CHAPTER 3

Early Modern Nautical Charts of the Adriatic Sea as a Medium of Communication

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1 Introduction

The Adriatic Sea, historically and during the early modern period, was a significant maritime corridor in the Mediterranean. Its strategic position as a connection between continents made it an important route for intense economic and cultural exchanges (Braudel 1997). Coastal settlements, ports, and a network of islands provided opportunities for the development of maritime trade while presenting significant navigational challenges. Nautical charts were indispensable for ensuring safe navigation in this complex geographic landscape, but their purpose extended beyond mere technical aids.

Communication can be simply defined as "the sharing of experiences." People communicate using various signs, including symbols, which enable indirect and mediated sharing of experiences. Symbols can be defined as entities that represent or refer to something else (Tubbs 2003). They

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convey complex messages that go beyond the graphical (visual) or linguistic simplifications of the subject or element involved in communication. This symbolic dimension is evident in nautical charts, which combined practical navigation with symbolic representation to convey a deeper understanding of the Adriatic region.

In 2021, members of the International Cartographic Association adopted a new definition of a map: "A map is a medium designed for the communication of generalized spatial information and their relationships" (Lapaine et al. 2021: 1). This concise definition directly identifies maps as media for communication. Early modern nautical charts of the Adriatic align with this definition, serving as tools for both navigation and the dissemination of cultural, political, and spatial knowledge. Koláčný's (1969, 1977) communication of cartographic information model provides a valuable framework for understanding the interactive role of charts: they acted as a medium for transmitting encoded information from cartographers (senders) to chart users (receivers), with successful decoding relying on the latter's knowledge and experience.

According to John B. Harley (1988), maps are not objective representations of space, but social constructs shaped by the perspectives of their creators. Nautical charts of the Adriatic epitomize this concept, encoding complex layers of meaning through their elements. The studied charts were part of a broader system of spatial organization and communication. Cartographic signs, toponyms, scales, allegorical representations, and symbols were used to encode information tailored to the needs of users and patrons alike. This encoding process involved choices by cartographers, shaped by the technical demands of navigation and maritime powers.

Nautical charts reflected the contested nature of the Adriatic, where the Venetian Republic, the Ottoman Empire, and the Habsburg Monarchy competed for control. These powers, particularly the Venetians, used charts to assert dominance, legitimizing their territorial claims and shaping perceptions of the region's geography. For instance, the Venetian naming of the Adriatic Sea as the *Golfo di Venezia* signified political hegemony. Similarly, religious and confessional symbolism, such as the cross or the crescent moon, depicted on compass roses, underscored the ideological divide between Catholic and Islamic powers (Faričić et al. 2023a). This research investigates the multifaceted roles of charts, emphasizing how early modern nautical charts of the Adriatic were dynamic tools of communication.

2 Research Methodology

The research employed a combination of qualitative and quantitative methods, with a predominance of qualitative approaches. Key methods included the analysis of relevant literature to contextualize the problem and establish a foundation for the comparative study of early modern nautical charts of the Adriatic Sea. The analytical-interpretative method was utilized within a historical-geographical framework to conceptualize new insights. The diachronic method facilitated the tracking of the development of nautical charts over centuries and the analysis of changes in content quality, design, and communicative potential.

The research aimed to investigate early modern nautical charts of the Adriatic Sea as vital communication media, emphasizing the decoding of cartographic elements. It concentrated on understanding how charts, through their representation of geographic reality, cultural and political influences, and navigational needs, conveyed complex messages that extended beyond the technical aspects of navigation. Special emphasis was placed on the analysis of symbolism, toponyms, cartographic signs, and scales to clarify how these charts reflected and shaped perceptions of the Adriatic Sea.

The theoretical framework was grounded in communication theory, interpreting nautical charts as multifaceted media for transmitting information between cartographers (senders) and chart users (receivers). These charts were considered complex communication channels, conveying not only geographical information but also political, cultural, and ideological messages. Deconstruction analysis, inspired by the works of Harley (1988, 1992), had an important role in uncovering the connections between the political, religious, and social contexts of chart production and their content.

Toponym analysis involved comparing geographic names from late medieval, early modern, and contemporary nautical charts to evaluate their significance for navigation and socio-economic functions. The study also examined cartographic signs crucial for navigation, focusing on those typical of nautical cartography. Significant navigational signs on the studied charts were highlighted, and a comparative analysis was conducted, comparing these signs with those used on modern nautical charts. Additionally, the analysis of scales documented the number of graphical scales, and the types of units of distance used across charts. Communication noise was identified through recurring errors across

different charts, further enriching the understanding of cartographic communication practices.

The research encompassed 84 nautical charts of the Adriatic Sea (42 manuscript and 42 printed), predominantly created in Venice, the leading maritime centre of the Adriatic at the time. Complementary to chart analysis, sailing directions provided additional context. Charts were sourced from institutions such as the Biblioteca Nazionale Marciana in Venice, the Croatian State Archives, the National and University Library in Zagreb, and the University of Trieste. Digital reproductions from European and American libraries and private collections, particularly the Marco Asta collection, were also utilized.

3 The Complexity of Maps as a Medium of Communication

Understanding the complexity of maps as a medium of communication requires a concise historical perspective on the evolution of cartographic theories. By the late nineteenth century, cartographers sought to establish cartography as a science. A key concept of this period was the "logic of maps," as defined by Max Eckert (1908). He argued that scientific rigour would eliminate subjectivity and ensure the objectivity of maps, despite their artistic elements. Eckert described maps as products of "art clarified by science." While he attempted to establish a theoretical framework for cartographic practice, the lack of advanced communication and semiotic theories at the time limited his practical impact (Pápay 2018). However, Eckert's work laid the foundation for the functionalist theory that emerged after World War II.

In 1952, Arthur H. Robinson's work *The Look of Maps* established the foundations of the communication paradigm in cartography, defining maps as a medium for transferring information between cartographers and users. His concept of "functional design" emphasized the importance of visual methods for clear and effective communication. Robinson stated, "the most scientific cartography concerns the dissemination of spatial knowledge" (Robinson 1952: 17), implying that maps are primarily tools for conveying the author's spatial understanding without considering user needs or feedback.

3.1 Communication Theory in Cartography

Within communication theory, the central issue is the accurate reproduction of the intended message across stages of the communication process. Maps are conceived as representations of reality, designed to provide users with precise and readable information. However, their success depends on understanding users' needs, knowledge, and context of use (Koláčný 1977). Claude Shannon and Warren Weaver's (1949) foundational communication model, which includes an information source, sender, channel, receiver, and destination, was later applied to cartography. Models simplify reality to highlight aspects crucial for solving specific problems (Maletzke 1998). In cartography the transmission of information occurs within the system of cartographer–map user, underscoring the importance of understanding the essential features of cartographic communication (Robinson and Petchenik 1975).

Maps differ from other media as they require specific skills to interpret and understand spatial relationships. Cognitive processes can lead users to interpret the same map information differently, highlighting the importance of effective design and standardized conventions. Konstantin A. Salitchev (1970) emphasized that cartography has strong ties to the theory of scientific information, viewing maps as critical sources of knowledge. Michael K. Bocharov (1967, as cited in Salitchev 1970) defined cartography as the science of transmitting information through cartographic forms, linking it with information sciences. Salitchev further emphasized the user's role through the concept of "theory and methods of map use," complementing the basic communication model.

Antonín Koláčný (1969) defined communication of cartographic information as a unified process that integrates the creation and use of maps. This approach enables the development of maps that meet not only technical standards but also the actual needs of users, ensuring optimal functionality in diverse contexts. His communication model focuses on cartographic information rather than the map's content. Cartographic information encompasses the intrinsic meaning and interpretation of the reality represented by maps. He outlined seven stages in his model, from selective observation of reality to intellectual transformation and eventual user application. This process emphasizes the selection, transformation, and objectification of information to create cartographic symbols that are comprehensible to users (Fig. 3.1). It begins with the cartographer's selective observation of reality, transforming a multidimensional model into a

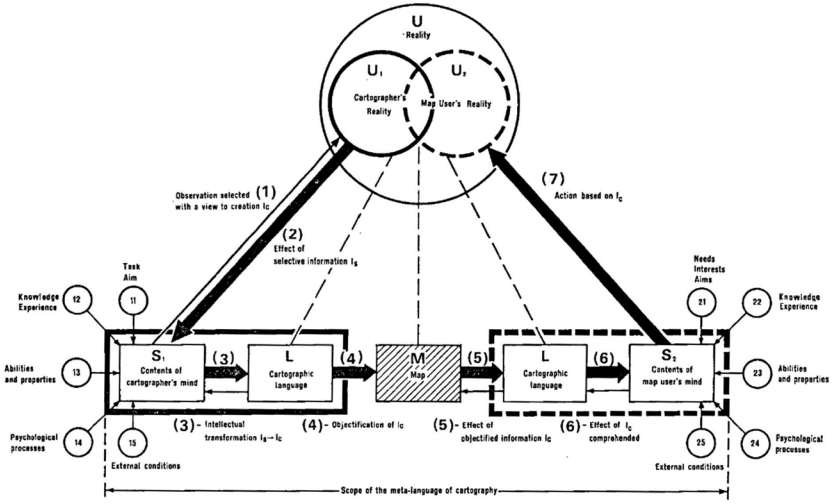


Fig. 3.1 Koláčnýs's communication of cartographic information model (Source: Koláčný 1969: 41)

two-dimensional representation. The information provided by the map enriches the user's knowledge, allowing for a reinterpretation of reality based on newly acquired cartographic insights. This process underscores the importance of not only technical precision but also a profound understanding of user needs, perception, and cognitive abilities (Koláčný 1969, 1977).

The aforementioned communication model provided a comprehensive view of the interaction between cartographers and users, highlighting that maps are not passive media but essential elements in the meaning-making process. The communication of cartographic information has become a key component of cartographic paradigms, integrating map creation and use into a unified process. This integration improves the functionality and precision of maps, ensuring they meet user requirements. In cartographic communication systems, key concepts include the observer, the map user, and the map reader (Robinson and Petchenik 1975). Observers acquire spatial knowledge through map interpretation, while users and readers utilize maps for specific purposes, such as determining navigational routes, without necessarily expanding their knowledge.

3.2 The Layered Dimensions of Maps as Medium of Communication

According to John S. Keates (1984), cartography is both a scientific and artistic discipline. While scientific approaches ensure accuracy and functionality, excluding art from cartography diminishes its aesthetic and symbolic value. Maps often include artistic elements, such as textures, shading, or iconographic symbols, that enhance their interpretive richness. Maps cannot be reduced to a binary division of scientific and artistic elements; their value lies in the complementarity of these approaches. The scientific approach employs reductionist methods to analyse processes, while the artistic approach provides a holistic perspective through intuition and critical experience. These approaches are mutually enriching, particularly in aspects such as perception, colour theory, and visual aesthetics (MacEachren 2004).

Postmodernist theorists such as Denis Wood and John Fels (1986), Wood (1992), and Harley (1988, 1992) highlighted the inherent subjectivity and rhetorical content of maps, opening new dimensions in cartographic studies. They emphasized the role of maps as social and political constructs. Harley's deconstructionist approach analysed maps as textual constructs imbued with symbolism, politics, and ideology. Maps are not neutral representations of reality; they legitimize dominant narratives, control space, and shape social reality. For instance, symbolic elements such as flags and allegorical depictions on early modern charts often served as tools of political legitimization, conveying messages of territorial aspirations and hegemonic ideologies.

A semiotic approach views maps as systems of signs with multiple meanings. According to Alan M. MacEachren (2004), the meaning of cartographic symbols is divided into denotative (what the map represents) and connotative (its broader meaning and symbolism). For example, while blue on maps often denotes water, light blue can signify shallow areas on nautical charts. Connotatively, symbols may include political or cultural implications, such as boundaries reflecting territorial ambitions.

Postmodernist perspectives, including discursive analyses (Barnes and Gregory 1997), argue that cartographic representations are not neutral but reflect social values and ideologies. Maps are not merely depictions of space but active participants in shaping it (Pickles 2004). Rob Kitchin and Martin Dodge (2007) proposed an ontogenetic approach, viewing maps as dynamic processes that transform with each use. Maps are not static

objects but tools for solving spatial problems in specific contexts. Each user interprets maps based on their needs, prior knowledge, and cultural background, making maps relational and mutable entities. The post-representational approach focuses on the social implications of cartographic representations, enabling a deeper understanding of the role maps play in coding the world.

A study of these theoretical frameworks reveals that maps are multilayered media, integrating scientific, artistic, semiotic, cultural, and other dimensions. Their interpretation requires integrating various theoretical frameworks, from functionalist and semiotic models to postmodernist critiques. Early modern nautical charts exemplify this complexity, where decorative elements, toponyms, cartographic signs, and other chart elements not only convey spatial information but also reflect the social, political, and cultural power dynamics of their time.

4 Imagology: Compressing Reality into Symbolism

The effectiveness of maps as communication tools lies in their persuasive and suggestive power, often causing users to disregard possible distortions of reality. As semiotic systems, maps contain symbolic representations of compressed reality, organizing geographical knowledge into visual schemes subject to culturally accepted interpretations of territories—both real and abstract. Their communicative potential also includes an imagological aspect, whose interpretation hinges on the dichotomy of Self/Us and the Other (Culcasi 2008). Geographically, the Other is placed on the margins, reflecting the discursive construction of identity and dominance, often tied to imperial and colonial projects (Mountz 2009).

The deconstruction of maps, as proposed by Harley (1988, 1992), is important for uncovering the ideologies and power structures that shaped their content. Identifying political, religious, or social centres of power reveals how cartographers depicted their empires as superior, often excluding the Other from charted spaces (Mlinarić and Gregurović 2011). An example of this is the naming of the Adriatic Sea as the Venetian Gulf (*Golfo di Venezia*), portraying the entire Adriatic as an extension of the Venetian harbour (Marković 1993; Faričić et al. 2023b). Early modern nautical charts, like other maps, allowed users to perceive spaces through the lens of imperial and cartographic policies, while providing a historical and cultural context. The messages conveyed by charts can also be

interpreted through vexillological, heraldic, and allegorical elements, which often reflect the political, cultural, and confessional narratives of their time.

4.1 Flags and Heraldry: Communicating Territorial Authority and Identity

Late medieval and early modern cartographers used flags and heraldic symbols on charts to convey layered messages about territorial authority, religious identity, and political relations. Examples such as the charts of Angelino Dulceti (1325/1330), Antonio Millo (1583), Joan Martines (second half of the sixteenth century), and Pietro Cavallini (1677) illustrate how these symbols functioned not only as aesthetic elements but also as tools for decoding territorial and cultural relationships, even in the absence of delineated borders.

On the eastern Adriatic coast, Dulceti depicted three flags: a quartered blue-and-white flag near the toponym *Narent*, a rectangular yellow flag with a white disc and red cross near *Sibinicho*, and a red-and-yellow flag with a white star near *Segna*. These flags marked territories under the jurisdiction of various entities. Dulceti also included flags bearing symbols such as a crescent moon (associated with Islam and Arabian sultanates), the winged lion of St Mark (symbolizing Venice), the stylized lily (symbolizing Florence), and two crossed keys (representing the Papal States), among others. These features indicated territorial control and confessional identities, reflecting the Adriatic as a site of long-standing imperial conflicts and encounters between diverse cultures.

Another example is Millo's 1583 chart, which differentiates the territorial and confessional affiliations of the Adriatic coast through nine flags adorned with heraldic symbols, including the winged lion, double-headed eagle, crescent moon, and St Blaise (Fig. 3.2). The largest flag, depicting the winged lion of Venice, is placed near Venice, with smaller ones positioned near Split (*Spalato*) and Kotor (*Cataro*). A square flag with a black double-headed eagle on a gold field, located near Rijeka (*Fiume*), represents the Habsburgs—kings of Hungary and Croatia and emperors of the Holy Roman Empire. Flags featuring crescent moons, symbolizing Islam and the Ottoman Empire, are placed near towns such as Obrovac (*Brouazo*), Drijeva or Gabela (*Naronra*), Durrës (*Durazo*), and Butrint (*Butrintio*). The flag of St Blaise, the patron saint of Dubrovnik (*Ragusi*), is placed near that city. Millo also depicted two coats of arms: the Keys of

Fig. 3.2 Antonio Millo, nautical chart of the Adriatic Sea, Venice, 1583 (Source: Biblioteka Narodnowa, Warsaw, BN ZZK 0.2399)

Heaven on the coast of Abruzzo, representing the Papal States, and two diagonally positioned towers on the coast of Apulia, representing the Kingdom of Naples.

Vexillological and heraldic practices on late medieval and early modern nautical charts highlight how visual symbols were leveraged to communicate authority, territory, identity, religion, and cultural affiliations, extending their meaning beyond mere decoration. These elements linked charted spaces to specific communities or cultural spheres, providing insights into the narratives of their time.

4.2 Metaphors of Dominion: The Allegorical Venice

Allegories have appeared on maps since antiquity. On Venetian charts, allegories became increasingly common, particularly with the advent of printed charts. Venetian political culture in the early modern period—perhaps more than any other city—relied on visual imagination to shape and communicate its political ideology, and allegories to give a pictorial form to their sovereignty (Horodowich 2021).

One of the most frequent allegorical depictions on charts is the Venetian lion—lion of St Mark. Beyond charts, this symbol appears on Adriatic coastlines under Venetian rule—in reliefs, statues, paintings, and written works. That lion is characterized by its saint's (in fact Evangelist Mark's) halo, book, and wings. Most lions are depicted as *leone alato andante*—a walking lion shown in profile. Occasionally, the lion is portrayed in a unique Venetian pose, seen from the front with spread wings, called *leone in moleca* (or *leone in maesta*), resembling a crab with open claws. This specific iconography symbolized Venice's divine mandate, its expansion from sea to land, and the sacred unity of Venice, its lagoon, and the Adriatic Sea (Zorzi 1980; Griffith 2005; Pedani 2006; Rizzi 2012).

Alvise Gramolin's 1624 chart features the winged lion of St Mark depicted as *leone alato andante*. In a similar vein, Jean François Roussin's (1661) chart features a winged lion positioned above a Venetian cityscape, visualy dominating the chart and underscoring Venetian propaganda and dominance over the depicted region. The chart's title, *Carta dv Golfo di Venetia*, further emphasizes Venetian claims over the Adriatic.

On charts by Gasparo Tentivo (circa 1700) and Vincenzo De Lucio (circa 1792–1796), nearly identical personifications of Venice appear (Fig. 3.3). Tentivo titled his chart *Carta Marittima del Golfo di Venezia con tutte l'Isole e Scogli che in esso si trovano* (Maritime Chart of the Venetian Gulf with All Islands and Islets Found Within It). By inscribing the title across the horonym *Dalmazia*, Tentivo visually suggested Venetian control over this part of the eastern Adriatic coast. De Lucio incorporated an allegorical depiction of Venice on both the chart sheet representing Central Dalmatia and the one depicting the island of Zakynthos (*I. Del Zante*) in the Ionian Sea—one of Venice's southernmost possessions,

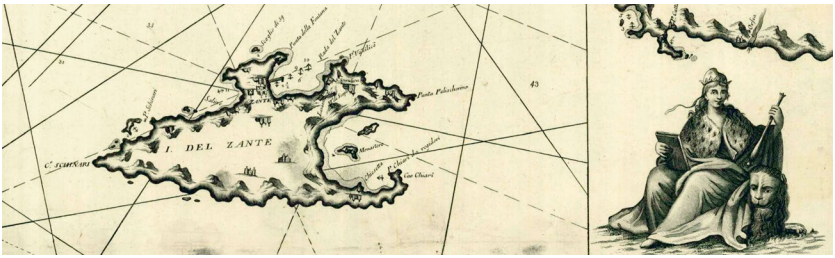


Fig. 3.3 The personification of Venice; Vincenzo de Lucio, ca. 1792–1796. (Source: Private collection Marco Asta, Bologna)

intermittently ruled from 1484 to 1797 (Miller 1903)—further asserting its imperial narrative.

Venice was often personified as a female figure. Tentivos's and De Lucio's allegories portray a richly adorned woman draped in a sable fur cloak, wearing the *Corno Ducale* (doge's cap), holding a book in her right hand and a sceptre in her left—symbols of the doge's authority (Garret 2001). The lion of St Mark is placed beside her, reinforcing Venice's dominion. Venice was also called the "Queen of the Adriatic" (Davenport Adams 1869), a title reflected in numerous books, paintings, and other works of art.

Allegorical representations on early modern nautical charts caption the sophisticated visual imagination of Venetian cartographers in articulating political ideology and territorial sovereignty. Venice employed a wealth of allegories to create powerful visual representations of its cardinal virtues and political culture. Allegories, as metaphorical forms, enabled users to recognize and identify deeper meanings in symbols and personifications, pointing to the political aspirations and cultural authority of the Venetian Republic.

5 Toponyms: Navigational, Cultural, and Political Dimensions

A toponym is a concise linguistic descriptor that effectively replaces excessive descriptions, facilitating spatial orientation and everyday communication (Faričić 2011). Nautical charts, being more than technical instruments, function as expressions (and productions) of ideological values, social and cultural norms, and worldviews. In this context, toponyms, inter alia, have a crucial role in understanding the performative process of "territorialization" and can be used to study cultural identity and political turmoil in the charted space. Changes of toponyms are not only part of the historical fluctuation of language, but they also act as "markers" of geographical features, territories, and identity spaces (Siniscalchi and Palagiano 2018). They are the longest-lasting link between people and places, providing a robust foundation for understanding cultural interaction (Skok 1950). Their analysis provides insights into how geographic names on nautical charts reflect and shape navigational practices, cultural identities, and political territories.

5.1 Hierarchy and Style in Toponyms

The characteristics of toponyms differ significantly between manuscript and printed charts, with the style of writing toponyms being a distinctive feature of portolan charts. On these charts, toponyms are most often inscribed perpendicular to the coastline, creating a curvilinear effect that follows the shoreline. Toponyms for islands, inscribed within the marine spaces of the chart, are typically rotated 180° compared to those representing mainland locations. According to Harley (1992), hierarchical tendencies in cartography involve omitting less significant spatial features—those outside the immediate purpose of the chart—in order to emphasize key information. This is evident in the hierarchical structuring of toponyms on early modern nautical charts of the Adriatic. On manuscript charts, more significant toponyms, such as those denoting safe harbours with resources like water and provisions, were marked in red (Nordenskiöld 1897; Brown 1979; Monmonier 2004), while others were written in black. With the advent of printing, the practice of marking toponyms in red and rotating island names ceased. All toponyms began to be inscribed in black, retaining differentiation through font size or the use of uppercase letters to emphasize more important geographic features. This visual hierarchy enabled chart users to quickly identify key locations and their significance (Fig. 3.4).

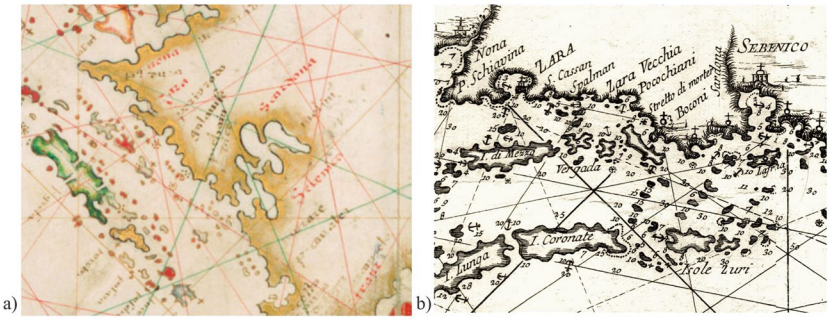


Fig. 3.4 The hierarchy of toponyms: coloured in red on a manuscript chart: (**a**) Diogo Homem, 1570, and use of capitalization on a printed chart; (**b**) Lodovico Furlanetto, 1784 (Sources: (a) Hrvatski državni arhiv, Kartografska zbirka, Zagreb, HR-HDA-902, D.XIV.6; (b) Državni arhiv u Zadru, Kartografska zbirka, Zadar, HR-DAZD-383 No. 3.1)

5.2 *Renaming History: Toponyms in Political and Cultural Transformations*

Toponyms often carry a symbolic component, reflecting the motivations of those who selected them and the cultural context of their choice (Orth 1987). Ideologically motivated toponyms are particularly susceptible to change during periods of radical socio-political upheaval, as renaming shapes new identities and alters or erases symbolic pasts. Thus, toponyms become a reflection not only of places but also of cultures (Šakaja 2015). Within this study, the phenomenon of multiple naming (polionymy) is particularly significant, where a single geographic feature bears several names. This allows for a diachronic perspective on the chronology of naming and changes, as well as a synchronic analysis of cartographers' or patrons' attitudes towards a space (Skračić 2009; Crljenko and Faričić 2022). A notable example of polyonymy is the Adriatic Sea, whose nomenclature reflects diverse political and cultural influences. Names such as *Mare Adriaticum* and *Golfo di Venezia* testify to historical and political processes that have shaped perceptions of this space. The Latinized name *Mare Adriaticum* highlights cultural continuity from Greco-Roman times (Kozličić 1990; Faričić et al. 2023b), while *Golfo di Venezia* represents Venetian political ambitions and hegemonic propaganda. During the late medieval and early modern periods, Venice viewed the Adriatic as its economic and maritime domain, forming the basis of its economic and political dominance (Lane 1973; Vivo 2003). Out of 84 analysed charts, the Adriatic Sea was unnamed on 34, referred to as the Gulf of Venice on 29 and as the Adriatic Sea on 11, and named with both terms on eight, exclusively on printed charts. The reproduction of Venetian chart templates in European cartographic centres, particularly in the Netherlands, France, and England, facilitated the spread of that name. However, this reproduction was often technical and uncritical, without deliberate transmission of political messages. The name "Gulf of Venice" gradually fell out of use and was replaced by "Adriatic Sea," reflecting shifting political and cultural dynamics, particularly after Napoleon dissolved the Venetian Republic in 1797. The Venetian choice of *Golfo di Venezia* exemplifies the "foundational technology" (Giraut and Houssay-Holzschuch 2016) through which Venetian cartographers sought to legitimize a new political and cultural order on both regional and global scales, as the name became embedded in European cartographic traditions. This practice highlights the power of charts as instruments of political propaganda. Changes in the

Adriatic's nomenclature reflect the complexity of socio-political and geo-political processes, making toponyms an important tool for understanding historical dynamics.

The analysis of the geographic name of Lokrum Island, situated in the vicinity of the Dubrovnik harbour, reveals the intricate layers of the communicative potential of charts and their role in shaping geopolitical discourse. As a strategic point and a target of hostile attacks, it became a focal point of conflict between the Republic of Dubrovnik and the Venetian Republic, culminating in the so-called Lokrum Crisis of the seventeenth century (Kunčević 2021). Venetian documentation from the 1620s often refers to the island as *Scoglio di San Marco* (Saint Mark's Island) (Makušev and Šufflay 1905). On late medieval and early modern charts, however, common names include *Lacroma* and *Croma*. The name *Scoglio di San Marco* first appears on a 1679 chart by Marccheto Fassoi. These variations in naming, ranging from the Venetian name to the local Lokrum (Fig. 3.5), illustrate how cartography records and reinterprets historical conflicts and cultural layers of space. The continued use of *Scoglio di San Marco* on charts following the fall of the Venetian Republic, including British and French charts and sailing directions of the nineteenth century,

Fig. 3.5 Depictions of Lokrum island on early modern nautical charts of the Adriatic: (**a**) Lokrum named as *I. Cromma*; Pieter Goos, 1650; (**b**) Lokrum named as I. *St. Marco*; Joseph Roux, 1764 (Sources: (a) Private Collection Marco Asta, Bologna; (b) Nacionalna i sveučilišna knjižnica u Zagrebu, Zbirka zemljovida i atlasa, Zagreb, S-JZ-XVIII-116)

demonstrates the resilience of cartographic elements (Sutlović 2024a). While the name on Venetian charts served as a vehicle for disseminating geopolitical narratives, later European cartographers reproduced it without its original symbolic connotations. By reflecting and perpetuating the cultural and political ideologies of their creators, charts transcend their technical function and become tools of communication that shape historical and cultural understanding of space.

5.3 Island Naming Practices: Balancing Scale and Maritime Priorities

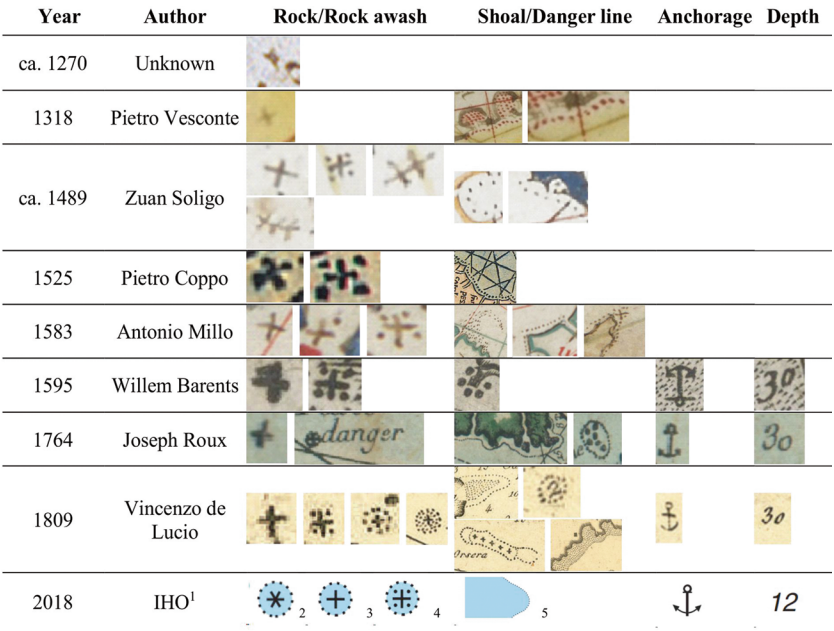
The naming of islands on Adriatic nautical charts during the Middle Ages and early modern period depended significantly on their socio-economic and navigational importance and the available space on the chart. In the absence of standardized generalization methods, the depiction of islands was subjective, relying on the amount of available information and the qualifications of the cartographer. The charts analysed indicate that relatively few islands were named, with no significant variation in the number of named near versus offshore islands, despite the higher number of near islands. Nonetheless, small islets like Galijula, Jabuka, Palagruža, and Pianosa were consistently depicted and named. For example, on charts at a scale of 1:1,000,000, an island with an area of 1 km^2 should be represented as 1 mm × 1 mm. Yet, small islets with areas below 1 km^2 were exaggerated and also named. These islets were depicted and named because of their critical role in terrestrial navigation. Failing to name or depict them would compromise maritime safety. Jabuka and Palagruža were unnamed on only 4% of the analysed charts, primarily those representing areas broader than the Adriatic Sea. The naming of small islands and islets reflects their vital role in maritime safety and efficient use of the Adriatic's maritime space. Even on charts at smaller scales, navigation-critical islets were regularly depicted and named, whereas larger islands with less navigational significance often remained unnamed. This practice highlights how cartographers prioritized maritime safety and navigational needs over strict adherence to technical scaling requirements. Through the consistent naming of key islets, charts served as communicative tools, enabling safe navigation and orientation in the Adriatic Basin while demonstrating cartographers' deep understanding of the specific needs of maritime traffic.

6 Cartographic Signs: The Language of Navigation

Cartographic signs are an essential component of any chart, as they enable effective communication between cartographers and users. Without them, the utilitarian value of charts would be almost non-existent. Their historical development reflects increasing complexity and sophistication, spurred by technological advancements in the early modern period (especially copperplate printing) (Robinson 1975; Verner 1975). However, during this time, there was no formal organization to guide cartographers in standardizing signs. In the Renaissance cultural ethos, which celebrated individual creativity, such constraints would have conflicted with humanistic values (Delano-Smith 2007). While semiotic inconsistency was common, particularly on topographic charts, maritime charts gradually moved towards a form of proto-standardization, adopting "customary signs" that facilitated clear and consistent communication. Safe navigation depended on unambiguous markings for natural hazards.

On the oldest surviving nautical charts, signs such as crosses or plus signs marked rocks/rocks awash, while red dots indicated sandy shoals. These were the only signs providing geomorphological information relevant to navigation (Campbell 1987). On the *Carte Pisane* (ca. 1270), only one sign for rocks/rocks awash is present. Over time, this sign gained several variations. Though arbitrary in origin, these signs were critical for safe navigation, denoting invisible or hard-to-spot dangers. While not all hazards were depicted, those that were significantly enhanced navigational safety. By 1325, portolan charts depicting the Mediterranean Sea displayed up to four different forms of rocks/rocks awash signs (Clawson 1979). The first chart of the Adriatic Sea to show multiple variations was Grazioso Benincasa's 1472 chart, which used three distinct signs for rocks/rocks awash. However, most Adriatic charts featured only two forms of this sign, typically a cross (+) and a cross with dots (⁜), with the former being more prevalent (Fig. 3.6). This distinction may reflect the categorization of "hazardous rocks" into visible, above-water rocks and submerged, less visible rocks awash. This sign with its variations appears consistently across the studied charts (Sutlović 2024b).

Sign for shoals first appeared on Vesconte's 1318 chart, depicted as red dotted lines or stippling, though the colour was later changed to black. This sign remained relatively consistent throughout the studied period. Clawson (1979) also identified a similar sign denoting "dangerous curves,"



[1] International Hydrographic Organization (2021). B-410: 5, B-420:1-2, B-430: 1.

[2] Isolated rocks which cover and uncover (IHO, 2021, B-420:1),

[3] Rocks which are always underwater (IHO, 2021, B-420:2).

[4] Rocks which are awash at Chart Datum (IHO, 2021, B-420:2).

[5] A danger line (IHO, 2021, B-420:1).

Fig. 3.6 The exemplary sample of cartographic signs on nautical charts of the Adriatic Sea. Sources: Unknown author, ca. 1270, (Bibliothèque nationale de France, Paris, GE B-1118 (RES)); Pietro Vesconte, 1318, (Österreichische Nationalbibliothek, Vienna, Cod. 594 (Cimel. 20), 10v-11r); 9. Zuan Soligo, ca. 1489 (British Library, London, Egerton MS 73); Pietro Coppo, 1525 (Pomorski muzej Sergej Mašera, Piran, No. 1002307, T. 15); Antonio Millo, 1583 (Biblioteka Narodnowa, Warsaw, BN ZZK 0.2399); Willem Barents, 1595 (Stanford University Libraries, The Barry Lawrence Ruderman Map Collection, Stanford, Tooley, A-D:85, 268; K-P:10); Joseph Roux, 1764 (Nacionalna i sveučilišna knjižnica u Zagrebu, Zbirka zemljovida i atlasa, Zagreb, S-JZ-XVIII-116); Vincenzo de Lucio, 1809 (Sveučilište u Zadru, Znanstvena knjižnica, Zadar, 15188 D-20)

marked by black dotted lines, indicating areas with reefs or rocks upon which waves broke. It is likely a sign denoting a danger line. Regardless of its exact interpretation, one thing is certain—caution is required when navigating the marked area. At times, distinguishing between islands, shoals, or zones dangerous for navigation was challenging, especially for navigators unfamiliar with the region. The sign for a danger line first appeared on Abraham Cresque's chart (ca. 1370—1380) south of Corfu. While abstract, the dotted texture evoked the appearance of shallow, sandy seabed, maintaining its design with minimal changes over time. This sign, albeit modified, continues to be used on modern nautical charts.

The next sign to emerge is the sign for safe anchorage, a stylized depiction of an anchor. It is a representational or pictorial sign first used by Pîrî Reis (1520), though not on Adriatic Sea charts. It became a standard feature of nautical charts by the late sixteenth century, with William Barents (1595) introducing it for Adriatic anchorages. The sign remained unchanged throughout the studied period, undergoing only minor stylistic modifications. Barents also introduced numerical depth markings in selected Adriatic harbours, marking another introduction in cartographic signs on charts depicting the Adriatic. Following Barents, Tentivo marked soundings in the Adriatic at the end of the seventeenth century, succeeded by Ioannes van Keulen in 1700. By the second half of the eighteenth century, soundings were regularly included on charts, even though the first hydrographic survey of part of the Adriatic was conducted from 1806 to 1809, by Charles-François Beautemps Beaupré (Horvat et al. 1999; Kozličić 2006). Along with charts of the Adriatic, Jacques-Nicolas Bellin (1771) and Roux (1779) created detailed harbour charts featuring soundings. The soundings were of great importance for sailors, especially when navigating shallow areas.

Additional signs emerged during the early modern period. Buoys appeared on charts from the late sixteenth century, followed by signs for lighthouses and other light signals in the second half of the seventeenth century, and currents by the early eighteenth century. On Adriatic Sea charts, however, these signs did not become common until the late eighteenth or early nineteenth century. V. De Lucio (ca. 1792–1796) first used the sign for sea current, an arrow with a feathered tail. Giovanni Grubas's 1803 chart included both current signs and buoy markers, marking the beginning of their consistent use in Adriatic cartography (Sutlović 2024b). Labels for seabed types were not introduced until 1820, despite the British

having developed a system of conventional signs and abbreviations for seabed types as early as 1776.

The transition from the eighteenth to the nineteenth century was pivotal for the standardization of cartographic signs. This period saw the institutionalization of nautical cartography with the establishment of hydrographic offices and the application of hydrographic surveys, laying the groundwork for modern nautical charts. The continuity of rudimentary signs for navigational safety (in use since the earliest nautical charts) and anchorages (introduced in the late sixteenth century) underscores the enduring utility of these features.

The communicative potential of cartographic signs grew with the introduction and standardization of new signs, enhancing the clarity of nautical charts regardless of their origin or the region depicted. This development established a cartographic system that turned nautical charts into a universal "language" for navigators, facilitating the exchange of vital navigational information across cultural and geographic boundaries.

7 The Complexity of Map Scales

A map scale is a fundamental mathematical element of any map/chart, contributing to the decoding of its content, particularly the linear and areal dimensions as well as spatial relationships. While users of old nautical charts may not have fully understood the concept of scale as "the ratio of distances on a map to corresponding distances on the surface of an ellipsoid or sphere" (Frančula et al. 2020: 122), they were familiar with its basic function. On the studied charts, a graphical scale was regularly included. It was usually shown as a horizontal line or several lines with equal-distance divisions that typically represented a number of miles or leagues within a one-degree arc along the equator, shrunk size-wise in accordance with the map scale.

The communicative potential of a nautical chart is significantly increased when the graphical scale was expressed in multiple units of length. Until the nineteenth century, various states, regions, and even cities used their own units of distance. A graphical scale can be converted into numerical form and used for calculations, but this requires knowledge of the unit's length and the measurement system applied by the cartographer (Mušnjak 1982). This process seems straightforward, but research has shown that cartographers often misnamed individual units of distance.

Of the 84 analysed nautical charts of the Adriatic Sea, 42 included a graphical scale without any unit of distance, a feature typical for portolan charts. Adolf E. Nordenskiöld (1897) coined the term "portolan mile" for this unit. Numerous debates have arisen about the length of this mile, resulting in various values, with the most recent calculations estimating its length at 1.25 km (Marelić 2025). In the analysed corpus of charts, the first author to include a unit of distance alongside the graphical scale was Alonso de Santa Cruz (circa 1545).

By the late sixteenth century, and particularly from the mid-seventeenth century onwards, cartographers began to specify not only the unit of distance but also the number of these units "within a degree," or within the arc corresponding to one degree of a great circle. W. Barents (1595) was the first to note how many of each unit fit within one degree. Barents identified three units of distance and provided their equivalents: *Miliaria Italica/Italiaenische milen* (70 per degree), *Hispanicae Leuce/Spaensche milen* (17.5 per degree), and *Miliaria Germanica/Duytsche milen* (15 per degree) (Fig. 3.7).

Excluding *Carta di Cabotaggio del Mare Adriatico* published by the Military Geographic Institute in Milan (1822–1824), which was the result of hydrographic surveying, as many as 16 charts in the analysed corpus featured three or more units of distance alongside their graphical scales.

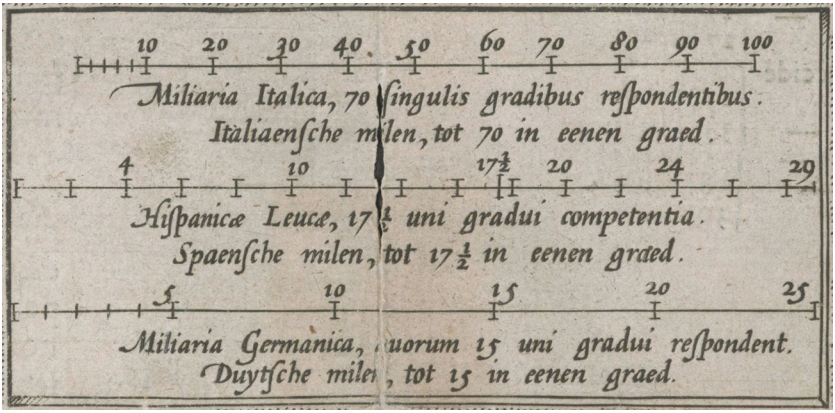


Fig. 3.7 Scales and units of distance on Barents's nautical chart of the Adriatic Sea, 1595 (Source: Stanford University Libraries, The Barry Lawrence Ruderman Map Collection, Stanford, Tooley, A-D:85, 268; K-P:10)

The most commonly noted units were: Italian mile (60 or 75 per degree), Spanish league (17.5 per degree), German or Dutch mile (15 per degree), and English or French league (20 per degree).

Due to uncritical copying of content, errors related to scale were also made by authors of nautical charts. The most frequent error involved confusing the terms leagues and miles. The modern league is generally considered to be about three miles, either statute or nautical (Moody 1950). Historically, however, the length of a league has varied significantly, ranging from approximately 2.4 to 4.6 miles depending on regional and temporal contexts (Chardon 1980). As early as 1595, W. Barents mistranslated *Hispanicae Leuce* as *Spaensche milen*. Analysis has shown that this unit referred to leagues, not miles. Similar terminological errors occurred among cartographers for Italian, German, and French units, indicating systematic issues in cartographic practices. The lack of sources in the literature explaining these errors leaves it unclear whether they arose from a single perpetuated mistake or another cause, though the first explanation is likely. The inconsistency in the use of the terms "mile" and "league" may have created problems for sailors, reducing the communicative potential of nautical charts.

The nautical charts with the greatest number of distance-units on their graphical scales were created by Keulen (1700), François Berthelot (1700), and Roux (1764). These Adriatic Sea charts feature four graphical scales with different units. While all correctly noted the quantitative value of each unit within the arc corresponding to one degree of a great circle, some included incorrect terminological designations of the units. Over time, the communicative potential of charts regarding scales improved. The chart with the highest communicative potential in this respect is *Carta di Cabotaggio* (1822–1824). In addition to scales for converting units of distance such as *Piedi di Parigi*, *passi Veneti*, *passi Napoletani*, and *Fadom Inglesi*, this chart includes numerical scales (e.g. 1:175.000, 1:70.000, 1:35.000, 1:25.000) and units such as *Metri*, *Tese di Francia*, *miglia geografici*, and *chilometri geografici*.

Based on the analysed corpus of nautical charts, it can be concluded that cartographers struggled with the terminological distinction between "mile" and "league," often using these terms interchangeably. The problems with unit terminology illustrate how semantic confusion can affect the interpretation and use of cartographic information. These challenges highlight the critical need for standardization and clarity in cartographic practices to enhance navigational safety and the utility of charts.

8 Communication Noise: Challenges of Island Naming and Positioning

In the context of communication, noise refers to any interference that negatively affects the reception of signals within a communication system. While not every disturbance obstructs the decoding of information, it can lead to difficulties in understanding messages (Shannon and Weaver 1949).

An analysis of toponymic data has revealed an issue with naming the island of Ist. Examining the chain of offshore islands from northwest to southeast between Ilovik and Dugi Otok, it is clear that the islands appear in the following order: Premuda, Škarda, Ist, and Molat. Among these, cartographers consistently named Premuda, Škarda, and Molat, while Ist was often unnamed or misnamed. On the oldest studied chart, the *Carte Pisane* from approximately 1270, Molat (*Melada*) is the only named island in this chain. On the chart by P. Vesconte (1318), Premuda (*premuda*), Škarda (*sechera*), Ist (*est*), and Molat (*mellada*) are all named. However, by the next studied chart, Giacomo Giroldi's chart from 1426, the issue with geographic names begins to emerge. Giroldi named Molat (*mellada*) and another nearby island northwest of Molat (*zanpontello*). This error persisted throughout the early modern period. The first cartographer after Vesconte to correctly name the island of Ist on a nautical chart was De Lucio (ca. 1792–1796), who added the letter "L" to the name, rendering it as *LISTO* (Fig. 3.8). By the early nineteenth century, this error disappeared, and Ist was regularly labelled with its proper toponym. Zapuntel is the name for a settlement on Molat near the strait separating Molat and Ist. It is presumed that this error originated from uncritical copying and a lack of geographical knowledge, leading to Ist being mislabelled as Zapuntel.

Other recurring errors were also identified, such as the incorrect positioning of the island of Premuda. Some cartographers erroneously placed Premuda between Susak and Ilovik, although in reality, it lies southeast of Ilovik. This mistake was made by W. Barents (1595), Willem J. Blaeu (1621), Pieter Goos (1650), Hendrick Doncker (1655), Francesco M. Levanto (1664), John Seller (1677), Pierre Van der Aa (1700), and John Mount and Thomas Page (1750), leaving the error uncorrected for over 250 years. In sailing directions by G. Benincasa, W. Barents, W. J. Blaeu, and J. Seller, there are no detailed descriptions of Premuda, but illustrations of the island are accompanied by brief comments. For instance, Barents, Blaeu, and Seller note beneath their illustrations of

Fig. 3.8 Snippets from charts on which Premuda, Škarda, Ist, and Molat are represented: (**a**) P. Vesconte, 1318; (**b**) G. Giroldi, 1426; (**c**) V. de Lucio ca. 1792–1796; (**d**) Nautical chart Silba—Pag 100–19, 2003 (Sources: (a) Österreichische Nationalbibliothek, Vienna, Cod. 594 (Cimel. 20), 10v-11r; (b) Biblioteca Nazionale Marciana, Venice, It. VI, 212 (=5694); (c) Hrvatski državni arhiv, Kartografska zbirka, Zagreb, T 3 B + 5 D—HR-HDA-902 E.IV.13-a; (d) marineregions.org, obtained on April 23, 2025)

Premuda that the island lies between Lošinj and Škarda, even though their charts misplace its location.

These are just examples of errors that can be found on the studied charts which underscore the importance of a detailed understanding of geographic spaces and a critical approach to the use of nautical charts. The creation of accurate and detailed charts was essential for navigational safety and the efficient communication within cartographic systems.

Communication noises could have had practical consequences for navigation. Decoding messages from charts required not only familiarity with signs and other conventional elements of cartography but also awareness of potential noise within the communication system.

9 Conclusion

Early modern nautical charts of the Adriatic Sea were not merely technical tools for navigation but multifaceted media for conveying geographical, hydrographic, navigational, political, economic, cultural, and confessional information. Their analysis reveals the depth and complexity of the messages embedded within their content, including imagological elements, toponyms, cartographic signs, scales, units of distance, and communication noise. Communication theory provides a lens through which these charts can be viewed as intricate channels for transmitting information between cartographers and users. Each element of the communication model is present in the creation and interpretation of nautical charts, where cartographers encoded geographic realities into visual representations designed to be decoded by users. This process required the careful selection of geographic and other information to convey layered messages, while users needed specific knowledge and skills to accurately interpret that information.

Through precise depictions of coastlines, navigational routes, and strategic points, these charts facilitated the effective communication of vital information critical for maritime traffic. Consequently, nautical charts directly influenced socio-economic development, as maritime activities often served as either a driver or catalyst of development. Late medieval and early modern nautical charts extended beyond basic navigational information to include vexillological, heraldic, and allegorical depictions, such as the winged lion of St Mark symbolizing the Venetian Republic, the Habsburg coat of arms, or personifications of Venice. These elements illustrate the communicative potential of charts in defining territorial belonging, confessional dominance, and political relationships.

The analysis of toponyms on Adriatic Sea charts demonstrates how navigational needs, cultural influences, and political dominance, particularly by the Venetian Republic, shaped cartographic practices. Hydronyms like *Mare Adriaticum*, reflecting the cultural continuity of Latin heritage, and *Golfo di Venezia*, emphasizing Venetian political aspirations, underscore how cultural and political influences shaped spatial perceptions.

Varied names for the same objects, such as *Lacroma* and *Scoglio di San Marco* for Lokrum, point to conflicts in geopolitical discourse. The hierarchical representation of toponyms, employing colours, font sizes, and styles, alongside the consistent naming of small islands as key navigational markers, underscores the methodical approach cartographers took to highlight significant locations for safe navigation.

The development and standardization of cartographic signs for rocks/rocks awash, shoals, anchorages, and other features reflect the continuous efforts to enhance nautical charts for improved navigational safety. Comparative analyses confirm that these signs developed into standardized elements, enabling the reading of critical information about navigational risks. The persistence of rudimentary cartographic signs for navigation safety, from the earliest nautical charts to the present day, demonstrates a remarkable continuity in nautical cartography. Hydrographic surveys and the institutionalization of cartography provided detailed, universally comprehensible representations of significant features and phenomena.

By the late sixteenth century, cartographers began incorporating multiple units of distance on the same chart, a practice pioneered for the Adriatic region by W. Barents in 1595. This introduction increased the communicative potential of charts, enabling comparisons of units used across different regions. Common units included Italian, German, and Dutch miles, as well as Spanish, French, and English leagues. The communicative potential of scales culminated in the early nineteenth century with *Carta di Cabottagio del Mare Adriatico*, marking a high point in the representation of measurement systems.

Errors in the charting of islands such as Ist and Premuda illustrate instances of communication noise that undermined the accuracy and reliability of navigational information. Often resulting from limited geographic knowledge or uncritical copying of older sources, these errors posed challenges to effective communication and safe navigation. The correction of such mistakes highlights the development of cartographic practices aimed at improving the reliability of charts as navigational tools, an effort made possible by the institutionalization of cartography and its reliance on systematic surveys.

The development of nautical charts of the Adriatic, most of which were of Venetian origin, aligns with broader European trends in cartography, while also reflecting regional characteristics, and the unique imprint of Adriatic maritime and geopolitical conditions. Despite this alignment,

there was a noticeable lag in the adoption of certain cartographic signs compared to Dutch, British, and French cartographers during the early modern period. This lag, evident in the late stages of the early modern period, highlights the decline of Venice as a leader in cartographic originality and technological innovation, as other European centres surpassed it.

Early modern nautical charts of the Adriatic Sea are not only documents for exploring the historical development of cartographic skill but also vital witnesses to the cultural, political, and social dynamics of their time. Their detailed analyses reveal complex layers of meaning that transcend the technical aspects of cartography, affirming that charts are indeed communication media with a significant impact on historical and, to some extent, contemporary perceptions of the Adriatic. This study highlights the importance of nautical charts as dynamic communication media, enriching the understanding of nautical cartography's historical development and framing these charts not only as mirrors of social and economic processes in the Adriatic but also as tools that shaped them. Early modern cartographers did more than depict; they conceptualized and shaped the Adriatic's coastal, insular, and maritime space as a zone of multifaceted contact and conflict.

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