KN - Journal of Cartography and Geographic Information (2023) 73:19–37
https://doi.org/10.1007/s42489-022-00129-z

Symbolism of Compass Roses on Early Modern Nautical Charts of the Adriatic Sea

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Received: 19 November 2022 / Accepted: 26 December 2022 / Published online: 3 February 2023

Abstract
This qualitative analysis of symbolic elements in nautical cartography aims to provide an interdisciplinary insight into some aspects of early modern cartographic representations of the Adriatic Sea. The nautical charts were supplemented with compass roses, a graphic structure that facilitates orientation and correlates with rhumb lines. The research objective focusses primarily on the variety of signs for the cardinal directions north and east, additionally considering some rare but innovative and avant-garde pragmatic uses of compass roses to indicate magnetic declination. On the majority of the selected nautical charts, most of which were created in Mediterranean and Western European cultural centres, decorative elements such as the fleur-de-lis and the cross were used in compass roses to determine the cardinal points. The compass roses of these nautical charts often served as symbolic evidence of the social and economic belonging of the Adriatic to the European part of the Mediterranean geographical system, as well as to the Christian sphere of tradition and influence. The study has thus proved the existence of significant symbolic communication capacity of a compass rose, which was not only a utilitarian but also an artistic element.

Keywords Nautical chart · Compass rose · Adriatic Sea · Early modern period

Symbolik von Kompassrosen auf frühneuzeitlichen Seekarten des Adriatischen Meeres

Zusammenfassung
Diese qualitative Analyse symbolischer Elemente in der nautischen Kartographie zielt darauf ab, einen interdisziplinären Einblick in einige Aspekte frühneuzeitlicher kartographischer Darstellungen des Adriatischen Meeres zu geben. Die Seekarten wurden mit Kompassrosen ergänzt, einer grafischen Struktur, die die Orientierung erleichtert und mit Loxodromen korreliert. Das Forschungsziel konzentriert sich hauptsächlich auf die Vielfalt der Zeichen für die Himmelsrichtungen Norden und Osten und berücksichtigt zusätzlich einige seltene, aber innovative und avantgardistische pragmatische Verwendungen von Kompassrosen zur Anzeige der magnetischen Deklination. Auf der Mehrheit der ausgewählten Seekarten, die größtenteils in mediterranen und westeuropäischen Kulturzentren entstanden sind, wurden Zierelemente wie die Lilie und das Kreuz in Kompassrosen zur Bestimmung der Himmelsrichtungen verwendet. Die Kompassrosen dieser Seekarten dienten oft als symbolischer Beweis für die soziale und wirtschaftliche Zugehörigkeit des Adriatischen Meeres zum europäischen Teil des mediterranen geografischen Systems sowie zum christlichen Traditions- und Einflussbereich. Die Studie hat somit die

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Existenz einer bedeutenden symbolischen Kommunikationsfähigkeit einer Kompassrose nachgewiesen, die nicht nur ein nützliches, sondern auch ein künstlerisches Element war.

Schlüsselwörter Seekarte · Kompassrose · Adriatisches Meer · Frühe Neuzeit

1 Introduction

In the past, mapping was a process of creating graphical representations of space which employed drawing and painting techniques and patterns whose main purpose was to express ideas and feelings about real or supernatural phenomena using two-dimensional visual language as a means of communication. Elements of this visual language include lines, shapes, colours, shades, compositions and textures that were utilised in various ways to produce a sense of volume, space, movement and light on a flat surface. These elements in cartography have been transformed into a system of cartographic signs which encode displayed space in such a manner that allows the map user to easily decode, i.e. interpret the content of the map, either with or without aids (legend of cartographic signs).

Cartographers have been "navigating" between science and art for centuries (Ribeiro and Caquard 2018), which is reflected to a certain degree in dualism of art and science (of both linear and "painterly" expression) in cartography (Karssen 1980; Krygier 1995; Cartwright 2009; Medyńska-Gulij and Żuchowski 2018; Medyńska-Gulij 2021). According to E. Vagnon, the map "can be observed like other artistic phenomena: creation of objects, medium of composition, circulation of motifs and their evolution." (Vagnon 2007: 293). In that sense, compass roses have been regarded as meaningful if not even main decorative and communication element of the selected maps, capable for expressing various interests and pretensions of multiple provenance, rather than only geographical content artistic embellishment of peripheral importance.

In addition to the utilitarian purpose in terms of depicting spatial relationships, great attention was paid to the aesthetics of the cartographic depiction with the aim of achieving harmony in the design of the map. That design involved embellishing the maps with various decorative elements, related to both, artistry and pragmatics (Rees 1980; Robinson 1982; Medyńska-Gulij 2021).

A premodern map resulting from scientific and professional work of geographers, sailors and protagonists of other disciplines and activities who were engaged in the study of space or carried out their activities in space (Fernandez and Buchroithner 2014), justified its utilised purpose if it was a reliable source of spatial data. However, this did not impose strict limitations on the utilitarian nature of maps. Since maps were a medium of communication about space and in space, besides obvious need to follow the rules of once established professional cartographic design for each cartographic technology, from manuscript to copperplate (Medyńska-Gulij 2013), various intentions could be realised using them. To map users, they suggested different messages and presented different perspectives on the displayed space. M. Wintle rightly pointed out that maps are actually interpretations of 'facts', which contain ideological and rhetorical devices. As such, "they can document a social history of power, especially power over space" (Wintle 1999: 137).

This is why maps are rich in symbolism that goes beyond mere encoding which allows for an easy interpretation of geographic content. However, it should be noted that they significantly differed from works of art in a way that content abstraction or the use of signs outside of communication standards, if one can speak about cartographic "standards" prior to the nineteenth century, were not tolerated in pictorial representation of space at all or as much (Mlinarić and Miletić Drder 2017).

When maps are interpreted, it is important not only to determine what is shown on a map and where, but also how and why certain content has been presented (or omitted). This applies to different types of maps, including nautical charts which may be considered as an early type of thematic maps. Nautical charts contained a clearly defined set of spatial data about a sea, a narrow coastal belt and islands in terms of content. Regarding the established designing principles of the early modern nautical charts, a black line was its base, additionally followed by colouring with purpose to increase the (public and commercial) interest for those kind of maps (Medyńska-Gulij 2013). These charts had at least two user groups—seafarers concerned with practical applications in planning and carrying out various navigational tasks, and other people (ship owners, merchants, scientists, members of the political elite, members of the ecclesiastical hierarchy, pilgrims, etc.) who were interested in knowing the geographical features of the coast and the sea as a space where various social and economic activities catalysed by seafaring took place (Gaspar and Leitão 2018, 2019; Schilder and Egmond 2007).

Regardless of the purpose of nautical charts, compass roses were regularly drawn on them in the early modern period. These were graphic structures that allowed users to interpret the spatial relationships between the objects depicted in terms of cardinal and inter-cardinal directions. On handwritten nautical charts and on printed nautical charts on which the graticule (network of parallels and meridians) was not drawn, they were the only means of orientation

Table 1 Nautical charts of the Adriatic Sea included in the research of compass roses

Chart (author, title—content, place and year of production, institution where it is kept and call number)	Number of compass roses	Sign for north	Sign for east
Manuscript nautical charts with rhumb lines			
Unknown author, Nautical chart of the Adriatic Sea, Venice, 1507 (British Library, London; Egerton MS 2803)	1	Arrow	Cross
Vesconte Maggiolo, Nautical chart of the Adriatic Sea, Naples, 1511 (John Carter Brown Library, Map Collection, Providence; 3-Size Codex Z 2)	0	None	None
Pîrî Reis, Nautical chart of the Adriatic Sea, Gallipoli, 1526 (The Walters Art Museum, Baltimore; W.658, fol. 208a)	1	Lily	None
Battista Agnese, Nautical chart of the Adriatic Sea, Venice, 1538 (University of Pennsylvania, Kislak Center for Special Collections, Rare Books and Manuscripts, Philadelphia; LJS 28)	1	Arrow	Cross
Unknown author, Nautical chart of the Adriatic Sea, Dieppe, c. 1538–1546 (Koninklijke Bibliotheek, Nationale bibliotheek, The Hague; 129 A 24)	11	Arrow	None
Unknown author, Nautical chart of the Adriatic Sea, Dieppe, 1547 (The Huntington Library, Art Museum, and Botanical Gardens, Library Collections, Maps and Atlases, Portolans, San Marino, CA, USA; mssHM 29)	1	Lily	Three circles
Joan Martines, Nautical chart of the Adriatic Sea, Messina, c. 1550 (National Maritime Museum, Greenwich, London; P/25(5); MS 39 9926C)	1	Arrow	Cross
Diogo Homem, Nautical chart of the Adriatic Sea, Venice, 1559 (Bibliothèque nationale de France, département Cartes et plans, Paris; CPL GE DD-2003 (RES))	4	2 lilies 2 arrows	4 crosses
Hieronimo Masarachi, Nautical chart of the Adriatic Sea, Venice, c. 1560 (Newberry Library, The Franco Novacco Map Collection, Chicago; Novacco 2R 1 (PrCt))	1	Arrow	Cross
Diogo Homem, Nautical chart of the Adriatic Sea, Venice, 1570 (Croatian State Archives, Cartographic Collection, Zagreb; HR-HDA-902, D.XIV.6)	5	Arrow	Cross
Alī ibn Aḥmad Sharafī al-Ṣifāqsī, Nautical chart of the Adriatic Sea, 1571 (University of Oxford, Bodleian Library, Oxford; MS. Marsh 294, f. 6b)	12	None	None
Antonio Millo, Nautical chart of the Adriatic Sea, Venice, 1583 (The National Library of Poland Warsaw; BN ZZK 0.2399)	8	Arrow	Cross
Vicko Dimitrije Volčić, Nautical chart of the Adriatic Sea, Naples, 1593 (National Library of Finland, Maps, The Nordenskiöld Map Collection, Helsinki; N-Kt-103c)	6	Lily	Cross
Joan Oliva, Nautical chart of the Adriatic Sea, Marseille, 1613 (British Library, London; Egerton MS 819)	6	Lily	None
Francesco Oliva, Nautical chart of the Adriatic Sea, Marseille, 1614 (Österreichische Nationalbibliothek, Vienna; Cod. 360)	5	Lily	None
Alvise Gramolin, Nautical chart of the Adriatic Sea, Venice, 1624 (Museo Correr, Gabinetto di Cartografia, Venice; Cl. XLIVa n. 0044)	4	Arrow	None
Brasito Oliva, Nautical chart of the Adriatic Sea, Venice, 1633 (Biblioteca Nazionale Marciana, Venice; It. IV, 126 = 5325)	8	Lily	None
Pierre Collin, Nautical chart of the Adriatic Sea, Marseille, 1642 (Bibliothèque Municipale de Lyon, Lyon; MS 177)	2	Lily	None
Giovanni Battista Cavallini, Nautical chart of the Adriatic Sea, Livorno, 1642 (British Library, London; Add. MS 22618)	12	Lily	None
Niccolò Guidalotti, Nautical chart of the Adriatic Sea, Venice, 1646 (Biblioteca Nazionale Marciana, Venice; It. IV, 10 = 5062)	10	Lily	None
Placido Caloiro et Oliva, Nautical chart of the Adriatic Sea, Venice, 1650 (Museo Correr, Gabinetto di Cartografia, Venice; Cl. XLIVa n. 0011)	8	Lily	None

Table 1 (continued)

Chart (author, title—content, place and year of production, institution where it is kept and call number)	Number of compass roses	Sign for north	Sign for east
Jean François Roussin, Nautical chart of the Adriatic Sea, Venice, 1661 (The Huntington Library, Art Museum, and Botanical Gardens, Library Collections, Maps and Atlases, Portolans, San Marino, CA, USA; mssHM 37)	5	Lily	None
Marco Fassoi, Nautical chart of the Adriatic Sea, Venice, 1675 (Biblioteca Nazionale Marciana, Venice; It VII 343 = 10045)	6	Lily	None
Marccheto Fassoi, Nautical chart of the Adriatic Sea, Venice, 1679 (The Huntington Library, Art Museum, and Botanical Gardens, Library Collections, Maps and Atlases, Portolans, San Marino, CA, USA; mssHM 30)	5	Lily	None
Jacob Robin, Nautical chart of the Adriatic Sea, Venice, 1694 (Museo Correr, Gabinetto di Cartografia, Venice; Cl. XLIVa n. 0023)	8	Lily	Cross
Printed nautical charts without graticule			
Pietro Coppo, Nautical chart of the Adriatic Sea, Piran, 1525 (Maritime Museum Sergej Mašera, Piran)	16	Arrow	Cross
Paolo Forlani, Nautical chart of the Adriatic Sea, Venice, 1568 (Bibliothèque nationale de France, Paris; GE CC-1380 (35RES))	1	Arrow and letter T	Cross
William Barents, Nautical chart of the Adriatic Sea, Amsterdam, 1595 (Stanford University Libraries, The Barry Lawrence Ruderman Map Collection, Stanford)	4	Lily	Cross
Pieter Goos, Nautical chart of the Adriatic Sea, Amsterdam, 1650 (Private collection Marco Asta, Bologna)	2	Lily	Cross
Pierre du Val, Nautical chart of the Adriatic Sea, Paris, 1664 (Private collection Marco Asta, Bologna)	3	Lily	Cross
John Seller, Nautical chart of the Adriatic Sea, London, 1677 (Croatian State Archives, Cartographic Collection, Zagreb; HR-HDA-902, E.IV.35)	2	Lily	Cross
Francesco Maria Levanto, Nautical chart of the Adriatic Sea, Genoa, 1679 (Private collection Marco Asta, Bologna)	2	Lily	Cross
Vincenzo Maria Coronelli, Isolario, Vol. III and IV, Venice, 1690–1694 (State Archives in Zadar, Library, Zadar; II.A*)			
Nautical chart of Island of Vis (Croatia)	1	Lily	None
Nautical chart of Island of Sazan (Albania)	1	Lily	None
Printed nautical charts with graticule			
Robert Dudly, Nautical chart of the Adriatic Sea (in three sheets), Florence, 1647 (National Library of Finland, Helsinki; URN:NBN:fi-fe201002051338)	1 on every sheet	Lily	None
Ioannes van Keulen, Nautical chart of the Adriatic Sea, Amsterdam, 1700 (Croatian State Archives, Cartographic Collection, Zagreb; HR-HDA-902, E.lV.30)	3	Lily	Cross
Pietre Van der Aa, Nautical chart of the Adriatic Sea, Leida, 1720 (Croatian State Archives, Cartographic Collection, Zagreb; HR-HDA-902, E.IV.29)	2	Lily	Star
Joseph Roux, Nautical chart of the Adriatic Sea, Marseille, 1764 (National and University Library, Map and Atlas Collection, Zagreb; S-JZ-XVIII-116)	3	Lily	None
Jacques-Nicolas Bellin, Nautical chart of the Adriatic Sea, Paris, 1771 (National and University Library, Map and Atlas Collection, Zagreb; S-JZ-XVIII-145)	1	None	None
Lodovico Furlanetto, Nautical chart of the Adriatic Sea, Venice, 1784 (State Archives in Zadar, Cartographic collection, Zadar; HR-DAZD-383 No. 3.1)	9	Lily	None

Table 1 (continued)

Chart (author, title—content, place and year of production, institution where it is kept and call number)	Number of compass roses	Sign for north	Sign for east
Vincenzo di Lucio, Nautical chart of the Adriatic Sea (in eighteen sheets), Venezia, 1792–1796 (Private Collection Marco Asta, Bologna)	2 on every sheet	Lily	None
Giovanni Fileti, Nautical chart of the Adriatic Sea, Naples, 1802 (Private Collection Marco Asta, Bolgna)	3	Lily	None
Arcangelo Sartori, Nautical chart of the Adriatic Sea, Ancona, 1802 (Private Collection Marco Asta, Bologna)	9	Lily	None
Charles-François Beautemps-Beaupré, Atlas of the Adriatic Coast (with 4 nautical charts and 11 harbour plans), Paris, 1806 (National and University Library, Map and Atlas Collection, Zagreb; A III-S18-9)	1 on every chart	Arrow and letter n	Letter e
Vincenzo de Lucio, Nautical chart of the Adriatic Sea, Trieste, 1809 (Scientific Library, Zadar; 15188 D-20)	2	Arrow	None
Ferdinando Visconti, Nautical chart of the Adriatic Sea, Milan, 1810 (Private Collection Marco Asta, Bologna)	22	Arrow	None
Ivan Grubas, Nautical chart of the Adriatic Sea, Trieste, 1816 (Private Collection Marco Asta, Bologna)	4	Lily	None
Georg Strudthoff, Nautical chart of the Adriatic Sea, Trieste, 1816 (Private Collection Marco Asta, Bologna)	4	Arrow	None
Pierre Henri Gauttier, Nautical chart of the Adriatic Sea, Paris, 1820 (Private Collection Marco Asta, Bologna)	3	Lily	None
Military Geographic Institute, Nautical chart of the Adriatic Sea (in twenty sheets), Milan, 1822–1824 (State Archives in Zadar, Cartographic collection, Zadar; HR-DAZD-383 No. 3.2)	A quarter of compass rose on every sheet	Arrow and Tramontana	Crescent and Levante

and at the same time a decorative element of the chart. On printed nautical charts on which a graticule was drawn, the function of the compass roses was not crucially utilitarian but aesthetic, for the user could determine directions even without such compass roses. Such compass roses, of course, in addition to their decorative function, also retained the role of one of the most important graphic elements that distinguished nautical charts from other types of maps. On some printed early modern nautical charts, they had only one specific useful function—they indicated the magnetic declination, the horizontal angle enclosed by the directions of the magnetic and geographic poles.

This study focusses on the multidimensional communication capacity of compass roses on early modern charts of the Adriatic. Compass roses, as a separate graphic structure, were integral and complex elements of almost every of selected nautical charts.

2 Research Methodology

The Adriatic Sea was depicted on smaller-scale nautical charts of the Central Mediterranean or the whole Mediterranean, as well as on larger-scale nautical charts, with its basin displayed across the whole map field and, thus, represented in detail (Kozličić 1995; Lago 1998; Marelić 2020). The Adriatic Sea as a whole is depicted on numerous geographical maps, most frequently on maps of Italy (Lago 1998). Certain parts of the Adriatic were also depicted on maps of the Dinaric and Pannonian regions in the early modern period, beginning with the *Fifth Map of Europe* in various editions of Claudius Ptolemy's *Geography*, and many were published in isolarios and on geographical and thematic maps of individual Adriatic regions, ports and islands.

In this research, the authors have considered 47 nautical charts of the Adriatic, one maritime atlas and one isolario (with charts showing magnetic declination) produced in the early modern period. These charts include 25 handwritten and 22 printed charts, produced in the period from 1507 to 1824 (Table 1). Nautical charts of the entire Mediterranean and the central and eastern part of the Mediterranean on which the Adriatic Sea was depicted were not analysed separately, nor were mediaeval nautical charts of the Adriatic, although these charts were also taken into account to contextualise the depictions of the Adriatic Sea on early modern nautical charts on which this part of the Mediterranean occupies the entire chart field. During the preparation of the study, the authors examined many other nautical charts of the Adriatic from the early modern period, but they did not consider all of them when several different versions were produced by the same author. The only exception has been made for nautical charts by D. Homem M. Fassoi and V. di

Lucio, since they are made in distinctively different manner, thus representing an alternative cartographic approach.

We have divided the researched nautical charts into three groups with regard to the function of the compass roses. On handwritten nautical charts, the compass roses are usually elaborately shaped and painted in different colours. The network of parallels and meridians was not drawn on such maps. They were therefore an important element of the nautical chart, providing orientation of the geographical content in relation to the cardinal and inter-cardinal directions, and at the same time a decorative element of the chart. On printed nautical charts without a network of parallels and meridians, compass roses also had an aesthetic and practical value as they enabled orientation, although they were usually printed in black and white and appeared less decorative compared to handwritten nautical charts. On printed nautical charts with a network of parallels and meridians, the compass roses, even if they looked less luxurious compared to the compass roses on handwritten nautical charts, had a purely decorative function, with the exception of the rare nautical charts on which the compass roses indicated the magnetic declination.

Old nautical charts on which the Adriatic Sea is depicted can be studied from different perspectives and with different aims in mind, examining their diverse communication capacities, especially within the recent cartographic discourse on multiple readings and interpretations of the symbolic power of extratextual communication (Panofsky 1970; Mlinarić and Miletić Drder 2017). These charts are a rich and multi-layered source of information about the displayed space, as well as the methods employed in their production, their authors and the milieu in which they were created (Bagrow and Skelton 1985). By applying the principle of analogy to iconographic or imagological interpretation, including decomposition or deconstruction (Harley 1989; Mlinarić and Gregurović 2011; Mlinarić 2012; Monmonier 2018), old nautical charts can also be read with regard to their symbolism.

Starting from similar previous scientific achievements, as well as the discursive configuration of the "new cultural cartography" (Harley 1988, 1989), this qualitative analysis aims to supplement the existing knowledge on early modern Adriatic charts and, based on an interdisciplinary approach taking into account geographic, historiographic and nautical discourse, to improve research on Adriatic nautical charts, especially with regard to the evaluation of cartographic sources as a medium of communication in space and about space, whereby compass roses stand out as an important element of this medium in view of their symbolic ornamentation.

There were numerous functions and differences between the compass roses, both on the same nautical chart and between different nautical charts. In certain elements, these roses differed considerably from each other. Clearly, aspects such as the position of the compass rose on a particular map sheet in relation to other geographical or decorative content, or the size of the compass rose in comparison between different nautical charts or in comparison with other graphic elements on the same nautical chart, still need to be thoroughly researched. Therefore, the authors of this study have selected the elements of the compass marks, namely the marks for north or east, as shown in Table 1, as well as the utilitarian and revolutionary use of the magnetic declination mark for a more in-depth analysis and related them to the cultural context.

As far as the compass roses of selected nautical charts are concerned, the aim of this research was to question their pragmatic capacity for orientation and their symbolic capacity to prove (or not) the social and economic affiliation of the Adriatic Sea to the traditional (ancient or mediaeval) Mediterranean geographical system, the Christian sphere of influence. After identifying the compass roses on each of these charts, the assessment will focus on the orientation markings of the wind directions (i.e. the cardinal points) and their tendency to indicate not only the geographical or cultural east or north, but also the associated cultural/religious/political background.

3 General Information About Early Modern Nautical Charts of the Adriatic

To outline the possible frames of the iconographic communication vocabulary of compass roses, especially for the readers not so familiar with the area, the early modern geostrategic and political changes on the Eastern Mediterranean have to be briefly displayed, all within the cultural and ideological discourse(s) of the time.

Given the geographic position and significance of the Adriatic in the socio-economic system of the Mediterranean (Braudel 1972), this maritime and coastal area has been the scene of numerous contacts and exchanges of ideas, goods and technologies for thousands of years. Maritime affairs are an important catalyst for spatial interactions affecting spatial organisation, economic and cultural development, as well as for interweaving economic and demographic structures. Consisting of various components (navigation, shipping, shipbuilding, port activities, fishing, etc.), they are based on the application of different sources of knowledge, tools and technologies, where nautical charts hold a special place.

From the end of the thirteenth century (Campbell 1987; Astengo 2007), they have become an indispensable means of navigation and, like many other types of maps, a multifaceted medium of communication. The content of these first nautical charts was associated with sailing directions or pilot

books (portolans), so that these charts are often referred to in the literature as *portolan charts*. Given the network of rhumb lines and compass roses covering the field of these charts, the term *rhumb line charts* and *compass charts* is also used for them (Campbell 1987). However, it is most appropriate to refer to them as *nautical charts* (Gautier Dalché 1995, 2002), as their content is directly related to maritime affairs, whether they had a function in navigation or were a source of spatial data for those who had an interest in knowing the area where various maritime activities took place. Previous research on mediaeval and early modern nautical charts of the Mediterranean Sea has shown that very few of them were used for navigation (no traces of sea salt, navigational divider holes, etc. have been found on them) and that most of the surviving charts were made for land-based users who wanted to know the geographical features of the sea and coast for various economic, political or academic reasons (Campbell 1987; Sheehan 2012, 2014). In their production, great attention was paid to aesthetics, which is why C. Astengo (2007) calls them *decorative charts*. Whether they were nautical charts (and atlases containing such charts) made to order or freely offered as testimonies in anticipation of favours, they are "masterpieces of the art and craft of maritime cartography" (Wallis 1997: 3). Such charts were often carefully preserved in archives and libraries, which is why they have survived to the present day, unlike the charts used in navigation, which were damaged by sea water and otherwise worn away, so that they have not been preserved (Campbell 1987; Astengo 2007). The fact that nautical charts were indeed used in maritime practise is supported by numerous documents, including those stating that nautical charts were a compulsory part of ship equipment (Campbell 1987).

Since the beginning of the fourteenth century, nautical charts of the Adriatic Sea were made. The first such chart was made by Pietro Vesconte in 1318 (Austrian National Library, Vienna, Call Number: Cod. 594 (Cimel. 20), 10v-11r). After that, many other authors produced nautical charts of the Adriatic Sea, which suggests that there was a great interest in this part of the Mediterranean.

As far as the organisation, identification and interpretation of geographical data in the early modern period is concerned, the expected higher quality of depiction and geographical understanding of the Adriatic Sea was not achieved on the nautical charts. The cartographic templates established in the Middle Ages were taken over by early modern maritime cartographers who did not introduce any significant improvements in the depiction of the coastline and islands, with only a few additions concerning geographical names or innovations concerning data on seafloor depths or magnetic declination. A significant step forward was made only with a survey of the Adriatic led by Charles-François Beautemps-Beaupré during the French administration (1806), and then with the implementation of the first systematic and comprehensive hydrographic survey of the Adriatic (1818–1819), which resulted in groundbreaking complementary editions—the *Carta di cabotaggio del Mare Adriatico* nautical chart, published by the Military Geographic Institute of Milan between 1822 and 1824, and the *Portolano del Mare Adriatico* pilot book by Captain Giacomo Marieni, published by the same institution in 1830 (Faričić and Mirošević 2017).

Cartographic production largely reflected personal drawing skills and expressiveness of each author and his geographical knowledge, ideological and political views, as well as the overall technological development and existing scientific achievements. In this context, E. Vagnon emphasises "Mapping the seas is a way of knowing, discovering, and conquering maritime space" (Vagnon 2021: 170).

In the period from the beginning of the 16th to the beginning of the nineteenth century, the Adriatic Sea provided an arena for numerous contacts and conflicts between several imperial systems. The eastern Adriatic was dominated by a triple confrontation between the Venetian Republic, the Habsburg Monarchy and the Ottoman Empire, whilst the western Adriatic was permeated with different military and economic interests of the politically fragmented Apennine Peninsula (Chaline et al. 2001; Ivetic 2019). Venice tried to impose its rule over the entire Adriatic by proclaiming a monopoly over maritime trade and often posing as a maritime power with the right to maintain control over the entire Adriatic. With this aim in mind, Venetian cartographers referred to the Adriatic Sea as the Gulf of Venice (*Golfo di Venezia*) on nautical charts and geographic maps, and this name (and the Venetian message implied in that name) was taken over by other European cartographers who used Venetian charts as templates for their cartographic achievements.

4 Compass Roses on Early Modern Nautical Charts of the Adriatic Sea

Compass roses were very important chart elements that provided orientation in relation to the cardinal and ordinal (intercardinal) directions. In the literature, they are usually considered as technical elements of maps and not as signs. For example, C. Delano-Smith (2007) excluded them from her comprehensive analysis of signs on old maps. We consider the compass rose as a graphic structure with signs that were used to mark directions.

From the early modern period onwards, the primary function of compass roses was gradually replaced by an orientation system based on a graticule, which made it possible to determine latitude and longitude on a chart. However, the decorative function of compass roses remained unchanged

until the early modern age ended, i.e. until modern nautical charts with standardised cartographic techniques and limited aesthetic expression were produced. Nonetheless, on the *Carta di cabotaggio del Mare Adriatico* from 1822 to 1824, which represents a turning point in the development of maritime cartography of the Adriatic, the compass rose was retained, along with latitudes and longitudes, not only as an ornament but as an important element, indicating to the user that the chart (i.e. its individual sheets) has been rotated 45° counter-clockwise in relation to the then already standardised orientation in which north stretches along the top margin of the chart.

The compass rose evolved from the wind rose, graphically representing the wind directions (the direction from which the wind blows), with division that varied from four cardinal points to eight, twelve, sixteen and even more directions (Taylor 1951, 1957; Kreutz 1973; May 1973). Wind roses became an integral part of the compass at the latest from the end of the thirteenth century. Compass roses have been marked on nautical charts since 1375. They were first used on nautical charts forming the so-called Catalan Atlas (Campbell 1987). On compass roses, the wind directions are functionally replaced by the compass directions (which correspond to the wind directions). Since the invention and application of compasses coincides with the oldest preserved nautical charts, it is logical to assume that drawings of compass roses on nautical charts are related to the application of compasses in data collection, their visualisation, and finally, their use and graphical visualisation in navigation (Taylor 1951; Kreutz 1973). On the nautical charts of the Middle Ages and most of the early modern period, the entire chart field was interspersed with rhumb lines—a network of straight lines that radiate from the centre of compass roses in the cardinal and ordinal directions.

The main purpose of compass roses on nautical charts was to enable orientation in space using a chart and magnetic compass or some other method of spatial orientation (using celestial bodies, etc.). This was especially important because the chart orientation system was not conventional. Before the mid-nineteenth century, there was no cartographic standard that would require north to be presented along the top of the chart, regardless of the projection. Many charts showing the entire Adriatic were rotated about 45° counter-clockwise because the sea stretches in the direction northwest—southeast. The alignment of the Adriatic Sea's NW–SE axis with the horizontal edge of the chart, performed by tilting its cartographic representation, was a method of optimising the use of chart-sheets (which are rectangular in shape). Nautical charts, especially those made by Italian authors, showed only the content related to the coastal belt and islands, leaving out the interior of the mainland or filling in the gaps with drawings of cities, their flags and other decorative content.

To make orientation and course plotting as precise as possible, the number of ordinal directions was gradually increased: from compass roses that marked only the cardinal directions, to those that had 32 or more directions. Petrus Roselli was the first to draw compass roses with 32 directions in 1449 and 1456, and after him other authors began to do so (Campbell 1987). On most of the nautical charts of the Adriatic Sea made since the beginning of the sixteenth century, the compass rose was divided into 32 directions (division of a full circle into wedges corresponding to an angle of 11° 15'), which in this relatively closed navigation basin was obviously enough to tackle the basic tasks in terrestrial and celestial navigation.

Compass roses became a standard scientific and artistic chart element, fusing function and ornament. Elaborate decoration of charts was considered a standardised aspect of geographic content, but this did not cause them to lose their primary function (Reinhartz 2012). In addition to their basic function (orientation and navigation), these elements allowed chart authors to give shape to different ideas, making them semantically rich. Compass roses contributed to the appeal of charts and their popularity as both works of art and scientific achievements that reflected the triplet of space, time and culture in which they were produced. As far as we know, from the 16th to the nineteenth century, the compass rose was not drawn only on the nautical chart of the Adriatic produced by Maggiolo Vesconte in 1511, although that author drew the compass rose on nautical charts of other parts of the Mediterranean published in the same maritime atlas in which this chart of the Adriatic Sea was published.

When examining nautical charts of the Adriatic Sea, it was found that there was no rule for the number and position of compass roses on the charts. On some charts, only one compass rose was drawn (usually at the edge of the basic geographical content), whilst on some nautical charts more than 10 compass roses were drawn (Table 1), forming a circular or oval system that encircled the entire Adriatic.

4.1 Signs for North on Compass Roses

Wind roses and compass roses usually have eight cardinal and ordinal (intercardinal) wind directions, i.e. compass points, marked with first letters of wind names: T—*Tramontana* (north), G—*Greco* (northeast), L—*Levante* (east), S—*Sirocco* (southeast), O—*Ostro* (south), L—*Libiccio* (southwest), P—*Ponente* (west), M—*Maestro* (northwest). On some compass roses, the letters A—*Africcio* or G—*Garbino* were used instead of the letter L for southwest, and the letter M—*Mezzodi* was used instead of the letter O for south.

According to the analysed early modern nautical charts of the Adriatic, such initials in compass roses were fairly

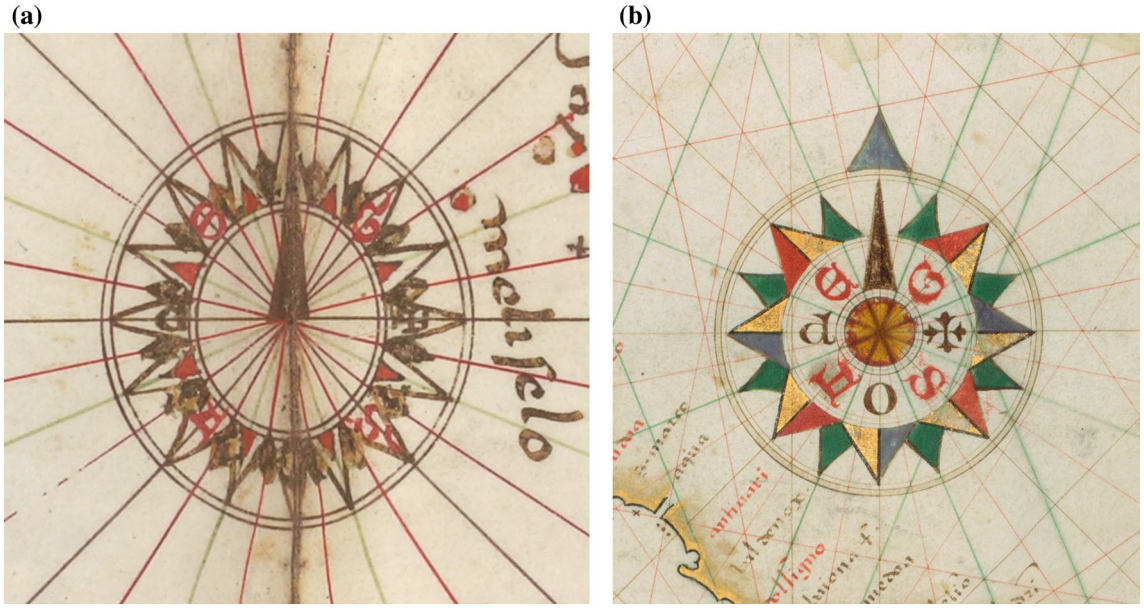

Fig. 1 Sign for north in the form of a stylized arrowhead on a compass rose: **a** B. Agnese, Nautical chart of the Adriatic Sea, 1538. *Source*: University of Pennsylvania, Kislak Center for Special Collections, Rare Books and Manuscripts, Philadelphia; LJS 28; **b** D. Homem, Nautical chart of the Adriatic Sea, 1570. *Source*: Croatian State Archives, Cartographic Collection, Zagreb; HR-HDA-902, D.XIV.6

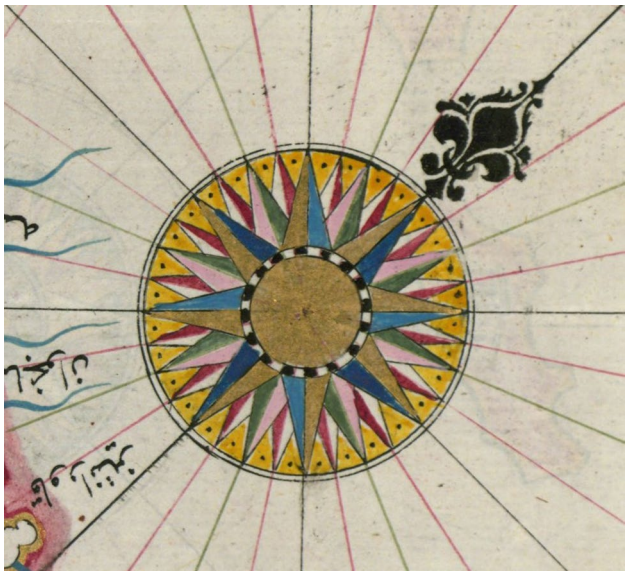

Fig. 2 Compass rose on Reis's nautical chart of the Adriatic Sea, 1526. *Source*: The Walters Art Museum, Baltimore; W.658, fol. 208a

rarely used. However, an example is Forlani's 1568 nautical chart of the Adriatic.

Given that north was the cardinal direction in relation to which the bearing/course was calculated, it was necessary to mark it differently from all the other cardinal and intercardinal directions. Since the twelfth century, it was a widely accepted view in Europe that the magnetic needle points to the North Star in the constellation Ursa Minor (Taylor 1951; Kreutz 1973). The entire compass rose was presented in the shape of a star. North was regularly marked on compass roses on maps made by Venetian and other Italian authors in the sixteenth century with a simplified or stylised arrowhead, which was a symbol for the tip of the magnetic needle in the compass (Fig. 1).

Since the end of the fifteenth century, a stylized drawing of a lily flower—*fleur-de-lis*—has been used to mark north, together with a drawing of the arrowhead. Jorge de Aguiar was the first to mark north on a nautical chart in this way in 1492 (Campbell 1987). The *fleur-de-lis* had religious symbolism (as a symbol of the Blessed Virgin Mary, mother of Jesus Christ, and as a symbol of the Holy Trinity), and was also used as a heraldic symbol of nobility and the ruling houses, e. g. the French dynasties of Valois and Bourbon and the related Anjou dynasty, as well as several English dynasties, including the current one (Feuillet 2007; Caldwell 2014). It should be noted that the North Star, which provided orientation on clear nights, was also called *Stella Maris.* This honorary title was associated with the Blessed Virgin Mary (Vagnon 2021). Using the lily flower to mark north blended spiritual with geographic symbolism. On nautical charts of the Adriatic Sea, with few exceptions in the sixteenth century, the north was not regularly marked with a lily flower until the seventeenth century.

Interestingly, this iconographic element was first used on the nautical chart of the Adriatic Sea by the Ottoman cartographer Pîrî Reis, published in the book *Kitab-i bahriye*

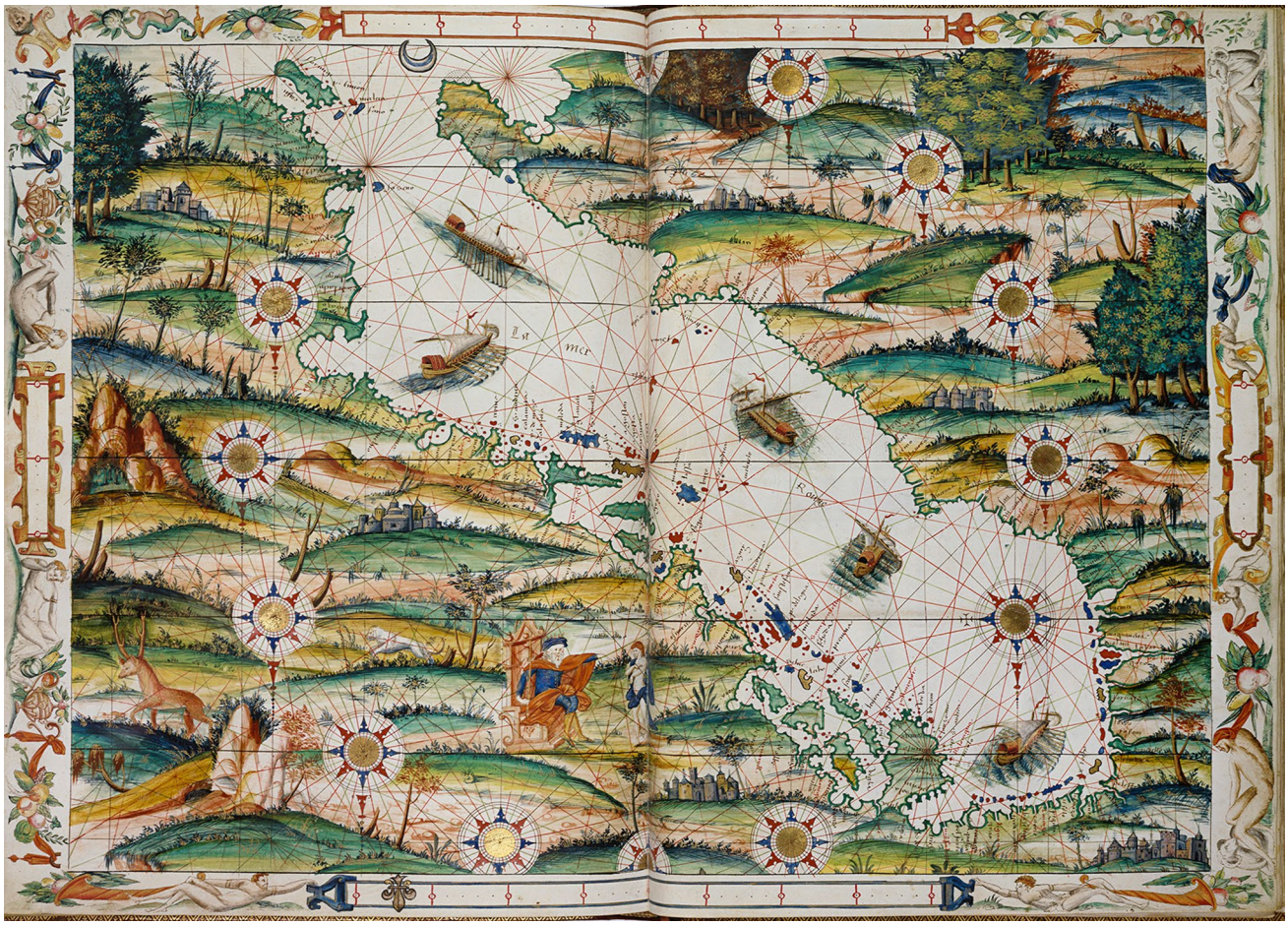

Fig. 3 Nautical chart of the Adriatic Sea from the Dauphin Atlas, c. 1538–1546. *Source*: Koninklijke Bibliotheek, Nationale bibliotheek, The Hague; 129 A 24

(Book on Navigation), and created in 1526 for Sultan Suleiman the Magnificent (Okte et al. 1988; Kozličić et al. 2015). Although Pîrî Reis's maritime cartographic production holds an important place amongst early modern cartographers of the Adriatic Sea, it is more of an exception than an illustrative example of Ottoman cartography in general. Moving beyond the established cultural framework, Pîrî Reis relied on contemporary Western European cartographic models in various elements of his work, so in addition to arrows, he sometimes employed the lily sign to indicate north on a compass rose. In these rare cases, he used the lily for decorative purposes (Fig. 2), most likely by adopting it directly from nautical charts of European authors, just like he adopted toponyms or other geographic details from local sources of information. He did so without broader knowledge of the Christian symbolism associated with the *fleur-de-lis,* judging by the fact that he did not use either Islamic or any other religious symbols in compass roses to indicate east. Unlike him, other Ottoman cartographers did not use this floral heraldic element, and drew compass roses without emphasising any direction in particular. This was the method employed, for example, by Alī ibn Aḥmad Sharafī al-Ṣifāqsī on a chart of the Adriatic that he made in 1571. On that chart he arranged 12 compass roses in a circle around the entire Adriatic Sea.

The lily as a sign of north is marked on the nautical chart of the Adriatic Sea which is part of the so-called *Dauphin Atlas*, compiled in Dieppe between 1538 and 1546 (Fig. 3). The colloquial title of this maritime manuscript atlas is associated with the assumption that it was made for Henri II, the then heir to the French throne (Wallis 1997), although there is no solid evidence for this (Serchuk 2019). The atlas is also known as the *Hague Atlas*, as it has been kept in the

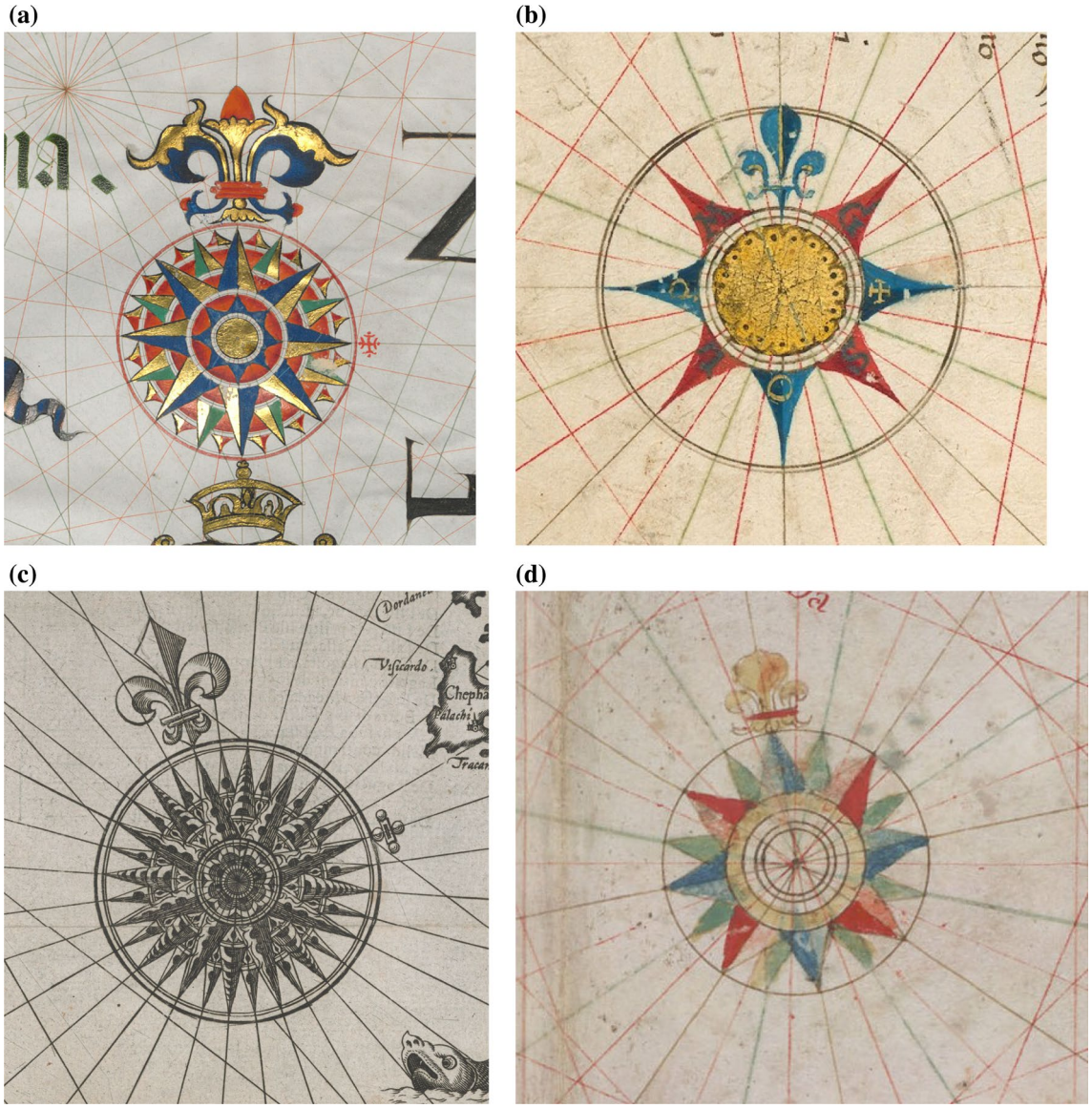

Fig. 4 Signs for north on compass roses on selected charts of the Adriatic: **a** D. Homem, Nautical chart of the Adriatic Sea, 1559. *Source*: Bibliothèque nationale de France, département Cartes et plans, Paris; CPL GE DD-2003 (RES); **b** V. D. Volčić, Nautical chart of the Adriatic Sea, 1593. *Source*: National Library of Finland, Maps, The Nordenskiöld Map Collection, Helsinki; N-Kt-103c; **c** W. Barents, Nautical chart of the Adriatic Sea, 1595. *Source*: Stanford University Libraries, The Barry Lawrence Ruderman Map Collection, Stanford; **d** J. F. Roussin, Nautical chart of the Adriatic Sea, 1661. *Source*: The Huntington Library, Art Museum, and Botanical Gardens, Library Collections, Maps and Atlases, Portolans, San Marino, CA, USA; mssHM 37

Koninklijke Bibliotheek in The Hague since 1790 (Wallis 1997). The unknown author of the nautical chart of the Adriatic Sea from this atlas used reduced ornamentation on the compass roses (marking north with a stylised arrowhead). The chart is oriented with south facing upwards. A *fleur-de-lis* is drawn at the bottom of the chart facing north and a crescent moon is drawn at the top of the chart facing south. This sign of the crescent moon bears no resemblance to the heraldic motif of the three interlaced crescents that was on the coat of arms of Dauphine Henri II (Serchuk 2019). H. Wallis believes that the decoration of this and all other nautical charts from the Hague Atlas with the drawing of a *fleur-de-lis* marking north is related to the emblem of the Valois dynasty to which Henri II belonged, whilst the marking of south with a drawing of a crescent moon is connected with

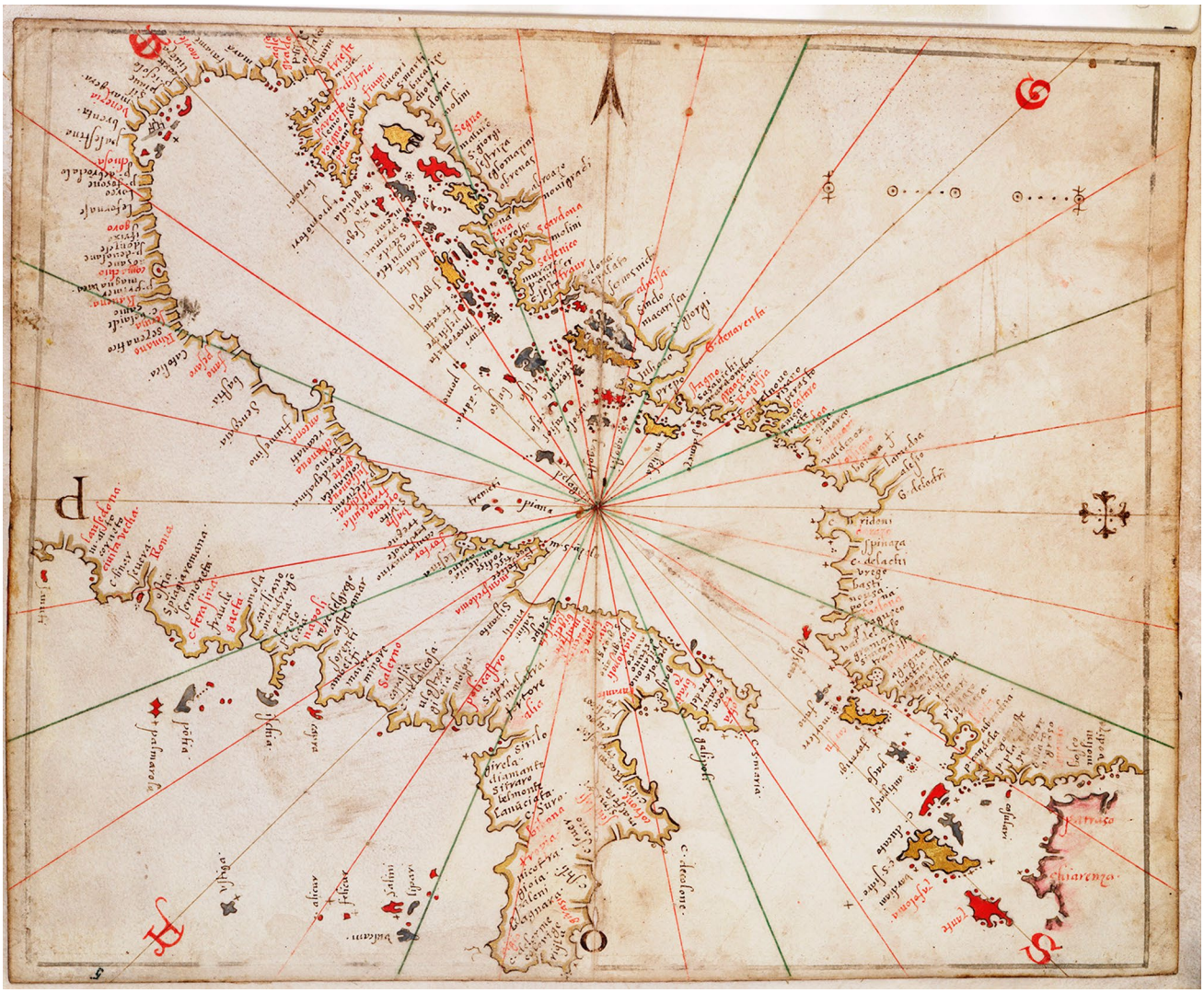

Fig. 5 Compass rose with the sign of the cross marking east on a nautical chart of the Adriatic Sea made by J. Martines in Messina, 1550. *Source*: National Maritime Museum, Greenwich, London; P/25(5); MS 39 9926C

the coat of arms of Diane de Poitiers, who became *la dame du Dauphin* in 1540 (Wallis 1997). This designation of south corresponds to the fact that the area south of the Adriatic and the Ionian Sea (Middle East and North Africa) belonged to the Ottoman Empire, whose sign is also the crescent moon. Incidentally, Ferdinando Visconti marked south on the compass rose with the sign of the crescent moon on the nautical chart of the Adriatic Sea he made in Milan in 1810. The fact that Visconti marked south this way has nothing to do with the coat of arms of Diana de Poitiers, but most likely with the fact that territories that belonged to the Ottoman Empire lay south in relation to the Adriatic Sea.

The lily flower on the compass roses of European authors was not drawn uniformly. There were artistically reduced versions, especially on printed nautical charts, and ornate versions on handwritten nautical charts. The most elegant is the depiction of the lily flower on the compass rose drawn by Diogo Homem on the nautical chart of the Adriatic Sea in 1559 (Fig. 4).

4.2 Signs for East on Compass Roses

On compass roses drawn on the charts of European provenance, east was often marked with the sign of the cross.[1] Bartolommeo Zamberti (dalli Sonetti) was the first to mark east with the sign of the cross on a nautical chart of the

[1] A cross was used to incorrectly indicate West on a chart of the Adriatic Sea made in Venice by the Portuguese cartographer Diogo Homem. On the same chart, he used the sign of the cross to mark East on two compass roses and West on one (this does not imply that he mistakenly mirrored the image of the entire compass rose).

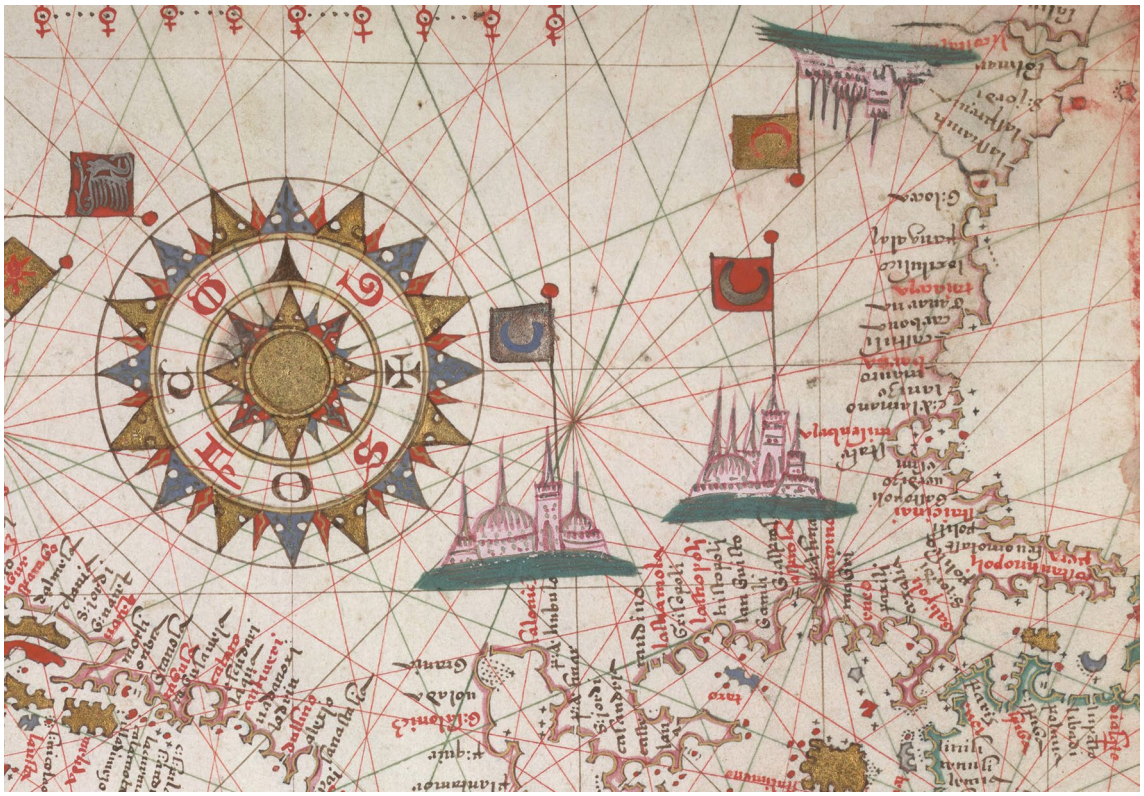

Fig. 6 Compass rose with the sign of the cross in the direction of Ottoman cities marked by a crescent on a chart of the central Mediterranean made by J. Martines, c. 1590. *Source*: The Huntington Library, Library Collections, Maps and Atlases, Portolans, San Marino, CA, USA, Call Number: mssHM 33

Adriatic Sea in 1485 (National Maritime Museum, Greenwich, London; P/21(2); MS 38-9920C), with the compass rose occupying the entire field of the chart. After him, the unknown author of a handwritten nautical chart in 1507 and Joan Martines in 1550 marked east in a similar way (Fig. 5), whilst Pietro Coppo was the first to do so on a printed nautical chart of the Adriatic Sea in 1525, drawing a cross on each of the 12 compass roses as a sign for east. This sign for east was also used on numerous geographical maps depicting the Adriatic, as well as on maps of Adriatic ports and islands published in isolarios (e.g. maps in isolarios by Benedetto Bordone, Giovanni Camocio, Simone Pinargenti, Giacomo Franco, Giuseppe Rosaccio and Antonio Millo).

A cross on compass roses symbolised the direction of Jerusalem, the place where Jesus Christ was crucified and buried. In European sacred and profane art, the cross is a symbol of Jesus Christ, but also of all Christianity. It stands for the suffering through which Christ redeemed the sins of all mankind and overcame death by resurrection (Moore 1974).[2] Jerusalem lies east of Italy and other Western European countries, the region where the earliest known mediaeval nautical charts and most of the oldest preserved geographic maps of the known world were made. However, the cross was also used to mark east on compass roses that were not located strictly westward of Jerusalem on the map. Such was the case with the Adriatic. The Holy Land and Jerusalem lie south-eastward of the Adriatic Sea, Asia Minor is located east of the compass rose placed in the centre of the Adriatic, and Constantinople (Istanbul) is east of the compass rose placed in the northern Adriatic.

The sign of the cross in compass roses generally symbolises east, whatever the actual position of Jerusalem in relation to the centre of the rose may be, or wherever the true east may lie in relation to that point. In Christian sacred architecture there is a similar phenomenon. Churches were oriented as precisely as possible to the east, even if in reality the church was in different places and Jerusalem was to the east, south, west or north (Gordon 1971; Ali and Cunich 2005). The construction of the churches with an eastern orientation did not necessarily have to be in the correct geographical direction to Jerusalem. They followed a more abstract spiritual concept *ex oriente lux* (Scheffler 2003), but related to astronomical and geographical markers. The

[2] Archaeological research has shown that the sign of the cross was used by other civilizations that had developed before the advent of Christianity; however, in Western art, the cross is an inherently Christian symbol (Healey 1977).

Fig. 7 A. Millo, Nautical chart of the Adriatic Sea, 1583. *Source*: The Huntington Library, Library Collections, Maps and Atlases, Portolans, San Marino, CA, USA, Call Number: mssHM 33

eastward orientation was based on the position of the sunrise at the time of the spring and autumn equinoxes or on the position of the sunrise on Easter, which falls on the first Sunday after the full moon following the spring equinox (Urrutia-Aparicio et al. 2021).

In reality, during the early modern period, east of the Adriatic is an area that was culturally, artistically, and sometimes even cartographically symbolised by the crescent moon—the emblem of the Ottoman Empire and Islam. For example, on a chart of the central Mediterranean made in Messina around 1590 (The Huntington Library, Library Collections, Maps and Atlases, Portolans, San Marino, CA, USA, Call Number: mssHM 33), Joan Martines indicated east with the sign of the cross in the direction of the Ottoman cities that were stylized as an Islamic architecture vedute with superimposed crescent flags (Fig. 6).

Unlike Martines, who marked the cities in the far south-east of Europe with a crescent, on the chart of the Adriatic made in Venice in 1583, Antonio Millo differentiated the Adriatic territory under Venetian rule by drawing flags with winged lions, symbolising Mark the Evangelist (the patron saint of Venice); the Dubrovnik Republic with the flag of St. Blaise (the patron saint of Dubrovnik); and the territory within the Ottoman Empire by drawing flags with the crescent (Fig. 7). Such application of Christian and Islamic iconography in depicting the eastern Adriatic coast points to a meeting of two European worlds that had quite literally interlocked in this area, both geographically and culturally.

The Eastern Adriatic was a direct border between the West, which was identified with the Christian Europe, and the East, which was identified with the Ottoman Empire. In this context, representing east with a cross in an area where the *cross* and the *crescent* had clashed for centuries, with the *crescent* on the offensive from the 15th to the nineteenth century, certainly implies symbolism beyond the level of maritime cartography. After all, one may wonder if a user of a nautical chart with a compass rose where east was marked with a cross, perceived this cross routinely or as symbolic identification of their religious and cultural identity with Christianity. To depict the eastern shores of the Adriatic Sea on a nautical chart published in Vallard's Atlas in Dieppe in 1547, an unknown cartographer drew camels, an elephant and other exotic creatures that do not belong to the indigenous fauna of south-eastern Europe (Fig. 8). Although east is not symbolised with a cross on its compass rose, this chart is nonetheless indicative of the perception of the Balkans as

Fig. 8 Nautical chart of the Adriatic Sea from Vallard's Atlas, 1547. *Source*: The Huntington Library, Art Museum, and Botanical Gardens, Library Collections, Maps and Atlases, Portolans, San Marino, CA, USA; mssHM 29

an eastern, exotic and apparently little-known area (Todorova 2009). In the early modern period, it was customary to place decorative elements (especially those that were exotic in nature) on maps and charts over areas which represented places that were geographically unknown to the cartographers who made them. Efforts were made to avoid gaps on a chart, either to cover up the author's ignorance of that particular space or to achieve aesthetically harmonious design of the chart. Qualitatively and quantitatively more opulent content, even if it was a product of imagination, also added to the professional credibility and increased the commercial value of a chart (Mitchell 1986).

The routine use of compass roses and rhumb lines on nautical charts by European authors is supported by the fact that these elements remained as decoration on the nautical charts onto which a graticule or at least scales of latitude and longitude were included from the second half of the seventeenth century onwards. Networks of rhumb lines continued to exist alongside the newly added graticule, clearly differentiating nautical charts from geographic and other types of maps, and compass roses additionally facilitated the orientation of the entire chart if north was not laid out along the upper margin. An interesting shift in marking east on nautical charts of the Adriatic Sea occurred at a time when these charts became a modern scientific achievement based on systematic hydrographic surveys. Quarters of the compass rose were drawn on sheets of a nautical chart with indicated latitudes and longitudes to show that it was rotated 45° to the left in relation to the standard orientation, where north runs along the top of the chart. Within these compass rose quarters, east was marked by a crescent (Fig. 9). It is difficult to determine with certainty why this was done. At that time a large part of the hinterland of the eastern Adriatic coast was still Ottoman territory (in the area of today's Bosnia and Herzegovina, Montenegro, Kosovo, Albania, Macedonia and most of Serbia). Did this really allow the true political situation to be faithfully captured on the first exact nautical chart of the Adriatic? The answer to this question is probably affirmative, indicating that European cartographers

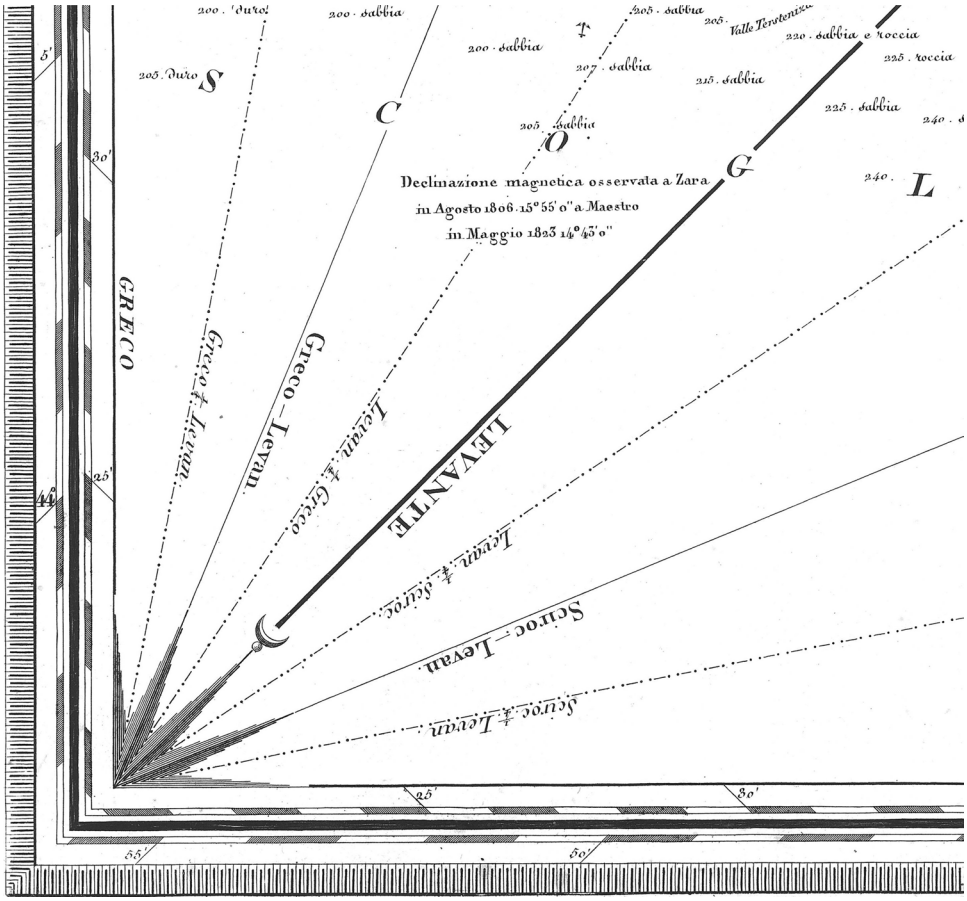

Fig. 9 Compass rose on which east is indicated by a crescent on the 7th sheet of the Carta di cabotaggio del Mare Adriatico, 1822–1824. *Source*: State Archives in Zadar, Cartographic collection, Zadar; HR-DAZD-383 No. 3.2

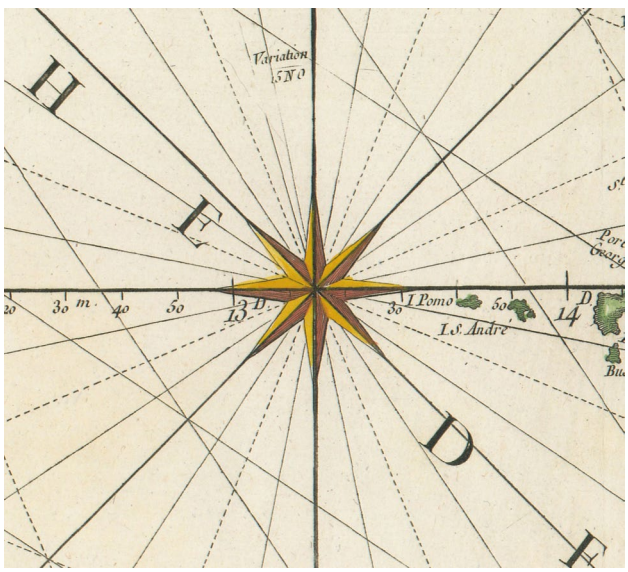

Fig. 10 Magnetic declination indicator on Bellin's nautical chart of the Adriatic Sea, 1771. *Source*: National and University Library, Map and Atlas Collection, Zagreb; S-JZ-XVIII-145

broke away from the tradition of continuous references to mediaeval sources, strongly marked by Christian overtones.

4.3 Compass Roses in the Function of Marking the Magnetic Declination

Compass roses with or without decorative elements were used for the special purpose of marking the magnetic declination. The first known drawing of the magnetic declination on a chart showing the Adriatic area was made by V. M. Coronelli. On the chart of the island of Vis in today's Croatia (*I. Lissa nella Dalmazia*), published in the third part of the *Repubblica di Venezia (Stato Veneto)* isolario,[3] the compass rose was used to suggest the easterly variation of the magnetic needle from the rhumb indicating the north–south direction. In the compass rose of the chart of the Sazan island in today's Albania, published in the fourth part of the *Repubblica di Venezia* (*Stato Veneto*) isolario,[4] Coronelli explicitly stated that this magnetic declination was established in 1690 and it measured 9° to the northwest (*Variazione della Lancetta Gradi 9 Verso Maestro*). Jacques Nicolas Bellin also indicated the magnetic declination next

[3] The year of publication is not indicated on the cover of Coronelli's work, but the last year recorded on a chart within it is 1694.

[4] The year of publication is not indicated on the cover of Coronelli's work, but the last year recorded on a chart within it is 1690.

to the compass rose on the *Carte hidrographique du Golphe de Venise* chart, which he published in 1771 (Fig. 10), and some other cartographers followed suit. Systematic measurement of the magnetic declination in the Adriatic was first carried out by Ch. F. Beautemps-Beaupré. On the charts, he published after a hydrographic survey conducted in 1806, he stated the magnetic declination on compass roses that were divided into cardinal directions, with an arrowhead marking north, but without any particular indicators of other directions. These Bellin's and Beautemps-Beaupré's methods of stating the magnetic declination are similar to those still used on nautical charts.

5 Conclusion

Based on the analysis of a sample of 47 early modern nautical charts of the Adriatic Sea, one maritime atlas and one isolario (with charts showing magnetic declination), it was found that compass roses were an important integral element of these charts. On handwritten and printed nautical charts without graticules, they had a utilitarian function as a means of orientating the geographical content, but also an aesthetic function, whilst on printed nautical charts with graticules they mainly played a decorative role, with the exception of the rare nautical charts on which the magnetic declination was indicated on the compass roses. Regardless of the primary function of the compass roses, they contributed to the visual attractiveness of the nautical charts.

The contact position of the Adriatic at the intersection of several European imperial systems and two major religious systems—Christianity and Islam—was reflected in cartographic patterns that transcended the primary function of charts as superlative depictions of space and geographic reality.

To facilitate the use of the compass roses in the context of determining the spatial relationships between the geographical objects depicted, two directions—north and east—were highlighted on them. Whilst the north played a primary role as the direction that could be determined by observing celestial bodies and related phenomena (especially the Pole Star and the shadows of objects at noon, when they are shortest due to the highest position of the sun) and using a magnetic compass, the east had a symbolic role to a greater extent, especially in religious systems (in Christianity as the direction of Jerusalem and in Islam as the direction of Mecca, i.e. as the direction of the space in which the Ottoman Empire lies in relation to Europe and in which Islam predominates). Using a selected sample of nautical charts covering chronologically the period from the beginning of the sixteenth century to the beginning of the nineteenth century, it was found that on almost all compass roses, mapmakers highlighted the north with various signs, most frequently with an arrowhead symbolising a magnetic needle or a *fleur-de-lis* (lily flower)—from artistically reduced versions, especially on printed nautical charts, to ornate versions on handwritten nautical charts. This lily flower is associated with Christian iconography (as a symbol of the Blessed Virgin Mary, the mother of Jesus Christ, and as a symbol of the Holy Trinity), but it can also be interpreted more simply, as an ornate representation of an arrowhead whose shape follows the usual heraldic motif. In contrast to the special emphasis on the north, which was the rule regardless of graphic variations, the east was less often specially marked. Based on the analysis of a sample of nautical charts, it was found that on about one third of the nautical charts showing the Adriatic Sea, a special sign was used for this direction (Table 1), whereby it was most frequently marked with a cross (a Christian symbol) on the compass roses of these nautical charts and with a crescent moon (Islamic or Ottoman symbol) only on the compass roses of one nautical chart.

The use of Christian iconography on drawings of compass roses as important elements of nautical charts of the Adriatic Sea in the early modern age is a symbolic testimony to the cultural and religious affiliation of the Adriatic Sea to the European navigation basin, i.e. Christian cultural area. The lily flower and the cross as dominant ornaments suggest broader imagological and communicative capacities of cartographic media aimed at a much wider (or different) audience than sailors for whom the nautical chart was first and foremost a better or worse source of spatial data relevant for planning and implementing various navigation tasks. The signs of the cross and the crescent as key signs of the two civilizations in the maritime cartography of the Adriatic Sea ultimately resulted in the recognition of the presence of the Islamic state in the eastern hinterland, which to some extent interrupted centuries of continuous reference to Christian sources. However, as far as the use of the sign of the cross to mark east is concerned, it should be noted that east was marked with a cross on nautical charts even when Jerusalem was not to the east of the position of the compass rose on the chart, which means that this was the practise of map authors who did not necessarily attach any particular religious significance to east. Regardless of the cartographers' personal religiosity, namely high or lesser importance given to Jerusalem, crosses which marked the east could not be strictly related only to the precise geographical positioning. Abstract and spiritual concepts of "the light which comes from the east" (*ex Oriente lux*) coincided and intertwined with the pure geographic and other types of accuracy in cartography and orientation, similarly as in sacral architecture.

From the middle of the nineteenth century, compass roses with signs (which we may consider as religious symbols) and other decorations started to give way to latitudes and longitudes as universal expressions of spatial coordinates, rooted in the mathematical foundations of

orientation and navigation. As a result of surveys, modern charts have become a more reliable source of spatial data, and cartographic representation has been reduced to a technical framework which no longer leaves much room for aesthetics complemented by artistic ornamentation.

In summary, according to the compass roses analysed, even purely geographical and cartographic signs and nomenclatures such as the cardinal directions can be used as a source or tool for the transmission of cultural messages. These cartographic signs hidden in the selected signs reveal the different influences (in intensity or appearance) of Christianity on the one hand or Islam on the other. The cartographic imagery of the mapmakers, based on the former, aimed not only to prove that the early modern Adriatic belonged to the Christian traditional sphere, but also to prove that the Adriatic belonged to the European part of the Mediterranean social and economic system.

Acknowledgements This paper is the result of research within the Scientific Project IP-2020-02-5339 Early Modern Nautical Charts of the Adriatic Sea: Information Sources, Navigation Means and Communication Media (NACHAS) funded by the Croatian Science Foundation.

Data availability All relevant materials (digital reproductions of nautical charts and digital reproductions of segments of nautical charts showing compass roses) are available in the paper.

Declarations

Competing interests The authors report there are no competing interests to declare.

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