

Fall 2013

Spatial Knowledge and Landscape Cognition

Dan Arseneau

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Spatial Knowledge and Landscape Cognition

Dan Arseneau SUNY-ESF Fall 2013

Amsterdam, The Netherlands

Advisor: Robin Hoffman

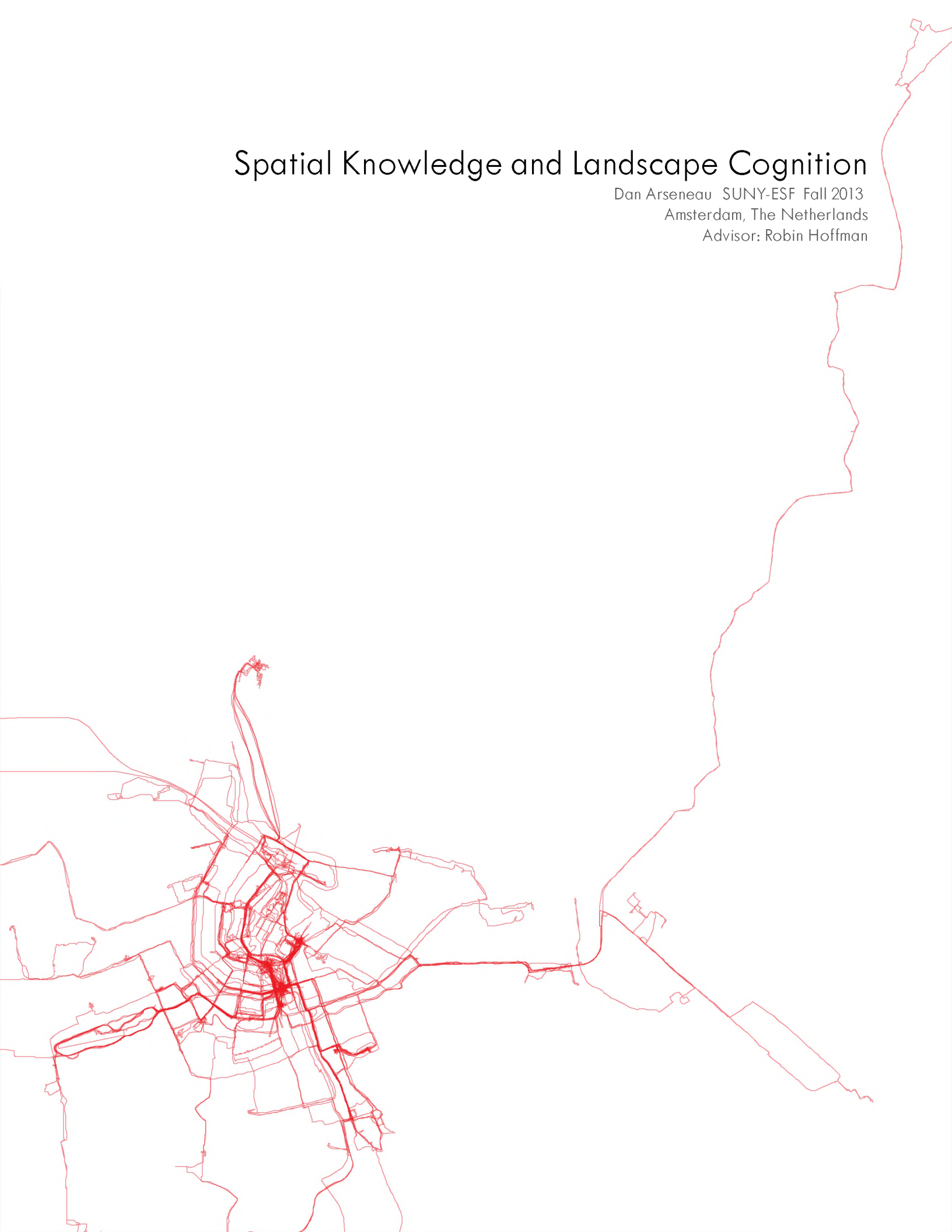


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Above:
Pythonbrug, Zeeburg.
Image Source: Dan Arseneau

Covers:
3 Months in Amsterdam
Image Source: Dan Arseneau

Welcome to Amsterdam

City of canals, bikes, tulips, and stroopwafels. You're here and it's time to get going, time to see the city.

But how do you get where you're going, how do you find your way home. Follow a map? Ask for directions? Wander aimlessly until you give up and decide to pay for a cab?

This report looks at how we place ourselves in our surroundings, how we communicate spatial relationships and what implications our spatial knowledge has on our understanding of the world.







Exit Syracuse

A mid-sized city located in Eastern North America, Syracuse is situated amongst the rolling drumlins of Central New York State.

Syracuse was formerly a stop on the Erie Canal. The city is now host to the annual New York State fair and several major universities and hospitals.

Enter Amsterdam

Amsterdam is located in North-Central Europe, the capital and most populous city of The Netherlands.

Amsterdam sits on flat low-lying land near the center of the country and is known world-wide for it's picturesque canals, colorful tulips and unique tourism industry.



New York State

Population: 19,570,261

Area: 141,300 km²

Density: 159/km²

The Netherlands

Population: 16,819,595

Area: 41,543 km²

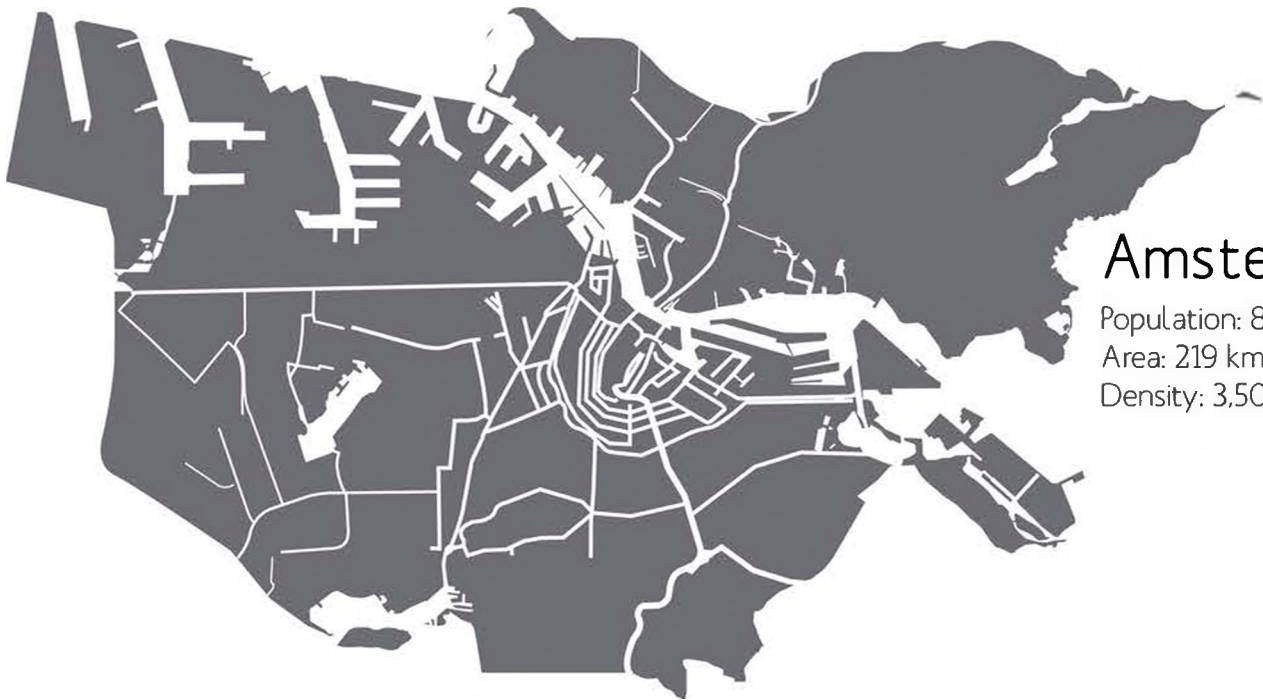
Density: 404.9/km²





Syracuse

Population: 145,170
Area: 66.4 km²
Density: 2,233.4/km²



Amsterdam

Population: 805,166
Area: 219 km²
Density: 3,506/km²

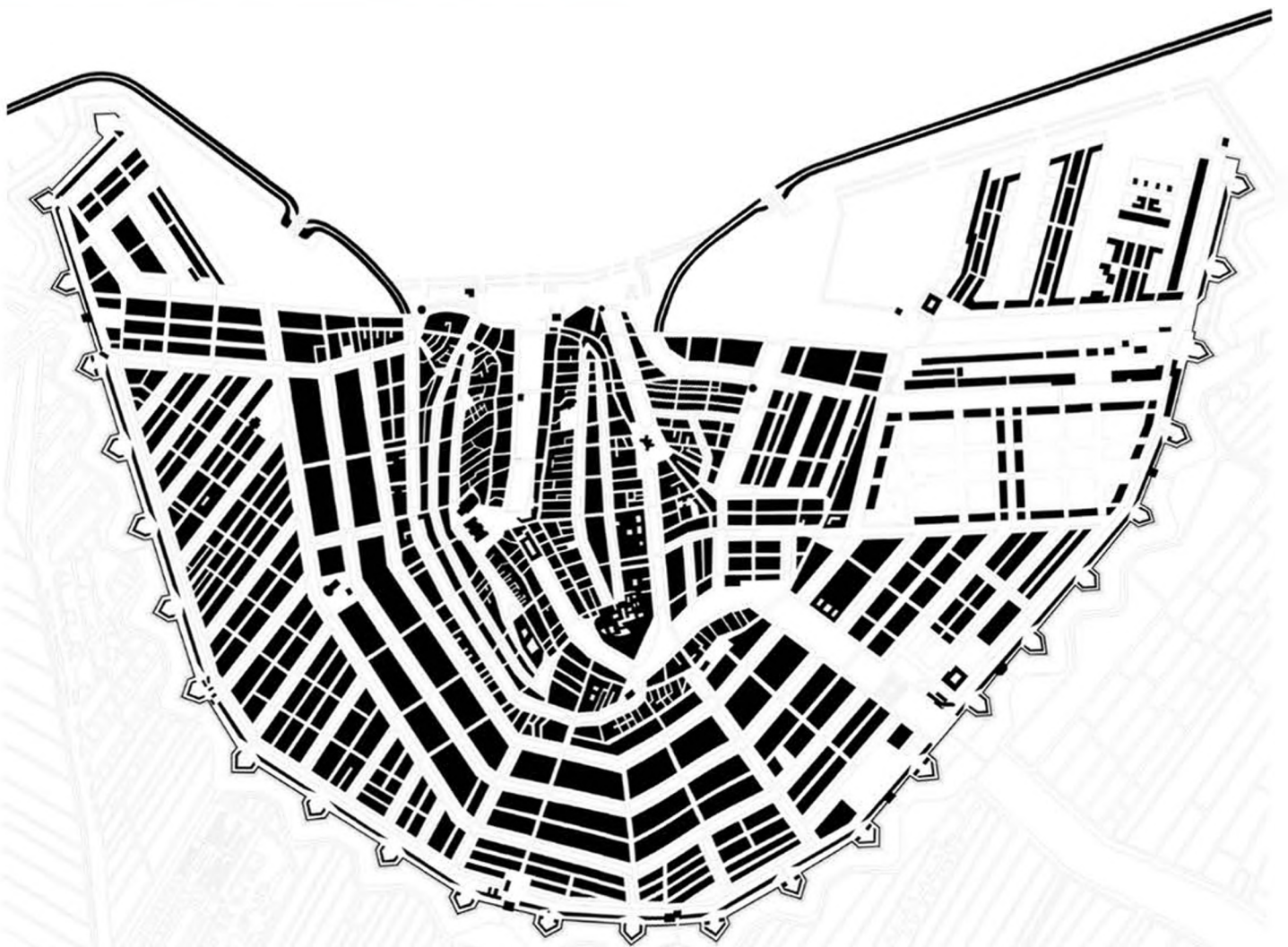
Introduction to *Spatial Knowledge and Landscape Cognition*

It starts with a map. A map exists to answer questions but, like any good answer, inspires even more questions.

For me maps have always been about offering a new perspective on an area, whether it was one I was familiar with or had never seen before. The idea of recreating a place miles wide at a scale that could be held in my hands was endlessly fascinating.

I set out to study the relationship between map and ground, intending to identify the similarities and differences between the two with the ultimate goal of understanding how people construct mental images of different types of place.

Fortunately, things don't always work out the way they are planned and in attempting to explore, define and quantify the role of the map in communicating and storing spatial knowledge I discovered some other things that were more interesting and useful than I ever expected I would find.



Amsterdam 1835
Image Source: <http://touf2011.files.wordpress.com/2011/09/amsterdamnl1835.jpg>

Study and Report Information

Spatial Knowledge and Landscape Cognition draws from observations made and recorded on location as well as from research in related literature completed before and after time on location.

The report was completed over the course of 113 days, 90 of which were on location in Amsterdam, The Netherlands in the months of August, September, October, November, and December 2013.

Time frames relevant to the report include:

Fall 2012: Fall Semester of 2012

Spring 2013: Spring Semester of 2013

Weeks 1-16: Weeks from date of landing on location in Amsterdam.

In the context of this document "report" refers to the document itself, *Spatial Knowledge and Landscape Cognition*. "Project" refers to the document plus all accompanying work (including proposal) during any time frame, "Study" refers to work done on location and after returning from Amsterdam (including project sketch and notebooks) and "Proposal" refers to the document *Surface Textures and Cognitive Construction of Space*. The symbol "PN" is used to reference pages within the Project Notebook.

Appendix A contains a glossary of additional project terms.



Rijksmuseum, Museumplein.
Image Source: Dan Arseneau

Why Amsterdam

Amsterdam is an ideal location for a study of mapping and form because the city and surrounding metropolitan area is home to a wide variety of organizational structures providing ample opportunity for documentation and comparison.

It's small size and multitude of transportation options, including the excellent and ubiquitous bike network, make even the most remote areas of the city and neighboring municipalities accessible.

Of particular importance to this study are neighborhoods like the Grachtengordel (Canal District), Centrum, Nieuw-West, and Zuidoost because of their unique character and contrasting organizational patterns.

A short trip from Amsterdam neighboring cities such as Haarlem, Zaandvoort, and Almere offer additional opportunities for study.

Although not necessarily related to the Project I was also attracted to Amsterdam by the scale of its image. While most major cities might be best identified through their skylines or major landmarks Amsterdam is best known by its canals and canal houses, at the human scale. Part of the reason I wanted to go to Amsterdam was to have the experience of living in a city that exists as its most important landmark rather being defined by it.



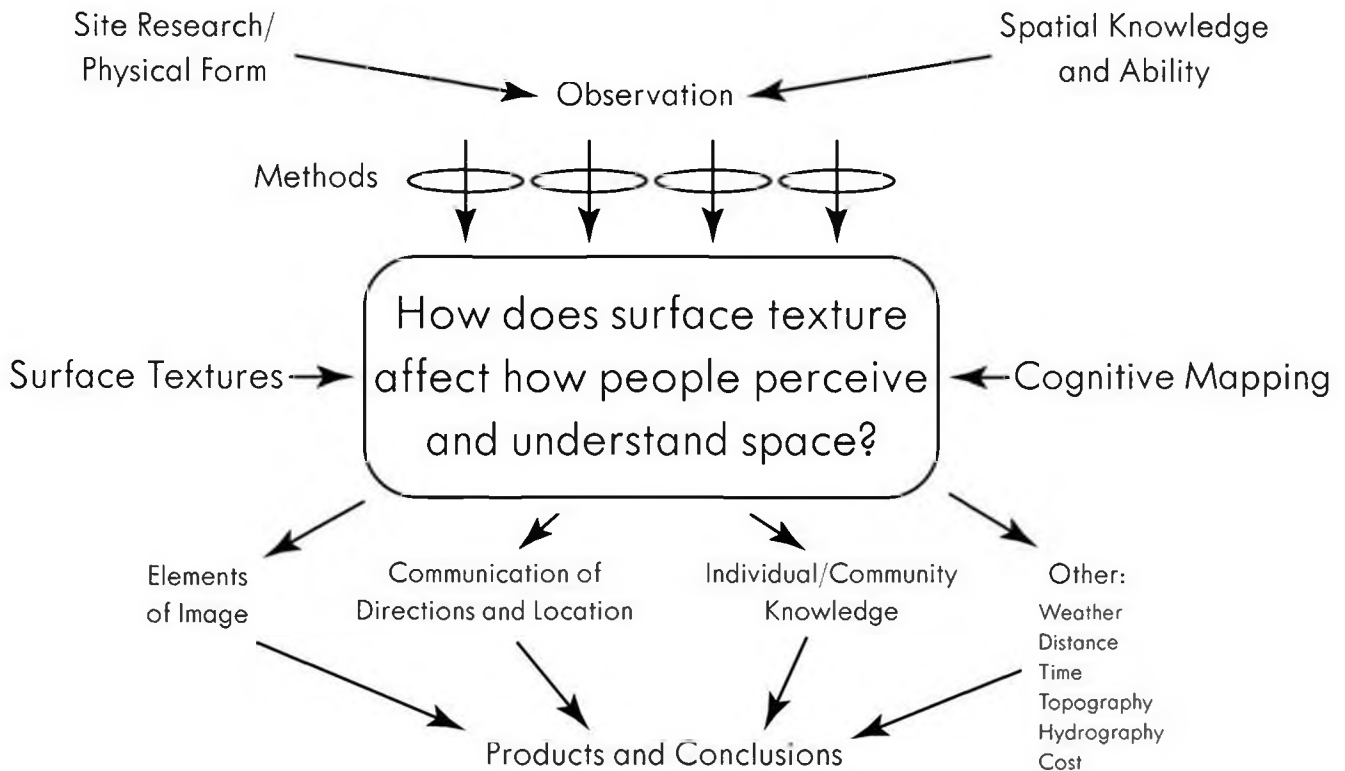
Project Proposal

The study outlined in *Surface Textures and Cognitive Construction of Space* was designed to guide observation of the relationship between maps and the ground they cover with the ultimate goal of understanding how people construct mental images of different types of space.

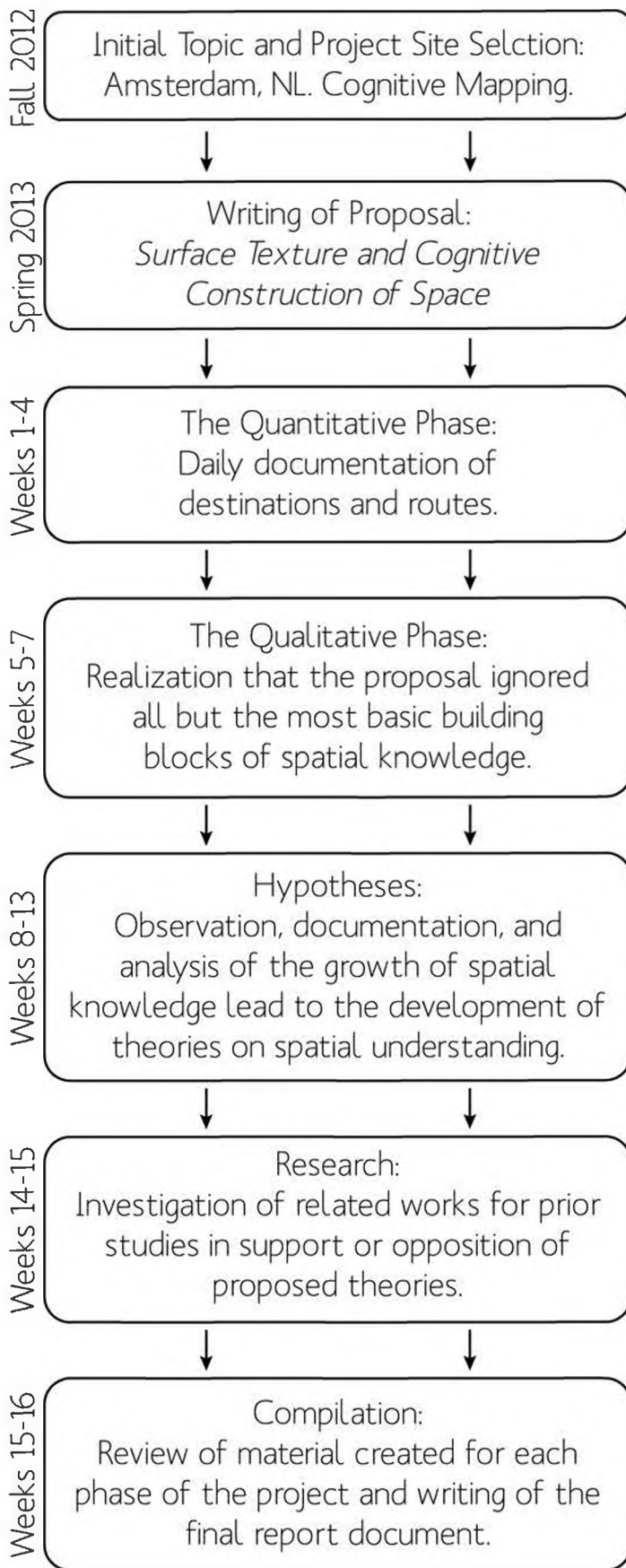
The identification of similarities and differences between the two and changes in the relationship over different types of ground would be used to inform the creation of environments that are easier to internalize and navigate and maps that effectively communicate information.

The importance placed on surface textures as a factor influencing cognitive maps was intended to narrow the focus of the study to something more manageable within the available time frame while maintaining an interest in the massing of built forms.

The final purpose and goals of the study were intentionally left open-ended in the proposal to accommodate any changes required on-site to be successful based on the prevalence and observability of phenomena to be studied.



Project Flow Diagram



As discussed above, Amsterdam was chosen as the project site for the variety of different figure/ground textures that could be found within and around the city.

The proposal, *Surface Texture and Cognitive Construction of Space*, was developed around the idea of exploring the relationships between various organizational structures of landscapes and physical and cognitive maps of those places.

The first month of project work in Amsterdam proceeded according to the proposal, focusing on the documentation of the physical aspects of Amsterdam.

Following advising meetings with Robin Hoffman and Jacques Abelman, the focus of the project was reevaluated and subsequently redefined to place greater emphasis on the qualitative aspect of knowing a landscape.

Review and analysis of documented observations from earlier weeks combined with active and focused observation of themes identified from those notes are used to form several hypotheses on the way landscapes are experienced, understood, remembered and communicated. These hypotheses will become the basis for the remainder of the project.

Based on the hypotheses formed in the later weeks of the time on location research was undertaken to establish if a relationship between project theories and observations and existing studies on the topic of spatial knowledge was present.

Final report is written presenting proposal, project work, findings, and applications.

Methods

Introduction

Several methods were tested in Amsterdam during the first few weeks on location to determine what types of data each could effectively gather and how they could be modified to provide the most complete and best directed collection of data.

As planned in the Proposal the methods used to gather and record data in Amsterdam changed and developed as the study progressed.

For the first four weeks on location data was collected indiscriminately as the rest of the study was organized. In documenting all physical movements and locations comprehensively during the initial stages of the study, the data collected could be reviewed and analyzed after the focus of the study was established.

Following advising meetings during Week 4 the methods were modified individually and as a whole to direct observation and documentation toward qualitative data.

The scale and location of study could both be roughly described as "city-wide" as throughout the on location portion of the study preference was not given to one area over another to avoid skewing tracking data.

Originally meant primarily to investigate the study question, these methods were more valuable as ways of documenting spatial and experiential data related to cognitive mapping for review and analysis. Though not used as planned, the methods described here should still be considered to be successful as they led to the discovery of information needed to undertake an in-depth study of the original study question.

Cognitive Mapping

This method is based on a synthesis of ideas on complexity and familiarity presented in Yi-Fu Tuan's *Space and Place, the Perspective of Experience* and Kevin Lynch's *The Image of the City*.

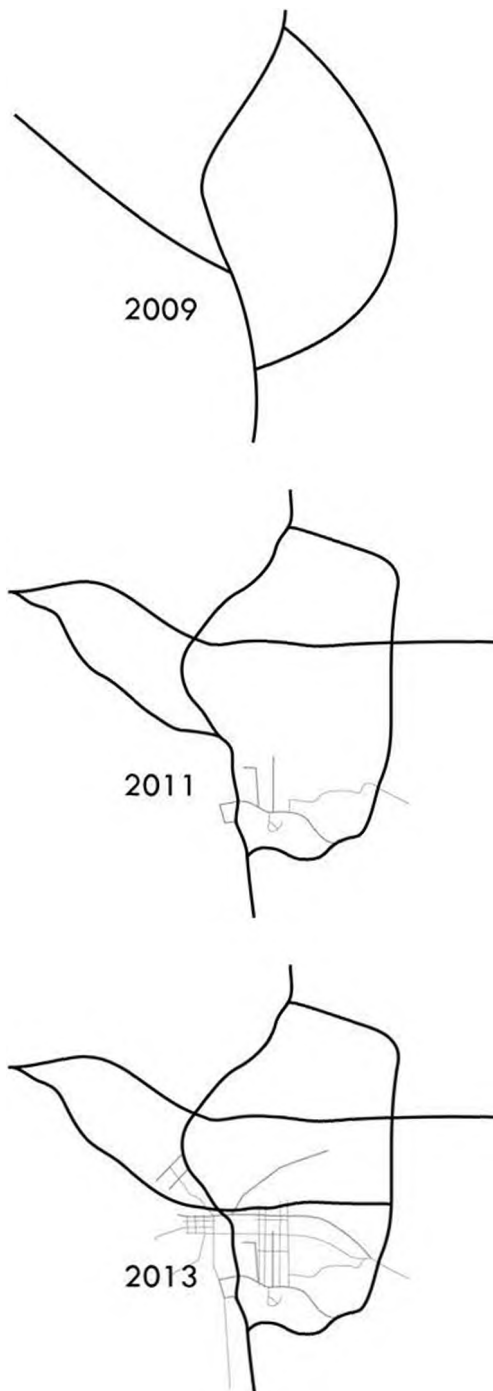
In *Space and Place*, Tuan postulates that in areas that an observer has a high degree of familiarity with they can navigate relying solely on spatial ability (navigational muscle memory) without having to access their spatial knowledge (the ability to actively envision spatial relationships and environments) while in *The Image of the City* Lynch states that an observer's image of a place is constantly growing in size and complexity.

This investigation was started with the presumption that as an observer's familiarity with an area grows they will be able to understand and communicate it to a greater level of complexity. It seeks to confirm whether the addition of elements to a cognitive map leads to an increase in geospatial accuracy indicated by more detail in the map. Conversely, maps that show limited growth over time would be indicative of increased reliance on spatial ability.

The image to the left, figure 1, is an example showing the growth of a cognitive map of the City of Syracuse. As more time is spent in the city it is remembered to a greater level of detail and is able to be reproduced more accurately.

A map of Amsterdam was drawn from memory on a weekly basis. Iterations from early weeks of the study show rapid growth of map area and detail while later weeks show a new understanding of how cognitive maps work and communicate an experience or understanding of the city rather just it's physical form. The implications of these trends are discussed in *The Familiarity Paradox*, page 21.

Cognitive mapping differs from the other methods used in the study in that it was designed with a specific question in mind. In addition, documenting the change in cognitive maps in relation to familiarity, data collected from cognitive maps contributed to the development of each hypothesis presented in the following section.



Cognitive Map Growth, City of Syracuse.
Image Source: Dan Arseneau

figure 1. The simulated growth of my understanding of the physical configuration of the City of Syracuse. As gaps between known locations are adjusted based on the new relationship. Longer time spent observing and experiencing a place will lead to a more spatially accurate cognitive map because there are more relationships between places and they exist across shorter distances.

Directions

Asking for Directions was included in the proposal as a way of collecting cognitive map data from sources external to the observer. By asking for and recording directions to the same location from several different subjects it would be possible to observe how spatial relationships are organized and communicated by others.

Asking for Directions was not scheduled to be implemented until the fourth week of the study, the estimated amount of time it would take to establish an internal cognitive map allowing the formation of expected of answers against which external responses could be compared.

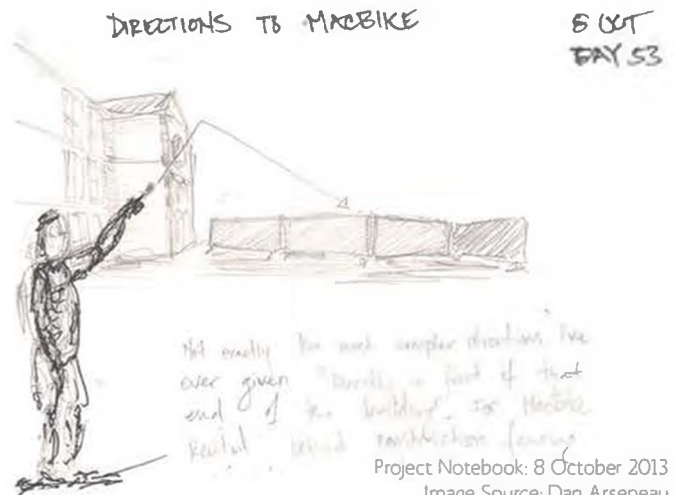
By the time that the method was set to begin the focus of the study had been modified to put emphasis on the development of individual spatial knowledge and expanding sample size became a secondary priority.

Asking for Directions would be replaced with Giving Directions, a series of project notebook entries in which several instances of being asked for and responding to requests for directions were recorded.

Although its reliance on external initiative made Giving Directions the least structured of the methods used in the study it served as an impartial way to test ability to communicate spatial knowledge. In the context of the post advising study, it became more valuable than Asking for Directions because it allowed observation of the thought processes preceding communication rather than just the final product.

Review of related project notebook entries contributed heavily to the development of the Landmarks: Finding Common Ground hypothesis and The Three Realities segment of the Spatial Knowledge Framework presented in the following sections.

In future studies, Asking for Directions would be best suited as a way to expand sample size after studying and understanding an initial test subject.

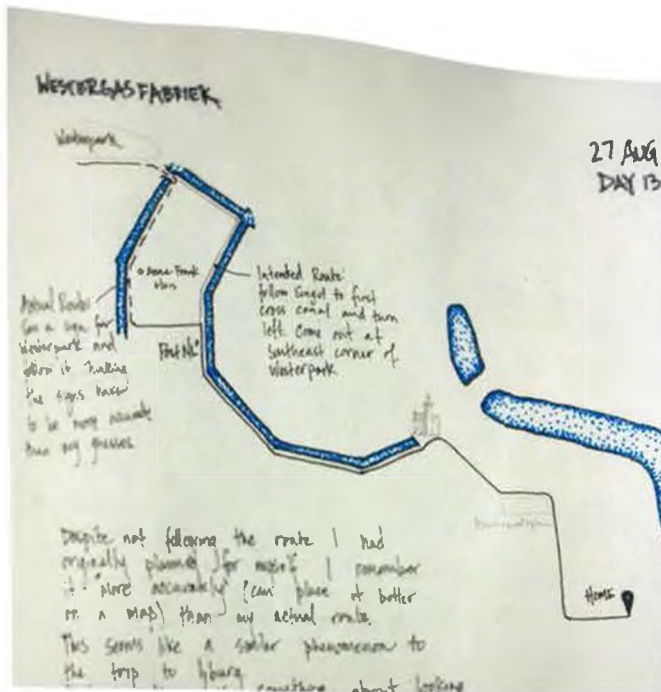


Trip Documentation/Tracking

The primary source of data collected during the first 4 weeks of the study, Trip Documentation and Tracking is comprised of two major elements, a drawn record of a trip and a GPS track.

This method was used to document day to day movements focusing on the route that was traveled until after the Week 4 advising meetings when it was modified to focus primarily on recording the experience of a location. GPS tracking continued as it had originally and was used to objectively study route selection over time and accuracy of certain cognitive maps.

Information frequently documented in Project Notebook trip entries includes the planned and actual route traveled, why deviations from the planned route occurred, major landmarks and reference points used to remember the route and other relevant information that contributed to development the Quantitative and Qualitative and familiarity Paradox hypotheses by illustrating the location and experience data side by side and change in cognitive maps over time.



Project Notebook: 27 August 2013.
Image Sources: Dan Arseneau

GPS Track: 27 August 2013.
Image Source: Dan Arseneau



The images to the left show an example of a Project Notebook trip entry and its associated GPS track. The pair are from Week 2, before advising meetings, and show more similarities than pairs from later weeks, which form a more complete picture of the experience of the trip by combining qualitative data from the Project Notebook and quantitative data from the GPS.



Royal Palace, Dam Square.
Image Source: Dan Arseneau

Hypotheses Through Observation

As with the methods, the end goals and products of the study were left intentionally vague in the writing of the Proposal. They provided loose direction to the early stages of study while accommodating on location modification of the project based on the presence and observability of related phenomena.

Accounting for the character and volume of observations made via established methods and otherwise, it was determined that the conclusions made at the end of on location portion of the study would be best conveyed in the form of hypotheses.

Phenomena observed during the course of the study or revealed through the review and analysis of Project Notebook and Journal entries were frequently indicative of a relationship between space and person.

In the process of refining and categorizing some of the more commonly recorded and observed phenomena several common themes were found in data collected across multiple sources.

Pursuing these themes led to the development of four hypotheses: Quantitative and Qualitative, The Familiarity Paradox, Landmarks: Finding Common Ground, and Language and Landmarks. These hypotheses are the end product of the on location portion of the study and they are presented in the next section of the Report.



Quantitative and Qualitative

Quantitative data is a prerequisite for qualitative data in the growth and acquisition of spatial knowledge.

After the changing the study focus to the collection of qualitative data in Week 4, the mapping of Amsterdam moved forward seamlessly, a transition that was unremarkable in every way until the mapping of new and unfamiliar areas began in Week 7.

Until the first map of Brussels, Belgium was completed it was assumed that the documenting of trip and experience would continue as it had prior to departure from Amsterdam.

Compared with the most up-to-date Project Notebook entry from Amsterdam at the time the entry from Brussels was less developed in its communication of qualitative data, most closely resembling entries from the third and fourth week in Amsterdam. These maps are characterized as created from quantitative data and qualified through annotation.

Throughout Week 7, maps of Paris and the German towns of Garmisch-Partenkirchen and Füssen struggled to capture any information beyond basic spatial relationships, routes and landmarks, drawing attention to the ease with which the first maps of experience had been created in Amsterdam.

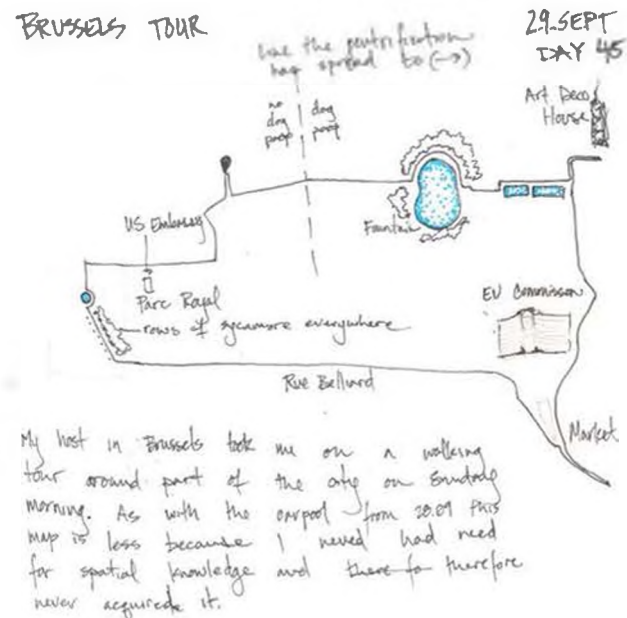
Upon returning to Amsterdam at the beginning of Week 8, the transition back into qualitative maps was as seamless as it had been the first time (see Week 8 Cognitive Map: PN-58), further supporting the notion that a strong understanding of the underlying spatial data is key to the documentation of an experience.

A single-minded focus on documenting movement and location to the greatest possible degree of accuracy during the first four weeks of the study had created a solid foundation of unqualified spatial data of the city of Amsterdam to which qualitative data could be assigned.

Though abnormal for the first iteration map of an unfamiliar area the presence of qualitative data in the initial Brussels map (PN-44) can perhaps be explained by the presence of the host. With access to the host's spatial knowledge the individual observer does not need to build familiarity with the area before they observe it qualitatively.

The necessity of access to spatial knowledge, be it through familiarity or proxy, for qualitative observation to be undertaken is a regulatory element in the development of spatial knowledge. The existence of quantitative data as a prerequisite for qualitative has implications for the spatial knowledge framework presented on pages 29-33 of report. Specifically the ordering of organizing and filler elements in the Structure of Spatial Knowledge segment.

Project Notebook Scan, 22 October 2013
Image Source: Dan Arseneau



The Familiarity Paradox

Greater familiarity with a place confers greater ability to recreate it with physical accuracy but reduces the need to do so.

The Familiarity Paradox is an extension of the relationship between quantitative and qualitative data. It arises when the process of collecting quantitative data proceeds far enough to confer a degree of familiarity that allows the collection of qualitative data to be undertaken.

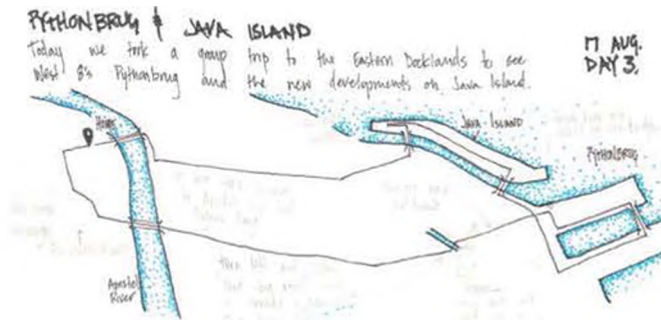
The continued studying of and additions to quantitative elements of a cognitive map leads to an understanding of place that is based on their attributes in addition to their location.

Thus, the repeated experience with quantitative data required to accrue familiarity in the pursuit of spatial accuracy also leads to the acquisition of qualitative data, affecting perception of the quantitative data so meticulously collected.

In *The Agency of Mapping: Speculation, Critique, and Invention*, James Corner (1999) claims that without a perceptual element, maps are merely tracings of reality and therefore without analytical value as they offer no additional insight into the condition and relationships of a place than observation of real thing would.

In this context, the emergence of the paradox can be explained as the result of a subconscious effort to understand not only the way the world is but to place ourselves in it through perception and experience.

The Familiarity Paradox illustrates the value of mapping as a tool for analysis and exploration and explains the interrelated nature of the relationship between qualitative and quantitative data.



Destinations: Landmarks: Scale:

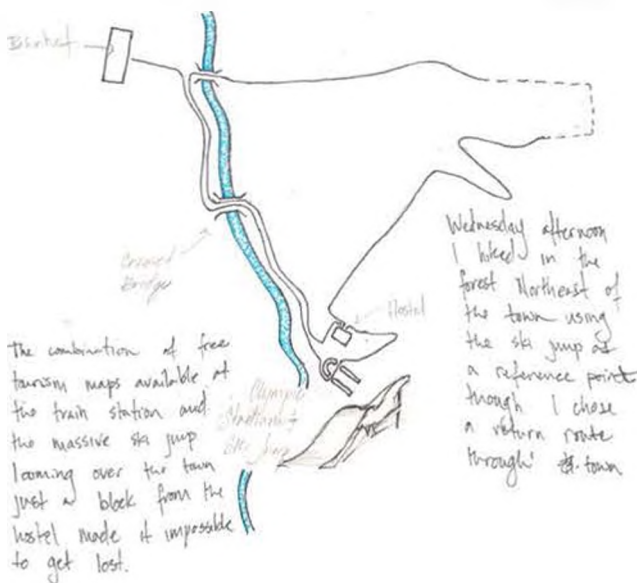
With the exception of Frederiksplein we made out our way across the city without more noted landmarks, the route was planned using a map so we had to rely on landmarks unique for other reasons (e.g. canal crossings) or related to landmarks we were already familiar with (left after Frederiksplein)

Project Notebook Scan, 17 August 2013
Image Source: Dan Arseneau

Project Notebook Scan, 2 October 2013
Image Source: Dan Arseneau

GARMUSCH - PARTENKIRCHEN

2 OCT
DAY AB



Landmarks: Finding Common Ground

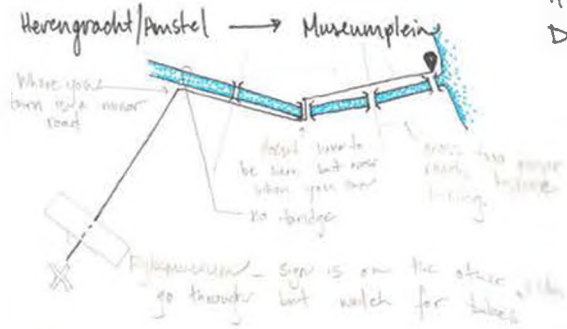
Landmarks exist in a nested hierarchy of scales that is used to determine commonly held spatial knowledge.

First observed as a scenario where landmarks are most useful at a particular scale (described in Proposal as The Object Cycling/Replacement Method) the Common Ground theory was developed after a series of interactions with strangers asking for directions in Amsterdam.

While individually unassuming, looking at these interactions as a whole reveals a trend wherein a shared minimum level of spatial knowledge is established via identification of commonly known landmarks prior to the communication of any direction in each interaction. The two most notable Project Notebook entries in support of this theory can be seen to the right and are described below. They are: The Lost Car (PN-22 Oct), and the I Amsterdam Tourists (PN-11 Oct).

The Lost Car: A middle age man who could not locate the street where he had parked his car approached me for help finding it. After establishing that the location of the street was not a part my spatial knowledge, he listed several landmarks of increasing scale (and therefore increasing distance from his car) that he would be able to use to find his car. The fourth landmark, the Heineken Brewery, was the smallest that I was able to recognize and provide direction to. Though I could not locate the car exactly, directions to the Brewery were sufficient because from that landmark he would be able to find it himself. Without establishing a connection between the areas covered by our respective spatial knowledge, I would not have been able to assist him.

Amsterdam directions



11 Oct
DAY 56

couple of tourists looking for the I Amsterdam sign
 he had a map so I showed them the best
 route to Museumplein with a few extra points

Because the car had no spatial
 knowledge how to use the common
 ground for communication

EdH

23 OCT
DAY 68

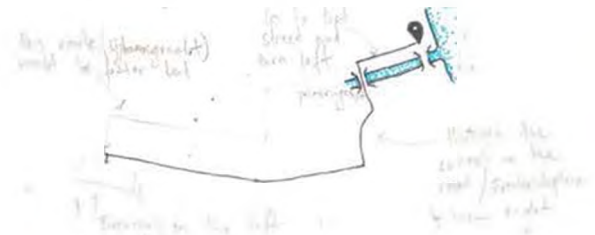
Project Notebook Scan, 11 October 2013
 Image Source: Dan Arseneau

Project Notebook Scan, 22 October 2013
 Image Source: Dan Arseneau

THE LOST CAR

First give directions to the car but realize
 landmark from which it could be
 found. Heineken Brewery

22 OCT
DAY 67



EdH

23 OCT
DAY 68

The I Amsterdam Tourists: A tourist couple was looking for the famous I Amsterdam sign but cannot locate it on their map. Although they are without internalized spatial knowledge of the city, we are able to communicate using the map as shared knowledge and I directed them to Museumplein providing landmarks that will mark each turn shown on the map.

In both cases a common understanding of the landscape is established before any directions are communicated, ensuring that they will be as accurate as possible to a level of detail that is comprehensible by all involved.

By organizing landmarks in a nested hierarchy we are able to identify relevant information more quickly, much like chapters in a book, as well as,

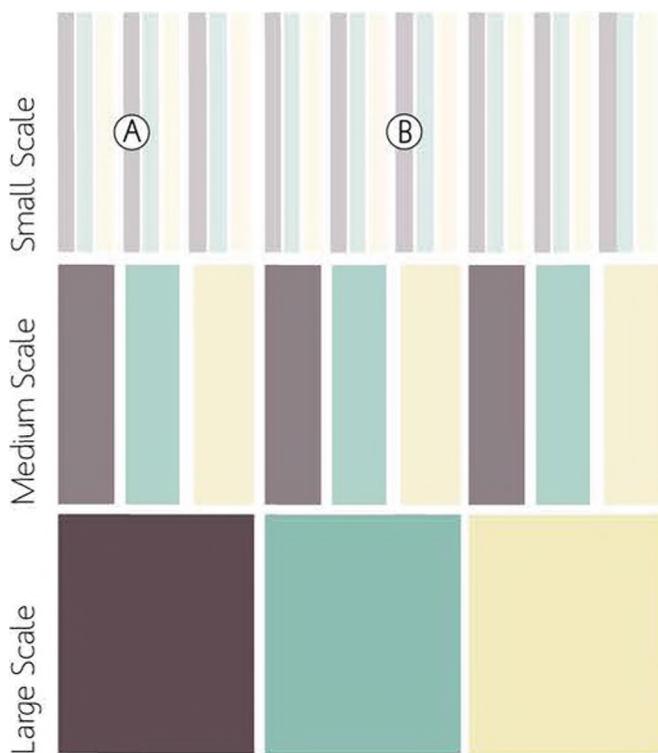


Figure 2: A few large scale landmarks cover a large area. Each has smaller landmarks within it. These smaller landmarks can repeat if they come from a different lineage. For example, A and B are very similar objects but can be distinguished by the larger landmark whose sphere of influence they sit within.

allowing the existence of multiple landmarks with similar character at smaller scales as they can be distinguished from each other by their relationships to the larger landmarks within whose sphere of influence they sit (see figure 2).

In *The Image of The City* Kevin Lynch (1960) describes landmarks as “simple physical elements which may vary widely in scale” (p. 78) and states that “the key physical characteristic of this class is singularity, some aspect that is unique or memorable in the context” (p.78), supporting the Common Ground hypothesis as far as its claim to the existence of a nested hierarchy of landmarks. Unfortunately, *The Image of the City* does not discuss the role of landmarks in the communication of spatial knowledge.

Further investigation of the Common Ground hypothesis would be best directed at discerning the process through which shared spatial knowledge is established. For example: At what scale is the initial connection typically formed and how is it refined or expanded upon to give the greatest level of detail?

The observations contributing to the development of this hypothesis illustrate the importance of the inclusion of imageable objects in the design of cities and towns and their role in the relationship between person and place as well as contributing to the development of The Three Realities section of The Spatial Knowledge Framework.

Language and Landmarks

The presence of foreign phonetic elements in a place name results in a lower probability of memory by name.

Despite a conscious effort to learn more street and place names during the second week on location a mere handful are present in the weekly cognitive map. A response to a near total lack of labels in the map from Week 1 (see to the right), the failure of actively seeking to add more names was made more obvious in contrast to the rapid growth of the geographic portion of the map.

Comparing maps drawn for the study to fully labeled maps of the city revealed that a common characteristic of the labels included in study maps was their phonetic composition. Those labels that were present were comprised almost exclusively with phonemes, the basic aural building block of language, shared by Dutch and English such as "Kerkstraat", "Centraal Station", "Dam Square", "Amstel", and "Vondelpark".

Names including several exclusively Dutch or particularly difficult to pronounce phonemes were frequently omitted or substituted for more descriptive titles. "Vijzelstraat" became "The Street to Museumplein" and "Brouwerij 't IJ" was better know as "The Windmill." Very few distinctively Dutch labels were present in any early drawings.

The standard placement of street signs created an additional layer of difficulty in learning the names of streets. As seen in the photo to the right, signs are placed high up and on buildings, setting them back from the street.

J.B. Carroll's Phonetic coding ability (PCA), "the ability to identify distinct sounds, to form associations between these sounds and the symbols representing them, and to retain these associations in memory" (as cited in Hu et al., 2013, p. 366) may explain the difficulty experienced in internalizing Dutch-language place names. As stated in a 2013 study published in *Brain and Language* by Xiaochen Hu et al., *Language Aptitude for Pronunciation in Advanced Second Language Learners*, pronunciation is the most difficult aspect of learning a language for an adult which, according to the theory of PCA could cause

a disconnect between name and memory.

The observations and analysis leading to the Language and Landmarks hypothesis and the theory of PCA suggest that the creation of a mental image of place follows the path of least resistance. The convenience of an existing name is taken advantage of whenever possible, only to be replaced should it require additional knowledge to memorize.

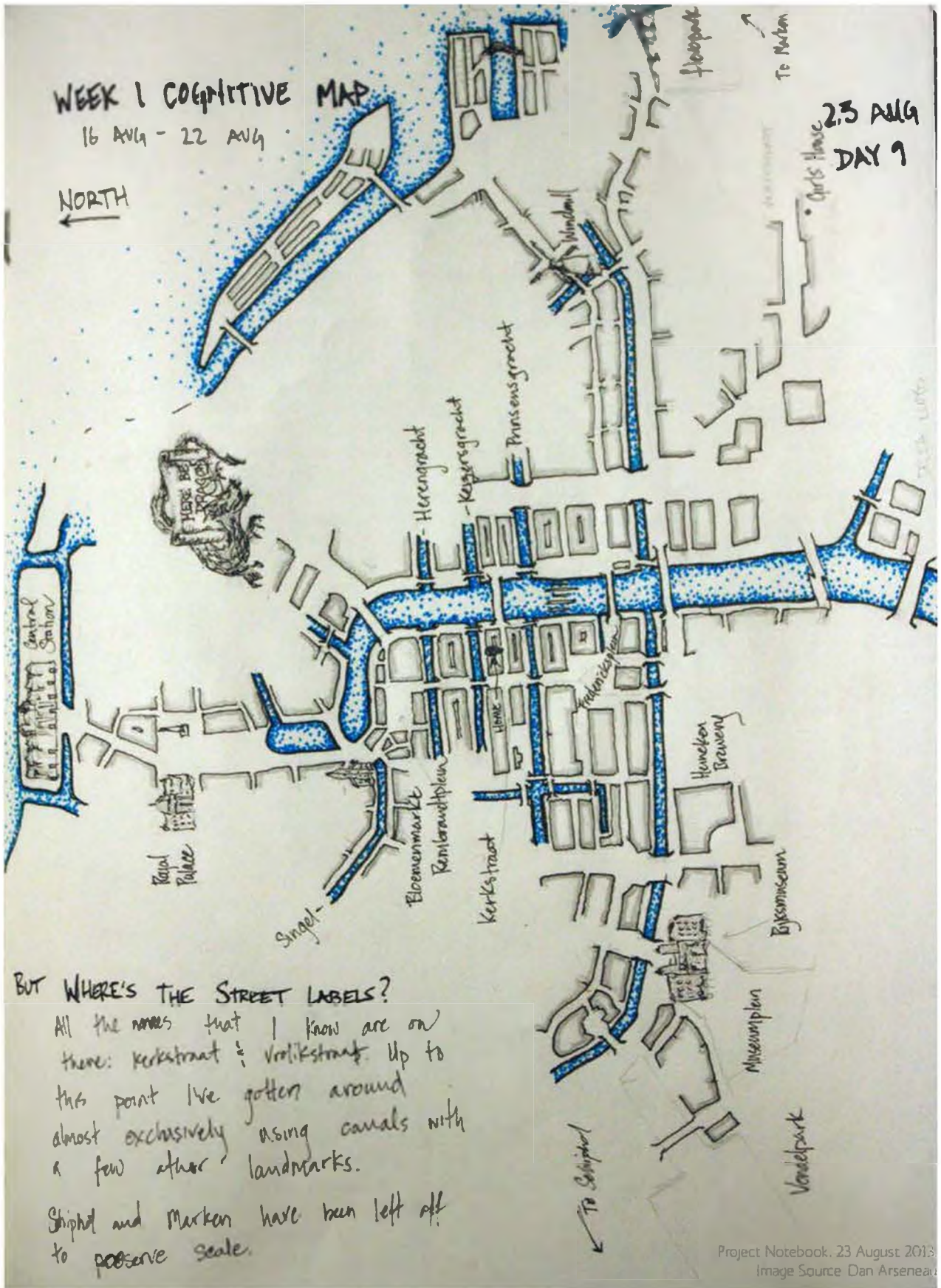
Further pursuit of the impacts of language and pronunciation on spatial cognition might investigate what qualities of an object contribute to its renaming should it be required and factors other than difficulty of pronunciation that might prompt an object to be given an alternate name.



WEEK 1 COGNITIVE MAP

16 AUG - 22 AUG

NORTH
←



BUT WHERE'S THE STREET LABELS?

All the names that I know are on there: Kerkstraat & Vrolikstraat. Up to this point I've gotten around almost exclusively using canals with a few other landmarks.

Schiphol and Marken have been left off to preserve scale.

Conclusions

The conclusions of *Spatial Knowledge and Landscape Cognition* are the product of the synthesis of all the components previously mentioned: Proposal, Project Notebook, Journal, and Hypotheses.

The conclusions were developed in a non-location reliant format such that the information conferred in them might be applied elsewhere.

The Framework of Spatial Knowledge and Building Spatial Knowledge are presented in the following section.



Framework of Spatial Knowledge

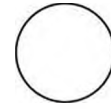
The Framework of Spatial Knowledge is a tool for organizing and visualizing the relationships between the various elements of spatial knowledge and reality.

A basic introduction can be found to the right and is elaborated on in the following pages.

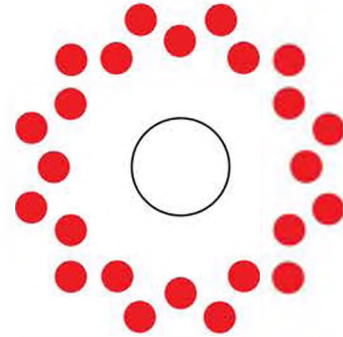
The framework outlines the relationships between known and unknown spatial information, the divisions and layers of spatial knowledge, and inter- and intra-individual relationships of spatial knowledge

Framework Basics

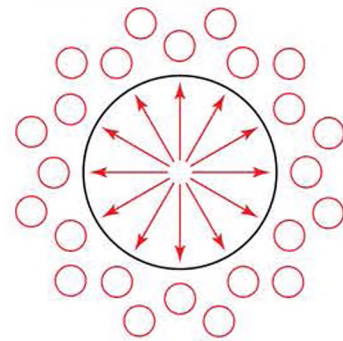
Imagine for a moment that this circle contains the entirety of your spatial knowledge. Everything you know about place and organization is in that circle.



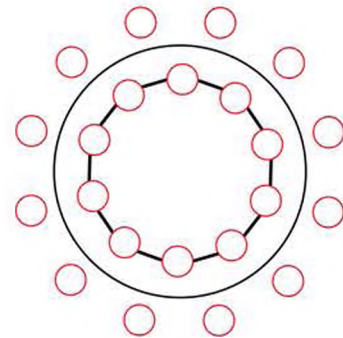
But everything you know is not everything there is. Surrounding the circle is physical reality, the way the world actually exists.



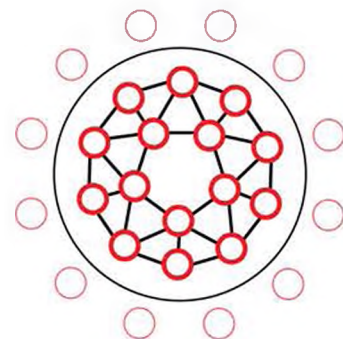
As your spatial knowledge grows, so does the circle: closer to physical reality.



As elements of reality are added to your knowledge they are qualified, becoming memories that are tied together through shared characteristics as well their spatial organization.



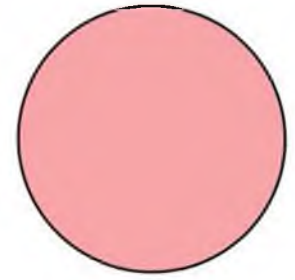
Essentially, the outside of the circle is space unexplored while the inside of the circle is space as seen through the lens of your experience.



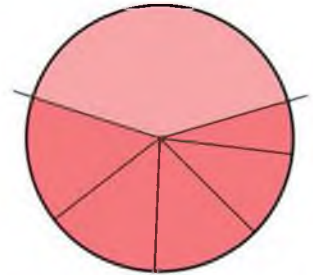
Scale and Proportion

Within the circle, the volume of spatial knowledge of different areas is represented proportionally. Each piece of the circle can therefore be displayed as a piece of an encompassing geography to study context or expanded into a circle of its own for a more detailed view of a specific area.

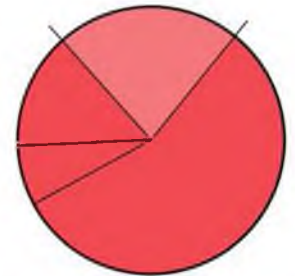
City of Amsterdam



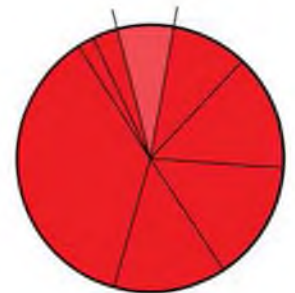
North Holland



The Netherlands

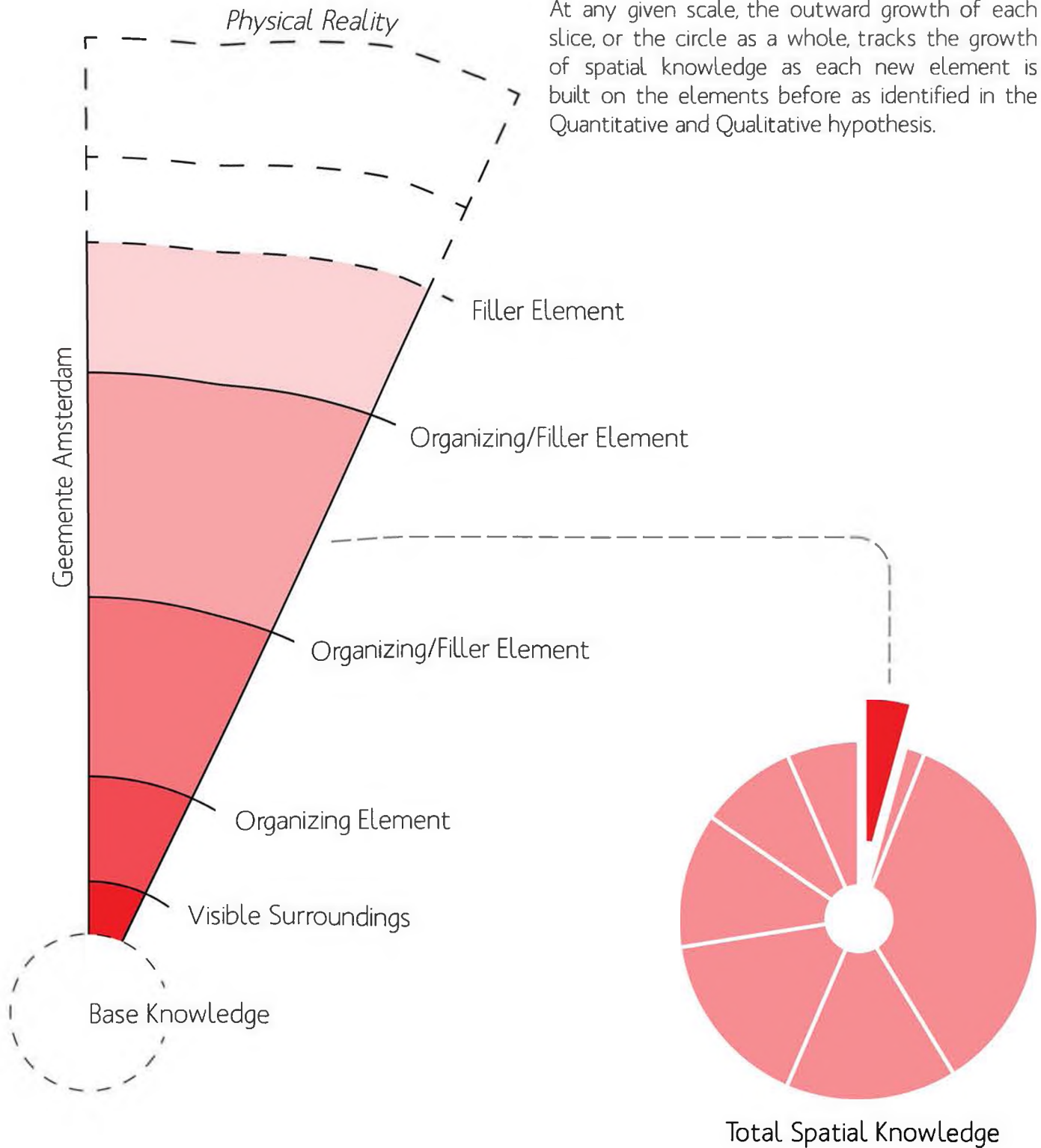


Total Spatial Knowledge



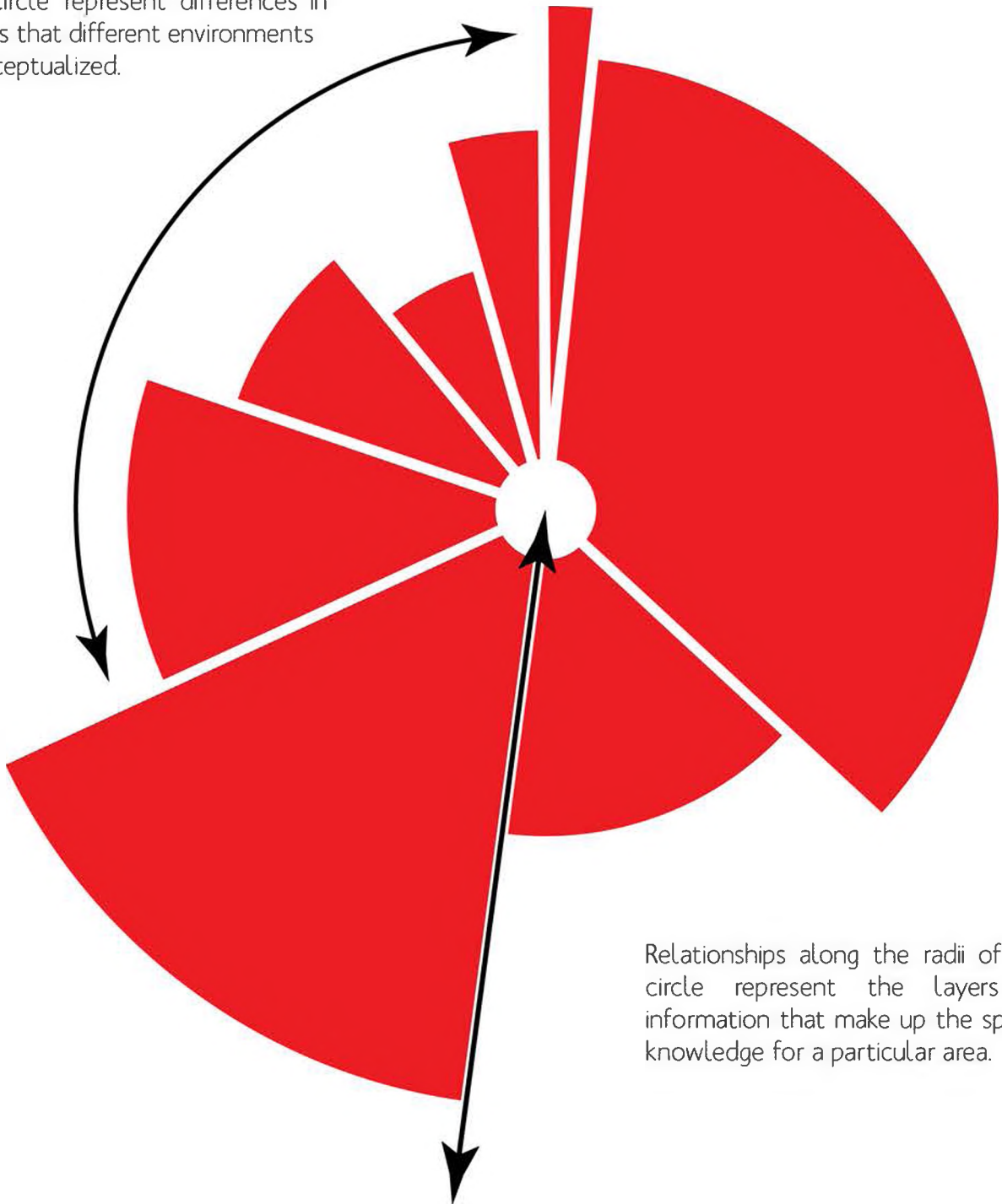
Structure of Spatial Knowledge

At any given scale, the outward growth of each slice, or the circle as a whole, tracks the growth of spatial knowledge as each new element is built on the elements before as identified in the Quantitative and Qualitative hypothesis.



Full Circle

Relationships around the circumference of the circle represent differences in the ways that different environments are conceptualized.

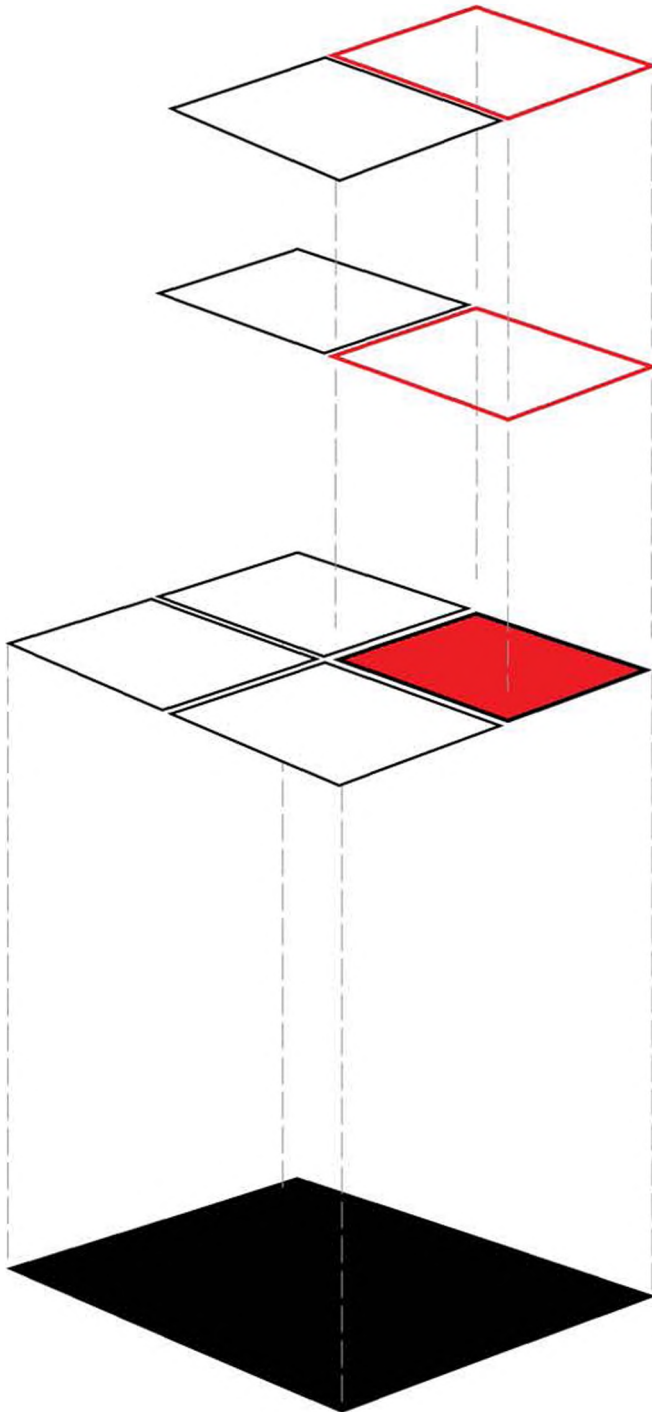


Relationships along the radii of the circle represent the layers of information that make up the spatial knowledge for a particular area.

The Three Realities

Spatial information exists simultaneously in three ways: As it is perceived by a single individual, as it is perceived by a group of individuals, and as it is independent of observer perception.

The levels shown in this diagram do not correlate to a level of detail of spatial knowledge. They separate the layers of physical, community, and individual reality to show the relationship between them.



Individual realities:

Are unique to the person to whom they belong. The creation and characterization of place is entirely dependent on the experience of the individual.

- The purpose of a map is to eliminate extraneous information and highlight important information.
- To communicate about space people must first create a shared reality that is built from actuality.

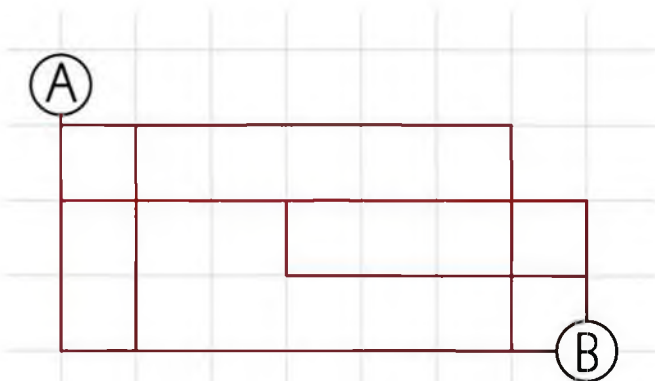
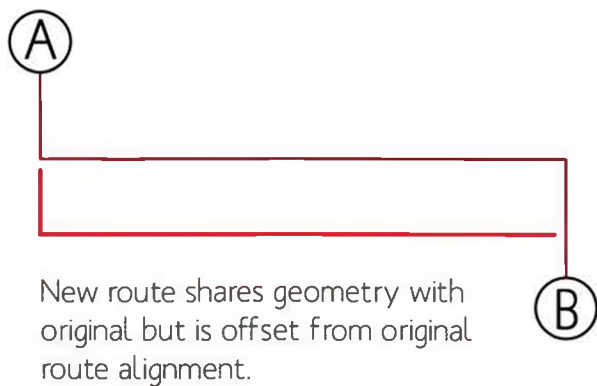
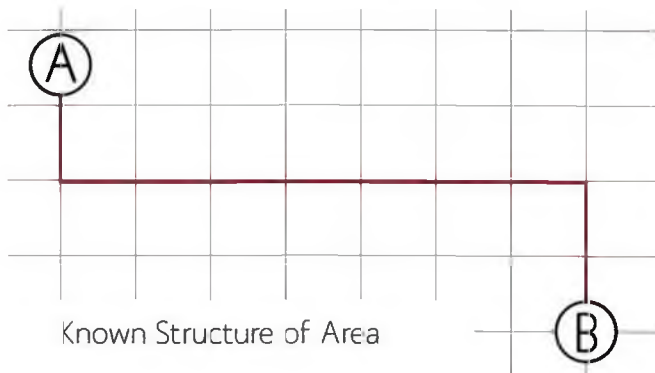
Collective Reality:

Is the intersection and average of two or more individual realities. As outlined in the Landmarks: Finding Common Ground Theory, a connection at this level allows an individual to reference their spatial knowledge against others and is required for the communication of spatial information.

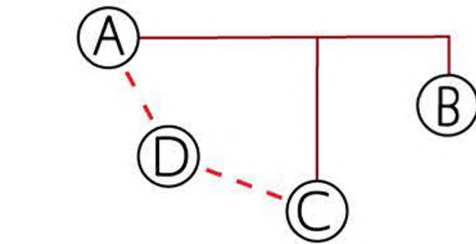
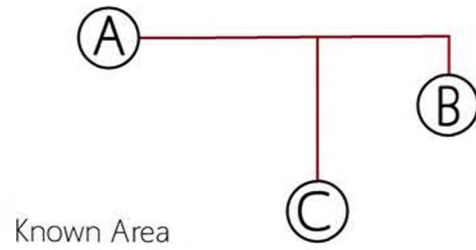
Physical Reality:

Is the way a place truly exists. It is the common starting from which all individual and community realities are developed.

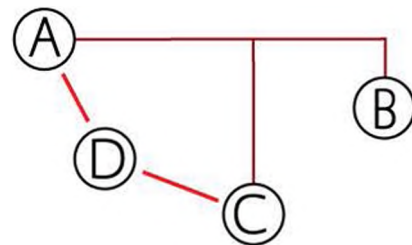
Parallel Paths



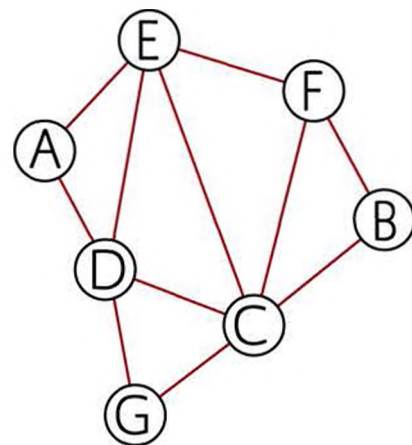
Visual Connection



Landmark Identifiable from multiple locations within known area (D).



New connections between points in known area via mutually identifiable landmark.



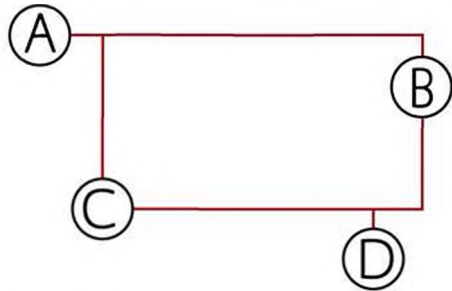
Cognitive map expands along sightlines connecting the locations of known landmarks.

See "Blomenmarkt": PN-21 Aug.

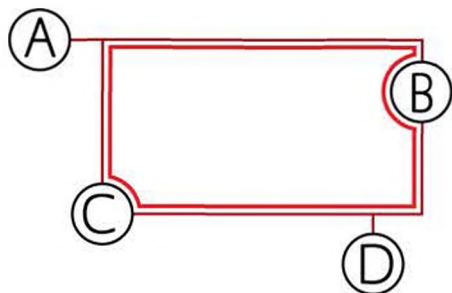
Building Spatial Knowledge

Increasing Area and Detail

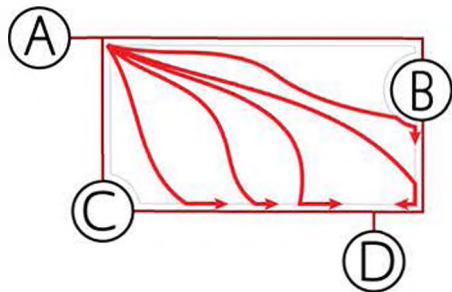
Exploration Within Borders



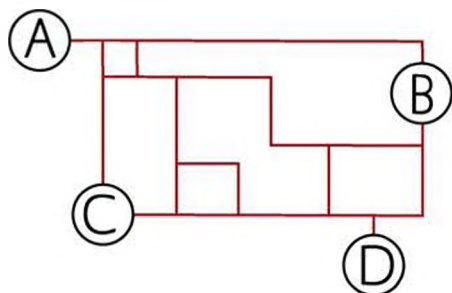
Known Area



Connections between known landmarks define an area bounded by familiar routes.



Boundary connections act as a funnel to catch errant travel and direct it back to a known landmark.



Cognitive map becomes more detailed as the area inside the boundary is defined by transecting connections.
See "Going West" PN-4 Sept.

The expansion and growth of spatial knowledge is always taking place and can occur through several processes.

Parallel Paths:

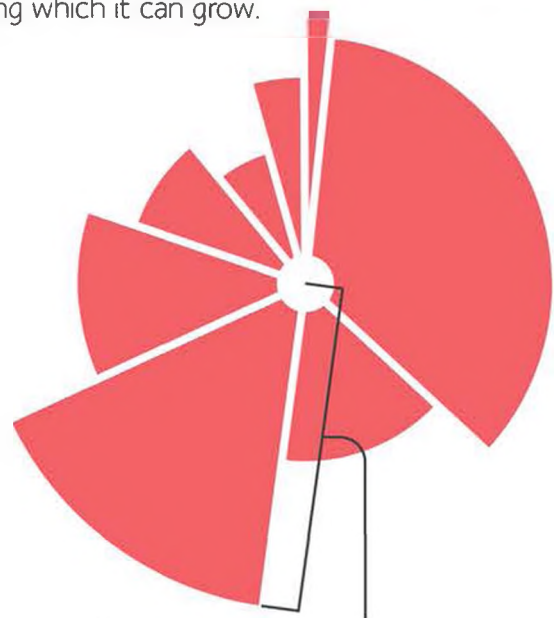
Extrapolation of a known organizational system into an adjacent unknown area.

Visual Connection:

Establishing relative locations through sight prior to making a physical connection.

Exploration within Boundaries:

An awareness of the processes by which spatial knowledge is expanded can be employed to inform the design of cities and towns by encouraging the provision of elements that create a framework along which it can grow.



The growth and development of spatial knowledge is tracked in changes to the radial axis of the spatial knowledge framework.

Practice for Professional

Although the ambiguity of the Proposal might have hampered the successful execution of the project, I believe that it had the opposite affect.

In leaving the focus of the study available for question, I put myself in a position to question it which, with the benefit of hindsight is something I'm glad I did.

In a final review of my proposal that accompanied the writing of this report it came to my attention that several of the phenomena I had observed and recorded were present in my literature review and had been used to support my claim that the original study question was something that could be studied.

However, after going through the process of observing, questioning and analyzing these things for myself I believe that I would have continued to struggle if I had persevered with my original study

question because at the time of the study I lacked the knowledge, tools, and experience needed to observe and understand the phenomena I had proposed to study.

The specifics of the study question were irrelevant because any related study in the field of cognitive mapping would have brought me to the same conclusions presented above, a starter kit for the investigation of spatial knowledge.

Using the frameworks developed in the writing of this report I believe I could undertake a much more successful and focused investigation of the original study question or a related topic.



Sunset over Zeeburg
Image Source: Dan Arseneau

The Last Word

The Amsterdam experience has been one of the best of my life. Equal parts education and excitement, memories of this trip will last a lifetime.

I made new friends and spent time with existing ones. I was immersed in a new culture and am better for the experience.

Though my memories of Amsterdam are cherished, the most important things I will take away from this experience are the knowledge of how to live and work on my own and the frameworks of spatial knowledge I have developed for the continued advancement of my understanding of how people interact with their landscape.

Appendices

- A: Glossary of Terms
- B: Works Cited

Acknowledgements

My sincerest thanks to my family, Mom, Dad, Katie, Mike, and Wilson for all their support.

My advisors, Robin, Maren, and, Jacques for all their advice.

And my group, Chelsea, Sara, Kyle, Jin, Ryan, and Kristy for making it all worthwhile.



Glossary

Project Specific Definitions:

Cognitive Map: An individual's image of a city or other place.

Surface Texture: The figure-ground relationships of an area. Inclusive of an area's density and organizational structure.

Communication: Ability of a person to clearly describe a route of movement through a texture.

Physical Map: Any map that is geospatially accurate.

Spatial Ability: Day to day movements within an environment. What we can accomplish and experience with our body.

Spatial Knowledge: The ability to envision and communicate spatial relationships and environments.

Perforation/Porosity: Number of passages through or open spaces in a dense figure area.

Scoring: Traveling a predetermined path that has been established without consideration of surface conditions.

From Kevin Lynch's The Image of the City:

Path: Channels along which observers move such as streets, transit lines, and canals.

Edge: Linear elements that do not act as paths and often form boundaries between areas or linear breaks in continuity.

District: Medium-to-Large parts of a city which observers mentally "enter in to" and/or have an identifying physical character.

Node: Point references, intensive foci to and from which a person is traveling. Major nodes are often combinations of junctions of flows and concentrations of activities.

Landmark: Point references external to the observer.

Legibility: The ease with which a place can be recognized, organized, and navigated.

Image: All the places a person knows and their knowledge of how to move between them.

Imageability: Likelihood of an object evoking a strong image.

From James Corner's The Agency of Mapping: Speculation, Critique, and Innovation:

Agency: The ability to act on or influence.

Map: Combines physical, social, historical, and economic elements to reveal and create new actualities through relationships and context.

Tracing: Representation of a physical condition.

Milieu: A seamless system of surroundings, connections, potentials, extensions and relationships.

Field: Surface and system in which other elements are arranged.

Extract: Elements of the Milieu drawn into the field. Selected and isolated from their original seamlessness.

Plotting: Drawing of the new relationships revealed between the fields and extracts.

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