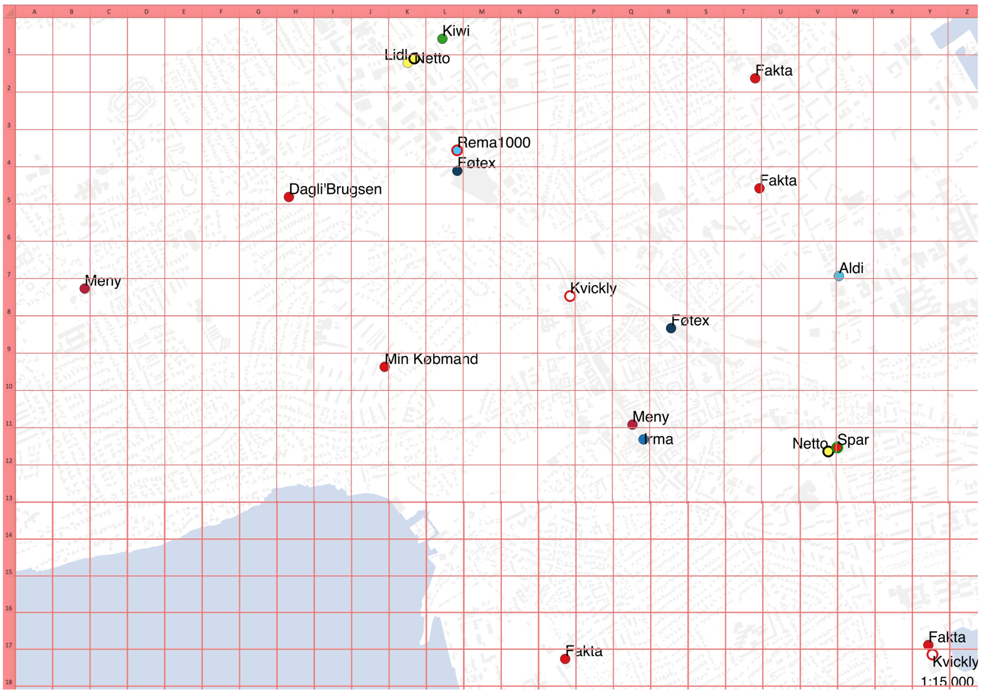
- ☐ Meget nemt
- ☐ Nemt
- ☐ Lidt svært
- ☐ Meget svært

Eventuelle kommentarer til kortet

På følgende kort vil du blive vist supermarkeder og svagt fremhævede bygninger i Roskilde. Kortet er roteret.

Kan du finde Sjællands Universitetshospital, Roskilde?

Kortet vises med et kvadratnet (bogstaver i toppen og tal i venstre side). Når du har fundet det kvadrat, du vil placere Sjællands Universitetshospital i, skal dette udfyldes nedenfor.



Vandret

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Hvor nemt var kortet at aflæse?

- Meget nemt
- Nemt
- Lidt svært
- Meget svært

Eventuelle kommentarer til kortet

Blev din stedsans udfordret?

- Ja
- Nej

Var det svært at finde stedet, hvis kortet var roteret?

- Ja
- Nej

Hvordan synes du selv din evne til at aflæse kort er, efter du har skulle aflæse disse forskellige kort?

- Rigtig god
- God
- Mellem
- Lidt dårlig
- Dårlig

Tusind tak, fordi du deltog i undersøgelsen. Har du spørgsmål, er du velkommen til at sende mig en mail på smba12@student.aau.dk