

THE SEMIOTICS OF CARTOGRAPHIC SYMBOLS ON OLD MAPS

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Part of Wolfgang Lazius's 1561 map of Carniola.

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The semiotics of cartographic symbols on old maps

ABSTRACT: This study analyzed selected cartographic symbols on old maps depicting the territory of Slovenia from the sixteenth to nineteenth century. A semiotic approach was applied to establish connections between cartographic symbols on old maps and the characteristics of society at the time the maps were created. This semiotic approach was used to discuss the impact of the interpretation of four symbolic cartographic elements, their iconic basis, and the reading of the five maps analyzed. Cartographic symbols changed in line with the development of cartography at the time, as well as society. The depictions of settlements were first stylistic and then geometric. Relief depictions were first stylized and then shown through plastic or spatial methods. Cartographic symbols gradually changed into symbolic signs (in the semiotic sense), including the quality of the map display, as a result of developments and the demands of changing society.

KEY WORDS: geography, semiotics, cartographic element, map, history of cartography, Slovenia

Semiotična sporočilnost kartografskih znakov na starih zemljevidih

POVZETEK: Analizirali smo izbrane kartografske znake na starih zemljevidih ozemlja Slovenije od 16. do 19. stoletja. S semiotičnim pristopom smo ugotavljali povezave med kartografskimi znaki na starih zemljevidih in značilnostmi družbe v času nastanka zemljevidov. S semiotičnim pristopom smo obravnavali vpliv interpretacije štirih simbolnih kartografskih elementov, njihove ikonske podlage in družbenega koncepta na branje analiziranih petih zemljevidov. Kartografski znaki so se spreminjali glede na razvoj takratne kartografske stroke in družbe. Upodobitve naselij so bile najprej stilizirane, nato geometrijske. Reliefne upodobitve so bile najprej stilizirane in nato prikazane s plastičnim ali prostorskim načinom prikaza. Kartografski znaki so se postopoma spreminjali v simbolne znake, vključno s kakovostjo prikaza zemljevida, kot posledica razvoja in zahtev spreminjajoče družbe.

KLJUČNE BESEDE: geografija, semiotika, kartografski element, zemljevid, zgodovina kartografije, Slovenija

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1 Introduction

In many languages, the word for 'map' is cognate with *chart* (from Greek *khártēs* 'sheet of papyrus', Lat. *charta* 'paper, writing'), referring to »a generalized representation of the Earth's surface reduced to a specific scale« (Kladnik 2001, 630) and depicted using agreed-upon symbols (Krušič 1982). A map can also be defined as »[a] symbolised representation of a geographical reality, representing selected features and characteristics, resulting from the creative effort of its author's execution of choices, that is designed for use when spatial relationships are of primary relevance« (International ... 2003, 17).

Every map is a synthesis of cartographic signs (in the semiotic sense), which as a whole make up a map, which, again in terms of semiotics, is a sign in itself. A map is thus a metonymic depiction of a certain geographical area, which is denoted by the map as a sign. A map is a tool for depicting geographical areas, natural features, and manmade changes. At the same time, the purpose of a map is to present as well as promote space and the map itself as a commodity or social capital (Logar 2019; Razpotnik Visković 2021). Like any technical product, a map is also created using a special code or language. Cartographic signs have specific relations, details, and highlights that make up the content and thus communicate a message. The elements and hence codes that make up a map differ to some degree; these differences also reflect the time when the maps were created and the development of cartography.

Like »symbol« in cartography, »sign« is an established term in semiotics, even though it is not conceived entirely the same way. However, what is key is that, in the part that semantically overlaps between the two terms, they both refer to a means of communication and hence the same phenomenon. Both cartography (geography) and semiotics conceive a printed sign or symbol as a socially agreed-upon graphic



Figure 1: Wolfgang Lazius's 1561 map of Carniola.

element. It has its own meaning, which it acquires within the context of the map's content as an »entity reflecting ... a landscape the way it was perceived and experienced by cartographers and the way it was contextualized« (Štular 2010, 86), in which a geographical name marks a sign in itself, and the semiotics reveals the signifier and the signified. The symbols used on a map hence build a code or a culturally agreed-upon system of signs (Saussure 1974), which the map as a sign in itself uses to communicate its message.

Semiotics is the discipline that explores and interprets signs and sign systems. Semiotics defines signs as part of our everyday lives. They are phenomena that we try to connect, they are the language we use to convey a message, and they are the images and experiences that evoke various associations for us. Semiotics is generally defined as the science of signs – that is, all the signs we use to communicate or receive information. Its founder was the structural linguist Ferdinand de Saussure (1974), who highlighted the fact that signs are part of language and social life, and he called the discipline semiology.

The basic elements of semiology are: the signifier + the signified = the sign. With regard to the developments in research on the sign itself, a further major contribution was made by Charles S. Peirce (1931–1958), who expanded the dyadic model of the sign with an interpretant, turning it into a triadic model: the object (the signified) + the representant (the signifier) + the interpretant = the sign. The interpretant plays an important role in deciphering a sign because, based on his or her interpretation, he or she can understand the sign correctly or incorrectly, regardless of the established codes. The interpretant thus plays a key role in understanding a sign.

Signs and one's prior knowledge of them evoke associations that form the basis for their division into three types: a symbol, an icon, and an index (Peirce 1931–1958). Symbols are signs that do not resemble the signified; they are either entirely arbitrary or entirely conventional, and must be fully learned (e.g., the stop sign). Icons are signs that resemble or imitate the signified (e.g., portraits and onomatopoeia). Indices



Figure 2: Gerard Mercator's 1589 map of Carniola.

are signs that are not arbitrary, but directly connected with the signified, in which the connection can be observed or affected (e.g., smoke is an index of fire, footsteps are an index of someone walking in the snow, and pain is an index of injury).

Semiotics was primarily developed through the study of language in the broader sense. This article, too, proceeds from language – that is, a specialized language that the map reader must know to understand the map's message. This language can be defined as a type of pictography or language depicted in the form of pictures, or as elements on the map that show a specific structure, feature, or process more clearly and in greater detail using a cartographic symbol (e.g., relief, a river system, roads, settlements, etc.; Kladnik, Lovrenčak and Orožen Adamič 2005). Elements within this larger scale define in detail the phenomena planned and required for every map; at the same time, these elements must be clear to the addressee. In semiotic terms, the signs on maps include symbols and icons. Older maps contain more icons, whereas modern maps primarily reflect the global conventionality and abstraction of geographical features in the form of symbols.

On a map, the clarity or meaning of individual symbols can be provided in a legend, which does not necessarily contain all the symbols. Therefore, this article does not focus on what a specific cartographic element signifies (e.g., a line may signify a border), but rather on how cartographic symbols mean what they signify (e.g., a point symbol defines the importance of a settlement). In addition, as fundamental building blocks, individual cartographic symbols (Gašperič 2022) create a »text« or, in this specific case, a map. The semiotic approach provides access to the cultural code or the socially agreed-upon system of signs that convey specific information, and to the premises that the author of the cartographic symbol used in creating the map: what kind of a symbol he had to draw so that the local reader could understand it. In any case, in these contexts, too, a sign refers to »correspondence between a signifier and a signified ... a sign



Figure 3: Nicolas Sanson's 1657 map of Carniola.

function when two functives (expression and content) enter into mutual correlation« (Eco 1976, 48–49); that is, whenever the signified and the content correlate, there is a sign. Signs on maps are divided into two types: pictures or images of objects, and combinational units (e.g., a legend of cartographic symbols; Schlichtmann 2009).

Comparisons of old and modern maps based on GIS have been very common in recent geographical research across the globe (Zorn 2007; Zorn, Breg Valjavec and Ciglič 2018). State-of-the-art information technology has turned old maps into an important source for determining landscape changes (Podobnikar and Kokalj 2007). Thus, cartographic sources can serve as a means of representing spatial features, as well as reliable documents of the specific time, place, and social conditions in which they were created (Slukan Altič 2003). All of this confirms that they can also be treated as primary sources and used to »determine the author's direct contact with events or conditions« (Grafenauer 1960, 252). They often contain information that is not provided in any other source. This includes various depictions of borders, rivers, roads, landforms, and place names (Rumsey and Williams 2002).

Maps are often neglected as a historical source, and in the past their content has not been adequately taken into account (Gašperič 2022), even though they can reveal spatial dynamics over an extended period. Because they depict how space was perceived at a given time, they provide access to the social conceptual structures of that time; for example, how cartographers depicted settlements so that this was clear to the readers. From the semiotic perspective, the focus is on cartographic symbols as »agreed-upon signs used to depict structures, features, and processes on a map« (Kladnik, Lovrenčak and Orožen Adamič 2005, 167). Due to their large number and thematic diversity, they can be divided into several groups called



Figure 4: Johann Baptist Homann's map of Carniola produced around 1718.

cartographic elements (Gašperič 2023). By using and depicting symbols, maps build their own sign system or code and message, which is the primary focus of this article.

In historical literature, the conceived primary function of maps was to present results (Grafenauer 1960). Now the importance of maps as sources of information on landscape changes is gradually growing, which is also confirmed by the latest research (Gašperič, Perko and Zorn 2018; Perko et al. 2019; Zorn, Ciglič and Gašperič 2020).

At the end of the twentieth century, maps began to be analyzed as part of a special branch of semiotics called cartosemiotics (Nöth 1998) or cartographic semiotics (Schlichtmann 2008). This branch specializes in the semiotic study of cartographic material (e.g., maps, globes, and relief models). The first analyses were already conducted by Wood and Fells (1986), but the first to tackle this topic systematically was Schlichtmann (2009), who highlighted the importance of semiotics for analyzing maps and hence providing broader insight into society. The subject of cartosemiotics is subsumed into five major themes: map symbolism (map language), the sign process, the context in which signs and sign processes are embedded, marginal notes (explaining the meaning of the entries and providing background information), and peripheral signification phenomena, which are style traits or reflect ideologies.

Cartosemiotics studies map symbolism as a complex semiotic system with spatial and non-spatial components; macrosigns (localized signs) are ultimately composed of minimal signs and in turn combined in texts (Schlichtmann 1985). Along these lines, Wood and Fells (1986) highlight ten codes that need to be decoded on a map to understand what it depicts. Because these codes are inextricably related and dependent on one another, they divide them into codes of intrasignification, which operate within the map or at the level of language, and codes of extrasignification, which are composed of five categories: the thematic, the topic, the historical, the rhetorical, and the utilitarian. All five indicate the map's main focus or discourse (Wood and Fells 1986) and operate outside the map or at the level of myth (Eco 1976): the map »succeeds in persuading us that it is a natural consequence of perceiving the world« (Wood and Fells 1986, 63). This article focuses on the codes of intrasignification, among which at least five categories can be distinguished (Wood and Fells 1986): the iconic (roads, towns, rivers, mountains, and hypsometric layers; the inventory or fragmentary world), the linguistic (the codes of names of places, roads, and areas), the tectonic (relationships in space, normally expressed in the form of numeric ratios for measuring distances and sizes), the temporal (this code is closely connected with the spatial code because it refers to the time needed to get somewhere or the temporal aspect of distance between individual elements; in addition, maps can be old or new, and some may refer to the future; e.g., they show projected roads), and the presentational (information such as a title, a legend box, a map image, illustrations, the scale, and instructions). This article primarily concentrates on part of the iconic codes of intrasignification – that is, on selected basic cartographic symbols.

Most cartosemiotic analyses are conducted on modern maps (Nöth 1998; Schlichtmann 2009), whereas this article relies on historical sources, providing insight into the development of symbols over time and hence also the social conceptions reflected in the maps. The analysis of cartographic symbols draws directly from maps, which has been rare in studying past developments in what is now Slovenia. The main interest is in what is conveyed through the changes on maps between the sixteenth and nineteenth centuries.

This article identifies the potential influence of social conceptions by assessing cartographic symbols based on a review of selected maps of Slovenian territory (e.g., a triangle representing a mountain or a circle representing a settlement as a complete whole). Because maps can also reflect the social and political situation in which they were created (Zorn, Breg Valjavec and Ciglič 2018), attention was drawn to the meaning conveyed by their fundamental building blocks: cartographic symbols. Therefore, a semiotic method was used to analyze the most frequent cartographic symbols on all the maps studied (i.e., symbols for settlements, vegetation, relief, and water).

The terms used in this article are »cartographic element« and »cartographic symbol« as defined by geographers and cartographers (Gašperič 2023). They are both considered the fundamental building blocks of any map. A cartographic element refers to the group of methods used to represent a specific topic, and a cartographic symbol is the method of representing a cartographic element on a map. For example, the cartographic element of 'water' can be represented with (single or parallel) line cartographic symbols or area cartographic symbols for rivers, lakes, and seas; the cartographic element of 'settlement' can be depicted with point cartographic symbols (e.g., a circle, triangle, square, or dot) or area cartographic symbols

used for settlements of various sizes (i.e., a simplified plan view of a settlement). This article specifically analyzes the cartographic symbols mentioned, determines the meaning of their diversity and changes through time, and treats them as semiotic signs that build a map and its discourse.

2 Methods

The methods used were as follows: selecting old maps based on the area mapped, scale, and time of origin; selecting cartographic elements that are depicted on all the maps studied and that varied by the time of origin and the cartographer's knowledge; analyzing the cartographic symbols used for representing individual



Figure 5: Peter Kozler's 1853 map of the Slovenian land.

cartographic elements in terms of composition, type, and evaluation; and comparing results between various periods and determining the main characteristics of changes in the representation of cartographic elements.

The article examines natural cartographic elements (relief, vegetation, and water) and built cartographic elements (settlements; Gašperič 2023). Cartographic symbols for the following were selected:

- Settlements (stylized point and area symbols);
- Vegetation (stylized point symbols);
- Relief (stylized, plastic, geometric, and combined method of representation; Perko 2001);
- Water (line and area symbols).

Five representative general geographical maps at a medium scale (approximately 1:500,000–1:800,000) from the mid-sixteenth to the mid-nineteenth century (figures 1–5) were selected for analysis. They all map the territory of what is now Slovenia, as well as parts of what is now Italy, Austria, Hungary, and Croatia (Table 1). The 1561 map by Wolfgang Lazius is considered the first known map presenting Carniola *per se*, and it stands out in the cartographic sense because of its great interplay of imaginary, historical, and realistic depictions and geographical names. Despite being created only a few decades later, Mercator's map of 1589 is cartographically more accurate and geographically more complete. It also served as the basis for the next two maps. The 1657 map by Nicolas Sanson and the map by Johann Baptist Homann created around 1718 are representative cartographic products of the seventeenth and eighteenth centuries, in which the accuracy of the features mapped and their names (e.g., Lake Cerknica) improved. Compared to its predecessors, Kozler's 1853 map (also Kosler) exhibits a significant advance in quality and, in terms of its content (i.e., the territory mapped and geographical names), its primary aim is to promote national identity.

This article focuses on the importance of symbols as pictorial signifiers of spatial features and, as such, how they build the »text« or map. The semiotic approach provides access to the cultural code or socially agreed-upon system of signs that represent specific information that the cartographer had and interpreted through symbols. In these contexts, too, a sign or a symbol reflects a »correspondence between a signifier and a signified« (Eco 1976, 48–49). The semiotic analysis of the maps selected relied on the theory of cartosemiotics, which considers a map a product made of signs – that is, a combination of various cartographic elements depicted in the form of cartographic symbols. Cartosemiotics, too, is based on elements.

3 Analysis

The maps contain all five major groups of cartographic elements: natural and built elements, geographical names, and mathematical and explanatory elements (Gašperič 2023). Explanatory elements, such as various illustrations and text added to the map, are more common on older maps (created before the nineteenth century). Their purpose was to attract the buyer's and reader's attention, and to highlight a special feature or event that was geographically or historically connected with the area mapped. Even though they cannot be found in the map's legend, they have their own function, just like all the other cartographic symbols, and they may even more clearly reflect the social systems and the predominant mindset (of the author, society, and authorities). This can be clearly seen on Lazius' 1561 map, which has a shape of an oval embraced by the double-headed Habsburg eagle and is decorated with ten provincial coats of arms. Because an analysis of all cartographic symbols on the maps selected would exceed the scope of this article, the analysis here

Table 1: List of selected maps with basic information.

| Year | Title | Author | Scale (roughly) | Cited (in text) |
|---------|---|-----------------------------------|-----------------|-----------------|
| 1561 | <i>Ducatus Carniolae et Histriae una cum Marcha Windorum</i> | Wolfgang Lazius (1514–1565) | 1:500,000 | Lazius 1561 |
| 1589 | <i>Forum Iulium, Karstia, Carniola, Histria et Windorum Marchia</i> | Gerard Mercator (1512–1594) | 1:700,000 | Mercator 1589 |
| 1657 | <i>Hertzogthüber Steyer, Karnten, Krain, & c./Duchés de Stirie, Carinthie, Carniole . . .</i> | Nicolas Sanson (1600–1667) | 1:800,000 | Sanson 1657 |
| c. 1718 | <i>Tabula Ducatus Carnioliae, Vindorum Marchiae et Histriae</i> | Johann Baptist Homann (1664–1724) | 1:500,000 | Homann 1718 |
| 1853 | <i>Zemljovid Slovenske dežele in pokrajini</i> | Peter Kozler (1824–1897) | 1:576,000 | Kozler 1853 |

is limited to the cartographic symbols representing settlements, vegetation, relief, and water. These symbols are the (most) common ones on maps and the ones the reader (most) easily recognizes. Because they changed and developed over time, this study assumes that they are good indicators of various directions of cartographic and social development.

3.1 Settlements

General geographical maps show all settlements in the area mapped that meet the agreed-upon principles for representation (e.g., detail of representation, and the population, size, and importance of the settlement). Especially on maps produced before the nineteenth century, the selection of settlements depicted was based on the author's judgment. Depending on the size and importance of a settlement, a cartographic symbol was selected for its depiction on the map. On older maps, settlements were predominantly depicted with geometric symbols (e.g., circles and rectangles), stylized symbols (e.g., a panoramic image of one or several structures), and area symbols (e.g., a simplified plan view of a settlement; Table 2).

Between the fifteenth and seventeenth centuries, stylized symbols for settlements were depicted in four predominant ways: a side view (up to three built structures drawn in a line), a stylized view (a line of unevenly distributed buildings, creating a sense of depth), a bird's eye view (a limited view of the entire settlement from various height), and a vertical view (a perpendicular view of the settlement). The side view is used on most maps from this period. However, it remains unclear whether settlements were represented systematically during that period, or the authors determined the number and importance of settlements subjectively (Delano-Smith 2007). It is presumed that the author's subjective judgment had considerable influence because it is difficult to believe that cartographers of that time had the expertise and geographical breadth necessary to objectively depict all places on a map. In any case, they at least tried to highlight the prominent function of the more important places.

3.2 Vegetation

Vegetation is already shown on the oldest maps, which indicates its great importance, especially in terms of the economy, defense, and travel. The term »vegetation« refers to all the vegetation depicted on a map (Peterca et al. 1974). On old general geographical maps, its depiction depends on the detail of representation

Table 2: Types of cartographic symbols representing settlements on the maps analyzed.

| Element | Symbol | Lazius 1561 | Mercator 1589 | Sanson 1657 | Homann c. 1718 | Kozler 1853 |
|------------|--|----------------|------------------|----------------|-------------------|----------------|
| Settlement | Point (geometric shapes: square, triangle, etc.) | No | Yes | No | Yes | Yes |
| | Point (stylized images of buildings) | Yes | Yes | Yes | Yes | No |
| | Area (plan view of settlements / town walls) | No | No | No | Yes | No |
| | Other | No | No | No | No | No |

Table 3: Types of cartographic symbols representing vegetation on the maps analyzed.

| Element | Symbol | Lazius 1561 | Mercator 1589 | Sanson 1657 | Homann c. 1718 | Kozler 1853 |
|------------|--|---------------------------------------|--------------------------|----------------|-------------------|----------------|
| Vegetation | Grassland Stylized images of grassland (areas with small vertical lines, clumps of grass) | No | No | No | No | No |
| | Forest Stylized images of trees (various density of the same or different trees) | Yes | Yes | Yes | Yes | No |
| | Other Stylized images of grapevines, wetland vegetation, olive trees | Yes (olive trees, wetland vegetation) | Yes (wetland vegetation) | No | No | No |

envisaged by the cartographer, with representations of forest and distinctive vegetation (e.g., wetland plants, olive groves, or vineyards) predominating.

Stylized representations of trees in the form of groups of various sizes, tree lines of various lengths, and various individual trees predominate until the nineteenth century. Trees are a metonymic symbol or an icon for forest and, on the two oldest maps, for olive groves and vineyards. The image of trees is often the same throughout the map, but it may also differ, especially by the size of the symbol rather than type of vegetation. Forests are depicted with stylized images of trees drawn from the side and, if they are depicted in the form of a group of trees, they may cover a substantial part of the map. Wetland vegetation is depicted on Lazius's and Mercator's maps; the iconic representation of wetland vegetation is probably important to show impassable areas. Table 3 shows the representation of vegetation on the maps discussed.

3.3 Relief

In depicting relief, cartographers deal with the challenge of how to depict three-dimensional terrain in two-dimensional form on the map. Representations of relief can be divided into four main categories (Perko 2001): stylized representations (simplified symbols resembling molehills and half-circles), plastic or spatial representations (using colors, color shades, hachures, and dots), geometric representation (contour lines and spot elevations), and combined representations (a combination of various methods). Stylized representations predominated until the eighteenth century, hachures were widely used in the nineteenth century, and combined representations have predominated since the twentieth century (Table 4).

The four older maps use brown or gray molehills and shading; a molehill is the iconic representation of a mountain. It is primarily higher and more visible mountains that are marked on the map; the ones that can be conceived as a barrier preventing access to a neighboring area, which was a key piece of information at that time. Nonetheless, mountains are not drawn consistently, and mountain ranges are used as an icon or metonymy representing an impassable area or an area that is difficult to pass. In this regard, Kozler's map shows a significant advance in quality because it uses spot elevations and hachures to represent relief. This is a more accurate and realistic method of depicting relief, and a shift to a completely symbolic representation.

3.4 Water

Water can be divided into still and moving, surface and underground, and freshwater and saltwater. Lakes and seas are depicted using an area symbol, which usually illustrates the envisaged size and shape of the body of water. Rivers and creeks are most often depicted with single or double (parallel) line symbols and area symbols. Area symbols are typical of older maps, on which a river is not depicted with two parallel lines, but as an undefinable elongated form that in the upper reaches may resemble a short tail, which grows thicker toward the mouth. The space between the two lines may be empty or filled with various patterns, most often several parallel, solid or broken, or curvy or straight lines. Waterfalls and springs are rarely depicted, usually with a stylized point symbol. Linear representation indicates that water was conceived as a line that cuts through the land or as a transport route. Water symbols on these maps do not show individual depths or major gradients, rapids, and so on.

Table 4: Types of cartographic symbols representing relief on the maps analyzed.

| Element | Symbol | Lazius 1561 | Mercator 1589 | Sanson 1657 | Homann c. 1718 | Kozler 1853 |
|---------|-----------------|----------------|------------------|----------------|-------------------|----------------|
| Relief | Molehills | Yes | Yes | Yes | Yes | No |
| | Contour lines | No | No | No | No | No |
| | Spot elevations | No | No | No | No | Yes |
| | Shading | Yes | Yes | Yes | Yes | No |
| | Hachures | No | No | No | No | Yes |

Table 5: Types of cartographic symbols representing water on the maps analyzed.

| Element | Symbol | Lazius 1561 | Mercator 1589 | Sanson 1657 | Homann c. 1718 | Kozler 1853 | |
|-----------|------------------------------|--|------------------|----------------|-------------------|----------------|-----|
| Water | General | Point symbols | Yes (waterfall) | No | No | No | No |
| | River | Line symbols (single line) | No | No | Yes | Yes | Yes |
| | | Line symbols (double line, often parallel) | No | Yes | Yes | Yes | Yes |
| | | Area symbols (colored areas) | Yes | Yes | Yes | No | Yes |
| | Others | No | No | No | No | No | |
| Sea, lake | Area symbols (colored areas) | Yes | Yes | Yes | Yes | Yes | |

Especially on maps created before the sixteenth century, problems with depicting water were connected with cartographic projection; these problems persisted on many maps up until the nineteenth century. On these maps, the territory is overly stretched or expanded in the east–west direction, which is why the courses of rivers are depicted disproportionately in the east–west direction and many also in the north–south direction; other directions of the main watercourses are less common (Slukan Altić 2003). The question is whether this can be understood within the context of the social conception of space and time: space seems to be expanded based on the more frequent and, first and foremost, longer and more long-term travel from central Europe toward the east or west (also because of sea travel or the route in stages to the final destination) than toward the north or south. Therefore, this map expansion could also be related to the general spatial connection with time. Table 5 shows how water features were depicted on the maps selected.

4 Discussion

This article identifies the reflection of social conceptions in cartographic symbols on selected maps of Slovenian territory. It analyzes the most common cartographic symbols on five maps published between the sixteenth and nineteenth centuries: symbols for settlements, relief, vegetation, and water. These symbols have a metaphoric character, which is why a semiotic approach is also used to analyze them.

Semiotically, signs on maps can be divided into symbols and icons. Older maps contain more icons, whereas on more recent maps (especially those produced from the nineteenth century onward) the signs already reflect global conventionality and abstraction in the form of agreed-upon symbols. Cartographic signs are stereotypical metonymic images of a feature, which is clearly evident with the following: forests, which are represented with a typical forest element (i.e., a tree or a group of trees); settlements, which are represented with a building or a group of buildings; moving water, which is represented in the form of curvy lines; and relief, which is represented through a group of (shaded) molehills on maps produced before the nineteenth century.

Signs on older maps before the nineteenth century are partly arbitrary and motivated by the expected understanding of the map reader. At the point of making the maps that were studied, no rules had been established yet, and signs were chosen by predicted understandability. At this point, it is exactly understandability that creates the (social) convention: what kind of sign would be understandable to the recipient. That is, in drawing the map, the cartographer had to take into account the stereotypical social images of these features to make the map understandable. The stereotypical image of a feature depicted with a sign or a symbol is often metonymic: a part of the feature representing a whole bears the entire meaning. Hence, for example, it can be observed that with settlements the image of a whole is represented by a tower and a few buildings. Based on his judgment or knowledge, the cartographer indicated the size of a settlement by using different numbers of buildings. The image is stylized and, in terms of semiotics, symbolic, even though it initially seems to be iconic (i.e., it imitates the image of a settlement). However, more or less the same generalized image is applied to all settlements, regardless of their image in the real world. Due to this uniformity, it can be semiotically referred to as fully symbolic, even though Wood and Fells defined these signs as iconic. By taking into account that these are stereotypical metonymic signs, one can already talk about conventionality within the representation: maps do not resemble that which they depict; these

images can only be connected by taking into account a series of complex principles or conventions – that is, an agreed-upon code. An example of such a code is the color blue to represent rivers on colored maps (Wood and Fels 1986), or (blue) lines used in graphs and diagrams, where they represent something entirely different (e.g., changes in water level). Just as it is completely clear that blue lines represent rivers on maps, it is also clear that a blue line in a medical diagram can refer to the human circulatory system. Hence, iconicity is always based on a systemic structure – that is, it is always analogue, rather than (merely) based on the image and subsequently metaphorical; for example, a blue line (Wood and Fels 1986). Thus, it is about the code used and not the signifier, which would mean that the code, rather than the signified itself (e.g., the river), determines the sign. To some degree, a sign can also be predictable due to its strong resemblance to real features. However, map users must know the code to successfully and fully decode (i.e., read and understand) the map. Nonetheless, it should be highlighted that (in cartography) the code is primarily founded on resemblance to features. For example, a river is represented with a line, a lake with an area symbol, and stereotypical colors are used for specific features (blue for water, green for vegetation, etc.). Hence, the iconicity of cartographic symbols is based on both their stereotypical symbolism and social convention. By combining both perspectives, a stereotypical social conception of an individual feature can be inferred. This article focuses on the interpretation of »intersignifications« or, specifically, the symbols representing settlements, water, vegetation, and relief.

4.1 Settlements

Except for Kozler's map, all the maps analyzed show a clear connection with a stylized conception of a settlement expressed in the form of buildings of various numbers, which may also contain a dominating tower or an iconic symbol resembling a fortress. At the time these maps were created, no uniform symbols had yet been established for towns, boroughs, and villages, and so, as expected, the symbols used reflect the cartographer's conceptions and subjective views. The predominating principle used on the first four maps is that a larger settlement is depicted with a more imposing iconic symbol, usually a fortress. An interesting detail on Homann's map is the plan-view depiction of Palmanova (now part of Italy), whose distinctive star-shaped defense walls have been preserved until today. On Mercator's map and all later maps, smaller settlements are marked with a circle (i.e., a geometric symbol), which is the second most frequent method used for representing settlements. Mercator and Homann used them to represent smaller settlements, but it was only Kozler that finally began using a circle as a point symbol with various sizes and centers for marking settlements.

Settlements are various forms of permanent human habitation (Kladnik 2001), with more or less compact buildings and various functions. Conceptually, this compactness is often understood as completeness, which is most likely based on the image of earlier settlements, which, due to their defense role, had a more clustered character and defense walls. The stylized depictions of settlements on maps also resemble fortresses with defense walls, and it can be presumed that every larger settlement was conceived as a larger cluster of protected buildings. A settlement usually had at least a church, and there was often also a castle within, above, or near it, which made it rank among major or more important settlements. Proceeding from the completeness mentioned above, parallels can be drawn with the complete point symbol, most often round or square in shape, which indicates that the settlement was conceived as a complete residential product of society – society as an independent whole or a bubble separated from the neighboring settlement or bubble. This hypothesis is supported by the use of such point symbols for smaller settlements on various old maps, even though in many cases the settlements were neither clustered nor walled (e.g., settlements in the Pannonian region, which have a distinctive oblong shape). The completeness of a settlement and the metaphorical completeness of society as a relatively closed cell (or an inner circle of identity) is thus transferred into the cartographic symbol.

It should also be mentioned that castles in the immediate vicinity of which there was no settlement at all were also marked as settlements on maps; usually the settlement was at some distance from the castle – for example, Stein Castle (*Stain*) and Kamnik (*Stainpuhl*) on Mercator's map – or there was none at all; for example, Bogenšperk Castle (*Wagensberg*) near Litija on Homann's map. The maps studied show a clear trend of practical adaptation of signs in the direction of greater symbolism. Lazius's map still tried to distinguish between settlements and castles by using different icons; nonetheless, the signs largely do not reflect the (metonymic) real image of the castle or fortress and are predominantly imaginary instead. Mercator's map already introduced symbolic signs – that is, circles, which are of the same size for all

settlements. Sanson's map predominantly depicts settlements using iconic images of a castle with a town, which differ by settlement size. Smaller settlements are only marked with a small circle. On Homann's map, settlements are marked with circles and fully symbolic, tiny images of towers. In turn, Kozler's map only uses fully symbolic signs (i.e., circles of various sizes) to depict settlements.

4.2 Vegetation

As expected, the maps originating from before the nineteenth century most often depict forests, with larger wooded areas standing out (e.g., the extensive Kočevje forests). Forests are represented with clusters of



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Figure 6: Typical representations of settlements on maps by Lazius, Mercator, Sanson, and Kozler.

iconic stylized (green) trees of various sizes, with no distinction between deciduous and coniferous trees because all trees are represented in a generic deciduous form. The maps analyzed do not depict grasslands, and other types of vegetation are only included on the two earliest maps: Lazius's map contains olive groves and vineyards (depicted with a symbolic stylized sign representing an olive tree and grapevine), and Mercator's map also features wetland vegetation (Figure 2).

In representing vegetation, there was a gradual shift from icons to symbolic images or, later on, complete absence (e.g., on Kozler's map). On Lazius's map, forests are represented with green stereotypical tree icons (a large group of trees), and olive groves and vineyards are marked metonymically, using a single green icon representing a plant. Green is the stereotypical color of vegetation, related to the immediate experience of observing extensive green areas, such as forests and grasslands. This color is metaphorically



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Figure 7: Typical representations of vegetation on maps by Lazius, Mercator, Sanson, and Homann.

transferred to vegetation, signifying natural elements or nature. All representations of forests on the first four maps contain an iconic image of a group of trees with trunks and crowns. Highlighting the size of a wooded area had a similar motive as with mountain ranges: these were regions that were considered alien or bordering another region, or even perceived as inaccessible or unpassable. Because people were unfamiliar with areas of extensive forests and mountain ranges (as well as seas) and considered them unattractive to live in and inaccessible, they conceived of them as mythological places. Therefore, they were merely vaguely drawn on maps, or presented fairly metonymically. Only part of a mountain range or forest was drawn, in a form indicating its presumed dimensions. Forests were often depicted linearly, in the form of green or tree belts. It was only Homann that also used clusters of vegetation to depict forests. As already mentioned, like mountain ranges, forests can be identified as a spatial barrier or dividing line between two areas; rivers and roads stop at forests or go around them. However, most importantly, this element is depicted metonymically on maps: merely as a part of a whole that is wider and larger than the one presented on the map. In general, the maps depict only a small portion of the forests that at that time existed in the area mapped.

4.3 Relief

On the maps from before the nineteenth century, hills and mountains are drawn as shaded molehills of various shapes and sizes, but with no relation to the actual elevation (Figure 3). Higher-elevation mountainous regions represent the approximate location and area of elevated landscapes, which primarily communicate the size of the geographic feature to the map reader. In the nineteenth century, relief was primarily depicted using the plastic method with hachures, whereby the thickness and length of hachures expressed the inclination and length of terrain, and their position and distribution indicated specific landforms. This method proved to be very accurate, which was greatly contributed to by its scientific justification in 1799 (Gašperič 2010). On Kozler's map, relief is thus depicted with spot elevations and hachures. Despite its monotonous black-and-white depiction of relief, this plan-view representation shows the characteristics of elevated areas across the entire map very realistically and evenly.

Before the nineteenth century, relief was represented using symbolic stylized signs for elevations, which had the shape of mountains and were stereotyped, because they were always shaded on the right side, with a typically narrower peak. Through this, the cartographic symbol reflected the understanding of a steep rise and descent of a slope and of mountains forming a mountain range, which can represent an unpassable barrier. This is also how elevations are depicted on the four older maps: as spatial barriers at which roads and rivers stop or must go around them. The conception of mountains as barriers is also reflected in the Slovenian collocation *gorska pregrada* 'mountain range' (literally: 'mountain barrier'), which can have an impact on weather or road construction. In addition, Slovenian also uses the term *gorska veriga* 'mountain chain', in which the linking of mountains together is metaphorically associated with a chain and conceptually with forming a contiguous series. The latter confirms the thesis that the cartographic symbols on older maps were based on the conception of mountains as chain-like spatial barriers.

The development of cartography around 1800 led to a change in the cartographic representation of relief, which is why Kozler's map differs greatly from the other maps. With the hachure method, elevated areas can be represented in plan view (i.e., more realistically). The representation moves from the iconic sign to greater abstraction and hence the symbolic sign: pointy peaks are iconically turned into triangular symbols on the map. This provides a higher-quality representation of terrain, and mountains no longer evoke an explicit association with spatial barriers.

4.4 Water

The maps analyzed show rivers, lakes, and seas. On Lazius's map, rivers are depicted with area symbols of various oblong shapes. Rivers are represented disproportionately to other features, but the map nonetheless makes a distinction between rivers in terms of their size and length. The course of larger rivers is accentuated with intermittent lines (most likely indicating waves and currents). The other maps studied use a combination of line and area symbols, which have a more convincing cartographic effect. As expected, the representation of streams is of the highest quality on Kozler's map, on which area symbols are rare. However, it is difficult to distinguish between rivers and roads.

The sea is only marked in color on Lazius's map. On all the other maps, the coast is marked with thin parallel lines. The sea is depicted in various ways (parallel hachures, lines, or sea currents), but this is primarily merely a decorative addition.

The maps analyzed also contain certain special features (Figure 4). On Lazius's map, certain settlements on or along rivers are depicted like islands in the middle of the river (in what is now Croatia), and Savica Falls (*Fons Saus*) is the only water feature depicted with a point symbol. Imaginary creatures (Lazius) and ships (Lazius, Homann) are also depicted on the sea. All the maps show Lake Cerknica, in which swallow holes are also depicted. As a typical karst feature and a natural wonder of Carniola (part of the year it is its largest lake and part of the year it is its smallest lake), it is a prominent element on the map, which cartographers before Homann depicted in the form of an excessively large ellipse.



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Figure 8: Typical representations of relief on maps by Lazius, Mercator, Homann, and Kozler.

On the maps analyzed, water features are represented with line or area symbols, which, as expected, have a metaphorical reference to a natural feature. On color maps, water features are exclusively marked in blue, which is stereotypically associated with water, regardless of its true color (e.g., brown or green). Rivers represented with line symbols reflect the cartographer's perception of the (linear) river course, rather than the width of the riverbed or the river network. A river is perceived as water that flows through a riverbed in a specific direction. The depictions of river basins on the map are reminiscent of a tree with a stem (i.e., the main river) and branches (i.e., tributaries). This is also reflected in the Slovenian expression *razvejano porečje* 'branched basin', which shows a conceptual connection between a river basin and a tree. This conceptual connection can be most clearly seen on Lazius's map, on which the Sava and its tributaries clearly resemble a tree. On the other maps analyzed, water is marked with black lines; rivers are represented with



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Figure 9: Typical representations of water features on maps by Lazius, Mercator, Homann, and Kozler.

one line or two parallel lines with a light uncolored surface in between. The branched structure of river basins is depicted more accurately and clearly on these maps, which is why the basins on them are not so reminiscent of trees anymore. In general, rivers are oriented correctly, although in some places the tiny meanders are clearly made up and only have a symbolic meaning. This reflects the stereotypical necessity for meandering riverbeds and branched basins, which also arises from the cartographer's lack of familiarity with the area mapped.

On Kozler's map, it is difficult to identify the rivers and their basins because the linear river representations resemble the representations of roads so much that it is difficult to distinguish between the two. In addition, it is also necessary to take into account the association between rivers and roads because both are understood and depicted as lines connecting places. Thus, they represent a (communication) link between two points or places. Even though rivers vary more in terms of width, from a cartographic perspective they are stereotypically associated with a stable, one-way linear flow in the riverbed. Here, a connection arises between the two symbols: both the river and road run or lead somewhere.

Lakes are depicted using area symbols, which mostly take a generalized form. Even though there are only two major permanent lakes in Slovenia (i.e., Lake Bohinj and Lake Bled), they are not included on Lazius's map. Mercator's map only shows Lake Bohinj, whereas the last two maps show both lakes. However, all maps include intermittent Lake Cerknica with a detailed depiction of swallow holes, which testifies to the uniqueness of this karst feature. On Homann's map, a depiction of Lake Cerknica with marked and named swallow holes and a description of this karst feature is added in the bottom right corner, following Valvasor's model.

The shores of lakes and the sea are marked with short parallel lines, which represent the border between land and water. This has to do with the stereotypical conception of a shallow water area, possibly cliffs, illustrating the change in relief at the contact of land and water.

5 Conclusion

Based on the analysis of five representative maps of Slovenian territory, certain trends related to social concepts (settlements as complete units, vegetation stereotypically depicted as deciduous trees, mountains perceived as spatial barriers, river basins depicted as branched trees, and rivers as lines cut into terrain) were identified in the development of cartographic elements from the sixteenth to the nineteenth century.

In cartography, a map is an aggregate of cartographic elements depicted with cartographic symbols. In the semiotic sense, a map is a range of codes expressed in visual interpretations oriented in time and space and combined into a final form: the map. These codes are fairly independent and can also differ (Wood and Fels 1986). An old map is a cultural artifact, a culmination of choices expressing the conception and value of a specific area or part of the world. This aspect is expressed in code, through which all meaning is conveyed to the map reader in an intelligible way. Hence, maps are a good source for cultural analyses because they often highlight various social views and values (e.g., forest areas, Lake Cerknica, or specific settlements). At the same time, old maps cannot escape the grasp of myth within the context of semiotic analysis. Namely, the purpose of a map is to persuade the reader that it is a realistic reflection of an area and social system (Wood and Fels 1986). Because they always draw their content from a concrete area, they seek to be reliable, even though they often deviate significantly from reality. However, this already has to do with the development of cartography, rather than the cartographer's perception, which has remained the same until today.

Especially with regard to the representation of relief, the analyses presented in this article reveal the development from a concrete and symbolic representation (e.g., a molehill representing a hill or mountain) that imitates a stereotypical image from the environment into a more abstract representation and use of iconic cartographic symbols (e.g., hachures). Other cartographic elements were also found to primarily depict space in an iconic manner on maps created before the nineteenth century. Symbols are stereotypical metonymic images of a specific feature depicted on the map. This can be clearly seen with forests, which are depicted with a typical forest element (i.e., a tree or a group of trees); settlements, which are represented with a building or a group of buildings; and rivers, which are depicted as curvy lines. It can be established that the metonymic cartographic elements that the cartographers used were sufficiently illustrative and clear for the maps to still be intelligible and readable today. However, with more recent symbolic cartographic

signs, resulting from the nineteenth-century development of cartography, the readers must know the meaning of an individual sign, regardless of their direct experience with the feature depicted on the map (e.g., vegetation, relief, etc.). This is also confirmed by the legend printed on Kozler's map and the absence of a legend on all the other maps.

The development from iconic to symbolic cartographic signs is generally apparent, and their conceptual background can also be traced (e.g., of complete shapes, such as circles or squares). This development is the most evident with the depictions of settlements, which moved from the symbolic depiction of a cluster of buildings to a symbolic circle or square – that is, a complete form, which could also be interpreted based on the conception of a settlement as a complete residential product of society. Rivers and roads are marked very similarly on all maps (i.e., with lines) and on some (e.g., on Kozler's map) they are difficult to distinguish. These are conceptually similar representations (lines), which connect places (river routes) and facilitate transport between them (with boats and rafts).

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