TECHNISCHE UNIVERSITÄT DRESDEN

Master Thesis

Methodology for Producing a Hand-Drawn Thematic City Map

submitted by: Alika C. Jensen

born on: 27.08.1992 in Dayton, Ohio, USA

submitted for the academic degree of
Master of Science (M.Sc.)

Date of Submission 16.10.2017

Supervisors Prof. Dipl.-Phys. Dr.-Ing. habil. Dirk Burghardt
Technische Universität Dresden

Univ.Prof. Mag.rer.nat. Dr.rer.nat. Georg Gartner
Technische Universität Wien

Statement of Authorship

Herewith I declare that I am the sole author of the thesis named

„Methodology for Producing a Hand-Drawn Thematic City Map“

which has been submitted to the study commission of geosciences today.

I have fully referenced the ideas and work of others, whether published or unpublished.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

Dresden, 16.10.2017 Signature Alika C. Jensen

Contents

Figures

Terminology

Artistic: relating to the field or industry of the arts; incorporating aesthetic elements and principles

Aesthetic: guiding principles that define an artist or art movement's most notable elements or motifs

Hand-drawn: constructed with analog pencil and paper by the user using traditional drawing methods.

Design: specific combination of visual elements and motifs, utilizing logical justifications for decisions regarding each element and motif.

Motif: any visual element that can be defined and isolated within a composition, i.e. use of the color red or repeating horizontal lines

Isometric perspective: viewpoint where geometries of lines are parallel and limited to a grid, thus eliminating any convergence or presence of vantage points within the construction.

Bird's eye perspective: viewpoint from an aerial position, looking down at the ground plane and objects, often with lines converging to one or more vantage points.

Chorography: realistic representation of an area, showing the essence of that specific place with disregard to mathematical precision in its representation

Relative contrast: the difference between two adjacent tones, shades, or hues, thus creating a visual distinction between the two areas.

Hue: name of a given color, i.e. red, green, or yellow-orange

Color scheme: deliberate combination of colors, accepting the standard recognized combinations in the field of art, i.e. monochromatic, triadic, tetradic, split complimentary, etc.

High-key color scheme: combination of colors where the majority of the colors are mixed with white, creating a lighter overall appearance

Low-key color scheme: combination of colors where the majority of the colors are mixed with black, creating a darker overall appearance

Warm colors: red, orange, and yellow on the color wheel, including combinations of these colors.

Cool colors: green, blue, and purple on the color wheel, including combinations of these colors

Lightfastness: ability for a pigment to retain its original color over time, particularly after exposure to external factors, i.e. ultraviolet light and/or atmosphere

Tooth (paper): roughness of a paper's surface, determining its amount of visual texture and willingness to accept dry media application, i.e. graphite.

1. Introduction

Illustrated maps boast a long and rich history of providing useful and beautiful city renditions to those of interest. Intended to inspire, navigate, inform and enlighten, illustrated maps can communicate in ways that transcend the unadorned map. By looking at the current market through the work of John Roman and Katherine Harmon, the capacity and diversity of illustrated maps is described. By incorporating the visual elements and graphic depictions of cities in a multitude of styles, communication is opened between the mapmaker and the viewer, providing information not only about the geography of a region, but about the culture, history, and that region's areas of interest. The accuracy with which a mapmaker conveys these ideas is the sole responsibility of that person, and thorough research is required to understand the needs, possibilities, and existing work within a specific application. (Kitawaza 1999) Within such broad possibilities, it is important to note the purpose of specific focuses within a body of work. This enables the clear communication of ideas based on a limited and concise list of principles, providing a clear message with solid decisions based on visualization methods of that message. (Gray & Mallins, 2004)

By understanding the integration and relations between the diverse fields of art and science, and defining and understanding the processes of creativity, a framework is provided for considering the work presented in this thesis. (D'Ignazio 2009 and Mace & Ward 2002) It is important to note what qualifies as creative work, and how fields are built upon and expanded to ensure the acceptance and credibility within the work. (Sternberg 2006) Current work in the illustration market is expansive, but not complete, and many creative illustrated maps have been produced. However, the framework for defining those creative decisions and providing clear instructions for creating artistic work provides a new level of accessibility to the previously mysterious creative process. Detailed descriptions about how to objectively make decisions about the creative process and visualization techniques highlights the comprehensive nature of this methodology.

The objective is to produce a repeatable methodology to create illustrated city maps in one technique. There exists a stigma around artistic creations that they are arbitrarily created with no repeatable or justifiable methodology for the graphic decisions and representations. However, this is not the case. Many artistic representations have definable and justifiable decisions when deciding how to depict an aesthetic city map. The methodology described here is just one solution for an artistic representation, which will provide accessible and repeatable instructions for how to produce an illustrated city map.

By combining features from previously unrelated maps created in different times, styles, and techniques, a new map-creation aesthetic will be produced, filling a niche in the market of illustrated maps. Furthermore, by distinctly describing the influences, workflow, and justifications for decision-making during the process, the methodology will become transparent to those wishing to recreate a similar aesthetic. The following steps are taken to create this body of work:

- Research
- Process and stylistic devleopment
- Final map creation

By describing in detail each step, clear instructions are thus provided, complete with with a framework of how to make aesthetic decisions based on concrete criteria. After providing an overview of the current market in illustrated maps, the niche is determined for what is missing and how this thesis can fill that niche. A visual analysis will be conducted of maps intended to inform the final map creation stage, providing visual motifs to draw upon during the sketch creation stage. The visual analysis describes each map of interest, analyzes its contents, considers its context and then provides an inferred judgement to its success, based on its alleged purpose. After this is conducted, a series of sketches are produced.

A series of sketches are produced during the stylistic development, drawing upon techniques from the maps analyzed in the visual analysis portion of this thesis. By trying out new combinations of techniques present in existing maps, notes are then taken about what is successful and unsuccessful for each attempt. These findings are then applied to the final map.

The purpose of the experimentation in the sketch stage is to allow for errors, try various techniques, and decide on elements that prove successful. The successful elements are thus combined and utilized during the creation of the final map. It is recommended for future users of this method to gain familiarity with the city of choice before attempting to create one's own thematic map. At any point, it is encouraged to familiarize oneself with the architectural features being depicted. This enables the user to choose the best viewing angle and most iconic representation. The experimentation period consists of small sample illustrations, hereby referred to as sketches, utilizing elements borrowed from the historic analysis.

After the completion of these steps, the final map of Dresden is produced, utilizing all the knowledge compounded during the previous considerations. This map is intended as a tourist map, featuring architectural highlights of Dresden.

2. Literature Study

The concept of taking an artistic process and outlining its processes is an amalgamation of art and science. This process requires an overview of artwork relating to the sciences and vice versa. First, existing literature about art and cartography is mentioned. Then, some similarities between artistic and cartographic elements will be highlighted. A discussion of creativity and its components will be held to fully understand the innovation of combining new elements into a graphic style. A brief overview of existing work, beginning from artistic pieces and moving towards functional maps in the cartographic sense is explored. Then, the historic context and overviews of the maps to be considered for this project is given. Similarly, historic context must be researched by those wishing to reproduce this method in their own map examples. Finally, a history of perspective highlights the developments bringing together the foundations for analyzing perspective in this work. These foundations bring together the core of this project, relating a broad spectrum of concentrations into the body of work considered here.

2.1 Foundational Knowledge

Foundations give the base for which the methodology and processes of this work will be built. By outlining the premises on which the arguments for decisions will be made, firm justifications can be made about the decisions made for this work. To begin, a discussion on the conjunction between art and science is made.

2.1.1 Art and Science

Context is key within any artistic field, and the combination of art and science into the field of cartography is no different. Understanding a painting or assessing a scientific paper has its similarities, for example by the necessity of understanding their context to fully understand the idea and contribution of the artist or scientist. Also, historic connections tie the fields of art and cartography together, presented by geographer Ronald Rees to draw connections between the interests of art and cartography. (Cosgrove 2005, p. 35–36) By being aware of existing work in a given field, whether it be a contemporary art exhibition or peer-reviewed article on the topic of remote sensing, it is crucial for a better understanding of what is the goal and achievement of a body of work.

The work of David Woodward unified many works on the topic of artistic and cartographic relationships in a collection of essays, published as *Art and Cartography*, giving modern and historic contexts for specific interests, such as Ehrensvärd's article, titled *Color in Cartography: A Historical Survey*. This article, which gives an overview and implications of historical use of color in cartographic artefacts, may be combined with current work of color-theorists in the artistic industry to create a complex understanding for modern and practical applications within the illustrated map field.

Woodward, in *Art and Cartography*, also challenges traditional viewpoints that cartography transformed from an artistic to a scientific endeavor. (Cosgrove 2005, p. 36) From a historic perspective, the distinction between the science and art is blurred and often overlaps; indeed, the distinction between the two fields is a modern development, beginning in the 19th and 20th centuries. (Cosgrove 2005, p. 36) The methods used to analyze historic cartographic artefacts on a set of criteria developed in the nineteenth century should be viewed with a critical eye and with the knowledge that this only one lens with which to view an object.

The "operational metaphor" of mapping is used today in a wide variety of applications and contexts, further entwining the fields of art and cartography and analyzed by scholars such as Robinson and Petchenik. (Watson 2009, p. 295). The field of science, according John D. Barrow and summarized by Watson, is becoming more visual in recent decades (Watson 2009, p. 304). With the increasing availability of tools such as aerial imagery and other GIS data, Wood estimates that 99.99% of all maps have been made in the last 100 years. (D'Ignazio 2009, p. 191) This increase in visualization invites an opportunity for aesthetics to take a part in the scientific world, and vice versa. This combination is in conjunction with the mapping metaphor, being ascribed to multiple applications and becoming a sort of umbrella term for charting, providing perspective, outlining, etc. (Watson 2009, p. 295) This relationship between objects in space applies to such a wide variety of topics, it thus expands the field of cartography to many practical scientific applications. As Yi-Fu Tuan summarizes in *Space and Place: Humanistic Perspective*:

> The interpretation of spatial elements requires an abstract and objective frame of thought, quantifiable data, and ideally the language of mathematics. Place, like space, lies at the core of geographical discipline. Indeed an *Ad Hoc* committee of American geographers (1965, 7) asserted that "the modern science of geography derives its substance from man's sense of place."

The increase of map production within the last century, new challenges to the viewpoints and relationships between art and cartography, and studies related to such art-specific fields such as color all compel a comprehensive study into a segue between the fields of art and

cartography. With this thesis, the creative process is outlined and delineated to a form of instructions and descriptive processes. Visual influences are analyzed to their core elements, artistic frameworks are applied to the science of cartography, and artistic decisions are delineated into a reproducible methodology for producing such aesthetic maps from a modern viewpoint. Creativity is a key component to the ingenuity of this thesis, in its unique combination of historic and modern influences into the aesthetic achieved. In order to clearly define the innovation of this project, the creative process and core components of creativity are considered in detail.

2.1.2 Creativity

The diverse solutions developed by many illustrators gives a sense for the enormity of potential outcomes when developing a technique to produce illustrated maps. This creative aspect of such a project is essential to achieving an outcome that is new and innovative to the field. A variety of factors contribute to creativity; and a basic understanding of the components required for creative ideas to occur is necessary before attempting to create new work in an existing, yet developing field. Without creativity, the innovation and contribution to the field of illustrated maps would be redundant, and not publishable as more than a mere recreation of existing illustration techniques. The multifactorial facets that compose creativity must be fully understood to ensure these criteria are met.

The standard definition of creativity used in modern research publications such as the *Creativity Research Journal* contains two components: originality and effectiveness. (Runco and Jaeger 2012, p. 92) In Runco and Jaeger's article, titled *The Standard Definition of Creativity*, it is noted that although originality is a requirement for creativity, it alone is not enough for an idea to be considered creative. While assessing the necessity of both components for an idea to meet the definition creativity, it is considered that although many original ideas can be contrived quite easily, the reason it is not already common must also be considered. "They [creative ideas] may be unique or uncommon for a good reason . . . a truly random process will often generate something that is merely original." (Runco and Jaeger 2012, p. 92) Without effectiveness, the idea may be nonsensical and useless. However, combined with effectiveness, the original idea becomes appropriate and utilizable in its cause. The effectiveness of the original idea can present in various forms or methods, e.g. of value. In other words, to present the necessity and usability of this idea to related projects and ideas. (Runco and Jaeger 2012, p. 92) This is dependent on the current state of the field, as creativity is likely to respond to current innovations and the most recent contributions, but not likely to skip forward to future developmental generations. This development is defined and described by propulsion theories in creativity. (Sternberg 2006 p. 96–97) For example, although it would be possible for the automobile to have been invented much earlier in time, it is highly unlikely that it would have been invented before that of the combustion engine.

In Sternberg's article *The Nature of Creativity*, the fundamental components required to promote creativity are outlined and explained in detail. The components work on the fundamental creativity theory of "buy low and sell high", also dubbed the investment theory. (Sternberg 2006, p. 87) This theory functions by promoting unpopular or unfavorable ideas that have potential to become lucrative and/or successful. The popularity of these ideas is often quite low, even in the final stages of presenting creative ideas. As eloquently explained by Sternberg:

> From the investment view, then, the creative person buys low by presenting an idea that initially is not valued and then attempting to convince other people of its value. After convincing others that the idea is valuable, which increases the perceived value of the investment, the creative person sells high by leaving the idea to others and moving on to another idea. People typically want others to love their ideas, but immediate universal applause for an idea often indicates that it is not particularly creative. (Sternberg 2006, p. 90)

The components required to create and invest in new ideas—and thus creativity—are divided into six categories: intellectual skills, thinking styles, knowledge, personality, motivation, and environment, with a final component of confluence, or merging of the previous six categories. (Sternberg 2006, pp. 88–90) The ratio of contribution from each of these components does not need to be equal, but all are required for creativity to be executed by the individual. Intellectual skills, for instance, are broken down by Sternberg into three groups:

> a) synthetic skill, which gives the individual ability to analyze a problem in a new and different way
>
> b) analytic skill, which determines whether the idea is good and worth pursuing or not
>
> c) practical-contextual skill, which is the ability to convince others of the value of your idea. (Sternberg 2006, p. 88)

Knowledge, on the other hand, involves knowing the state of the field up to its current point: an essential aspect before true creativity within a field can occur. Thinking styles refers to the way in which a person applies one's skills, i.e. a decision one makes. This, according to Sternberg, is important at both the local and global levels for successful creativity. Personality, although not strictly defined, is usually defined by the willingness to induce creative functioning. For example, the willingness to ". . . take sensible risks, willingness to tolerate ambiguity, and self-efficacy. . ." are all supported by various research investigations as contributions to personality. (Sternberg 2006, p. 89) Environment, another important aspect, must be present to cultivate and reward creative behavior. As for the creative acts themselves, those also can be categorized by type of contribution.

Types of creative contribution to a field holds a significant weight as to how that contribution, and the person that made the contribution, is perceived by peers. This propulsion theory, proposed by Sternberg, Kaufman, and Pretz, describes the type of creative contribution to a field. (Sternberg 2006, p. 95) There exist three categories to help define types of creative contribution: a) "types of creativity that accept current paradigms and attempt to extend them" b) "types of creativity that reject current paradigms and attempt to replace them", and c) "a type of creativity that synthesizes current paradigms". (Sternberg 2006, p. 96). This thesis proposes to work within the first type of contribution, where it accepts current paradigms of creativity within the field of illustrated maps, and extends those methods into a new realm, thus creating a new product.

2.2 Current Work in the Field of Illustrated Maps

Many illustrated maps exist today and the field of illustrated cartography, once a small, niche industry, is growing monumentally in recent years, with artists and scientists producing more maps than ever before. An overview is presented, providing works of diverse artists and illustrators, many of which are neatly summarized in Roman's book *The Art of Illustrated Maps*.

However, additional specialized fields exist, such as within the fine art world or illustrated ski maps, which enjoy rich traditions and similar noteworthy artists from their specific niches. A brief overview is given, with the purpose of describing the niche for such creation methods of illustrated city maps provided in this thesis.

Katherine Harmon, in her book *The Map as Art*, explorers many artistic representations of cartography, transforming the cartographic element into an art object through artists' lenses and manipulations. These manipulations communicate an idea or commentary of the artist, whether it be social, political, or cultural. Through the artistic lens, an artist is empowered to ". . . chart singular perceptions rather than assert meaning for any collective truth." (Harmon 2009, p. 15)

Figure 1: Lin, Maya. Landscape. *2006. Maya Lin Studio, courtesy of Pace Gallery. Orlando Weekly Online. [accessed online]. 17 September 2017.*

With the distinction between art and science in the field of cartography becoming less distinct, the invitation for commentary from both an artistic and scientific perspective is invited. Maya Lin, an artist that combines the starkly contrasting fields of contemporary art and topographic mapping, provides insight from this unique artistic perspective. Lin creates sweeping landscape sculptures that trace topographic isolines and inspire imagery of topographic maps within her work. Her use of rhythm in form inspire ". . . natural organic forms: hill, lake, land." (Harmon 2009, p. 246) Her sculpture shown in figure 1, titled *Landscape*, evokes a grand sense of sweeping form, evoking thoughts of vast terrain and topography.

Her vast combination of small wooden cubes gives an expansive sense to the work, and Lin explains "I am inspired by landscape, topography, and natural phenomena, but it's landscape from a 21st century perspective, landscape through the lens of technology." (Harmon 2009, 246). In figure 2, Lin's *Blue Lake Pass* evokes imagery of Eduard Imhof's contour lines in *Cartographic Relief Presentation* (figure 3). (Imhof 2007, p. 254) Through the artistic lens, an artist is empowered to ". . . chart singular perceptions rather than assert meaning for any collective truth." (Harmon 2009, p. 15)

Figure 2: Lin, Maya. Blue Lake Pass. *2012. Pace Gallery. The Tartan. [accessed online]. 17 September 2017.*

Lin utilizes the contours of particle board in relief to highlight and shadow the undulating terrain. The similarity between production methods of isolines and Lin's sculptures is not such a large leap to make. Lin's artistic reflections of scientific models represents a blending of technology and art, as the technological advancements provide the inspiration for artistic views that would have otherwise been unimaginable.

In another artistic example, the silk batiks of Mary Edna Fraser evoke landscape imagery in her resist-dyed colored fabrics. Exhibited at the International Cartographic Conference in Washington D.C. in 2017, Fraser's silk bolts delicately hung in the central conference room, and a gallery reception at the *Joan Hisaoka Healing Arts Gallery* provided more examples of her series *Rising Tides*. (Fraser 2017) The delicacy of the silk fabrics reflects the delicacy of the landscapes she depicts, conveying a message of warning and preservation to viewers. (figure 4)

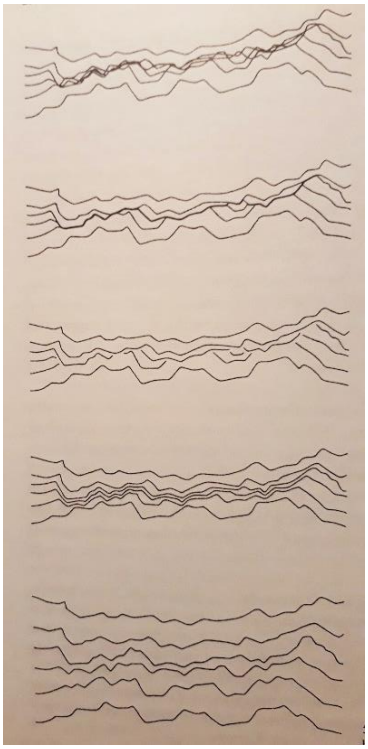


Figure 3: (above) Imhoff, Eduard. Contours of an overhanging rock wall. 2007. Cartographic Relief Presentation. Eduard Imhoff. California: 2007. p. 254

Figure 4: (above) Fraser, Mary Edna. Bangladesh. 2017. Mary Edna Fraser's website. [accessed online] 17 September 2017

Combining art and cartography is also done seamlessly through illustrated maps, often for a more practical application than those of a purely artistic focus. Not that artistic products do not have a purpose, but their communication of ideologies, philosophies, and criticisms is the reflection of the artist, not necessarily seeking any sort of approval or usability by peers. By providing cartographic products for specific client or goal, usability and other considerations play a larger role than in purely artistic cartographic products. This hybrid between artistic aesthetics and the application for which it is intended must combine to create a competitive stake in the illustration market.

Illustration, as opposed to fine art, is created for a specific purpose and utility. Whereas fine art is made first for the artists sole intention and later finds its place in a gallery or collection, illustrations are created as a response to a problem or need, oftentimes from a client. Although the opinion is long withheld that illustration is not in itself an artform, as it often is created for commercial intent, the artistic principles remain the same, and are often incorporated in ways that elevate user experiences with everyday objects, e.g. books, advertising, electronic interfaces, and maps. The methodology developed for this thesis does not incorporate client interests, however the process could be integrated with commercial applications.

This is true for illustrated maps as well, which enjoy a rich history and continue to thrive in an ever-digitizing world. Although there is a strong market push for new digital methods and automation, the practice of illustrating maps has not disappeared. Quite the contrary, the market for traditional illustration methods and hand-produced artistic works remains strong, and more illustrators are finding their niche in the industry for illustrated maps. Roman, in his book *The Art of Illustrated Maps,* states that “The doors to this line of work [illustrated maps] are wide open for new and imaginative artists entering the industry, and the playing field where

illustrated maps are being commercially applied has widened far beyond their previous historical bounds." (Roman 2015, p. 273) Often there exists a hybrid between traditional and digital media, as in the method presented in this thesis. Goodchild presents his thoughts on the two waves of digitization in the cartographic field, the first being automation to achieve the same results at a lower cost, and the second being the evolution of the very operations defining the organizational structures. This higher level of evolution encourages result-driven processes, often new and hybrid techniques. To quote, "The survivors in this world will be those who can think beyond past practices, and adapt quickly to new opportunities." (Goodchild 2000, p. 5) Through a wide variety of production techniques, styles, and purposes, the wealth of diversity and intricacy within the current market of illustrated maps can be demonstrated while simultaneously preserving quality in draughtsmanship and aesthetics in a digital age.

John Roman, along with publishing about illustrated maps, is an illustrator that has made many tourist maps, utilizing his own personalized method, outlined in his book *The Art of Illustrated Maps.* His process begins with photographing the area of interest, creating sketches—beginning with rough sketches and progressing towards a final sketch— and then using a mix of watercolor and digital painting to complete the look. (Roman 2015, pp. 207–222) He also incorporates a variety of perspective views in his maps, some utilizing what appears to be an isometric, top-down view while others recede into space and include a horizon and sky in the composition. The campus map, in figure 5, is rendered with traditional watercolor, with soft green and yellow tints, provide a warm, peaceful and inviting heir for the overall impression of the campus. The advertising map of Charlotte, NC, United States of America, mimics this color scheme for a similar effect (figure 6).

Figure 5: Roman, John. University of Illinois at Springfield. 2015. p. 230.

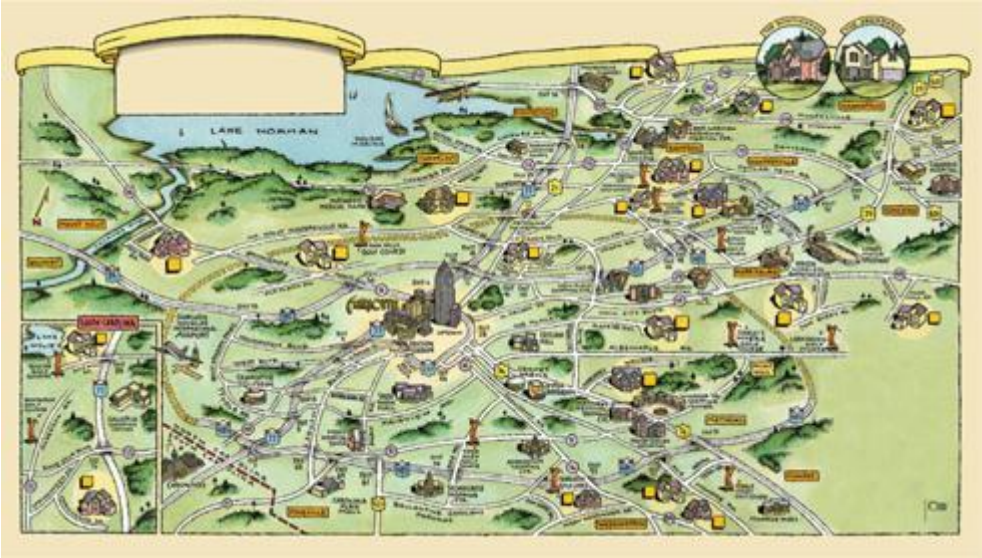


Figure 6: Roman, John. Advertising Map of Charlottsville, North Carolina. 2015. John Roman. The Art of Illustrated Maps: A Complete Guide to Creative Mapmaking's History, Process and Inspiration. Cincinnati. p.256.

Figure 7: Katherine Baxter. New York Map. 2006.Katherine Baxter's website. [accessed online] 17 September 2017.

Another map illustrator working in a predominately traditional method today is Katherine Baxter. Her map of New York City, shown in figure 8, imposes important landmarks on a relatively unadorned, isometric ground plane, using rigid edges and impeccably straight lines to emphasize the stark heights and rigidity of New York's skyline architecture. An interesting motif, iconic in her work, is her choice to place labels in perspective on the ground plane, integrating them into the compositions and strategically locating them between buildings and other features. This integration creates additional emphasis to the heights of the buildings, as even the labels appear bound by the geometry and gravity of the rendition. The lack of including any other buildings other than those deemed most important creates additional emphasis, freeing the eye from other information that could clutter the image or distract from the main landmarks in the map.

Thematic historic maps, although not the entire extend of Randy Green's repertoire, provide illustrious examples of his ability to plan and execute a complex and information-rich concept into an image plane. (Roman 2015, p. 329) In figure 8, his historic map of Pennsylvania utilizes vignettes, insets, margin illustrations, and more to completely immerse the viewer into the map's concept. His ability to seamlessly fade between images of sea and sky, or between ground and roof, are just one example of his meticulous compositions. There is much to be admired for

such ability of planning and executing a complex composition, and to incorporate so many elements without appearing cluttered or confusing to the viewer.

Figure 8: (above) Randy Green. Historic Pennsylvania. Roman, John. The Art of Illustrated Maps: A Complete Guide to Creative Mapmaking's History, Process and Inspiration. 2015. p. 332.

Figure 9: HC Berann. Japan Olympics. 1998.Retrieved from www.berann.com.

A specific genre of illustrated maps that has received significant notoriety is ski slope maps. These are still often painted by hand in traditional methods, as found by Amy Lippus in her thesis about the evolution of North American ski resort maps. (Lippus 2015, p. 49) One of the well-known figures in the genre of ski slope maps is Heinrich Berann. (figure 9) Berann began work in the 1930's and influenced many panoramic artists after his long legacy. In his years as an illustrator, Berann painted over 500 panoramas. (Lippus 2015, p. 49) His work is iconic for avid skiers, producing many maps throughout the Austrian Alps, as well as all over the world.

2.3 Overview of Works Analyzed

The following two works will be considered closely for a visual analysis, thus borrowing motifs and elements for the style created in this work. Historic context and background is given here on the Nuremberg Chronicles and Bollmann maps.

2.3.1 Nuremberg Chronicles

Given the historic nature of The Nuremberg Chronicles, there exists many publications on the historic context and analysis of the codex. This gives a multitude of information to better understand the what, where, why, and how of its creation. One can try to formulate answers to these questions by following other researchers' footsteps and putting oneself in the creator's reasoning mind. Only then, can one attempt to understanding the underlying reasoning for making decisions on parameters of the codex and its contents, including aesthetic decisions within its pages.

Historic Context about where, when, and why the Nuremberg Chronicles was created further develops the underlying ideas and goals of the text. The city of Nuremberg and birthplace of The Nuremberg Chronicles was a bustling town of approximately 20,000 occupants towards the end of the 15th century. Nuremberg was enjoying relative economic freedom, as merchants traveled to and from the city, unregulated by governmental impositions or restrictions. Although Nuremberg lacked a university or similar catalyst for uplifting its inhabitants towards literacy and reformed interest in education—traits quintessential to the renaissance—figures such as Gregor Heimburg brought Italian learning to Nuremberg through a small intellectual circle before moving on to other cities. (Besaha 2014, p. 5) The effects of such transient intellectuals did not necessarily leave a long-standing impression on the city's culture, although the effects on artistry show through its prominent history in the arts and printmaking.

The Nuremberg Chronicles were created towards the end of a relatively lively period for printing in German-speaking countries, ranging from the 1470's–90's. (Patkus 2014, pp. 1–2) Nuremberg was one of the six German cities that dominated printing during this time, with Anton Koberger being the founder of the largest print company during this time. With his substantial financial means, he would have been able to help fund the large investment necessary to create such a large project. (Patkus 2014, p. 2) The Nuremberg Chronicles, proposed by Sebald Schreyer, merchant, and brother-in-law Sebastian Kammermeister, was proposed as the largest and most impressive print undertaking of the time; as a world history, it encompasses a total of 326 leaves in the Latin edition, with 1,804 woodcuts. (Patkus 2014, p. 4)

The city views were taken from observation or created as copies of previous views of areas from Hartmann Schedel's library where observation was not possible. (Patkus 2014, p. 3) Schebel is credited for authorship of the Nuremberg Chronicles. As the city of interest here and the city in which the manuscript was produced are the same, it is therefore concluded that the depiction of Nuremberg is one of the woodblock illustrations created from observation, perhaps by the artists Michael Wolgemut or Wilhelm Pleydenwurff, who ran an artistic workshop specializing in woodcuts for books and the local artists employed for the task. The young Albrecht Dürer was employed at the workshop during the codex's creation, although there exists no definitive proof that he worked on a specific woodcut in the Nuremberg Chronicles. (Patkus 2014, p.3) Given the size and magnitude of The Nuremberg Chronicles, it is no surprise that such a team was employed for its creation.

The Nuremberg Chronicles was the largest and most grandiose undertaking up to this point in time; appropriately, Kroberger's printing business was famous for creating ". . . typically expensive, well-made, multi-volume works in Latin." (Patkus 2014, p.2) The Nuremberg Chronicles is an exemplary showcase of the abilities of printing during the incunable printing period, between its invention in 1439 until roughly 1500. (Encyclopaedia Britannica eds. 2017) The time, money, and hours invested in such a large undertaking exemplify the dedication of the patrons and artists alike during the uncertain early days of printing; the printing of the final leaves alone was completed over the course of nine months in 1492. (Patkus 2014, p.5). Since then, many similar printed editions and facsimiles have been created.

In 1509, 16 years after the production of The Nuremberg Chronicles, 600 of the original 1,900 copies remained unsold (Patkus 2014, pp. 5–6). One possibility for this is due to another printing of the codex by an Augsburg printer between the years of 1496 and 1500. The codex is very similar to The Nuremberg Chronicles, but varies in small details, such as offering a smaller, quarto size and newly-made illustrations (although the subject of the illustrations themselves remain largely the same). (Patkus 2014, p. 6) Since then, many modern facsimiles have been produced from the early 20th century onwards, attesting to the continued popularity for such historic artefacts. (Patkus 2014, p. 7) The presence and distribution of these facsimiles attests to the interest such a seemingly outdated work such as The Nuremberg Chronicles continues to inspire in a modern audience.

2.3.2 Bollmann Maps

Hermann Bollmann developed a new perspective technique for drawing his iconic, hand-illustrated maps. (Hodgkiss 1973, pp. 3–5) This technique, through a long history of development through his career, presents an iconic view of city plans that, while maintaining a multitude of information about the surroundings and details of the city to the viewer, continues to clearly communicate valuable navigation information for tourists. (Hodgkiss 1973, p. 145) The development of this process and its contribution to the field of illustrated maps in cartography outline the value of Bollmann maps to cartographers today.

Hermann Bollmann created maps early in his career entirely by hand, using his own sight and a multitude of sketches to carefully articulate the details of each city for which he created maps. (Hodgkiss 1973, pp. 134-135) However, later in his career and as he worked to produce a higher output of maps, it was necessary to create a method of producing maps that he could employ to others that lacked the master draughtsmanship attributed to Bollmann himself. With the aid of aerial photography, his workshop was born and the techniques transferred to a team of workers, now able to work within Bollmann's style. (Hodgkiss 1973, p. 135) Even with the addition of a team to help complete the maps, much time was still required to produce each map. Bollmann's map of Manhattan, shown in figure 10was produced in 8 months from start to finish, according to Hodgkiss 1973 p. 137, and utilized 67,000 aerial photographs taken with cameras specifically designed for the task. (Wood 2010, p. 88)

Figure 10: Hermann Bollmann. New York (City) Picture Map. 1963. David Rumsey Map Collection.

2.4 History of Perspective

The contributions of Bollmann's perspective is better understood after gaining insight into the development of perspective and its insurmountable influence on illustrated maps. The renaissance marks a time of rebirth of interest in the sciences, art, and pursuit of knowledge. With that came the development of accurate perspective techniques, thus creating a mathematical method for transferring the illusion of three-dimensionality onto an image plane. In addition, chorography, defined by Ptolemy as "a separate realm of geographic arts" that require the skills of an artist, played an important role. (Roman 2015, p. 19) As Roman so eloquently summarizes, ". . . chorographic art deals with details, not with scale." (Roman 2015, p. 19) This combination of accurate depiction and chorography gives the accurate and true-to-life depictions developed and celebrated during the renaissance and today.

The accurate depiction of three-dimensional space was allegedly discovered by Brunelleschi in Rome and was unveiled in 1423 in his central-vanishing point perspective, according to Georgio Vasari's '*Lives of the Artists'*, recorded 140 years after the fact. (Roman 2015, p. 86) This breakthrough gave a single vanishing point in the center of the image, where all lines diverge to that point and give the illusion of all objects receding to that final point (figure 12). After this breakthrough, work continued to develop more complex techniques to create more complicated, multiple-vanishing point images.

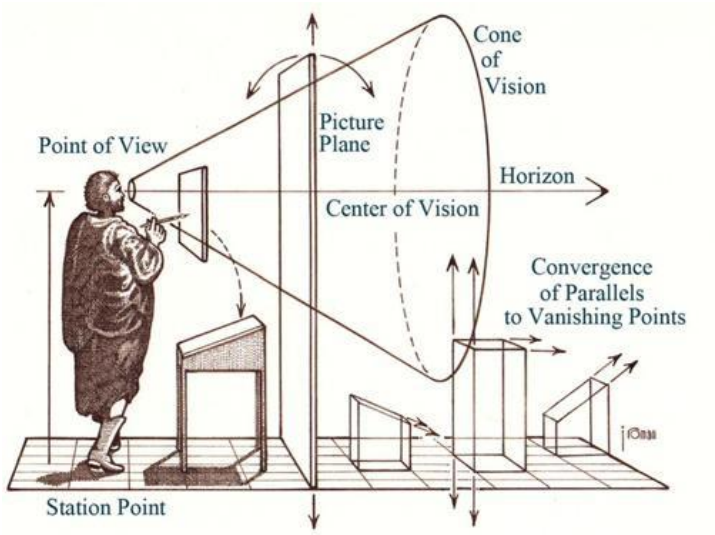


Figure 11: (above) Leon Battista Alberti. Legitimate Construction (Perspective System). Roman, John. The Art of Illustrated Maps: A Complete Guide to Creative Mapmaking's History, Process and Inspiration. p. 88.

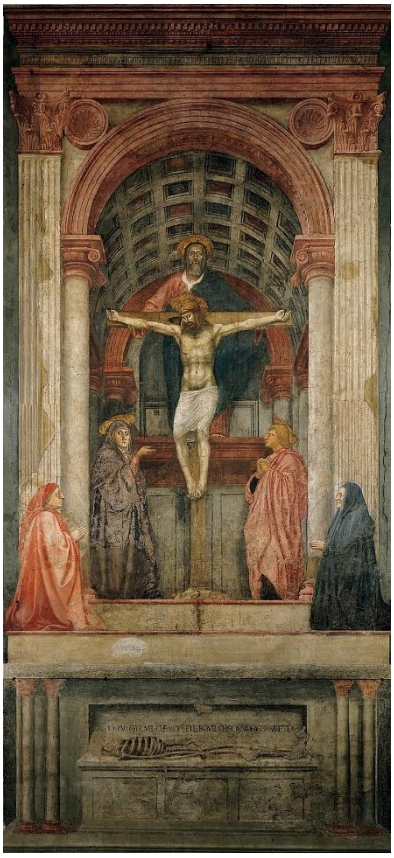


Figure 12: (right) 667 cm × 317 cm. Fresco. Masaccio. Holy Trinity. 1425-27. Florence. Wikimedia Commons.

Masaccio's '*Holy Trinity'*, shown in figure 11, is one of the first depictions with accurate perspective during the renaissance, was painted in Florence between 1427–28. (Roman 2015, p. 87) The lines of the vaulted hallway can be seen to converge accurately to specific vanishing points, a technique not seen in the predeceasing centuries of the middle ages. Shortly after the development of this one-point perspective, Leon Battista Alberti, also located in Florence, developed accurate three-dimensional perspective drawing, thus expanding on linear and one-point perspective. These findings were published in Alberti's book titled *'On Painting'* which was published in 1435. (Roman 2015, p. 88) This contribution to the visualization of space on a two-dimensional surface changed the accuracy in which cities could be drawn and depicted in a way so the creator may better depict how a place is viewed from a specific vantage point. (Pinto 1976, p. 35) Since then, many contributions to the perspective and views of cartography have also been made.

In addition to developing accurate multiple-point perspective, the ichnographic city plan was developed between the years of 1450 and 1550, with contributions made from both artists and scientists. (Pinto 1976, p. 35) The term ichnographic is described by Pinto:

> Unlike perspective views, in which topographical features are drawn in relief, this new type of plan delineates every building, street, and square in outline as a ground plan. All topographical features are drawn as if reflected on a single horizontal plane. The characteristic flatness of the resulting images may be termed ichnographic . . ." (Pinto 1976, p. 35)

The term was first used by Vitruvius and signified the use of a ground plan, and was again reintroduced during the renaissance. (Pinto 1976, p. 35) This new cartographic perspective is shown in figure 13 by Leonardo da Vinci's *Plan of Imola*, created circa 1503. This top-down perspective thus flattened the city, creating a unique perspective for each building depicted. Although this gives advantages for planning and navigational use—eliminating the effect of distances decreasing as objects recede into the distance—it also creates a divide between what the viewer sees in the plan and how the city appears in real life. The ichnographic perspective provides the ability to depict larger, complex objects, whereas the bird's-eye perspective better shows situations that can be depicted from a singular vantage point. (Pinto 1976, p. 35)

Figure 13: 44.0 x 60.2 cm. Leonardo da Vinci. Plan of Imola. 1502. Royal Collection Trust.

The perspective developed by Bollmann is described by Hodgkiss as plans drawn in optical perspective, thus combining the bird's-eye perspective and ichnographic views. However, what differentiates Bollmann's perspective from a bird's eye view or other similar depiction is that the scale does not diminish as distance recedes from the image plane. (Hodgkiss 1973, p. 137) In addition, unlike other maps drawn in this manner, no specific scale is chosen for the maps. Bollmann allegedly created his own optical perspective, but eliminated the artistic method of foreshortening, which decreases the size of objects the farther they recede from the image plane. (Hodgkiss 1973, p. 135 and Ragans 1988, p. 285)

Today, there are many cartographers making illustrated maps and using a multitude of visualization tools to show each place, ranging from ichnographic to bird's-eye perspective city views. Roman gives a nice overview of contemporary map illustrators and their work in *Part IV: A Showcase of Contemporary Map Illustration* in his book *The Art of Illustrated Maps.* However, for the sake of brevity and isolating specific motifs to be utilized in this thesis, only the historic

examples, chosen for their aesthetic, and the modern perspective and extent of Hermann Bollmann's maps will be analyzed in depth. Even though Bollmann's career ended since his death in 1971 (David Rumsey Map Collection 2017), a studio creating maps in the same analog style still works today in Braunschweig. (Grimwade 2017a) The continued creation of maps in this style for commercial use punctuates the relevance of this analog creation method in a modern and digital world.

It should be noted that although Bollmann's maps were created for tourists to create a lively navigational experience through many German cities as well as to create memorable keepsakes after said travels, these maps were also intended as a historic documentation of the development and rebuilding of German cities after their destruction in World War II. By producing maps of the same city at regular intervals, the city's development and reconstruction could be documented and referred to historically as well. (Hodgkiss 1973, p. 134) Figures 14 and 15 show the same map of Braunschweig, in the years of 1948 and 2011, respectively, thus depicting the changes over time by the reconstruction of the city. Bollmann particularly used his home city of Braunschweig as an example of this historic documentation.

Though the maps create historic documentation, their ability to transport the viewer while maintaining usefulness as navigational tools for tourists is of particular interest to this thesis. A visual analysis of the methods and motifs used to create such a transcending visual effect to the viewer is conducted in the visual analysis section. The use of the unique perspective, developed by Bollmann, will be discussed, as well as its extent, in which a large amount of detail was incorporated over the span of each city.

Figure 14: Hermann Bollmann. Braunschweig. 1948. (detail) David Rumsey Map Collection.

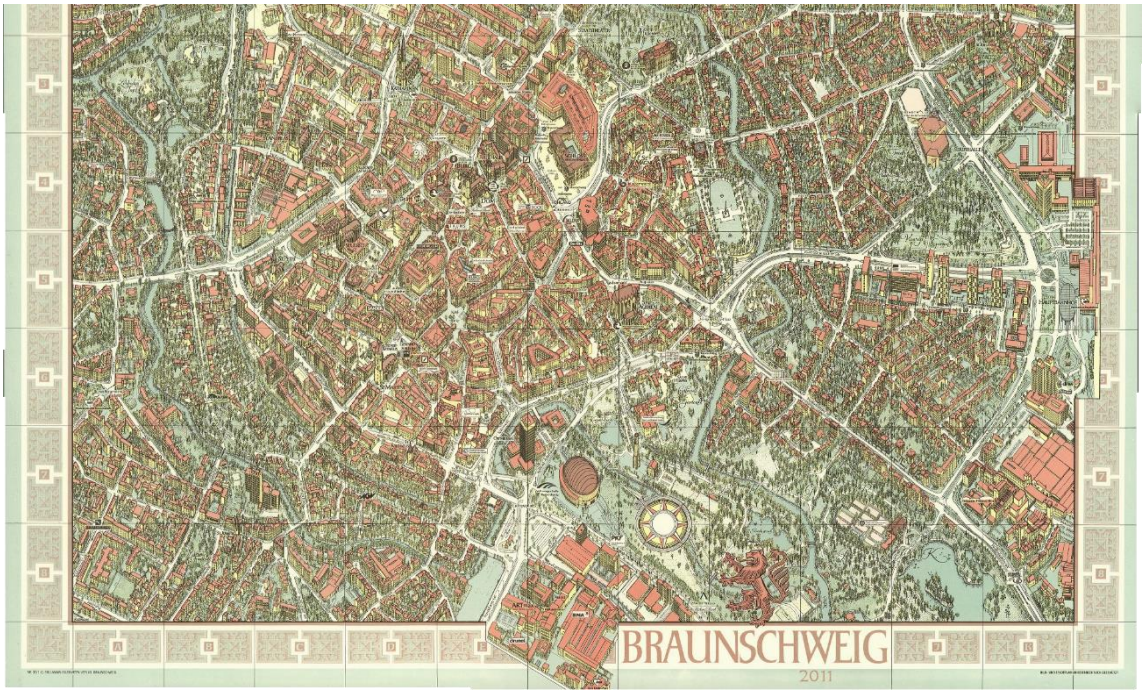


Figure 15: Hermann Bollmann. Braunschweig. 2011. David Rumsey Map Collection.

3. Methodology

The methodology for the creation of the city maps in this thesis relies on an initial visual analysis of a chosen set of historic maps to develop of set of visual "tools" so to say, that are then incorporated into the final map production. By combining elements of already-existing historic maps, this thesis creates a new method for producing thematic tourist maps in a modern age. The tools that are isolated and utilized for this thesis will be discussed, but should the user choose to apply the basic framework without using these specific examples, a wider degree of stylistic results will result. This possibility will not be considered in this methodology, as the purpose here is to describe the seemingly sporadic artistic processes of cartography into a definable and repeatable framework. To ensure the highest level of reproducibility, the historic examples utilized here provide that framework.

The generic methodology for the entire project, beginning in the research portion and ending in the practical application with sketches and final map production is visualized in figure 16.

But before the final map can be produced, samples of visual elements from the visual analysis are first created in sketches. This process of using existing elements in a new and functional combination comprises the creative element, an essential aspect of the artistic process (see the visual analysis section for more information on creativity). This creative process often appears to be spontaneous and sporadic to an outside viewer. However, there exist many techniques for artists to produce these creative results, and a singular method is developed and described here for this work. This new combination of visual elements is the graphic style created for the Dresden map. The graphic style is theoretically applicable to any number of other cities, however more maps were not created for this thesis in the interest of time.

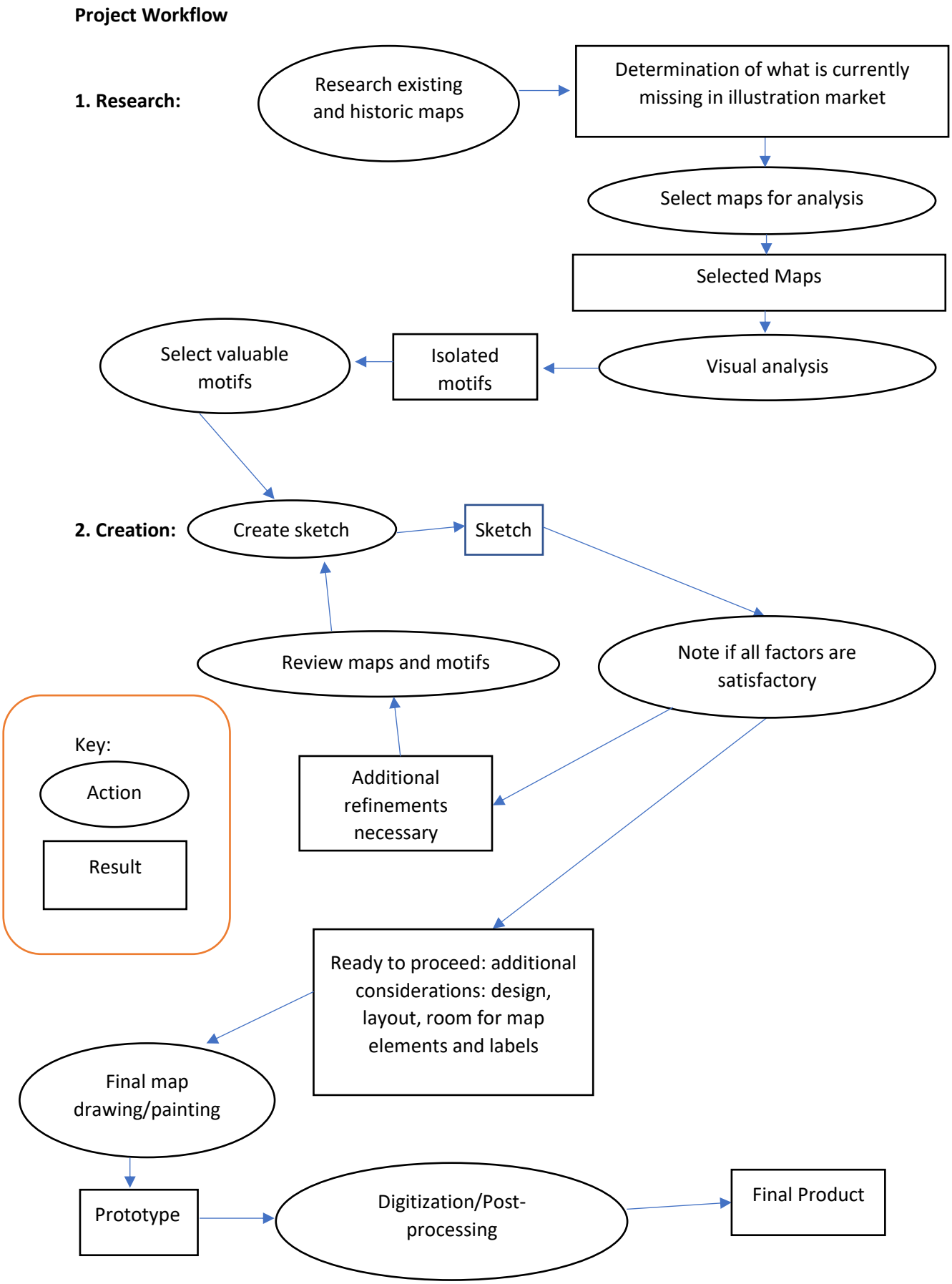


Figure 16: Overview of entire project workflow, divided into two stages: research and creation stages.

3.1 Visual analysis

Explaining, evaluating, and drawing conclusions about a map all take place within the visual analysis. By isolating prominent motifs to inform the user's own creations, the visual analysis is a quintessential step to the methodology utilized in this project.

3.1.1 Purpose

The visual analysis serves to better understand the components that make up the inspiration for the samples and, eventually, the final map. By understanding the components comprising each piece, it is easier to formulate the most accurate hypothesis for how an aesthetic is achieved. This is done by first isolating motifs, which can be any visual variable in a map. An element of art, such as the use of line, could be a visual motif. Likewise, subject matter, such as the use of human figures as decorate elements in a map could also be a motif. The visual analysis will isolate motifs and inform the next stages of this thesis:

1. User sketches
2. The Execution of the city map

A table showing the steps required to isolate motifs is presented below, in figure 17. A visual analysis also works on a higher level than isolating motifs alone. Conducting a visual analysis requires the physical description and analysis components required to isolate motifs, but extends the process further by considering the context of the map and finally determining a judgement for the map. Considering context factors in other exterior motivations and information about the map, including when, where, why, and by whom it was created. Figure 18 outlines the four steps overarching the process of visually analyzing a map under the same steps used in art criticism.

Isolating Motifs

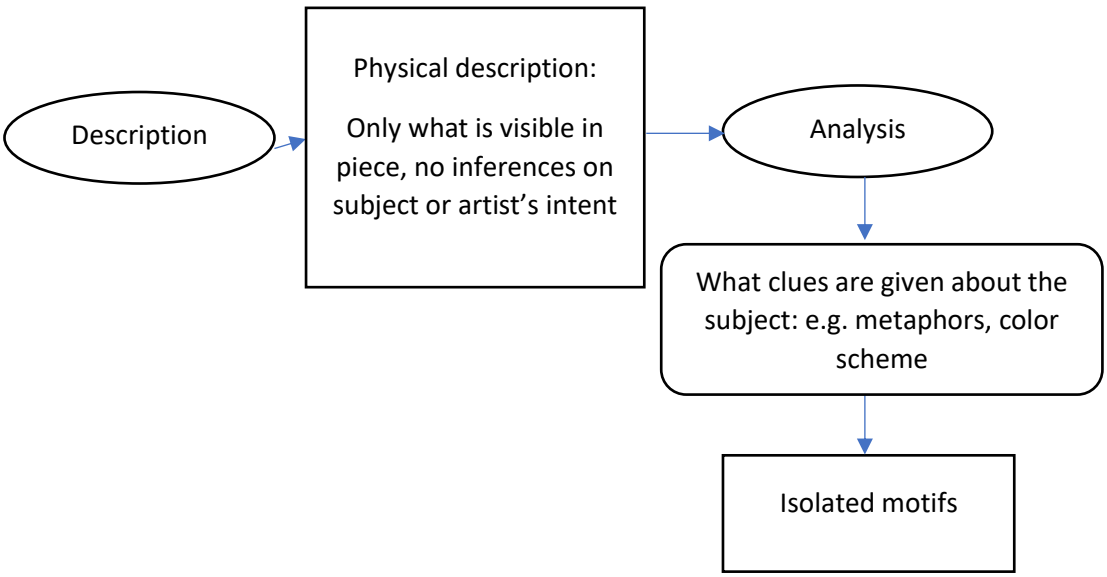


Figure 17: Steps required to objectively isolate motifs within a map. This process is to be followed in order to most objectively visually quantify the components that create a map's aesthetic.

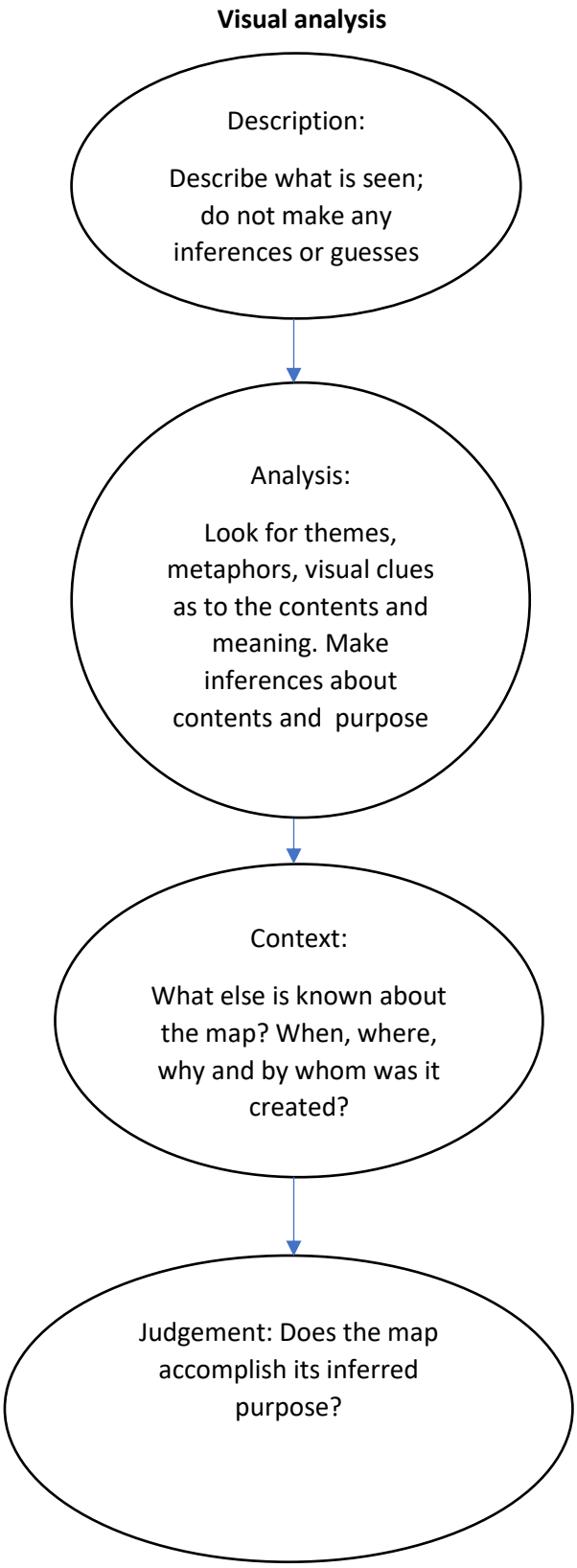


Figure 18: How to conduct a visual analysis, presented in four steps.

3.1.2 Isolating motifs

The visual analysis of select historic maps is a means of visually describing and dissecting the works of previous mapmaker's work to therefore separate and distinguish individual visual elements, or motifs. These motifs are then replicated by the user in a sample sketch after the discussion, and is incorporated into the user's toolbox for future use during the final map creation if the motif(s) is/are deemed successful and desirable for the final map production.

Motifs should be isolated by one quality during the visual analysis, and not be a combination of two or more specific qualities. The combination of all motifs creates the overall graphic style of each map considered, thus making each historic work unique. The discussion regarding the isolation of each visual element will be analyzed using the framework of the elements of art: form, color, shape, space, texture, and value (Ragans 1988, p. 16). For example, the use of color in a historic map will be analyzed for its use of color, i.e. saturated or non-saturated, high-key or low-key, or other identifiable color scheme. For a more detailed explanation of the various recognized color schemes, see chapter two of Ragans' book titled *Arttalk*.

The elements of cartography have also been isolated and discussed at length, and many similarities can be observed between the two elemental frameworks of art and cartography. This premise is used for the application of artistic elements to the visual analysis of the maps viewed, utilized, and created in this thesis. Cartwright, Gartner, and Lehn's *Art and Cartography* presents many views from both artistic and scientific viewpoints on the integration and duality of the fields. Similarly, Misra and Ramesh summarize succinctly:

> Since the aim of cartography is to improve the graphic representation of the earth, it cannot avoid being partly artistic in nature. A map not only portrays details visually in accordance with certain scientific principle but also in a way that is pictorial and aesthetic. The study of cartography, is, there, partly a study of map graphics. The cartographic methods of representation and exposition follow the same principles and laws which underlie other types of graphics. And since art is the highest form of graphics, a good map cannot afford to be non-artistic. (Misra and Ramesh 1989, p. 14)

The framework of the artistic elements of art is chosen for this discussion due to the artistic nature of the historic maps, thus giving a consistent framework for the creation of the illustrated city map and its evaluation.

3.1.3 Analysis

Each map is analyzed for its most prominent elements and principles. Although many or all elements could be considered for each map, some elements are more prominent in each map, i.e. dominant elements. (Ragan 1988, p. 17–18) Therefore, those elements will bear the bulk of each discussion. The discussion of each map's most prominent motifs enables the viewer to consider each isolated feature of the map, instead of simply enjoying the overall visual result, referred to as the graphic style. Graphic style, in the cartographic sense, is divided into categories. Attempts at defining cartographic style are subjugated into terms of appearance or content, "dependent of the geographic space represented in the map. . ." (Ory et. al 2013, p. 3) Approaches to characterize graphic styles are also attempted, and the verbal approach will be used here, which is better adapted to describing heterogeneous map examples in a qualitative manner. (Ory et. 2013, p. 4) As an untrained eye might enjoy the aesthetic of a painting without knowing the techniques used to stretch the canvas, mix the oil paints, and carefully apply thin layers of paint, the untrained user may enjoy the look of these historic maps. However, to

critically observe each map to thus borrow and combine motifs in a new creation, the user must objectively observe each aspect of said historic map, should an objective, reproducible graphic style be established. The discussion on small, individual inconsistencies as a challenge to illustrated, yet reproducible maps, is found in the discussion.

Specific terminology is used to conduct a visual analysis and this vocabulary is essential to articulately describe the visual elements that make up each map. The terminology is the same used for any critical analysis of art, and is utilized in the visual analysis to most clearly describe each map, thus integrating the techniques used for art criticism to the field of cartography.

3.1.4 Historic Context

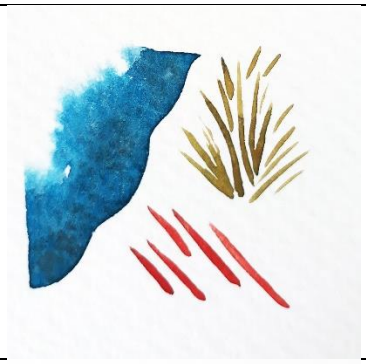
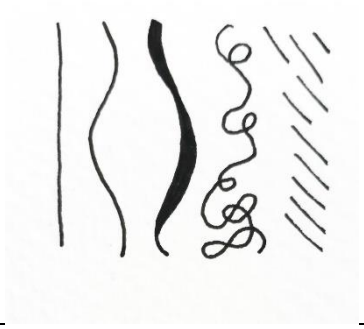
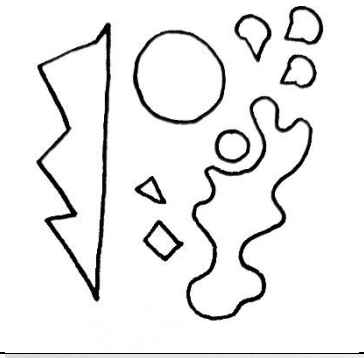
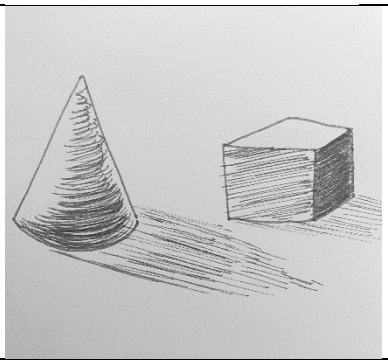
Considering context is another important step of conducting a visual analysis, but unlike the previous steps, where visually describing the piece and isolating motifs that comprise graphic style are the focus, this step considers outside variables about the map. Information about where, when, by whom, and why the map was created gives important clues to decisions about the physical appearance of the map. If the intended audience may be inferred, additional information about graphic decisions by the mapmaker may also be deduced. This factors into the final judgement of the map, and gives more information to judge the success or failure of the map as objectively as possible. The judgement for the map and methodology in this work will be noted in the discussion portion of this work.

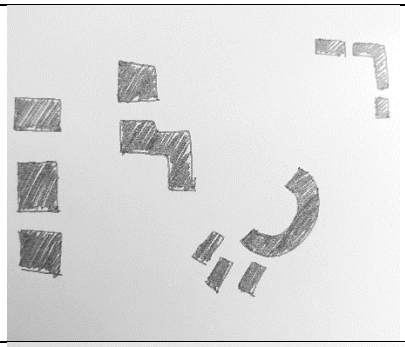
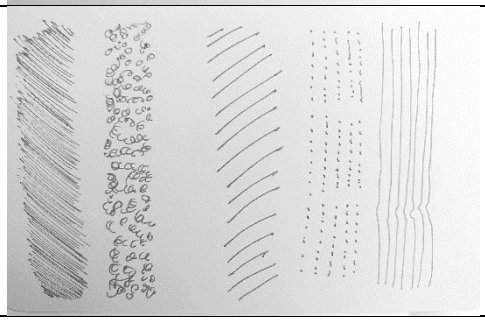
3.2 Visual Variables of Graphic Style

The following visual elements of art exist, however not all elements present equally in each historic map. The most prominent elements will be described and explained, oftentimes in congruence with their corresponding principles that the element achieves. The principles are not listed here, as they are comprised of the elements themselves. Further information about the principles of art may be found in Ragans' book *Arttalk*, listed in the references.

Line, the first visual element, is defined by a point moving through space, shown on the next page. Line may two-dimensional, three-dimensional, descriptive and implied. Implied line, for example, is created by two intersection forms, where the contrast between the two defines the implied line. Shape describes an entity that is two-dimensional, existing only in the fields of height and width. Form is an entity existing in three-dimensional shape, enclosing volume. For example, a cube, cylinder, and cone are all forms. Form may also divert from any specific geometric, i.e. freeflowing form, and be either rectilinear or curvilinear. Color consists of three components, being hue, intensity, and value. Hue refers to which color is being represented; think of the color's name: is it red, yellow, or blue? Intensity refers to how concentrated the color is, i.e. the color's saturation, and value references the lightness and darkness of a color, and is thus divided into tints, shades, and tones. Tints describe colors which have been mixed with white, shades are colors that have been mixed with black, and tones are colors which have mixed with grey. Color affects a viewer's perception of a piece, and is linked with feeling and impressions about certain places. For more information on color theory, Josef Albers' book *Interaction of Color* is a great place for fundamental theories from one of the great contributors to the field. Space is an element used by the artist to define the distances around, between, and in relation to objects. Space can refer to the space between objects, otherwise known as negative space, or the area occupied by the objects themselves, known as positive space. Texture refers to how something feels, or looks like it feels. Textures include smooth, rough, silky, hard, clear, and many more. Value, as mentioned above relating to color, is the lightness

or darkness of a color. Different values placed next to each other create contrast within a piece, whereas similar values reduce contrast. (Ragans 1988, p. 75–76.)

Element:	**Sample:**
Line • Implied • Thick/thin • Long/short • Flowing/straight	 
Shape • Made by contrasting tones, color, or combination of lines	 
Form • Three-dimensional object + space it occupies • May refer to implied three-dimensionality on a two-dimensional surface	 
Color • Light reflecting from an object • Hue, intensity, value	

Space • Object foreground/background relationship • Space between objects on a map	
Texture	

3.2.1 Color:

Color is a core component of how graphic style is achieved within a work. Due to its high impact on the outcome of a piece, it is considered individually as its own critical component for creating a tourist city map in this methodology. Various combinations of colors, or color schemes affect mood and impressions of a piece. Many works have been published on the effects of color alone, and will be considered for this thesis as well. For example, a painting with a high-key and warm color scheme will appear lighter, happier, and more whimsical than one with a low-key and cool color scheme. High- and low-key refers to the amount of light present in the color; high-key color schemes have a higher amount of white mixed with the hues, and low-key color schemes have a higher amount of black mixed with the hues. Figure 20 shows an example of a high-key color scheme. Monet's *Autumn Effect at Argenteuil* how light affects the appearance of the subject, in this case the autumn trees and river. The use of color mixed with white gives a light, delicate impression of the landscape and buildings in the background. The scene is idyllic, giving a serene and peaceful feeling of the river and town.

In Vincent Van Gogh's early period of painting, he often depicted the imagery surroudning him. His low-key color scheme gives a moody and sullen appearance to the imoverished potato eaters—the subject of figure 21. Note how the use of color mixed with black gives a very different mood than the previous example.

Figure 19: Claude Monet. Autumn effect at Argenteuil. 1873.

Figure 20: Vincent Van Gogh. Potato Eaters. 1885. Wikimedia Commons.

Color varies on three independent axes, which combine to specifically describe each one. Known as the Munsell color system ,this is useful to understand and use as a tool to analyze and note colors in a map, or any other visual representation for that matter. Figure 23 depicts the three axes: Hue, intensity and value. Any combination on the scales of these axes will provide a different effect. Visualized three-dimensionally, it appears in figure 22. This gives a concrete foundation on which to record different colors and color systems.

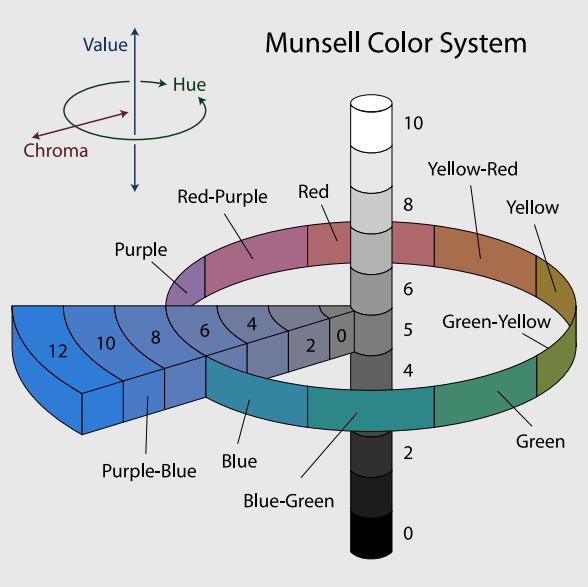


Figure 21: Munsell Color System, showing a three-dimensional view of color space. Wikimedia commons

Colors also go through various trends, oftentimes giving work from certain eras a distinctive and recognizable style. Three distinct styles are presented by Ehrensvärd in *Color in Cartography: A Historical Survey*. Ehrensvärd presents the first distinct style as hand-colored manuscripts. Here, color was deeply connected with the author, and provided more involvement and personalization than the later stages of automation in more modern printing methods. (Ehrensvärd 1987 p. 124) This personal involvement gives the creator more control over small details within the coloring of a map, and lend to its informative nature as much as other components. For example, coloring in marginal illustrations within a historic map provide more detail when such comprehensive information about the map's geographic accuracies was unavailable. In this case, color serves to describe the subject just as much as a choropleth map presented today, with rich amounts of detail available on almost any location. (Ehrensvärd 1987 p. 123)

Figure 22: Color axes (from top to bottom): Hue, saturation, intensity

It is important to note that studying historic coloring of maps must be done with a critical and cautious eye. Colors tend to degrade over time and to various degrees, depending on the conditions upon which they are created. Various qualities of pigments exist, that provide higher and lesser degrees of lightfastness. This degradation of the pigments over time dulls the overall appearance of the maps coloring, oftentimes giving an aged look to the map. (Ehrensvärd 1987 p. 126) This effect, although probably not desired by the original creator, is an aesthetic that could be intentionally reproduced today, along with other contributions such as paper color. Other possibilities that can affect the colors seen in a

historic map include: location/conditions under which the map has been stored, the possibility that color was added much later after the production of the original map, and variances in photographic reproduction. It is important to keep these factors in mind when analyzing historic artefacts, so that incorrect conclusions about the intent of the author are not drawn.

3.3 Creation Stage

Creating follows the informative process of the visual analysis, once all research and conclusions about the considered works has been conducted. This begins the hand-drawn portion of the thesis, where the user develops their own work.

3.3.1 Sketches and Map

The experimentation pieces, referred to here as sketches, are small-scale sections of the city of Dresden, focusing to various degrees around the historic Altstadt. These small-scale experimentation sketches are large enough to get a feeling for the technique applied, while small enough to be able to be completed within a relatively short amount of time. A larger scale sample would have proved too laborious and therefore time-consuming, while a smaller sample would not have enabled adequate opportunity to gauge the success or failure of the technique(s) attempted. The sketches are categorized and divided by the following focuses:

- Perspective
- level of abstraction
- graphic style
- color

Each topic therefore provides the flexibility to try various options, with influences taken from the visual analyses.

Once the visual analysis has been performed for all historic works and inspiration maps, an attempt to recreate one's own rendition of each motif that has been isolated is made. The city of Dresden was used as a case study for these sketches, but any city of interest could also be used. Dresden was used for the sake of simplicity of this thesis, as familiarity with the area being depicted is desirable for the user's benefit during map creation. To practice reproducing an isolated visual element in one's own sketch, first some basic working parameters must be established. Various factors should be the focus of each sketch, as shown in the table below.

Important Factors of Consideration within each Sketch

Graphic Variable:	Sketch #1	Sketch #2	Sketch #3	Sketch #4
Perspective	X	X		
Deg. of Abstraction	X	X	X	X
Graphic Style	X	X	X	
Color			X	X

Factors of consideration for each sketch

In addition to these focuses of consideration for each sketch, specific considerations should be made within each sketch to thoroughly test variations on each consideration, outlined specifically in table 2. This combination relies on the inherent assumption that results from the previous sketch will thus inform the next. Variety is key within this experimentation and practice process, so oftentimes the opposite of one attempt is attempted in the next. For example, if a low-key color scheme is used in one sketch, a higher-key color scheme would be utilized in the

next. The overall or general perspective techniques are attempted with specific variations to handle different visualization problems in different ways. The result is that of compromise between the most effective solutions attempted in various sketch attempts.

Sketch Relationships: Project Specific

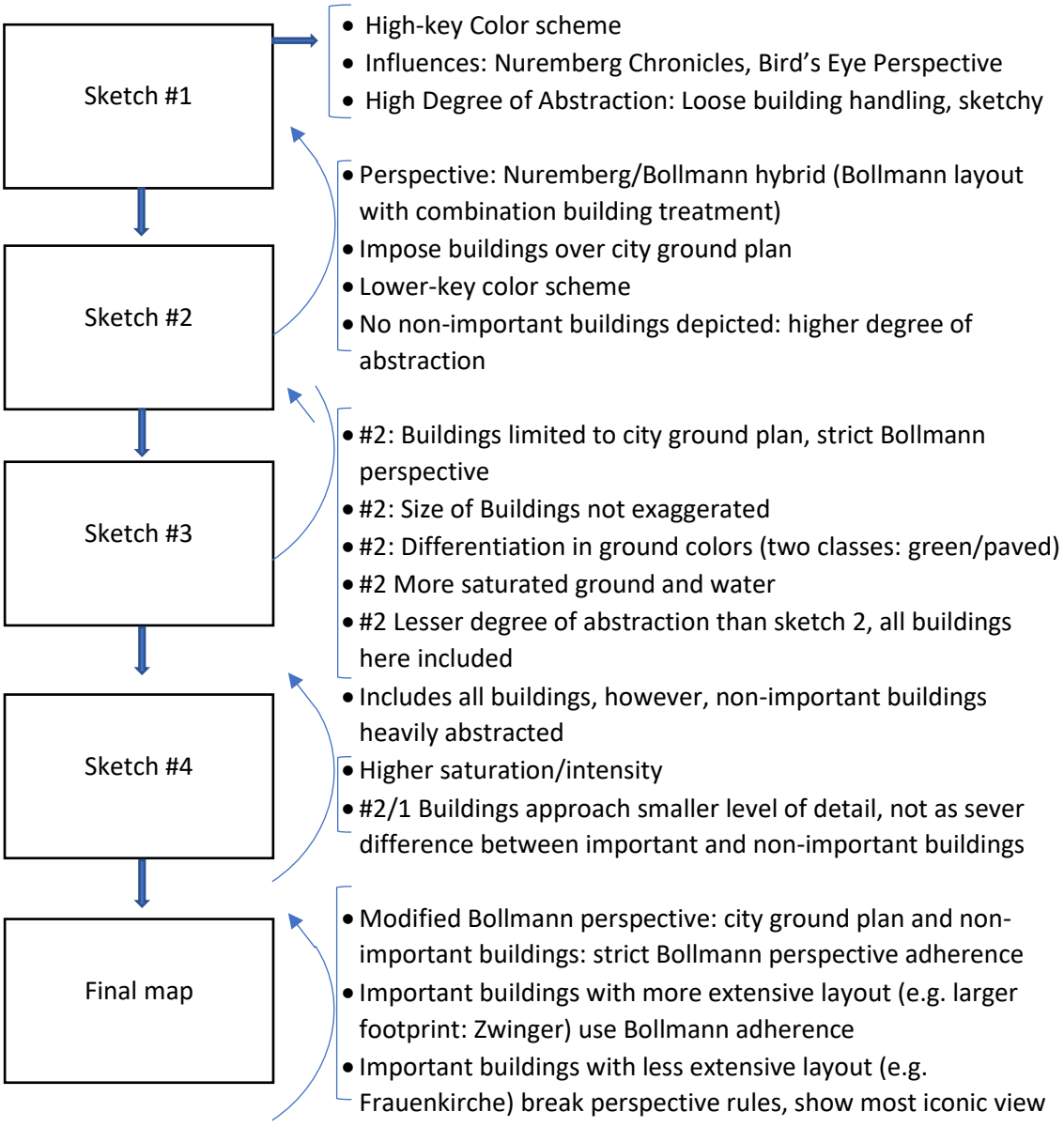


Figure 23: Specific considerations within each sketch and the final map creation.

3.3.2 Materials and Techniques

The following materials are required for the creation of sketches and the final Dresden map:

- Watercolor paper (A3, specified below)
- Pencil (2H, B, preferably non-mechanical)
- X-Acto knife (#11, extra blades if necessary)
- Scalpel (#10, optional, but a great tool to correct minor painting mistakes)
- Low-adhesive masking tape
- Two Watercolor paint brushes, between the sizes of 4–7
- Tracing paper (A3)
- Eraser
- Ruler
- Bone tool
- Protractor/Triangle
- Watercolor paints (Winsor&Newton carry excellent quality watercolors, look for their Series I lightfastness pigments for the best archival quality)
- Access to a scanner
- Adobe Photoshop, InDesign

Paper choice is an important component to the outcome in this thesis. 300gsm2, cold-press, white watercolor paper is used for its durability and versatility. The heavy weight gives a robust surface that can endure plenty of drawing mistakes and erasing, as well as many watercolor washes without warping or buckling. The cold-press provides more tooth, giving the paper more texture to highlight the unique painterly qualities of traditional watercolor washes. There exists no digital painting brush or technique that can replicate the subtle texture and delicacy of the traditional watercolor medium; experimentations with digital coloring give acceptable results, although differing from the effects of watercolor. White paper is chosen to give more versatility in color-choice, such as changing the background color after the painting is completed and the sketch is scanned and digitally corrected.

For the sketches, a smaller size is chosen. This is because two sketches can easily fit on one A3 sized sheet of watercolor paper, with ample margins around each sketch as a protective measure. Ample margins are desirable in case of the edges of a sheet becoming damaged, being able to handle each sheet without touching the image plane of either sketch, or other similar happenings that could otherwise deteriorate the overall presentation of the work.

To create an image plane for a sketch, measure a horizontally, or landscape-format rectangle with the specified dimensions. Use a 2H pencil or harder to lightly mark the bounds of the rectangle, being careful to create precisely 90-degree angle corners. The use of a triangle or protractor is helpful during this step. Caution should be used when marking the lines, making sure to hold the pencil gently with the fingertips to prevent a heavy-handed line. The pencil should not indent the paper, or else the line becomes harder to erase and the indent will be visible during the inking and watercolor stages of each sketch.

Once the rectangle is created, use the low-adhesive masking tape to tape the outside perimeter of the rectangle, being careful not to crease the tape on the borders. This creates a crisp border for each sketch during the inking and watercolor process. Once a sketch is completed, the tape should be removed immediately, as longer the tape adheres to the paper, the higher the risk of it damaging the paper upon removal. Should there be instances of the paper being lifted off with the masking tape, use a hairdryer or heat gun to slowly heat the tape before attempting removal. This will warm the adhesive glue and help release it from the paper. Be sure to wait for the paint to dry completely before attempting this, otherwise the paper is more likely to buckle and the washes could be disrupted.

Two sketches should easily fit on one A3 watercolor sheet. After drawing both image planes on one sheet, use masking tape and a spare sheet of acid-free paper to create a cover sheet for the bottom image plane. This ensures that the image plane will remain clean and free of oils from one's hands, small drops of ink or paint, dust, and smudges. Only the top image plane should have its borders masked at this point, the other may remain untapped until it is time to create the sketch. It is important to work in a top-down manner, as the first sketch should also be protected with a cover sheet and left untouched during the creation of the second sketch. Continue in this manner during the entire sketch phase to ensure presentable, clean work.

For some isolated elements, using a generic basemap is sufficient to try each technique. Use discretion to decide whether the generic basemap is appropriate for the isolated element to be recreated. To better isolate each element, if the view and aspect is not a part of the isolated element, the same view and aspect should be used for each sketch. For the basemap of the sketches here, Google maps was used to pan and zoom the desired crop of the chosen area—Dresden Altstadt in this case—to create screenshots of this area. The area should be within the extent of the final map, but it must not envelop the entire area of the final map, for the sake of brevity. Consider an aspect that matches that desired in the final map creation to get a better sense of how successful each element will be in the creation of the final map. Here, the scale is 1: 5,000.

Once the area is chosen, use a sheet of tracing paper to trace the layout of the streets and other large features of the city. For Dresden, streets, highways, the river, and small notes on which notable landmarks are included in some blocks were included, i.e. churches. Streets are chosen as the prominent method for transferring the geographic information as a framework for the sketches due to their prevalent use to people. These paths provide a likely framework amongst which people will travel, hence their importance in the resemblance of the city structure. (Lynch 1960, p. 110)

A light table, digital tablet, or Cintiq are all suitable methods for tracing the city paths, but for this thesis a windows surface was used, lying flat, with the tracing paper taped to the edges to prevent any movement during the tracing process. A softer, B pencil lead is ideal in this step, so requiring less pressure to create a clear line and preventing any potential damage to a tablet or Cintiq screen. To transfer the traced layout to the sketch area, transfer paper will have to be bought or made. Since it is easy to make at home, this method is described.

To make a sheet of transfer paper, a B-pencil or softer is needed, along with a sheet of smooth, A4, acid-free paper. Use the pencil's flat side (as opposed to the tip, which should be sharp and would create indentations on the paper) to rub small circles, approximately 2 cm in diameter, across the entire surface of the paper. It will take a few minutes to ensure even lead-coverage

over the entire sheet, but it is essential for an even transfer process. Circles and preferential to any other line, as it most-readily guards against uneven coverage of the paper.

Once the transfer paper is created, tape the transfer paper—lead-side down—over the image plane. It is only necessary to tape the corners of the paper, taking care that the transfer paper is precisely flush and flat against the image plane. Then, tape the tracing paper containing the traced basemap directly over the image plane, using the same taping method. One can feel the edges of the image plane to better align the transfer paper by feeling the masking tape underneath and/or lifting the transfer paper slightly to view the underlying space.

To transfer the layout to the image plane, use the bone tool to trace the lines of the streets and landmarks, using a firm hand and enough pressure to create a line from the transfer paper onto the image plane. Using the blunt end of a paintbrush is a suitable alternative to the bone tool. Use the handle of a paintbrush to steady the paper next to the area being traced. This helps to prevent bumps during the tracing process. Once the tracing is complete, remove the tracing and transfer paper; save for the next use. Note that after a few transfers, it may be necessary to add more lead to the transfer paper, as more lead transfers from the paper with every use.

From this point, the basic city layout is available, and the user may draw building footprints, create landmark images, or otherwise treat the sketch space as desired, following the historic example element. A more efficient method of transferring the sample basemap to the sketch is by printing the google maps image on the A3 paper as a 10% opacity grayscale image. This is easy to create in Adobe Photoshop using the layer window to change the opacity and Image>Grayscale to eliminate Google's colors. However, this is only a possibility if one can find a print service able to print on 300 gsm^2 watercolor paper. For this reason, the samples created in this body were traced in the traditional method. This analog method, including the painting section, is shown on the following page, figure 25.

Sketch and map creation

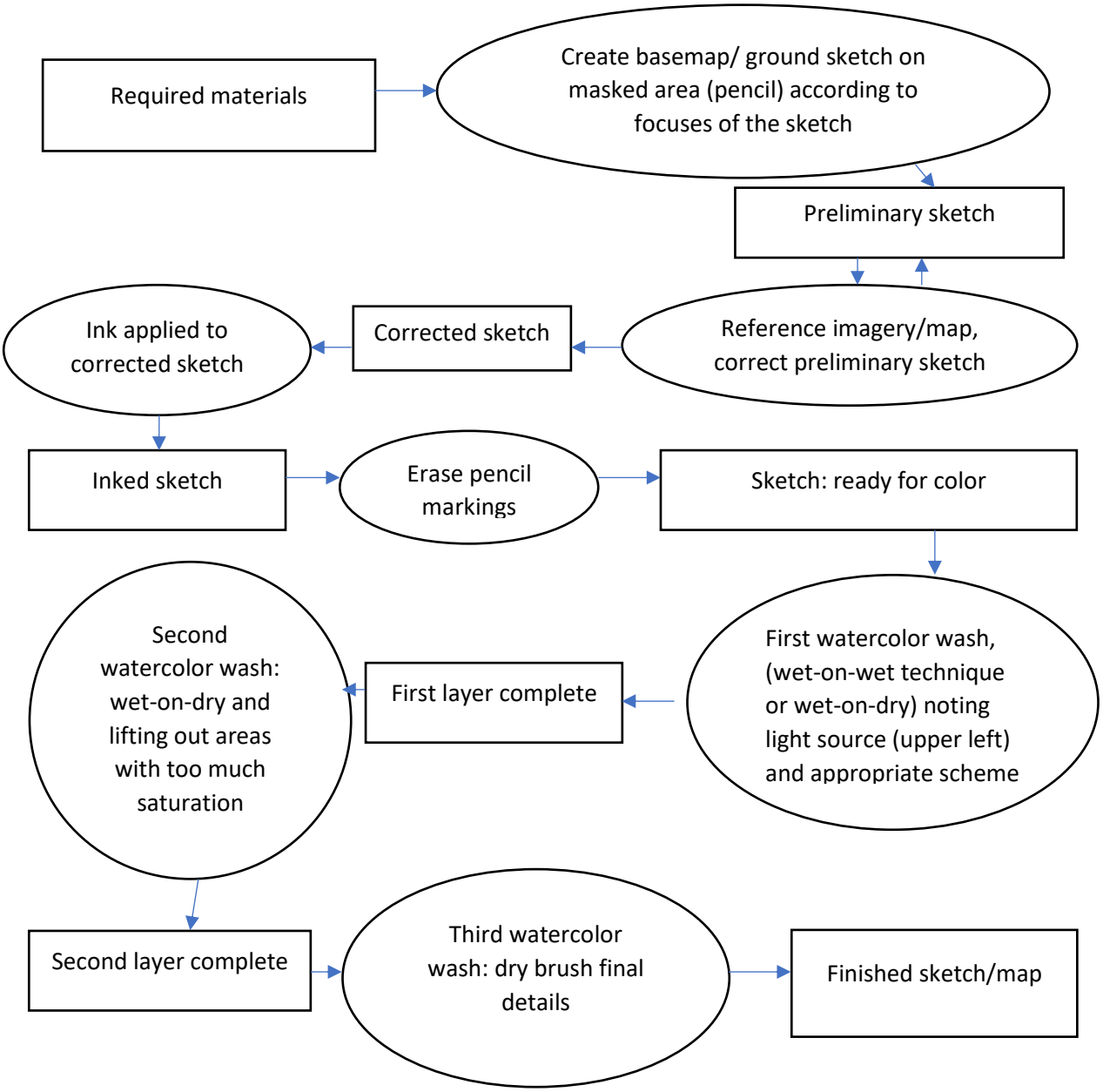


Figure 24: Painting and inking steps for sketch and map creation

3.3.3 From visual analysis to sample sketch: considerations

While considering a visual element in a sample sketch, it is important to identify what specific characteristics make that element unique from other map representations. This body of work focuses on the following considerations, chosen for effectiveness and limited for the sake of making a concise focus for the project:

- Color
- degree of abstraction
- perspective
- graphic style.

The methods to conduct a visual analysis are presented in detail in the methodology segment.

If the sketch is considering a specific color-scheme, for example, then it is important to spend time color-mixing, and make swatches to identify a proper palette before beginning the sketch. Through the experiences of this thesis, limited color schemes have provided for more cohesive and harmonious color scheme, in the sense of the definition given by Ragan: “Harmony is the principle of art that creates unity by stressing the similarities of separate but related parts”. (Ragan 1988, p. 295) Brief notes are taken at the end of each sketch to note the successes and failures of each piece. Each sketch should provide more practice and provide ample experimentation time to determine the best possible method before moving to the final map execution stage.

3.3.4 Map Execution

The map execution stage resembles the sketch stage, as similar methods and the same materials are used. Differences include the size of the canvas, the extent of area depicted, and additional considerations, such as allocated place for the map information, i.e. north arrow and scale. The digitization process also must be considered, shown below.

An additional step that can be helpful in the planning of the final map is creating a mock-up. Although not strictly necessary—some may possess the ability to visualize in their minds what the final map should look like—it can help plan where the title, information and other map elements should go. This also helps discover problems before any significant amount of work has been contributed the final map creation. Finding these layout and planning problems early saves time in later stages of the work. Again, this step is not necessary, but if one finds it helpful, sketching, drawing boxes where the map and other elements should be placed, finding a mock title and folding the paper can certainly help in imagining how the final product should be constructed.

Digitization/Post Processing

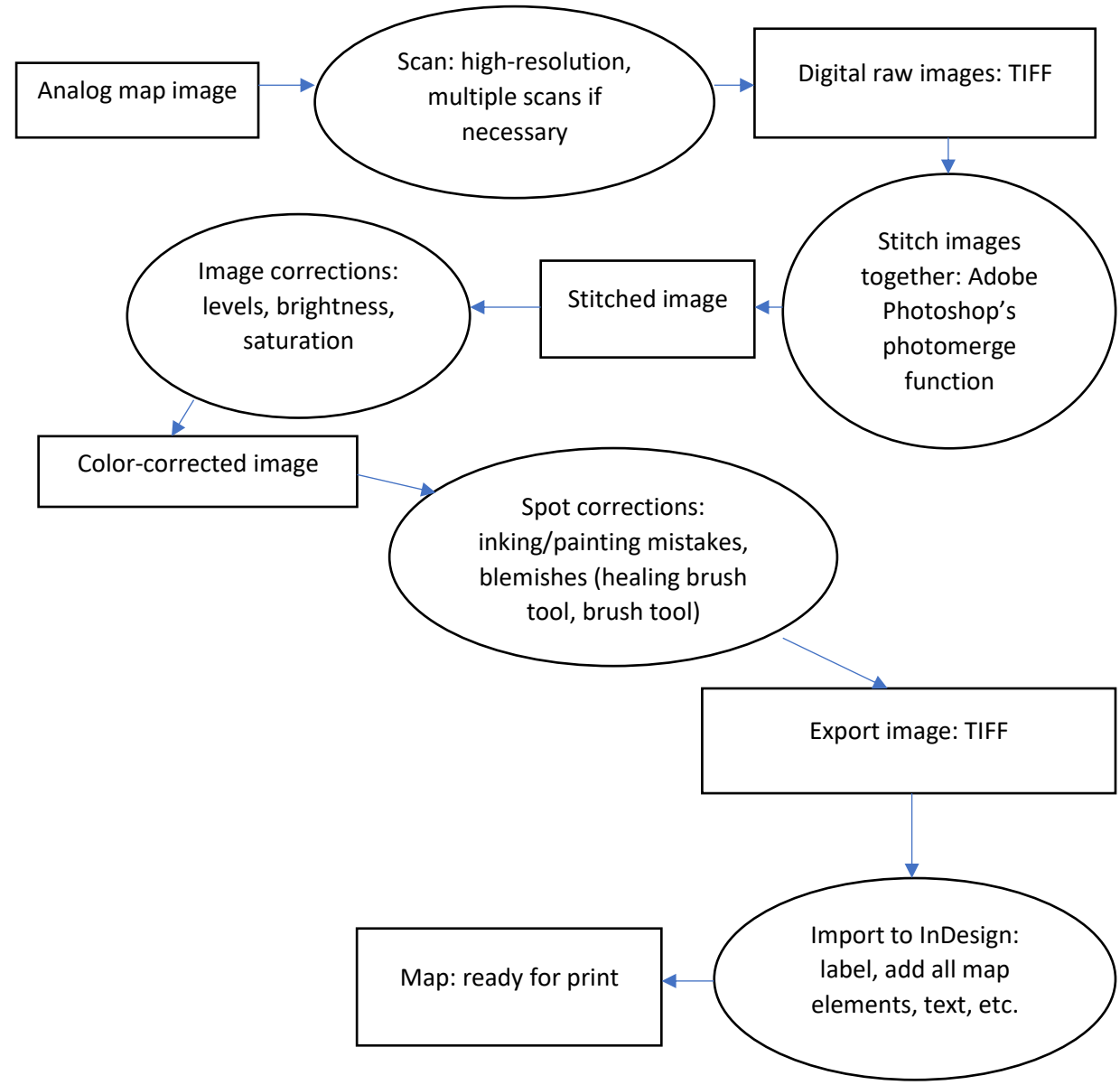


Figure 25: Digitization and post-processing steps necessary during the final map creation.

Drawing and rendering the various buildings within each sketch and the final map is quintessential to the outcome. The level of detail will greatly influence the overall outcome of the map's final appearance. Begin by referencing aerial imagery or use Google satellite view to determine the footprint of each building. Sketch the footprint lightly into the ground plan already drawn, which outlines where each city block resides. At each point where the line of the building footprint changes direction (i.e. corner of a building), extend a vertical line upwards, making each line proportional to the other for how many floors the building contains. Then, connect the lines upwards, creating points or planes, depending on the roof style. Windows, doors, pillars, and other decorative building elements may be included to however much detail the scale allows for, and for which level of detail is attempted. For example, windows may either be drawn with rectangles, including outlines depicting the type of frame, window panes, etc., or they may simply be indicated as small dots or not at all.

When buildings are simplified to a low level of detail, the method for drawing the building remains the same, but ignore superfluous details on buildings deemed non-important to the architectural highlights theme. For example, a roughly rectangular apartment building may include small outcroppings for balconies, stairwells, etc. These should be ignored, and a simple rectangle should be depicted, extending the lines simply upwards and completing the roof with a flat or gabled roof, depending on the style. This, along with dots indicating a rough estimate to the number of floors the building has, is enough for the amount of detail to be included. This method of drawing each building should ensure a unified appearance to the overall map, and thus provides the ability to focus on other parameters throughout each sketch and the final work: Perspective, the elements and principles that combine to create graphic style, and color. Color plays such a large role in how an image is perceived, it is given its own parameter, even though it is already an element of art, and thus a part of graphic style. For more information on color theory and how color affects the impression of a piece, refer to the section on color, and additionally the work of Josef Albers, noted in the references.

Individual building handling is a specific consideration of this thesis. Treatment of individual buildings has been attempted in various ways since the creation of maps, and many have various pros and cons. In this thesis, the technique begins with the building footprint. Using aerial imagery, draw the footprint of a building on the corresponding city block of the sketch or map drawing. Then, draw vertical lines upwards from each corner or angle from the footprint, creating a corresponding line length to building-height ratio. Then, connect the tops of the lines in a rendition of the roof, varying the amount of detail depending on the desired result. For example, for the most simplified building handling, rooves may be treated simply as rectangular and flat surfaces. Detailed renditions include the angle and shape of the rooves, windows, crown molding, and many other details. After a sketch or map is finished, it is time to move on to the digitization and post-processing.

Digitization begins with an accurate scan. Use the scanner on its highest possible spi (spots per inch) setting, ensuring highest quality. Even though the final map will only be printed at 300 dpi (dots per inch), a higher resolution scan allows for more accurate image manipulation and it is always better to start working at a higher resolution and downsize later, as opposed to beginning with a low-quality image and being unable to add more details. If possible, adjust scanner settings with a preview mode to create an image that looks as similar to the original as possible. Avoid the temptation of increasing the saturation and/or contrast higher than necessary. This can all be changed later, but the most important consideration during this step is to create a digital representation that most resembles the original work. Then, open the sketch in Photoshop or use Photoshop's photomerge function to stitch multiple scans together.

Use Adobe Photoshop's photomerge tool and select all raw scanned images to be merged, if the scan bed is too small to scan the entire image at once. Be sure to have enough scans of every section of the piece to ensure a seamless result. Once the scan is stitched and/or opened, it is now time to adjust the levels to ensure an even spectrum of values through the image. Ideally, there should be some values in almost every part of the spectrum. Move the arrows so that they lie just under the spike of lowest values (blacks) and highest values (whites). These should approximately indicate the black ink and white of the paper. Any other corrections to mistakes made (mistakes in smearing ink, watercolor outside a desired area, etc.) can now be fixed with the clone stamp tool. Sample a desired area and easily replicate that over the mistake.

To add all other map elements, place the saved image (TIFF) in an appropriately sized (A3) InDesign document. Here, labels, descriptions, credits, title, etc., may all be easily added and manipulated until desired. Only after all these steps are followed is it time to print the final map. For the creation of the sketches and final map, a visual analysis is conducted with the examples included in this work below. Visual analyses of other inspirational works for the reproduction of this methodology should follow the same organizational pattern, but the content will naturally vary.

4 Application

The application portion records the author's work, following the methodology developed in the previous chapter. Individual results will vary to slight degrees; however, the overall framework will remain the same, giving only slight differences in results, presented in the following chapter. The visual analysis, for example, is conducted for the chosen influences of this thesis. However, the visual analysis will be different when the user chooses different influences in a sequential visual analysis.

4.1 Visual Analyses

Creativity requires the new combination of existing components in a useful way, as discussed by Runco and Jaeger in *The standard Definition of Creativity.* To borrow elements from historic artefacts, it is necessary to conduct a visual analysis to isolate the fundamental motifs that comprise the piece. Once each work is broken down into its fundamental elements, those elements are identified to the artistic principals that may be assessed as singular motifs of the whole of the piece. The most dominant motifs are retained as noteworthy. This process is repeated for all historic materials used as inspiration for the creation of the Dresden map, thus giving a framework for how to visually identify the components of the graphic style of each map.

The combination of the elements and principals, similarly within art as in cartography, combine to create the overall aesthetic, or graphic style, of each work. The term aesthetic refers to the philosophy of the nature given by a work, which is determined by individual criteria (Ragan 1988, p. 26). However, although this aesthetic is subjective to each person, as each will have their own individual criteria, through the analysis of its unique components the graphic style can be determined and outlined in concrete terms. Each of these components within a work, that is somehow thematic in its repetition, is identified as a motif (Ragan 1988, p. 202). The motif may either repeat identically or with variation. The framework for which these motifs will be identified and described is through their elements and principals. This completes the description and analysis portion of the visual analysis.

The following step in a visual analysis is to interpret the map, for the author's possible intents, message, or purpose for creation. Context, such as the publication place, funders for the publication, and historic context all play a role in the interpretation of a piece. (Ragan 1988, p. 34) As historic artefacts, the purpose of the maps to be considered must not necessarily be that of what maps are commonly considered today. The amount of time and dedication required to create such a work—and, indeed, the entire manuscript—certainly places these objects in a distinct category.

Finally, a judgement will be made on the success of the piece. However, implied by the decision to include these examples and references for the maps in this project, the judgement of the

success of these pieces for their intended purpose stands; at the very least, they are successful in their historic and cultural value, as treasured artefacts from a time past. The Nuremberg Chronicles is chosen for its aesthetic properties; although the scale and aspect vary, or are often not listed in the modern sensibilities of mapmakers, it represents more pictorial illustrations of the cities they represent. The Nuremberg Chronicles represents an attention to detail and pictorial quality immersive to the viewer, discussed in detail in the visual analysis below.

4.1.1 Nuremberg Chronicles

The Nuremberg Chronicles are chosen as an influence for the graphic style of the final map to be produced. A multitude of maps could have been chosen for inspiration of graphic style, but the Nuremberg Chronicles was chosen for a very specific set of criteria. The map of Nuremberg included in the codex and described below features a historic aesthetic achieved by the traditional media used, the aged paper, and stylized use of line. The limited color palette is typical of codices produced, and gives a unified presentation of the city view. For architectural tourism in the historic city of Dresden, this aesthetic is preferred. For this reason, more modern examples are forewent in lieu of an authenticity historic artefact. By conducting a visual analysis, below, one may gain a deeper understanding of what specific motifs are utilized in the creation of such an aesthetic.

Figure 26: Hartmann Schedel. The Nuremberg Chronicles. 1493. World Digital Library. [accessed online]. 10 September 2017.

Beginning with the description, pages 99v and 100r (labeled as XCIX verso and C recto) of the codex depict a congregation of buildings, centrally clustered from the top to the bottom of the page. The buildings stretch the entire span of the spread from left to right. There exist three figures in the composition, all in the lower foreground of the image, on the ground plane preceding the buildings. The left figure appears to be female from the long skirt, while the other two probably male, determined by their stockings and beard. There exists a series of barricades

Figure 27: Hartmann Schedel. The Nuremberg Chronicles, 100v (detail). 1493. World Digital Library. [accessed online]. 10 September 2017.

around the buildings, with the outer series being a gated structure with sharp protrusions surrounding the entrance, and the inner being a wall, hatched with uniform horizontal lines. Structures and towers of a different material are interspersed and integrated within. A small cluster of buildings resides in the bottom right portion of the composition, apparently outside any protective structure. Two isolated buildings, smaller than most others in the composition, are alone outside the walls as well. These appear to be smaller than other buildings proportionally, ignoring any sense of linear perspective and naturalistic size relationships.

Within the walls, a series of smaller towered buildings protrude upwards from the other city buildings. Above two sets of these towers, small labels exist. A flag motif extends to the left from 10 of the poles extending above said towers, and one flag motif extends to the right from the left-most tower, residing near the edge of the 99v sheet. These towers are adorned with varying levels of detail, some appearing less adorned, with some small horizontal lines, apparently indicative of wood beams. Simple, black geometric rectangles represent windows, with varying heights, widths, and placements, depending on the tower.

Two towers, closer to the center and apparently receding from the middle of the ground plane, and to the left of the center, are adorned with taller, narrower windows. They are divided vertically by lattices or divisions between each set of windows. These are also equipped with a more conical roof structure, as opposed to most towers, with pyramidal rooves.

Roof structures are relatively uniform throughout the composition, with a few varying motifs utilized seemingly randomly throughout the central city buildings. The rooves either have no adornment, utilized most frequently with the smallest buildings and rooves, or have a slight gradation of shadow, indicated with parallel hatching lines. These often appear to be shadowed from the top down, creating a non-uniform lighting contrast with the uniformly shaded rooves. The roof structure covering the main entrance from the wall to the city is adorned with tiles, with one wooden structure featured with protruding openings from the otherwise uniform planes. These opening motifs are included on various other buildings as well, including the structure adjoining the two towers containing the adorned window features.

The structure here, along with on other pinnacle to the right of the city contains cross motifs on the corners of the rooves. Others are adorned with nothing, small geometric spheres, or chimneys. The chimneys accompany small buildings within the central building cluster, or at the top middle, where a large structure contains chimneys, roof decorations, and the most varied

and ornate window details. The windows here range in detail from a single, short, black line, to a large, latticed arched. There appears to be a partial wall built around this structure as well.

The separation from the top, central building is apparent from the wall structure partially surrounding it, whereas no other buildings contain its own separating wall. In addition, a descending, raised wooden construction recedes to the right of this wall, creating a more elaborate sense of depth, no other structures have such a severe perspective, created by the decreasing size and proportion of the receding structure.

There are four towers that could be included in this structure, two of which are obviously connected by proximity. The other two are slightly separated and in the background, thus making it unable to tell if the features are truly connected. However, their proximity to the prominent structure is and lack of adornment to the smaller buildings obstructing the rightmost tower's base provide this distinction. Yet another feature that separates the central structure with the rest of the city is the presence of a sloped, lightly hatched area, painted a varying yellow-green. There is a tree drawn with line and painted, partially obscured by the edge of the walled structure. There is no other area as such rendered within the city, implying a proximity within all other buildings encompassing the city.

Smaller, unadorned, prism-shaped buildings line the streets, with multiple rows apparently connected, and many following apparent contours of negative space between the illusion of receding space. The shadowed faces of some of these rows are facing to the left of the piece, insinuating that the light source illuminates from the right of the composition. In addition, some of these buildings contain latticed adornment on either end, although this detail is only present on one slightly larger building within the city, and one featured in proximity to the large, central building at the top-center. Other structural wood decorations depicted are on towered buildings and the tower-detail on the outer edge of the wall spanning the foreground. The buildings outside the walled limit also contain lattice work, barring the small, unadorned construction on the upper left, far in the background and on the horizon of the ground plane. Several appearances of a rectangular or square motif adorn various walls and buildings, featuring various combinations of white and yellow bands and a full-to-partial winged creature, paired with a yellow background. These appear on the sides of various towers, as well as above the archway serving as the entrance to the inside perimeter of the wall surrounding the buildings.

Regarding color, it is important to note that the printed woodblocks were hand-colored after the printing process. This creates large variation between different copies of the codices. The color scheme discussed below describes that used in this copy, and no other renditions of the codex. It is also possible that the colors viewed at the time of this analysis are different than those originally used for this work; lightfastness of the pigments is not always guaranteed, and faded colors may result from years of exposure or deterioration from other external factors. Ultraviolet light, either in the presence or absence of oxygen, often deteriorates pigments to a certain degree over time, causing the need for historic preservation in many paintings. (Korenberg 2008, p. 49) Other considerations, such as exposure to ozone, has been proven to deteriorate artwork at a higher rate. (Shaver and Cass 1983, p. 748) The appearance of the pigments at the time of this analysis are considered, without regard to any potential higher brilliancies or saturations of any pigments used.

The predominant colors noted for use in this spread are a type of rich blue, an earthy red pigment, green, and yellow. The blue tones appear to be the most saturated, creating rich tones in the sky, faded out to the natural beige of the aged paper. The green grass and foliage of the

ground plane recedes, transitioning to a slightly more toned blue towards the horizon, insinuating the effect of atmospheric perspective.

Regarding color, whether the scheme is unsaturated due to aging, limitation of pigments of the time, or intended by the artist, the result is one of tone, tints, and shades. Saturated values remain elusive in the piece, except the blue wash on the upper border to the sky. More saturated color is concentrated in the center of the piece, mainly depicting the castle. Lighter tints are seen surrounding the ground plane around the castle and in the foreground. Optical blending occurs in some of the tints between the translucent paint application and the color of the paper. Rooves are treated with varying washes of reds and blues, with predominant red-tones serving for most buildings. Greens and yellows could be mixed with varying washes, particularly in the foreground, where trails and green areas intermingle in the transition between hatched shrubs and exposed dirt. However, the subtle transitions between the greens and yellows in the foreground indicate probable mixing before brush application. These, along with the fine, even gradient of the sky and exposed paper, reveal a skill to the colorist. Creating such an even tonal wash—including a negative space for the city's place name— is not something achieved without a certain attention during the process. Next, the analysis will be conducted.

The city of Nuremberg utilizes crisp lines to define the edges and features depicted in the spread. Forming the edge of the buildings, direct lines trace the geometries of the architecture, creating many sharp angles and few curved shapes. The lines of the rooves create many strong rectangular and oblique geometries. The horizontal lines create a uniform movement throughout the piece, replicating the similar shapes repeatedly throughout the composition. This repetition and lack of lack of multiple vanishing points creates a staccato rhythm as the viewer's eye moves through the buildings of the city. The triangular façades of the buildings and vertically-oriented spires add variety to the plane geometries, interrupting the rooves irregularly and providing small accents on which the eye can rest.

The composition is that of approximate symmetry, with the tallest and highest-placed feature being the castle in the center of the composition. This triangular composition, created between the castle and descending horizons on either side, creating a triangle and sense of stability between the apex of the city and its surroundings.

The labels placed above two of the prominent buildings in the city indicate cathedrals, the largest of which towers above every other building in the city, save for the castle itself. A larger amount of detail is awarded to the churches and castle, with more lines indicative of the type of decoration and building construction. The smaller buildings lack any indication, and if there exist any adornments on them, it was not recorded. Further emphasis is drawn to the general fortitude of the city. The walls of the building are quite tall, and create a strong horizontal field of a yellow-beige across the bottom third of the spread. This is mirrored by the wide horizontal band of sky, left blank to expose the color of the page. The strong horizontal trend is further reinforced by the beige roads that flow across the bottom of the composition, all congregating before the entrance to the city.

Regarding color, whether the scheme is unsaturated due to aging, limitation of pigments of the time, or intended by the artist, the result is one of tone, tints, and shades, but pure saturation remains elusive to the piece, except the blue wash on the upper border to the sky. Rooves are treated with varying wash dilutions of reds and blues, with predominant red-tones serving. Greens and yellows could be mixed with varying washes, particularly in the foreground, where trails and green areas intermingle in the transition between hatched shrubs and exposed dirt.

These, along with the fine, even gradient of the sky and exposed paper, reveal a skill to the colorist. Creating such an even tonal wash—including a negative space for the city's place name— is not something achieved without a certain attention during the process.

Regarding the map's navigational utility, the cityscape of Nuremberg does not, by many standards, function. The lack of street presence, street nomenclatures, and other landmarks other than the main cathedrals and castle would be confusing for a viewer trying to navigate the occluded streets. However, by giving a bird's eye perspective and thus a general overview and details of the city, the viewer of this map is immediately transferred the vision of Nuremberg, without requiring any prior familiarity with the city. (Roman 2015, p.102) The transformative qualities provide a scintillating overview to the city, giving an overall impression, without troubling the viewer with extraneous information upon first impressions.

Perhaps, as a cover or banner, this image could assist in peaking interest to those interested in visiting the city of Nuremberg, without any previous experience of the location. However, without more practical navigational information, it would not stand as a navigational map for tourists alone.

The depiction of Nuremberg is a prized historic artefact, copied many times since its creation well into the 20th century through early plagiarism and modern facsimiles. The graphic style, historic aesthetic, and use of color lend to its appeal to audiences for centuries. The emphasized bird's eye perspective utilized gives an accurate impression of the city without lending to more navigational attempts by other illustrators—such as those of Jean-Louis Rheault—in modern illustrated maps, discussed in Roman's book *The Art of Illustrated Maps*. However, there are key motifs that can be attempted to gain better understanding of how to achieve such an aesthetic.

4.1.2 Bollmann Maps

Hermann Bollmann's maps utilize a wide combination of factors to achieve the transcending effects to the viewer. A visual analysis of these techniques is conducted here, with a focus on the unique perspective developed by Bollmann, and the choice of extent to best represent the city plans. To better understand how this is achieved, a closer look at Bollmann's Braunschweig maps is taken, as these depict his home city and give a representational example of the development of Bollmann's unique perspective.

Created between the years of 1948-2011 in eight editions, the Braunschweig map series documents the reconstruction and changes to the city's center after its destruction in World War II. All are created from the same vantage point, but the extent is expanded since the first edition. The first map, from 1948, depicts Braunschweig with many open areas in the city blocks, with hatching lines indicating piles of rubble where buildings once stood. All of the buildings are depicted three-dimensionally, as in a bird's-eye perspective, but foreshortening is not utilized. Instead, each city block appears to be drawn from its own elevated vantage point, creating the impression that the viewer is looking down at an angle upon each building. This view resembles that of an isometric view, used often in architectural drawings in favor of bird-eye perspective or other views. (Pérez-Gómez and Pelletier 2000, p. 85)

The advantage of this perspective is that roads are no more occluded towards the edges of the city center than in the middle. Although occlusion still occurs on every building, the wide white spaces give ample opportunity for city name placement and other labels. All buildings appear to

be oriented true to their orientation in the actual city, regardless of whether this gives the most iconic representation of that building. For the treatment of individual buildings, various motifs are utilized to describe each feature.

Each building includes enough detail to determine the number of floors it has, indicated by rectangles representing the number of windows present. Buildings that have been partially destroyed are indicated by black walls, indicating the lack of rooves on some and the partial remains of others. The limited color scheme chosen helps to unify the buildings of the city, giving a clear first impression of which city blocks are destroyed. The amount of detail included in this map is achievable by the chosen extent.

The extent of this map gives only the center of Braunschweig and is not comprehensive of the whole city. However, for the purpose of tourism, this center-only view would be sufficient for one touring the old section of the city. For all latter editions of the Braunschweig maps, the extent is expanded, giving detailed views of neighborhood blocks and apartments. Such detail is incorporated, that individual streets are shown in every city block, including specific tree types. Balconies, walkways, steps, and individual parking spaces may all be discerned. The line quality for hand-illustrated work is impressive in the sense that no mistakes can be made during the final inking attempts, as the Bollmann maps are still produced in the original, analog method.

Overall, the Bollmann maps of Braunschweig give an adequate extent for tourism and the amount of detail included for such an extent of the city would be exhaustive, would the map cover the entire city limits. A similar choice will be made for map creation in this thesis, using the same principles as in Bollmann's map extent. Even if the map was created digitally, with the aid of software such as Photoshop or Illustrator, a larger extent would still take considerable amounts of time for creation, considering the individual attention to detail for each specific building, street, etc.

The perspective techniques, being a modified isometric view, also appears to give successful representation of the city. All buildings are visible, even if some are occluded by a particularly tall feature in the foreground. Some buildings are not seen from the most iconic viewpoint, due to the limitations of a single viewpoint from the image plane. This gives an altogether more naturalistic appearance for the viewer, but not necessarily the most descriptive for iconic features of the city. For more information regarding the context of Bollmann maps, refer to the literature study in this work.

4.2 Sketches

Sketches follow the visual analysis, as presented in the methodology, and reflect the visual cues given by the analysis. They also reflect on the previous sketch in an iterative process, noting what techniques of the designs work best.

4.2.1 First Sketch

Figure 28: First sketch

Nuremberg, depicted on pages 99v and 100r of The Nuremberg Chronicles, provides the influences for the first sketch in the small sketches portion of graphic experimentation. The sketch created, shown in figure 29, depicts a bird's eye perspective view of the Altstadt in Dresden, viewed from the Neustadt. Letters are placed above important architectural features, which correspond to a key of toponyms for those features. The following notes on the perspective used can be made.

Utilizing a bird's eye view perspective mimics that used in The Nuremberg Chronicles, which easily communicates the appearance of a place to the viewer's mind. This allows for a larger amount of detail to be incorporated into features in the foreground, with less detail as space recedes. The bridge, for example, shows individual steps leading to walkways on the Neustadt side, and no steps are seen on the far side of the river, Elbe. The perspective used for the bridge crossing the Elbe river mimics the foreshortening implied by the river entering the city of Nuremberg. However, as described by Katiwaza, "Maps need to represent space as extending beyond obstructions such as buildings, forests, mountains and so forth. Although a bird's-eye view can represent the invisible space hidden from sight in maps, the more nearly a view is from directly above, the more two-dimensionally space is shown" (303). The bridge entering the city of Nuremberg, which does use foreshortening, was not chosen as a reference due to its relatively small length and therefore depth of field in the Nuremberg image. The river in Nuremberg provided a longer depth of field, mimicking the length of the bridge crossing the Elbe.

Another advantage of using a bird's eye perspective is that it more easily envelops the viewer into the visual experience of a place, before seeing it in person. However, as described by Katiwaza, "Maps need to represent space as extending beyond obstructions such as buildings, forests, mountains and so forth. Although a bird's-eye view can represent the invisible space hidden from sight in maps, the more nearly a view is from directly above, the more two-

dimensionally space is shown" (303). The bird's eye perspective is similar to how a topography would look if a viewer was standing at the hypothetical viewpoint of the image plane. This, as opposed to a top-down, two-dimensional planimetric view, is the most naturalistic for a viewer to process, and therefore requires less cognitive power to imagine oneself exploring the place of interest. This representation visually transports the viewer, as if they were looking at the area in person and not at a constructed representation.

The level of detail and abstraction is relatively similar to The Nuremberg Chronicles, where individual features of buildings may be discerned, and those in the background are more simplified than those in the foreground. The buildings depicted towards the top of the sketch—and farthest away from the viewer—are simplified to the basic architectural framework depicted the horizon of The Nuremberg Chronicles. The windows of the Catholic Church indicate which type of window is depicted (e.g. with arches, on the lower level), while distant buildings do not include as much detail (buildings in the distance receive only dots or hashes to indicate windows). Figures are seen in the foreground of Nuremberg, riding a horse, carrying a bundle, etc. and although no figures exist in this sketch, boats are placed in the Elbe river, providing details that are also transient in nature.

The graphic style does not exactly resemble that of The Nuremberg Chronicles, but an attempt at a similar handling of the features was made. More important architectural features incorporate more line details. The larger amount of line utilized shows additional features of the Frauenkirche, and the castle of Nuremberg depicts additional features than other buildings, i.e. in the large, arched windows depicting individual stones.

The colors used in the sketch were mixed in a limited color palette. A similar red is used on many of the building rooves, similar to those depicted in Nuremberg, but a green mix is used instead of the blue in Nuremberg, representing the patina of copper rooves. A light brown wash is used for the bridge, part of the foreground and some buildings to indicate shadow, resembling the paper color and browns used for the city's outer walls and buildings. Finally, a banner provides the city name, Dresden, on the upper portion of the sketch, with its size and placement at the top of the composition giving it a higher visual weight than any individual building in the sketch. The Dresden banner in the sketch is the most saturated brown in the piece, differing from the Nuremberg label, which is treated in the opposite manner: left unpainted and placed on a saturated background. Both techniques provide relative contrast between the banner and its background.

4.2.2 Second Sketch

Figure 29: Second sketch

The second sketch uses a different method for the city blocks and street placements. By imposing iconic, rotated views above the block where the architectural feature is located, the viewer receives a combination of the chorography easily shown in bird's-eye perspectives (see the literature study for an in-depth description of chorography) and navigational use of a top-down, isometric basemap, similar to the one used in Bollmann's maps. In this case, Google maps is used.

In response to the results of the first sketch, the level of detail here is reprioritized. Unlike the first sketch, it does not depict buildings deemed non-essential to the architectural features of Dresden (this is an arbitrary from the creator's knowledge decision at this point, and additional research and refinement is made before the final map creation). This creates a higher emphasis on the navigational use of this map through street names, and less emphasis on navigation through the use of landmarks.

The colors used in the color palette remain the same those in the first sketch, but are mixed differently, creating cool purple tones for the unadorned city blocks and saturated greens for green areas of the city. Warm yellows decorate parts of the architectural features, creating a complimentary contrast between the warm yellows for the highlighted features and cool purple hues from the background.

4.2.3 Third Sketch

Figure 30: Third sketch

This effect approaches something closer to Bollmann's maps, but with far less detail. The buildings non-important buildings are simple geometric volumes, without specific roof-types indicated, and without any indication of windows or other descriptive features. This is combined with a more detailed view of the important architectural features, where windows, roof types, and additional details are included. Regardless of the type of building, the drawing techniques remain similar, but more time is taken to incorporate details to the footprint and sides of the buildings on important buildings.

The third sketch combines factors from the first two attempts. All buildings are shown three-dimensionally and given volume, similar to those in the bird's-eye perspective view in the first sketch, but fixed with an isometric projection utilized from the second. This achieves a result approaching the building treatment of Bollmann's perspective style, where each building is seen from the isometric view. The theoretical view of each building is as if the viewer is standing directly south and peering northwards, or changing location to give a unique view of each building. This type of perspective, with theoretically infinite vanishing points, compliments the isometric layout of the city blocks, streets, and groundwork. The lack of a horizon, as seen in many other contemporary illustrated maps, is not shown here in favor of Bollmann's perspective technique. This eliminates the necessity for foreshortening anywhere in the piece.

This sketch is a middle-ground from the levels of abstraction from the first and second sketches. By combining the city blocks treatment in the second sketch with the buildings drawn three-dimensionally as in the first, a hybrid is formed. The buildings, however, are not drawn in such a severe perspective, giving a slight relief and less occlusion of the buildings directly behind those in the foreground.

4.2.4 Fourth Sketch

Figure 31: Fourth sketch

The final sketch, taking into consideration results from the previus three, focuses more on the use of color and degree of abstraction. The buildings all approach a similar level of detail, regardless of the building's importance so that roof types, color, and some indication of building height is indicated on most buildings, except those too small or occluded to indicate clearly. The color scheme is more saturated than previous attempts. The ground use classifications remain, utilizing the same, two-scale system: paved and unpaved. However,there are a few areas where a third classification is used: archeological/construction sites, where the ground is significantly large and neither paved nor green. This is in sync with the higher level of detail incorporated on all buildings, so that the entire piece approaches a higher level of detail. The final map will incorporate a similar style, and increase the extent of the map, but not the size in which the buidlings are represented.

4.3 Generic application

The specific work presented here in the application portion comprises the specific results of the author. However, for the purposes of reproducibility, the generic groundwork for reproduction is outlined in figure 33. These considerations give specific meaning to each sketch, and outline the intent for reproducing this work. Single building treatments vary on their degree of abstraction, although the method for drawing them remains the same through each sketch. Thiemann presents ideas for generalization applied to 3-d building models and thus borrowed for the work here, as the generalization process is presented successfully. Thiemann, in his model solution, selects important buildings for higher levels of detail, and generalizes unimportant buildings, thus creating a map that easily focuses the viewer's attention to the important points without incorporating distracting details. (Thiemann 2002, p. 2) A similar attempt was considered during the sketch progressions, but the final map incorporates a similar

level of detail to preserve a more interesting and navigational view to the viewer. The general considerations chosen with the completion of each sketch, for use for reproduction of this methodology, is presented in figure 34.

Sketch Relationships: Generic Methodology

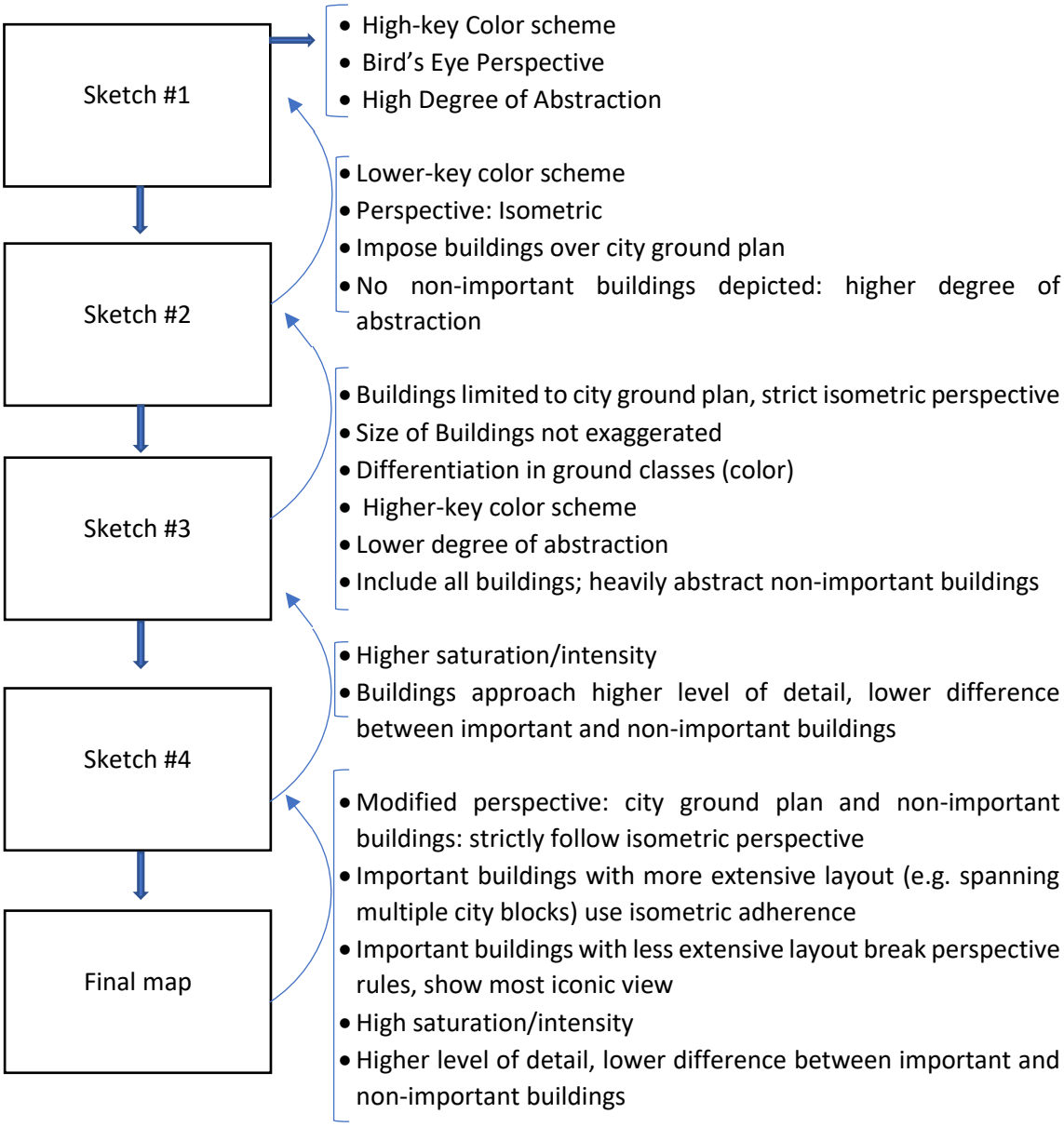


Figure 32: Components to consider for each sketch rendition, to be used for reproduction of this method.

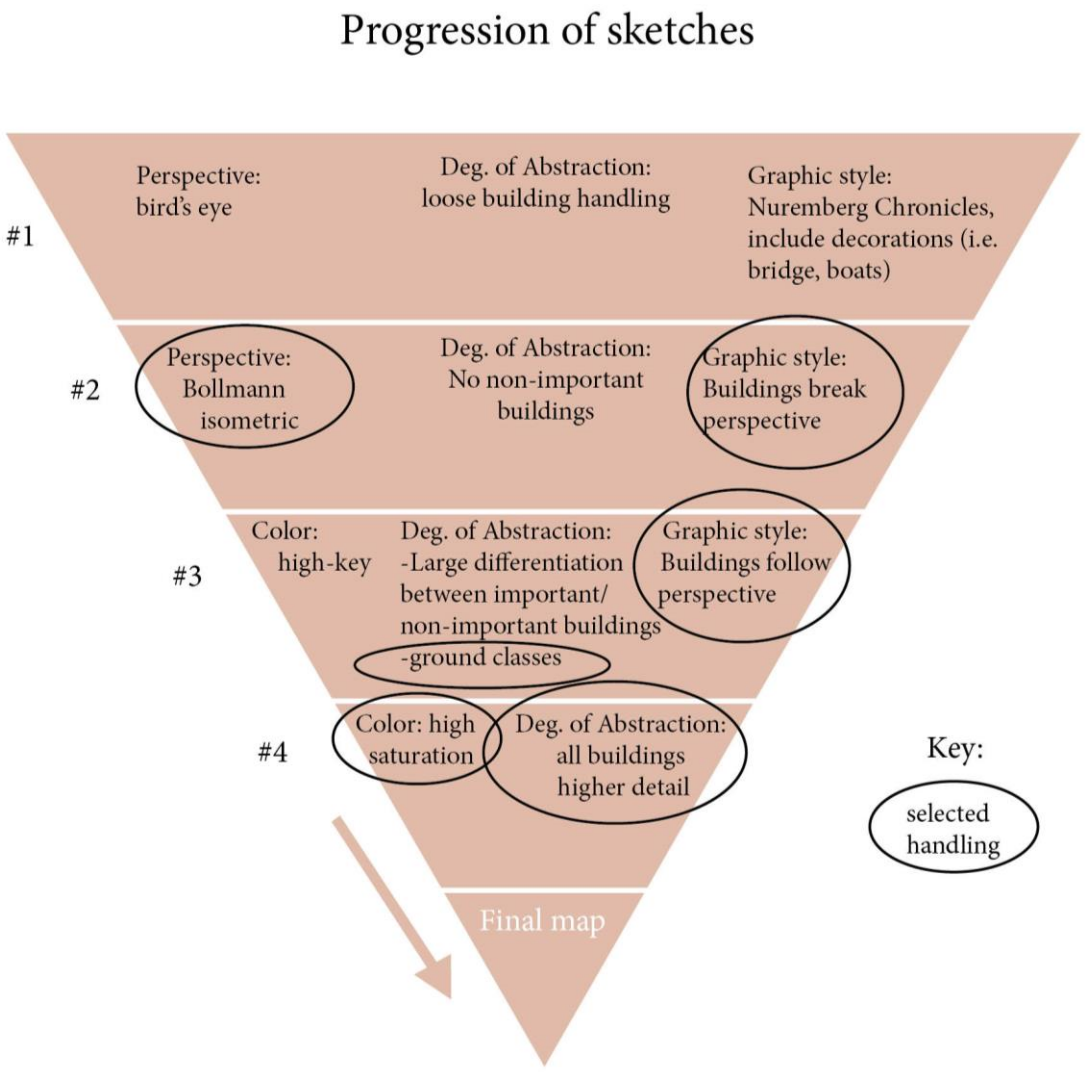


Figure 33: Sketch progressions, beginning with the first sketch at the top. Each circled feature is chosen for the next sketch, to reproduce and test its successful representation for the city view.

5. Results

Presented here are the results, consisting of each sketch and the final Dresden map.

5.1.1 First Sketch

The first attempt, although successfully replicating certain details from The Nuremberg Chronicles, creates drawbacks in other respects. Like the depiction of Nuremberg, the first sketch depicts instances of occlusion, such as that of the Castle, occluded by the Catholic church. The provides a problem, as the street is not shown in between the two features, creating difficulties in navigation. Also, it becomes harder to discern details the farther away buildings are from the viewer. Images in the foreground are given more attention to detail than those farther away. A different, isometric perspective could solve this issue. The letters corresponding to the architectural features in the picture and the table of labels become lost in the lines of the surrounding buildings; a larger buffer of space between the letters and building lines could solve this problem. As a different solution, a grid could be used to identify the locations of features.

5.1.2 Second Sketch

The disadvantage exists that due to the rotating of buildings to show their most iconic features, they no longer fit precisely into the city blocks, creating additional occlusion of streets and difficulties in navigation.

The use of simplified city blocks without the presence of non-essential buildings is a less-cluttered attempt, which increases ease of legibility, but in the end, appears unfinished or oversimplified in contrast to the more detailed Nuremberg Chronicles.

5.1.3 Third Sketch

As a combination of the first two sketches, the third sketch represents the most successful attempt in terms of combining chorographic aspects with navigational use. The attempt at a perspective that mimics that of Herrmann Bollmann gives a more detailed and intricate map, including all buildings present, without having the large amounts of occlusion seen in the first sketch. The differences in this technique for producing an isometric perspective is different than that of Bollmann's creation, but the use of aerial imagery is the same, giving a similar approach, where each building is considered at the same angle.

Non-essential buildings, referring to those present but not deemed particularly noteworthy of their architecture, are still highly simplified. This a graphic style not altogether unsuccessful, but not that desired in resemblance to The Nuremberg Chronicles. The differences between the two graphic styles are numerous, but notably in the amount of linework in the building representations.

The presence of additional details in the building handling, even in the non-essential buildings, gives the Nuremberg Chronicles' Nuremberg map a unified look through its line quality and complexity. In the third sketch, this unity is degraded through the high contrast between the degree of abstraction between the non-essential buildings and the highlighted buildings.

The lack of a horizon prevents the necessity for foreshortening, making it easier to place labels and street names on the upper section of the map, an advantage for ease of navigation.

5.1.4 Fourth Sketch

The fourth sketch strictly adheres to each individual building following its perspective space, similar to Bollmann's treatment for city maps. This representation is successful in many ways, but sometimes limits the view of interesting architectural features, such as the case with the Synagogue. The higher level of detail within all buildings unifies the piece, as well as increases production time. However, along with the high-saturation color scheme, the highest level of interest is presented.

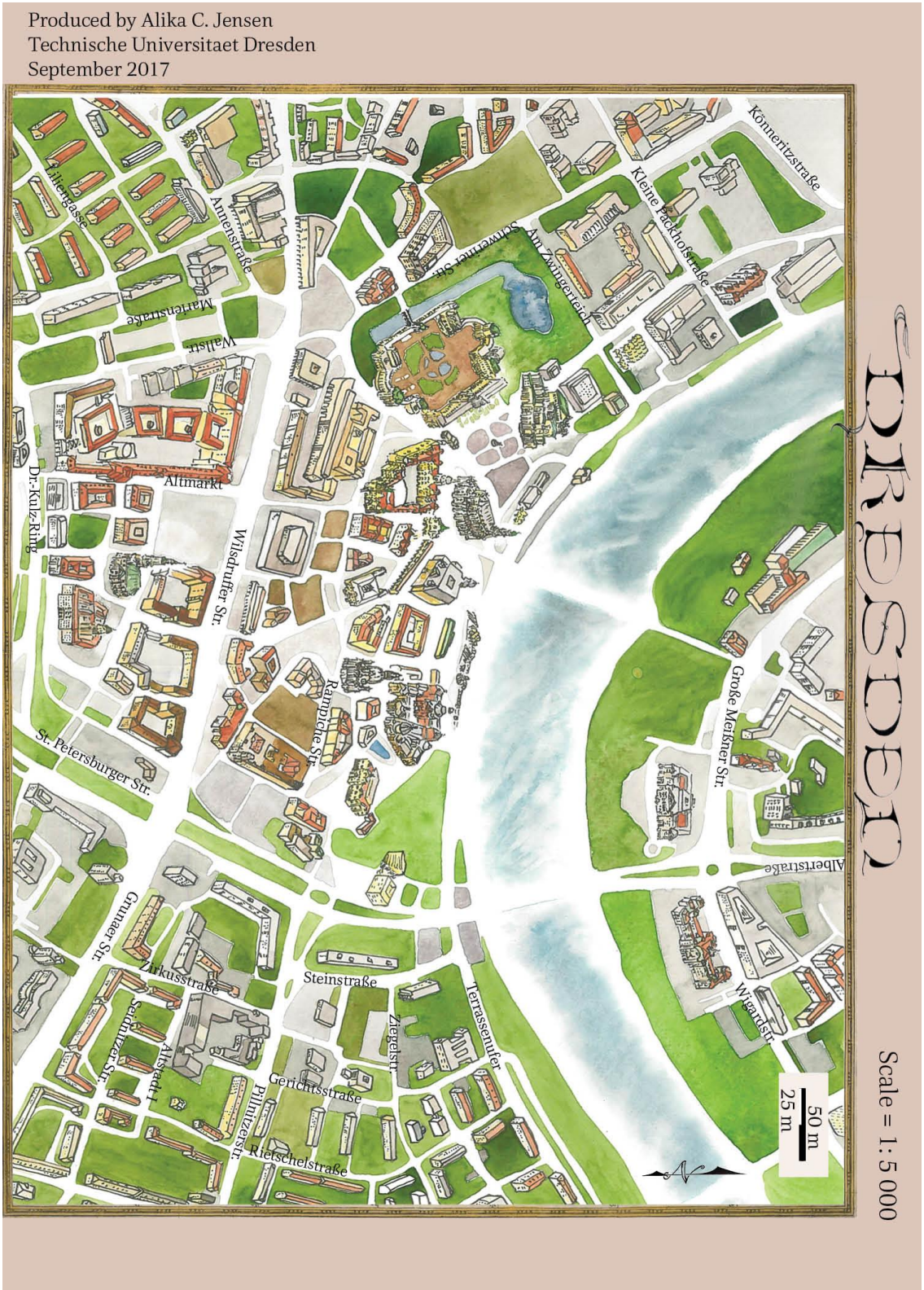


Figure 34: Final Dresden city map

5.2 Dresden Map

A final map of Dresden is produced, shown in figure 35. The map allows room for some street labels, however the point size would have to be smaller than 6 points to fit labels in the central Altstadt, the location of many prominent architectural features. Labels that are placed tend to be in the perimeter of the central Alstadt. The final saturation is higher, similar to the fourth sketch. The final map does not incorporate more detail than previous sketches, as the image is larger and the extent is higher in the final, building sizes are approximately the same as sketches two, three, and four. The treatment of the buildings' level of detail is more similar between important and non-important buildings, but emphasis is given to some of the architectural features by rotating them out of the perspective and showing their most iconic view. Particularly, the Semperoper is shown almost entirely from the side, severely distorting its natural perspective from the viewpoint of the image plane. Other features similarly break the perspective, such as the Frauenkirche and the Neue Synagoge.

Occlusion of the buildings is lessened, as the larger extent of the map allows for wider streets, so that the buildings occupy less relative space in the final composition. This, along with wider streets, allows for clearer label placement without overlapping buildings in the composition.

A qualitative critique from other artists and designers noted additional factors about the map:

Regarding the graphic style, that the labels/typeface appear "sharp, with a contrast to the fluid watercolor appearance", and that ". . . some street names are either missing or hard to find." Additionally, the symmetry was noted as giving the composition a balanced look. The title was noted as appearing ". . . fantastic, like a children's book, but still able to be taken seriously."

6. Discussion

The methodology developed for this project is specifically focused towards the creation of city tourist maps. Some of the techniques described may also apply to other fields, but the main application is as such. By isolating the four parameters deemed most influential to the outcome of a city map—perspective, degree of abstraction, graphic style, and color—an in-depth focused analysis of these factors can be conducted and analyzed, beginning in the visual analysis of the inspiration works and ending in the critiques of the sketches and final map. By limiting these variables, it enables to user to better focus on key criteria. Likewise, if more variables had been considered, which could also be argued as essential to the map's outcome (i.e. labels), the study would have become too broad and specific observations between sketches could not as easily have been observed. Focusing the parameters on which to study provides a deeper consideration of the implications of changing those parameters, thus yielding more focused results.

6.1 Remarks

Although this methodology is intended for city tourist maps, the result of this map of Dresden contains certain limitations, which hinder its overall use for tourists. A larger extent, covering areas such as Schillerplatz or the Blaues Wunder would give more useful information for tourists. In addition, the limitations of street labels hinder its navigational use in the central Altstadt. The recognizability by architectural landmarks is useful, but not entirely reliable for navigation in an unfamiliar place. Perhaps a more appropriate application is as a wall map. The limits of

navigational usage would become insignificant, and the overall impression of the city in an illustrated style would become the key focus. Its application as a poster or large-print edition is worth investigating in future developments. As it is now, its function as a wall map meets the requirements and overlooks its shortcomings in other aspects.

By expanding the map's coverage, it would be possible to further develop its usefulness as a tourist map. Future work could include an expansion of its current coverage, giving more options and navigational tools to tourists looking to utilize the map. Further work could expand the breadth of this map's extent, digitizing and stitching them together seamlessly using Photoshop's photomerge function. Adding additional featurues to the map's appearance could also enhance its visualization and ease of navigation by adding other prominent landmarks. One solution for this could be by adding bridges over the Elbe river, for example such as in the figures below.

Figure 35: Additional bridges as an optional addition

Another means of expanding this project to future work would be to create more editions, each featuring a different city. The application of the process developed for this thesis to new areas would demonstrate its reproducibility. A unified map series of various cities would serve to highlight those cities in a specific aesthetic while simultaneously demonstrating the varieties of architectural styles in each city. It would be interesting to see how cities with very different architectural styles respond to the techniques described here.

Occlusion also occurs in the digital 3-dimensional (3-D) city model. Although many successful processes exist to model and represent the city in a 3-D city view, the cities which include many high-relief buildings and elements pose an issue with occluding relevant geographic and contextual information that is not directly within view from any given viewpoint. Aggregation is one method to help generalize and clarify city views, as described in the typification process by Anders in *Level of Detail Generation of 3D Building Groups by Aggregation and Typification* (Anders p. 2) However, with this more naturalistic representation, the occlusion factor diminishes the representation of geographic space (Kitazawa 1999, p. 303).

This issue remains in the method here by allowing building representations to break their assigned parameters within the path framework, including some cases where it naturally occurs, i.e. where a building crosses or envelops the road—in the case of the Residentzschlossas it creates a tunnel over Schloßstraße—or the architectural features occluded were deemed non-essential to the thematic representation. 3-D digital city models have solutions to the problems of occlusion, such as distorting building size and street width to provide a less crowded view. The same principles apply to making many traditional city representations. The Bollman map-making process has its own unique solution for determining the heights and spaces between buildings, providing a different angle of view for each city depicted (Grimwade 2017b).

The ability to render an illustrated image onto a city block, rotated to show its most defining feature, comes more easily and quickly by studying the feature and rendering by hand, than constructing a three-dimensional digital city view and then imposing imagery to the façades of those buildings. There are advantages to both processes, however the navigational necessity and ease of creation for the experimentation process provoked the current method ultimately chosen for this methodology.

Although it may be easier for a viewer to get a concept of the true look of an area with a bird's eye perspective view, many instances of occlusion remain, particularly in city representations that have a tendency towards higher relief topography. This problem of occlusion is still noticeable in other modern illustrated maps utilizing similar perspectives, such as the Bollman New York City map. The tall buildings of Manhattan show one side of the iconic buildings and landmarks, e.g. stores, banks, etc., however farther buildings are often occluded. The strict adherement to the buildings' views provides a more naturalistic representation of Manhattan. However, the most iconic or recognizable view of all buildings may not be the same. The maps created in this methodology, however, aim to minimize occlusion of significant landmarks, and have the versatility of rotating the view of each important feature so it is best conveyed to the map user for the essence of the feature, instead of the strict adherence to its true orientation in geographic space.

The benefits having of artistic, aesthetic maps are numerous, ranging from cultivating interest in a place to creating a memorable keepsake after a treasured vacation. While this thesis works to provide a map-creation method accessible to anyone, regardless of their artistic ability, there will always be an element of individualism inherent in a project requiring hand-illustrated maps. This form of inconsistency inherently compromises the reproducibility of this work, however, explicit instructions for the creation methods, drawing, painting, post-processing, etc., give the most detail possible for consistent attempts at reproduction. The decision-making processes, discussion of creativity and its workings, and outlines for creative decision-making give objective and clear parameters for attempting the project in as objective a manner as possible. The creative decision-making processes for choosing inspirational maps, delineating the processes probably used by its creators through visual analysis all provide concrete frameworks for attempting a project of this kind. The individual discrepancies in the results are simply unavoidable past a certain level of consideration, and are still considered an inherent aspect of artistic products, regardless of their degree of objectivity in their creation. Following are some concluding remarks about the work presented.

6.2 Conclusion

Artistic decisions made in the creation of illustrated maps are in part definable and explainable by objective terms. The terms for these decisions are outlined, described, and utilized to create

a methodology for creating a specific type of illustrated map. Although the general workflow of this thesis is not new, the unique combination of both historic and modern map influences, discussed in a visual analysis, provides a new framework from which to derive a unique artistic style. First, a fundamental discussion about the combination of arts, sciences, and creativity is given. Then, an overview of current artistic and illustrated maps is provided. Then, a visual analysis is conducted on two maps that together provide visual inspiration for this project. The components that comprise the framework for analysis and application for this style are as follows, and limited for clarity and breadth:

- Perspective
- Graphic style
- Degree of abstraction
- Color

The practical portion of the thesis draws upon these influences to create an illustrated city map, designed for touristic use and focusing on architectural highlights of Dresden. It was found that the result is not entirely practical for touristic use, due to its limited extent and lack of space for more street labels and other useful navigational landmarks. However, the map could be useful for display purposes, founded on its painterly qualities and general overview of prominent architecture in the Altstadt. For future work, the extent of the map could be expanded, and maps of other cities could be made in the same method. The work presented here aims to provide objective access and a creative solution to the seemingly arbitrary artistic choices required to produce illustrated maps in a modern world. Beautiful maps have been in demand since the beginning of cartography, and their continued production will serve to enrich the lives of those who view them, regardless of the age we live in.

References

J Albers. (1963). 'Interaction of Color', Yale University Press, London.

KH Anders. 'Level of Detail Generation of 3D Building Groups by Aggregation and Typification', University of Hannover, Germany.

N Bisaha. (2014). 'Never Before Has Your Like Been Printed: The Nuremberg Chronicle of 1493' [online], essay exhibit in Vassar College Special Collections Library, https://specialcollections.vassar.edu/exhibit-highlights/2011-2015/nuremberg-chronicle/essayexhibit.html (accessed 07 September 2017).

D Cosgrove. (2005). 'Maps, Mapping, Modernity: Art and Cartography in the Twentieth Century' *Imago Mundi,* 57:1, pp. 35-54.

C D'Ignazio. (2009). 'Art and Cartography', *International Encyclopedia of Human Geography,* 1, pp. 190-206.

U Ehrensvärd. (1987). 'Color in Cartography: A Historical Survey', in *Art and Cartography: Six Historical Essays,* ed. by D Woodward, pp. 123-146, The University of Chicago Press, Chicago.

Encyclopaedia Britannica eds. (2017). 'Incunabula' [online], https://www.britannica.com/topic/incunabula (accessed 07 September 2017).

ME Fraser. (2017). '28th International Cartographic Conference Exhibitions in Washington, DC' [online] maryedna.com/category/exhibitions (accessed 30 August 2017).

MF Goodchild. (2000). 'Cartographic Futures On a Digital Earth', *Cartographic Perspectives,* 36, pp. 3-11.

C Gray and J Malins. (2004). 'Visualizing Research: A Guide to the Research Process of Art and Design', Ashgate Publishing Company, Vermont.

J Grimwade. (2017a). 'The incredible Bollmann map workshop (1)' [online] http://www.johngrimwade.com/blog/2017/03/27/the-incredible-bollmann-map-workshop-part-1/ (accessed 06 September 2017).

J Grimwade. (2017b). 'The incredible Bollmann map workshop (2)' [online] http://www.johngrimwade.com/blog/2017/03/27/the-incredible-bollmann-map-workshop-part-2/ (accessed 06 September 2017).

K Harmon. (2009). 'The Map as Art: Contemporary Artists Explore Cartography', Princeton Architectural Press, New York.

AG Hodgkiss. (1973). 'The Bildkarten of Hermann Bollmann', *The Canadian Cartographer,* 10, pp. 133-145.

E Imhof. (1982). 'Cartographic Relief Presentation', Esri Press, California.

Y Kitazawa. (1999). 'The Accountability of Hand-Drawn Maps and Rendering Practices', *Human Studies,* 22, pp. 299-314.

C Korenberg. (2008). 'The Photo-ageing Behaviour of Selected Watercolour Paints Under Anoxic Conditions', *British Museum Technical Research Bulletin*, 2, pp. 49-57.

AE Lippus. (2015). 'The History and Evolution of North American Ski Resort Design and Style,' thesis, University of Montana.

K Lynch. (1960). 'The Image of the City', Massachusettes Institute of Technology, Cambridge.

M Mace and T Ward. (2002). 'Modeling the Creative Process: A Grounded Theory Analysis of Creativity In the Domain of Art Making', *Creativity Research Journal,* 14:2, pp. 179-192.

RP Misra and A Ramesh. (1989). 'Fundamentals of Cartography', Conceptual Publishing Company, New Delhi.

J Ory, et. al. (2013). 'Identification of Styles in Topographic Maps', in *Proceedings of the 26th International Cartographic Conference (ICC 2013),* Dresden, August 25-30.

R Patkus. (2014). 'The Printing of the Nuremberg Chronicle: Background, Production, Legacy' [online], essay exhibit in Vassar College Special Collections Library, https://specialcollections.vassar.edu/exhibit-highlights/2011-2015/nuremberg-chronicle/essayprinting.html, (accessed 07 September 2017).

A Pérez-Gómez and L Pelletier. (2000). 'Architectural Representation and the Perspective Hinge', Massachusetts Institute of Technology, Cambridge.

J Pinto. (1976). 'Origins and Development of the Ichnographic City Plan', *Journal of the Society of Architectural Historians*, 35, pp. 35-50.

R Ragans. (1988). 'Arttalk', Glencoe Publishing Company, Texas.

J Roman. (2015). 'The Art of Illustrated Maps: A Complete Guide to Creative Mapmaking's History, Process and Inspiration', HOW Books, Cincinnati.

MA Runco and GJ Jaeger. (2012). 'The Standard Definition of Creativity', *Creativity Research Journal*, 24:1, pp. 92-96.

CL Shaver and GR Cass. (1983). 'Ozone and the Deterioration of Works of Art', *Environmental Science Technology,* 17, pp. 748-752.

RJ Sternberg. (2010). 'The Nature of Creativity', *Creativity Research Journal,* 18:1, pp. 87-98.

F Thiemann. (2002). 'Generalization of 3D Building Data', presented at the Symposium on Geospatial Theory, Processing and Applications. Ottawa, Canada.

YF Tuan. (1979). 'Space and Place: Humanistic Perspective', in *Philosophy in Geography,* ed. by S Gale and G Olsson, pp. 387-427, D. Reidel Publishing company, Holland.

R Watson. (2009). 'Mapping and Contemporary Art', *The Cartographic Journal*, 46:4, pp. 293-307.

D Wood. (2010). 'Rethinking the Power of Maps', Guillford Press, New York.