Abstract
This paper compares two different forms of representations that communicate geographic information to the mariner: the sailing direction and the chart. The sailing direction with its narrative, sequential, description of the world from a natural, surface, perspective, and the chart with its static and synthetic bird’s eye view of the world. Both are historically examples of successful mediated communication. Today they may become the starting point of new types of dynamic, virtual reality media, helping the mariner to safer navigation.

Introduction
In March 2003 the crew of the last manned Swedish lighthouse, Holmōgadd, in the northern Sea of Bothnia, locked the doors and left the station and the remote island. (See Figure 1) For years to come the light will shine from the high tower kept only by electronic sensors, but it is a fair guess that it will not do so for unlimited times to come. Modern techniques, such as GPS positioning, have made an ancient means of navigation redundant. Now effort is being made to move navigational beacons into the virtual world. A study of the historical development of mediated communication has been undertaken and this paper is an overview of some findings.

Lighthouses and cairns were elements in a vast chain of devices built during thousands of years to communicate navigational information from authorities and from past generations of mariners to the present. This paper will take a brief look at two links in the chain: mediated communication through sailing directions and nautical charts.

Way-finding at sea is as old as humankind. One can imagine that the first attempts to cross over lakes and rivers were done by men sitting on top of pieces of timber or simple rafts. Later carved out logs were used for transportation and fishing.

Way-finding was probably done using simple landmarks: a known hill, a certain cluster of trees. For the precision navigation needed to find for example a fishing ground in an open inlet, cross bearings from two or more leading lines could have been used, such as “The old oak under the top of Fur Hill, and Goose Island in the middle of Home Sound.” This is a guess; no evidence has survived through history of how navigation was undertaken in these early days. In fact, documents about the craft of navigation appear relatively recent in history. The techniques of piloting a ship were of no concern for the clerks and scribes who alone had the art of writing in the early days. Yet we know from pictures on seal-engravings, of large ships driven by sails and oars from the second millennium B.C. Crete in the Mediterranean. (Taylor 1956, p. 1)
As long as those early men stayed in the vicinity of their home ports, the geographic knowledge necessary to find their way could be harboured in their memory. But when voyages became longer? How could knowledge of distant water and coasts be communicated from the locals to the maritime community? No doubt local pilots were of crucial importance and trading trips required a constant stream of pilots coming and leaving the ship. The pilots had to be paid, and one could imagine that pilots were not always to be found, so it is only natural that once a literate mariner turned up, he would make notes of his voyage, the places, the distances and the landmarks. It is in this form, as a verbal narrative, and later illustrated by simple drawings that the first accumulated knowledge of way-finding at sea reaches us. The communications were serial. Once large amounts of data were acquired and different direct routes became known, the sequential sailing direction became difficult to handle. A new medium was needed which supported parallel communication. The nautical chart, the mariners map, was the answer.

A navigation chart represent the accumulation of more observations than any one person could make in a lifetime. It is an artifact that embodies generations of experience and measurements. (Hutchins 1995, p. 111)

Sailing Directions – Reading Charts

The first traces of how navigation was undertaken reach us in fragments from an old peripli,1 which we today call a sailing direction or a reading-map. This is the peripilius of Scylax of Caryanda, a set of sailing directions for the Mediterranean and the Black Sea from the fifth century B.C.. The following fragment is typical:

Libya begins beyond the Canopic mouth of Nile… The first people of Libya are the Adymachidae. From Thonis the voyage to Pharos, a desert island (good harbourage but no drinking water) is 150 stadia. In Pharos are many harbours. But ships water at the Marian Mere, for it is drinkable. It is a short sail from Pharos to the mere. Here is also Chersonesus and harbour: the coasting thither is 20 stadia. Beyond Chersonesus is the bay of Plinhine. The mouth of the bay to Leuce Acte (white beach) is a day and a night’s sail… (Cotter 1971, p.250)

It would still be fifteen hundred years until the compass came in use in European ships. Trading routes normally went along the coasts and the sailing direction was an account of ports and distances, of prominent landmarks, occasional warnings for underwater shoals and possible places for finding supplies, especially water.

Some eight hundred years later the same part of the North African coast west of Alexandria is described in Stadimos or Periplus of the Great Sea by Menippus of Pergamon:

1. From Alexandria, sailing westward to Chersonesus – there is a harbour for smaller vessels – 70 stadia.
2. From Chersonesus to Plinhine – there is a roadstead; the place lacks a harbour – 90 stadia.
3. From Plinhine to Taposiris – a town without a port; a temple of Osiris – 90 stadia.
4. From Taposiris to Chimo – there is a village; shallows visible above the surface of the water – 90 stadia.
---
18. From Calamaeus to the Hag’s Knee – 70 stadia. It is a rugged cap with a rock on the summit; on the shore there is a tree; there is anchorage; and beneath the tree there is water. Beware of south winds! (Cutter 1979, p.8)

This typical style of sailing direction was established right from the beginning and has remained so for present day coast pilots.

The following is an extract from the 2003 edition of United States Coast Pilot, vol. 2, depicting the harbour of Newport, Rode Island:

The following objects are prominent when approaching Newport Harbor either from the southward or northward: a hotel on Goat Island; a white building of the yacht club near Ida Lewis Rock in the southerly part of the harbor; church spires in the town; and the buildings of the Naval Education and Training Center and Naval War College on Coasters Harbor Island in the north part of the harbor. --- Numerous navigational aids mark the passages through the harbor. Goat Island is marked by a light at its northern end and a light and fog signal at its southern end. Buoys mark the shoals along the southeasterly and southerly sides of the island. (U.S. Coast Pilot vol. 2, p. 230)

The peripili and its followers, the portolans and compassos of the Italians and the leeskaarten of the Dutch renaissance, all the way through to modern day pilots, all had this in common: the narrative. They were sequential descriptions of a voyage, verbal snap-shots of the coast from specific points, as seen from the “bridge perspective” of the ship.

Between The Kenning And The Landfall

A moment of utmost importance for the mariner, once he had left the coast and dared out on the open sea, is the landfall on a new coast. Has he reached the shores he had been heading for? Will an open harbour await him or unfriendly rocks? From Old Norse the

---

1. Cotter 1971, p.250
2. Cutter 1979, p.8
word *kenning* (landkänning) has been incorporated into the English language. The *kenning* is “a unit of distance used by the early mariners, equivalent to the distance at which the shore could first be seen from the offing when making a landfall.” (Cotter 1971, p. 260.) It follows that the *kenning* was longer, off a high coast than off a low one. Once land had been sighted the mariner quickly had to identify the location by whatever means he had, often just his recollection of earlier encounters, or the verbal descriptions from fellow mariners, or maybe a sailing direction. Not all destinations had a prominent and easily described landmark, such as the tower of the island Faros outside the port of Alexandria, or the giant statue of Rhodes. Here drawing of the coastal features would have been of great help.

This was the situation when the French pilot Pierre Garcie in 1483 published his *Le Grands Routier et Pilotage*. The new thing that he incorporated was woodcut coastal views in the text. The pictures were still very crude, but were refined and further developed by the Dutch. (See Figure 2 and 3)

Figure 2.
A coastal view incorporated in a sailing direction over the French west coast: *Ushant* is the English name for Île d’Ouessant at the western tip of Bretagne. A woodcut from Robert Normans 1590 *Safegarde of Saylers*, a translation from a Dutch original. (Taylor, p. 169)

Figure 3.
The bridge perspective is now very obvious: The shore profile depicted the coast from a specific point at sea; the silhouette of land was emphasized. It was absolutely crucial for the pre-GPS mariner to be able to establish his position by identifying landmarks.

The same techniques are used by modern pilots but often photographs have replaced the drawings. (See Figure 4)

Figure 4.
Below: a low angle air photo from Björkö in lake Mälaren. Shallow areas are drawn on to the photograph. Symbols point to different facilities and services. From Swedish Coast Pilot vol. 5, 1990.

The sailing direction was the major medium for communicating navigational information to the mariner until the end of the eighteenth century, when its function was overtaken by the chart. (Hutchins 1995, p. 108.)

The Nautical Charts
Maps have been used by mankind for a very long time. The earliest maps to be found are clay-maps from the old Babylon, 3,500 years ago. In Western civilization it was the ancient Greeks with figureheads like Eratosthenes and Ptolemy that developed geographic science and cartography.

Although established on land, the mariner’s equivalent, the nautical chart, did not evolve until the end of the thirteenth century. First mentioned in writing in 1270, the first nautical chart to be preserved is the Carta Pisana, from the Italian city of Pisa, dated to 1275. (Taylor 1956, p. 109)

These kinds of charts are called portolan charts, named after portolani, the Italian type of sailing direction which appeared after that the compass was introduced in western navigation at the end of the twelfth century. In the new sailing directions, bearings for different destinations where set out, and the most characteristic trait of the portolan charts was the maze of intersecting rhumb-lines that covered the sea area. (Cotter 1971, p. 260). (See Figure 5)

Figure 5.
Carta Pisana (1275), the first nautical chart, was depicting the Mediterranean and drawn on a sheepskin. The intersecting rhumb-lines of the wind-rose are constructed in a large circle. (Taylor 1956, p. 110.)

The Wind-Rose
The rhumb-lines correspond to the winds and half-winds of the wind-rose, or the compass bearings as they often are referred to today.

The eight winds (or directions): Tramontana (the northern), Greco (the north-eastern), Levante (the eastern), Sirocco (the south-eastern), Ostro (the southern), Libeccio (the south-western), Ponente (the western) and Maestro (the north-western) and in between them, their half-winds, were drawn out on the chart from points of intersection, in a geometric way so
that a navigator could always find a line leading in about the direction that he was headed. The lines were colour coded; the four cardinal winds were drawn in gold or black, the remaining four winds were drawn in red and the half-winds were drawn in green. (Holmes 1991, p. 33) (See Figure 6)

Figure 6.
The wind rose, here from the Vallard Atlas, 1547, was often not only eight or sixteen intersecting lines but often a richly decorated “star”, probably after the compass star, Stella Maris, the Pole Star. The rhumb-lines were colour coded. Also, the convention of drawing the chart north-up did not come into general use until the end of the seventeenth century (Cotter 1972, p. 256.)

The Compass Rose
The same division of the circle was used on the compass. The compass, when it came into use in the eleventh and twelfth century was often referred to as “the needle and stone”. An iron pin was rubbed against a magnet stone, stuck into a straw and left to float in a basin of water. In the beginning it was thought that the needle pointed towards Stella Maris, the Northern Star, this ancient aid to navigators at night, the only star on the northern hemisphere that did not change its position. A picture of the Northern Star sometimes appeared on the lid of early compass boxes and it is probable that the richly decorated rhumb-line intersection points on the portolan charts had the form of this star. (Taylor 1956, pp. 94 – 100.)

Cartographic Inventions
The transition from sailing directions to charts went slowly. From the thirteenth century when sailing directions were the major aid to navigation until the end of the eighteenth century when the chart had overtaken this role, attempts were made to incorporate useful features from the sailing directions into the charts.

By the end of the sixteenth century, the Dutch had become the leading craftsmen of chart printing. Lucas Janzoon Wagenaer published in 1584 a chart collection called Spieghel der Zeefaert. In this work Wagenaer tries too incorporate the coastal views of the sailing directions into the beach lines of the charts. (See Figure 7)

Figure 7.
A section of the Swedish east coast in Wagenaers Spieghel der Zeefaert from 1584. Note the coast profiles incorporated into the beach lines and the odd surface perspective of the central island.

Many new cartographic inventions followed, making the chart into a better and more useful aid for the mariner, but Wagenaer’s incorporated coastal views, was not one that would survive. On a flat coast without islands and peninsulas, it was possible to produce a running isographic picture of the landscape, but not when it came to islands and peninsulas. Instead other iconic representations were tried which would both give the natural view of the coast, and at the same time some sort of bird’s eye overview. (See Figure 8)
Figure 8.
Top: Multiple views of the island of St. Helena by Linschoten, 1598. The approach to the island from the east, north, and west sides are depicted simultaneously. Below: Also St. Helena by John Ogilby, 1670 from his book Africa. Note the oblique representation trying to be both a coastal view and a bird’s eye map at the same time.

The experimentation with different kinds of representations to give the mariner the necessary information was soon to disappear and the chart found its form in an orthographic bird’s eye perspective. New symbols evolved to improve communication. Examples of new symbols that would remain until modern days are the anchor icon, to mark a safe and protected anchor berth; the dot textured areas, depicting shallow water; the cross-sign, to mark a dangerous shoal and the stylised keel and frames of a sunken ship, an icon of dangerous wreck. (See Figure 9)

Figure 9.
Some examples of lasting chart symbols to appear in the sixteenth century, early to the left and recent to the right. From the top: The symbols of anchor berth, shallow water, shoals and wreck.

The Dutch were still the major chart makers during the first part of the seventeenth century. In fact, it was the Dutch that charted the English coast, but in 1669 an Englishman, Johan Sellers, announced his intentions to prepare a “sea waggoner for the whole World”. In 1671 the first book of The English Pilot was published. To begin with Sellers used discarded Dutch plates for his charts, but in 1689 the Fourth Book of The English Pilot, the first wholly English sea-atlas of American waters, appeared. (Cutter 1979, p. 10.) The coastlines are depicted with a single solid line like modern day charts. The rhumb-lines from the portolan charts are still there, but also a net of longitudes and latitudes. The modern chart is born, and from now on it is this
chart that will be the major navigational aid to the mariner and the sailing directions will start to move into the background. (See Figure 10)

**Conclusion**

Reflect for a moment on these two different representations of world space, the sailing direction with its sequential narrative of a ship’s journey from a bridge perspective, and the static bird’s eye perspective of the chart.

These two representations form two different methods for communicating geographic information to the mariner. In the first case, the perspective is that of a static first person, and the surrounding world is passing by, just as is the case in our everyday life when we go shopping or go to the office.

In the other case, the perspective is that of the third person, the world is static and we imagine our selves as an object travelling over the representation as in a bird’s eye view.

Both these perspectives have their advantages and disadvantages.

The coastal views of the sailing directions are very good at communicating the actual look of the coast to facilitate our orientation. But note that this is only the case for one specific position, the one from which the picture or the photo is taken. Only a slight change in position might make the coastal view unrecognizable. On the other hand, topographic features, which most often are omitted from charts, give the mariner valuable information. The most obvious point for the coastal view is the “natural” perspective, allowing mariners access to intuitive decision making (as opposed to the synthetic perspective of the chart which have to be learned). The biggest problem is the static nature of the coastal views.

The chart is superior when it comes to planning and monitoring the route, easily giving an overview of the voyage. Geographic positions are easy to plot and the chart works as an “analogue computer” (Hutchins, p. 61). Used in the conventional north-up mode, the chart facilitates our sense of directions, and our ability to recognize geographic forms (How easy is it to recognize the map of Great Brittan “lying on the side”?) Used in a head-up mode, (for example turning the map upside down going south) the sense of relative directions is enhanced, but the sense of absolute directions is hampered.

**Merging Old And New**

In a research project at Mälardalen University, we are trying to use modern virtual reality (VR) technique to develop dynamic coastal views as a compliment to the traditional chart. By using a three dimensional geographic database and adding the navigational information of a chart database, a decision support system can be developed that we hope will facilitate steering and decision making, particularly in high speeds when decision times are short and the result of a wrong maneuvre can be catastrophic. (See Figure 11)

No one but the electronic sensors is watching over Holmögadds lighthouse. Still for some years to come, the light cone from the high tower will continue to sweep the horizon. But fewer and fewer will use the information it communicates and in the end the light house will just be an historic monument. Other media have overtaken its role. It’s a sad fact. A consolation is that new media makes navigation safer.

**References**


Dahlgren, P. and Richter, H. (1944) *Sveriges Sjökarta*, Stockholm: Statens Sjöhistoriska Museum, Handlingar 1,


*Svensk Lots del II Östersjön, Svenska kusten Falsterbo _Simpnäsklubb, Bornholm.* (1952) Stockholm: Kungliga Sjökartverket


Figure 10.
The New England chart from the Forth Book of The English Pilot 1689, engraved by John Thornton. His chart was the first chart depicting American waters, accurate enough for navigational use. It includes soundings as well as banks, shoals, islands and coastal features.
Figure 11.
A screen shot from the authors’ prototype software using both the traditional bird’s eye chart perspective (left) and the bridge perspective (right) of the traditional coastal views. The difference is the dynamic motion of the eye position always reflects the mariners position in the real world. The entrance to Mariehamn in the Åland archipelago in the Baltic Sea.

---

Footnotes
1 The Greek word *periplus* mean “round voyage” or “circumnavigation”.
2 *Potrolano*, It. “book of ports” (Dahlgren, p. 4)