ATLAS OF OFFSHORE URBANISM

Using design to understand, represent and employ human-sea relations in the spatial reorganisation of the Barents Sea.

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C O L O F O N

All images are produced by the author
unless noted otherwise.

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URBANISM FROM AN OCEAN PERSPECTIVE

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Topos   [to be changed by the sea]
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Water / Soil / <u>Air</u>

Conditions of air

<u>01. wind direction and force</u>
The movement of air at a certain velocity following a certain path through the atmosphere. Carrying scent, sound, pollution, temperature and other conditions of air across the face of the earth.

<u>02. air temperature and frost</u>
A measure of how hot or cold the air is. Changes of air temperature are perceived through the skin. Heat and frost affect our bodies, bodies of water and soil.

03. air humidity
The concentration of water vapor present in the air. Generally invisible to the human eye, exept for fog, dew or precipitation.

04. precipitation
The falling of condensed water from the sky towards the earth in the form of rain, snow or hail.

05. cloud cover
The fraction of the sky obscured by condensed water vapor observed from a certain location on earth.

06. storm frequency
The average expected interval in between two rainfall events of a certain extremity.

07. noise pollution
The harmfull introduction of noise through human activities into the environment. Noise pollution has a certain radial limit of reach.

08. air pollution
The harmfull introduction of a substance into the air through human activities. The scope of reach can incre-ase significantly depending wind conditions.

09. greenhouse gases
Gases in the atmosphere that absorb solar radiation and radiate heat. Excesssive emission of carbon dioxide is the main casue of the global 'greenhouse effect' .

10. solar radiation
Electromagnetic radiation emitted by the sun that reaches the earths atmosphere. An excess of greenhouse gases in the atmosphere traps radiation inside the atmosphere and causes global warming.

11. hours of daylight
The amount of time per 24 hours during whic h there is sunlight, direct or indirect at a certain location on earth. Daylight allows sight, photosynthesis and has a known effect on a person' s state of mind.

Being in the air

<u>01. breath / phenomenology</u>
The air taken into and let go out of the lungs of a living organism. A physiological exchange between body and climate. A vital condition for enabling life on earth.

02. the spoken word
A medium for conveying information expressed in speech. The spoken word a as a transaction can only exist in the pressence of both speaker and listener.

03. story
A sequence of words creating a narrative or account of imaginary or real events, people and places. Meant to be conveyed to others. Often contains a representation of the speakers identity, experience or opinions.

04. history
Chronological account of past events considered significant. The study and knowledge of said account. Alternatively: stories of the past that are collectively considered to be true.

05. myth
A story or idea that is widely held, but considered to be untrue. Myths often describe traditional or cultural beliefs regarding natural or social phenomena including deities or the supernatural.

06. memory
The act or fact of recalling information from the mind. Memory can be shared and passed on. Collective me-mory refers to shared memories of a social group that is significantly associated with their identity.

07. belief
A conviction or attitude about reality that is accepted by an individual or social group. A fraction of our beliefs are scientifically proven and considered 'knowledge' .

08. tradition
Customs or beliefs shared by a social group or culture that are being passed down through generations within a community significantly associated with their identity.

<u>09. heritage</u>
Something that belongs to one by reason of birth, pas-sed down intentionally or unintentionally by a predeces-sor. Propriety, traditions but also conditions of climate can be inherited.

10. state of mind
Temporary psychological conditions concerning thoughts, feelings and attitudes a person has towards propositions.

11. scent
The conditions of air you perceive through smell. Scent and memory are found to be closely connected.

12. sound
Conditions of air you perceive through hearing. Sound helps us to identify and move through our surroundings. Also it is a key form of communication.

Shortlist

01. wind direction and force
02. phenomenology
03. air temperature and frost
04. heritage

Air is a physical condition. Even though we would sooner describe it as invisible or ungraspable, it is in fact matter. The air consists of concentrations of nitrogen, oxygen and a small amount of other gasses. Air also carries a considerable amount of water vapor (approximately 1% above sea) and displaces soil and seeds. Matters of water and soil can thus be found in the air.

Vice versa, the matter of air can also be found in bodies of water and soil. Indeed, the presence of air concentrations in lakes, seas and rivers allow for biotic life. In soil, aeration is a vital condition for microorganisms that release nutrients necessary for plants to grow.

The matters of air, water and soil are thus to a certain extent composed of each other. Yet, what makes air so particular is its boundlessness. Air does not just cross the domains of water and soil, it also passes over the administrative borders we draw on our maps. Air is in constant movement, more so than water or soil. Its winds can reach a speed of 100 km/h traversing land and sea and crossing the coastline in between.

The air is everywhere. It surrounds our bodies and it flows through our lungs. It is the atmosphere that makes our planet so uniquely a place of life.

Hammerfest

Tromso
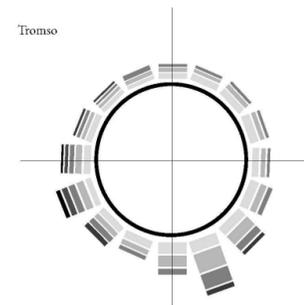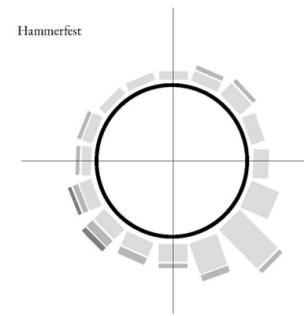
Air, water and soil

A snapshot of wind direction and velocity at the coast of Finnmark at surface level on 10/10/2020, 10AM. The wind roses show the relative frequency and average velocity of each wind direction for 2012-2019 in Hammerfest and Tromsø.

Source data: (Windy/ECMWF, 2020)

Map

23 - 35 kn	11.8 - 18.0 m/s
17 - 23 kn	8.7 - 11.8 m/s
12 - 17 kn	6.2 - 8.7 m/s
8 - 12 kn	4.1 - 6.2 m/s
0 - 8 kn	0.0 - 4.1 m/s

Wind roses

- 23 - 35 kn
- 17 - 23 kn
- 12 - 17 kn
- 8 - 12 kn
- 0 - 8 kn

N

0   50 km

Finnmark Scale

0°   10°

70°

Hammerfest

Tromso
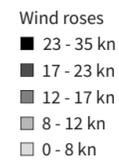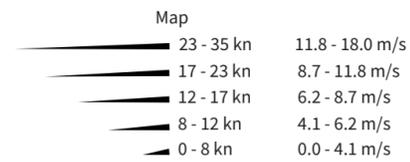
The physical power of air can most profoundly be experienced through its alterations. For instance, a different wind direction might carry a different smell. A sudden cold draft might cause goosebumps. We can hear a gust of wind ringing in our ears, we can see it swirl the leaves on the forest floor, and we feel it pulling our hair.

Imagine a place where the air is perfectly immobile. We would hear no sound, would smell no scents, we would barely feel more than the ground beneath our feet. Air enables perception. It is a medium (Horn, 2018) that links the alterations of climate to us, the perceiving. Air binds the person to the land.

The sensorial aspects of air can be studied through a phenomenological approach. This approach focuses not on the air itself, but on the forces it applies to our bodies and our surroundings. The sections on the next page can illustrate this. Without drawing the air flow itself, the image still reads 'wind!'. A phenomenological approach allows us to understand the consciousness or personal experience of a place.
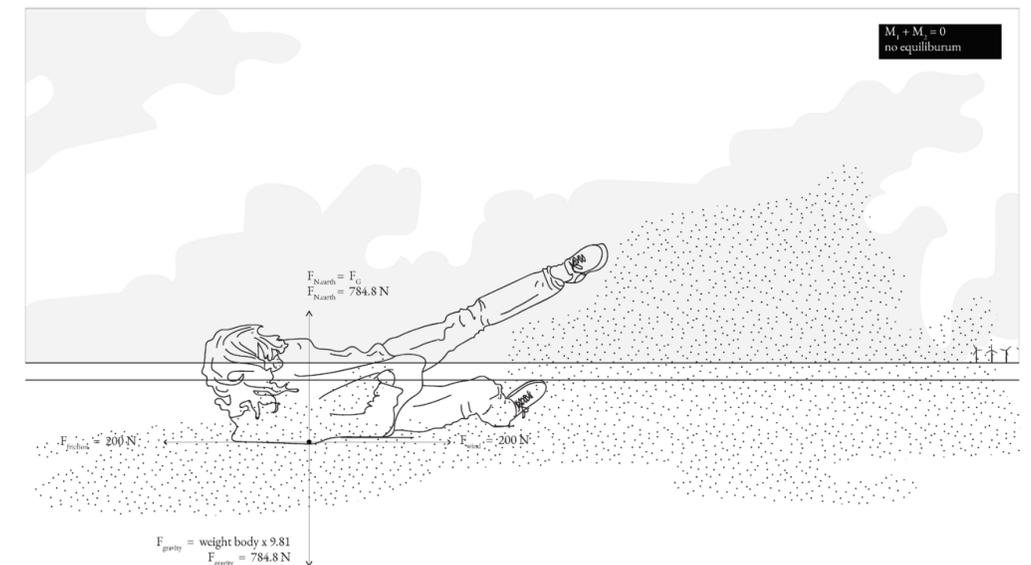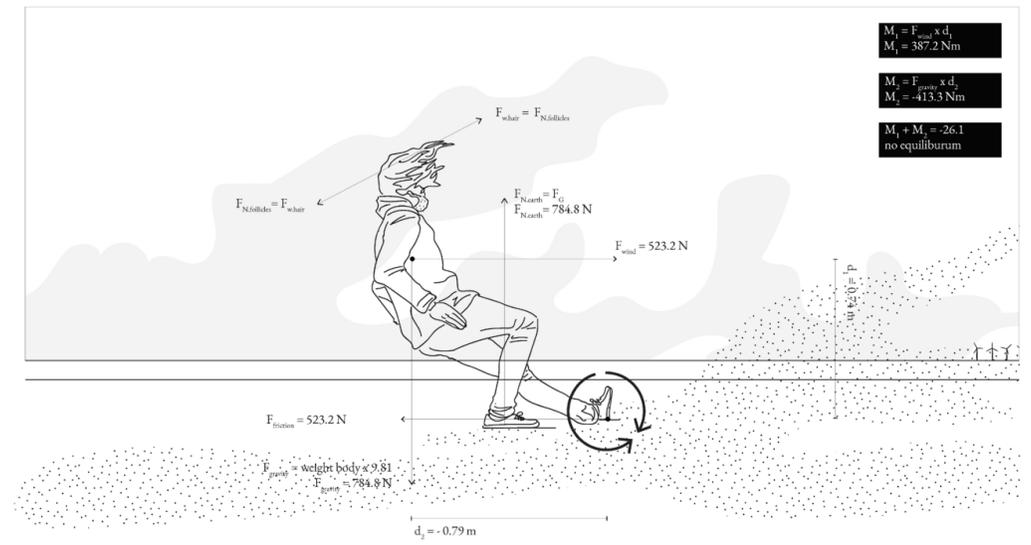
MATTER

The reflecting pool: filmstill of human body mid-air above undisturbed water. Another example of the body (un) balanced in between water, air and soil. Source: (Bill Viola 1977)

Air and the body

Depitcing air as an unseen, yet phenomenological force. And the body in three sequential stages of equilibrium in between the forces of earth and air.

☐ condensed water vapor
▨ sand particles

$M_1 = F_{wind} \times d_1$
$M_1 = 627.8 \ Nm$

$M_2 = F_{gravity} \times d_2$
$M_2 = -627.8 \ Nm$

$M_1 + M_2 = 0$
equiliburum

$F_{N,folliicks} = F_{whait}$ $F_{whait} = F_{N,folliicks}$

$F_{wind} = 523.2 \ N$

$F_{N,earth} = F_G$
$F_{N,earth} = 784.8 \ N$

$F_{gravity} = weight \ body \times 9.81$
$F_{gravity} = 784.8 \ N$

$d_1 = 1.20 \ m$

$F_{friction} = -523.2 \ N$

$d_2 = -0.80 \ m$

$M_1 = F_{wind} \times d_1$
$M_1 = 387.2 \ Nm$

$M_2 = F_{gravity} \times d_2$
$M_2 = -413.3 \ Nm$

$M_1 + M_2 = -26.1$
no equiliburum

$F_{whait} = F_{N,folliicks}$

$F_{N,folliicks} = F_{whait}$

$F_{N,earth} = F_G$
$F_{N,earth} = 784.8 \ N$

$F_{wind} = 523.2 \ N$

$F_{friction} = 523.2 \ N$

$F_{gravity} = weight \ body \times 9.81$
$F_{gravity} = 784.8 \ N$

$d_1 = -0.79 \ m$

$M_1 + M_2 = 0$
no equiliburum

$F_{N,earth} = F_G$
$F_{N,earth} = 784.8 \ N$

$F_{friction} = 200 \ N$ $F = 200 \ N$

$F_{gravity} = weight \ body \times 9.81$
$F_{gravity} = 784.8 \ N$

13

Air impacts us, and we impact air in return. We alter the composition of air through pollution, deforestation and excessive CO2 emission. These alterations originate from local human activities. In Tromsø, the AQI pollution index rates are significantly higher than the rest of Norway, with an exemption to the Oslo area (NILU, 2020). This could quite possibly be the cause of the intensive oil industry situated along the Finnmark coast. It is the agglomeration of such local impacts that causes the global phenomenon of climate change.

In the last 20 years, air temperature rise in the Arctic has exceeded the average global trends. In fact, Arctic temperatures currently rise at more than twice the rate of average global warming (Overland et al., 2018). It is the velocity of change that threatens us. Because, it affects not only us as individuals, or communities, but our generations as well. Each child is delivered to a changing world that is more extreme than the world of their parents. It is important to view climate change from a socio-cultural perspective, beyond the scope of our own lifespan.

Ultimately, air is both global and local (Horn. E, 2018). It is not bound by administrative borders, nor is air pollution. Climate change may be caused locally, but its effects are shared by everyone, everywhere, now and in the time to come. So, when we address air politically we should look beyond the limitations of space and time. Is that possible? Where do we draw the political boundaries of air? And most importantly, if we all share air, who will take responsibility for it?

Air as heritage

Ranking of average monthly air temperature anomaly from 1979-2020 compared to the 1981-2010 baseline. Measured at surface level for the Arctic (70N+). Juxtapositioned to the expected lifespan of four generations of women in Finnmark.

Source data: NCEP (2020); Plecher (2020).
Inspired by: (Zachary Labe, 2020).

Warmest monthly average temperature

Coldest monthly average temperature
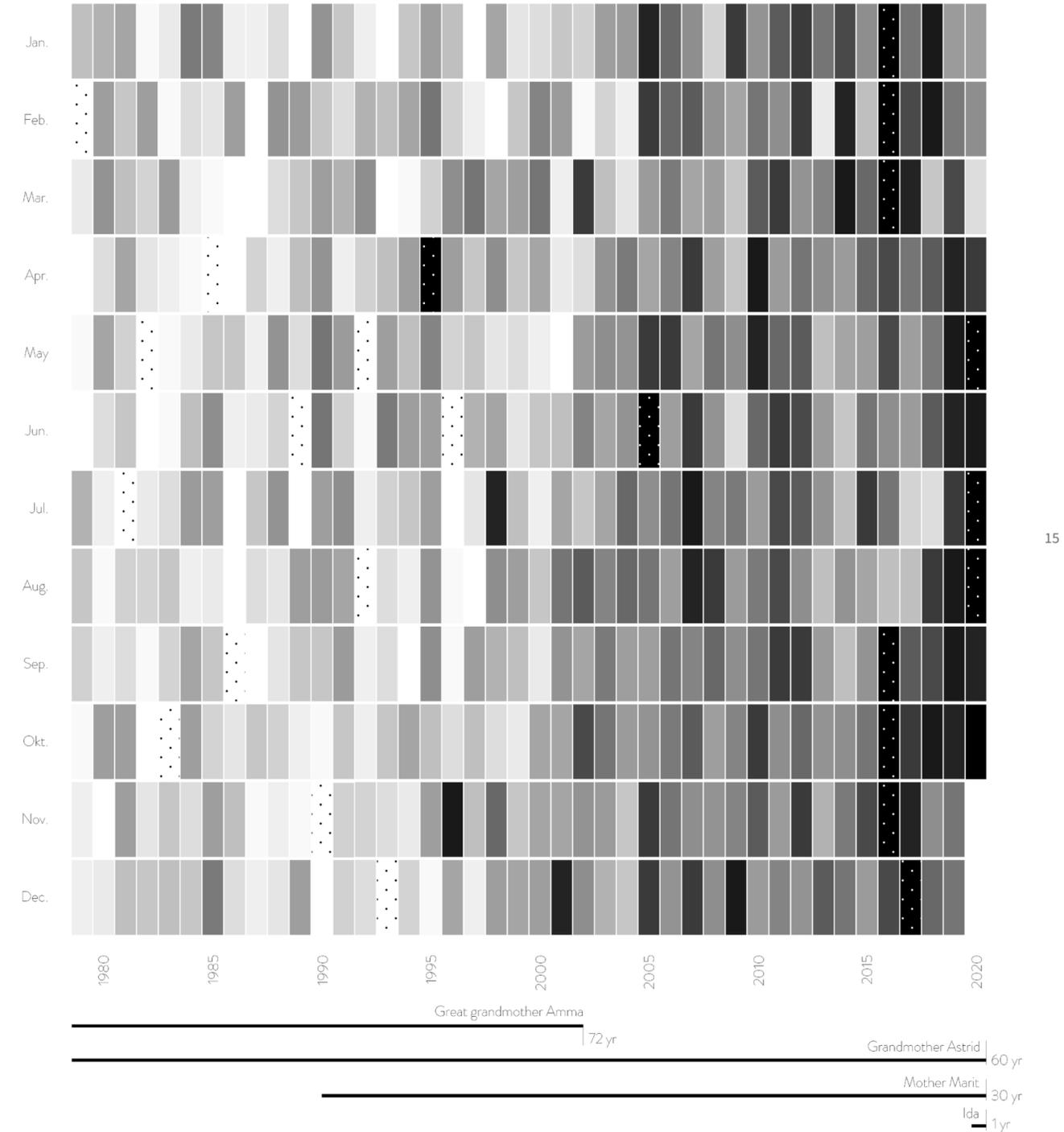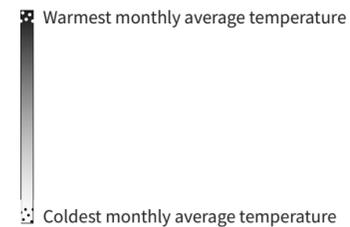
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Terraforming / Erasure / <u>Translations</u> / Flux

01. <u>sea level rise and fall</u>
The increase or decrease of the surface level of the ocean. From the sea level we measure the depth and elevation of the Earth. A rise or fall of the sea level thus translates bathemetry to topography and vice versa.

02. <u>Shore</u>
A zone where sea meets land, or, the edge between water and soil. The shoreline is the boundary between bathemetry and topography.

03. Coast
A zone where inland meets seaward. The coastline is not necessarily positioned at the shore. In the case of Hammerfest it lies at the submarine continental slope at the end of the strandflat.

04. <u>position settlement</u>
Placing of urban area or architectural manifestation of human occupation and inhabitation in space. The proximity to shore is especially relevant.

05. resettlement
Repositioning of an urban area or architectural manifestation of human occupation in space. The repositioning of a population, or the inhabitants of a settlement is called: migration.

06. retreat
The act of moving back. Also, withdrawing from a fight as a result of the other force' s superior power. As a result of sealevel rise, coastal communities may choose to retreat inland.

07. defense
Active protection of safety against a force or attack. Water defense takes physical form in e.g. dykes, dams, sluises etc.

08. <u>topography</u>
The study of the forms and features of land surfaces, including elevation, water courses, vegetation and man-made features.

9. <u>bathemetry</u>
The study of the forms and features of the 'beds' or 'floors' of water bodies such as the ocean, rivers and lakes. Also: ocean depth relative to sea level.

Shortlist

01. topography
02. bathymetry
03. settlement position
04. shore
05. sea level rise and fall

The oldest Norwegian settlements were located at the coastline (Møller 1987). Since historic settlement, coastal communities have relied heavily on the ocean for food, trade, transport and livelihood (Gee 2019). Human-sea relations have developed since then, embedding into local culture and heritage (MEA 2003). At present, the vast majority of the Finnmark population resides at the coast (EEA 2020). Their dependency on marine resources is reflected in Norway's main industry sectors: oil and gas, aquaculture, hydropower and shipping (Statistics Norway 2019).

Aside from a dependency on the ocean's resources, the agglomeration of human settlement on the coast could be explained by the topography of the land. A characteristic typology of the Finnmark coast is the 'strandflat', roughly translated as 'beach flat'. The strandflat is a low and wide bedrock plane, eroded and partially submerged. Inland, sudden steep cliffs outline the flats. Providing a surface suitable for human settlement and occupation, yet one that limits inland expansion. As such, coastal communities in Finnmark expand along the coast and are often positioned on hillsides oriented to the water.

Aerial view of strandflats at the coast of Lofoten. Note the agglomeration of human settlement on the strandflat. Photo: by author 2018.

Settlement at the strandflat

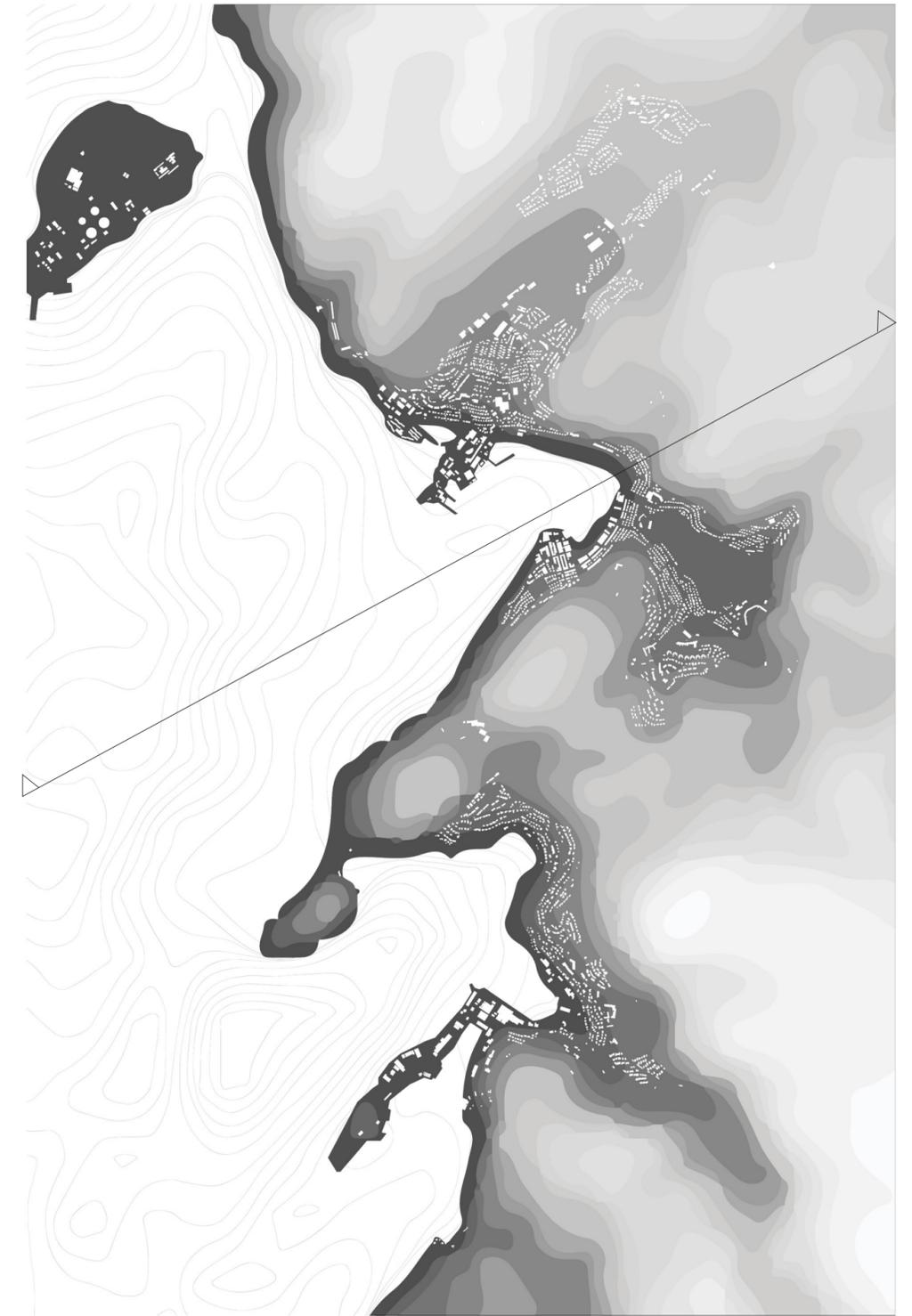Urban agglomeration along the coast of Hammerfest. With simplified elevation.
Source data: GEBCO (2020); OSM (2019); Google Earth (2021).

■ 00-10 m elevation
■ 10-20 m elevation
■ 20-30 m elevation
■ 30-40 m elevation
■ 40-50 m elevation
■ 50-60 m elevation

☐ building
— bathemetry

|0 |1 km

N

Hammerfest scale

Just as on land, the settlement, occupation and inhabitation of marine space is defined by the topos. The tools of a woodman are fitted to the forest and the tools of the miner are shaped to handle rock. Reeds are long and sturdy to emerge from the shallow riverbed and lilies are flat-leafed in order to stay afloat on the water surface. In exactly the same way, the morphology, positioning and operability of an oil rig varies for different depths, soil types and environmental conditions. The same goes for other forms of marine urbanisation.

Evidence of this can be found when comparing forms of urbanisation as a response to both bathymetry and topography. I will do this at the coast of Hammerfest, where urban land and urban sea come together. The mapped forms of urbanisation are: i) occupation (sea/land use), ii) inhabitation (density) and iii) settlement (architectural form).
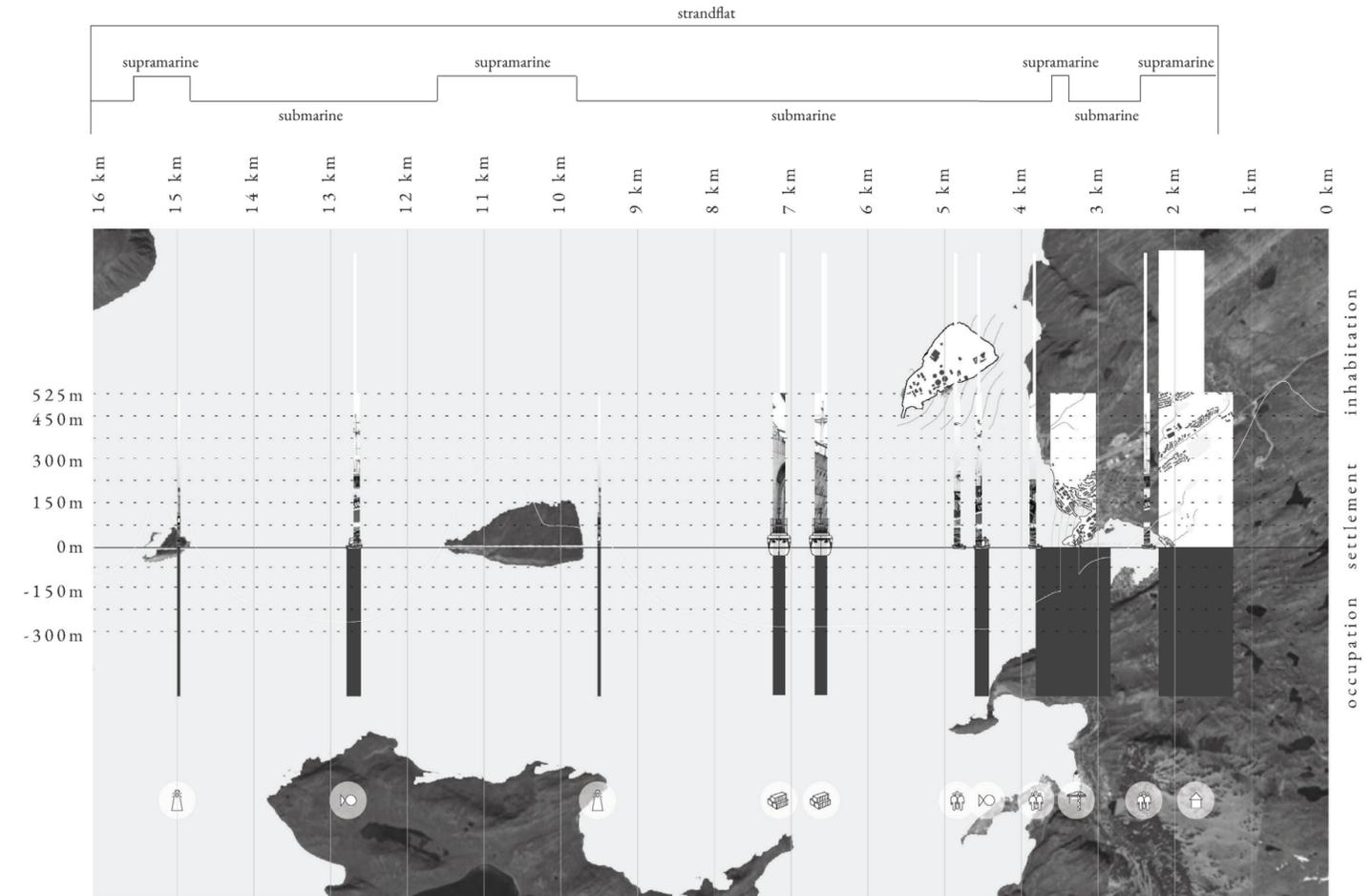
Urbanisation across the shoreline

The bathemetry and topography in Hammerfest in both section and plan view. Note the sub- and supramarine zones of the strandflat. Along the section intensities of human occupation, settlement and inhabitation are indicated schematically. Note how the urbanisation of space extends boyond the coastline, albeit in the form of fragmented and less frequent urban nodes.

Sources: (Google Earth 2021).

0   2 km   N

Hammerfest scale

As stated before, Nordic settlements were historically always positioned in approximation of the coastline. However, since the first settlement in 8000 B.C. the coastline has shifted alternately seaward then inland due to changing sea levels in the Holocene time period. Interestingly, archaeological research has provided evidence that the average altitude of prehistoric settlements shifted along with the shoreline displacement during that time, maintaining an average altitude of 4.8 meters above sea level.

When the sea level rises, it affects the coastline in three dimensions. In the y-axis, the coastline changes in elevation. In the x-axis, the coastline shifts seaward or inland. Behind this two-dimensional plane lies the topography and bathymetry. The coastline cuts the soil and divides it into topography and bathymetry. When the sea level rises that division rises as well. What was once considered topography is now (submerged) bathymetry. This translation forms the third dimension. Along the z-axis, the morphology of the coastline changes as it cuts through a different topography.
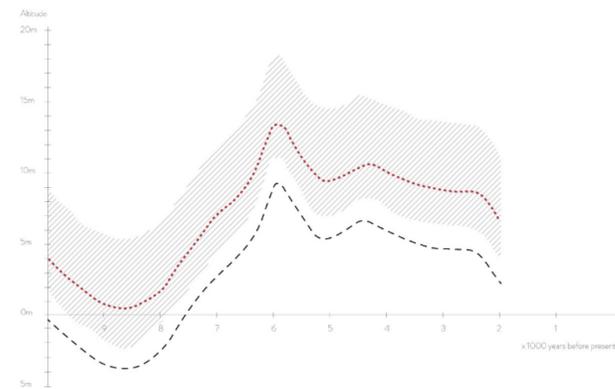
Graph showing the rise and fall of the sea level (black dotted line) in prehistoric times, and the average elevation of prehistoric settlements during that time (red line). Source: Møller (1987).

Translation of the coastline in three dimensions

A schematic transect of the Hammerfest coast depicting sea level in 1020, 2020 and 3020. When the sea level rises or falls, the position of the coastline changes in three dimensions. Simultaneously, the devision between above and below water landscape is translated.
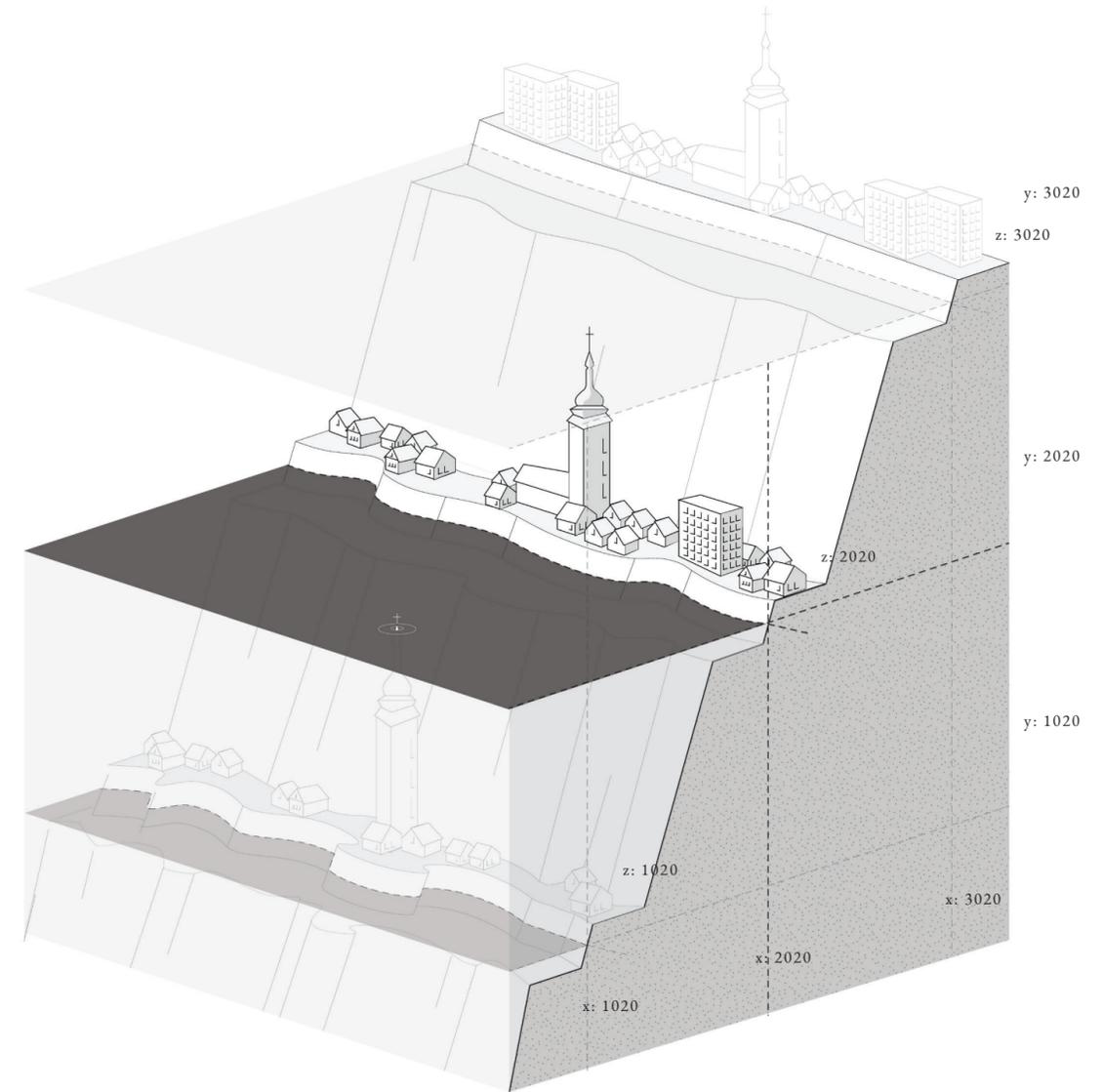
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Mutualism / Competition / Diversity / <u>Entropy</u>

01. <u>to reside</u>
To have one's home in a particular place. Also: belonging of a right or power to a person or body.

02. to occupy
To use, fill, exist in or take up space for a period of time. Urban occupation is the human use of land (or sea) for urban purposes.

03. to own
To possess something or to have rights and control over property. Ownership indicates that which belongs to someone and to whom it belongs.

04. to settle
To establish a community in a place which has been previously been uninhabited by that community. Urban settlement can be defined as the physical manifestation of this inhabitation, such as a house, road or platform.

05. to live
To be and remain alive, or to have life. Also: to have life at a particular place, which is, to reside.

06. to resettle
Repositioning of an urban area or architectural manifestation of human occupation in space. The repositioning of a population, or the inhabitants of a settlement is called: migration.

07. to migrate
The repositioning or moving of a population from one habitat to another.

08. <u>to traverse</u>
To move or travel through a certain area or place, often in great length. To go across, to bridge, space.

09. to commute
To travel regularaly between one's home and work place. Also, to travel back and forth.

10. to transport
To take, move or carry people or goods from one place to another by means of a vehicle, aircraft, ship and/or infrastructure.

11. <u>home</u>
A place or architecture used permanently as residence by a family or person(s). It is a house occupied with life.

12. to build
To constuct, create, or add parts of material together. The formation of architecture requires the act of building.

13. to terraform
To worldbuild. To form and reform earth in accordance with a certain worldview, vision or ideal. Generally used to support and ease human life.

Shortlist

01. traverse
02. home
03. reside

Man first crossed the oceans in a search for new land upon which they might settle and build a home. Yet, when we leave our house, what happens to the home? Does it remain, or does it travel with us when we traverse the sea. Let's propose the latter. In that case, human habitat is not stationary, but mobile. With every raft we push onto the ocean, with every ship we board, we take a part of our habitat and sail it away from shore.

People constantly move across the coast. The captain of a ferry might arrive at and depart from the coast more than twenty times per day, whereas a technician working on an oil rig spends two full weeks off-shore after every two weeks on land. At any given time hundreds if not thousands of people reside at sea (MarineTraffic 2020). As such, human habitat is not confined to land at all. It is an ever changing sprawl that spreads with every ship, aircraft, train and subway. As we reach underground and skywards, inland and seawards.

**Crossing the coast, traversing the sea**

Traces of all seafaring routes in 2019 on the Barents Sea. Darker lines indicate a higher density of routes per 4.89 km². Also depicted is the main roadnetwork on land. Note the difference in fabric of these networks of movement. Crossing the coast to move inland or seawards means to change to a different mode and network of movement.

Source data: (MarineTraffic 2020; OpenStreetMap 2014)

500.000 routes / 4.89 km² / year

1 route / 4.89 km² / year

0   200 km   N

Barents Sea scale
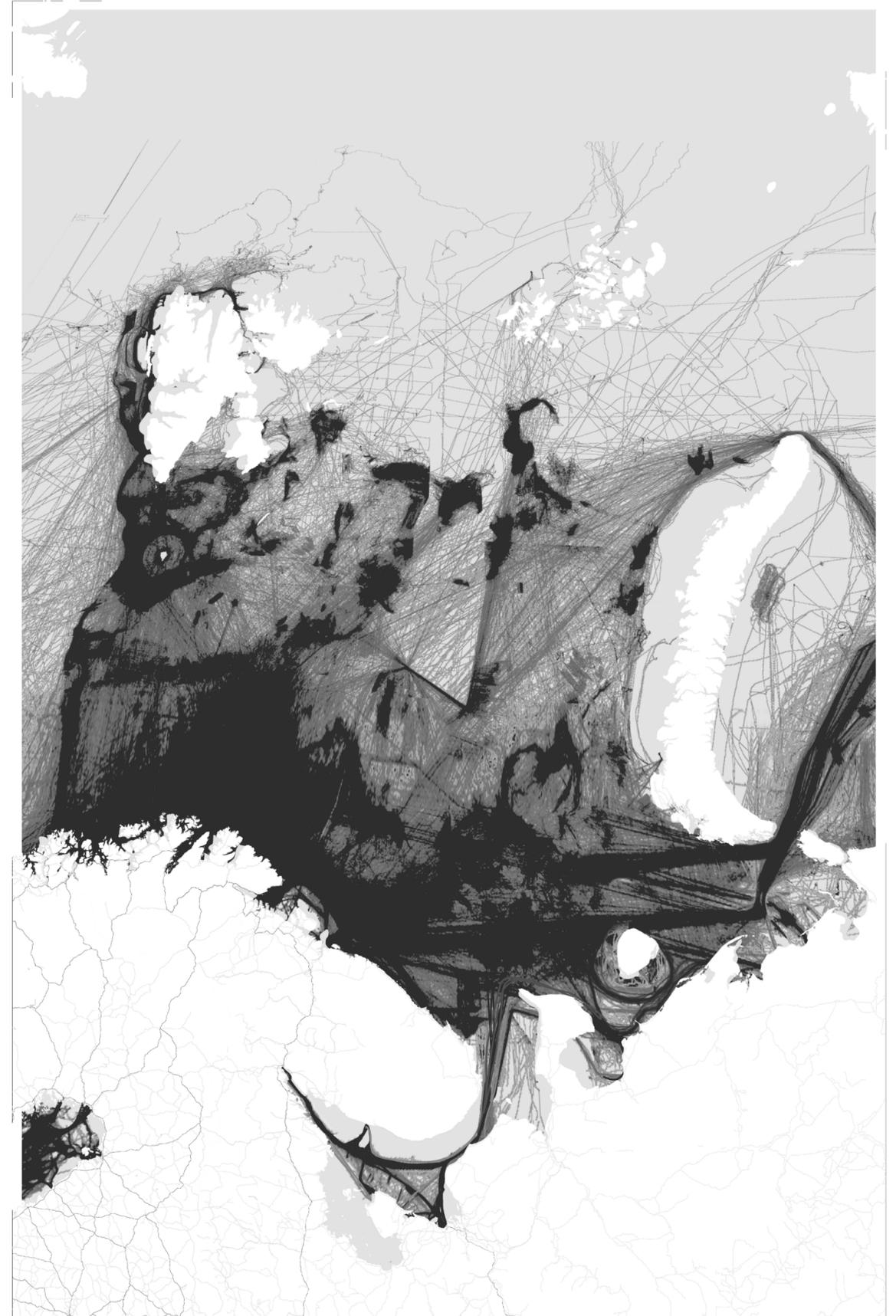
Habitat is both space and place. It is both house and home. It is life, manifested in physical form. Indeed, a house is only a home when it accommodates life. If we do regard the ocean as a place for life, human life, then human habitat is not confined to terrestrial forms of urbanisation. If a house can be a home, why not a boat or an oil rig?

In the Barents Sea, spatial manifestation of marine inhabitation can be found in both fixed forms, such as oil rigs and platforms, and in flows, such as shipping routes and vessels. For both fixed forms and flows, marine settlement is mostly of a temporal and functional nature.
        The architecture of marine settlement responds to this. The architecture of house and home at sea is considerably different from terrestrial homes. Imagine the cabin of a crab fishing vessel or the food court on an oil rig. Could you feel at home there? What is on your night stand? The architecture of marine settlement provides for a different life.

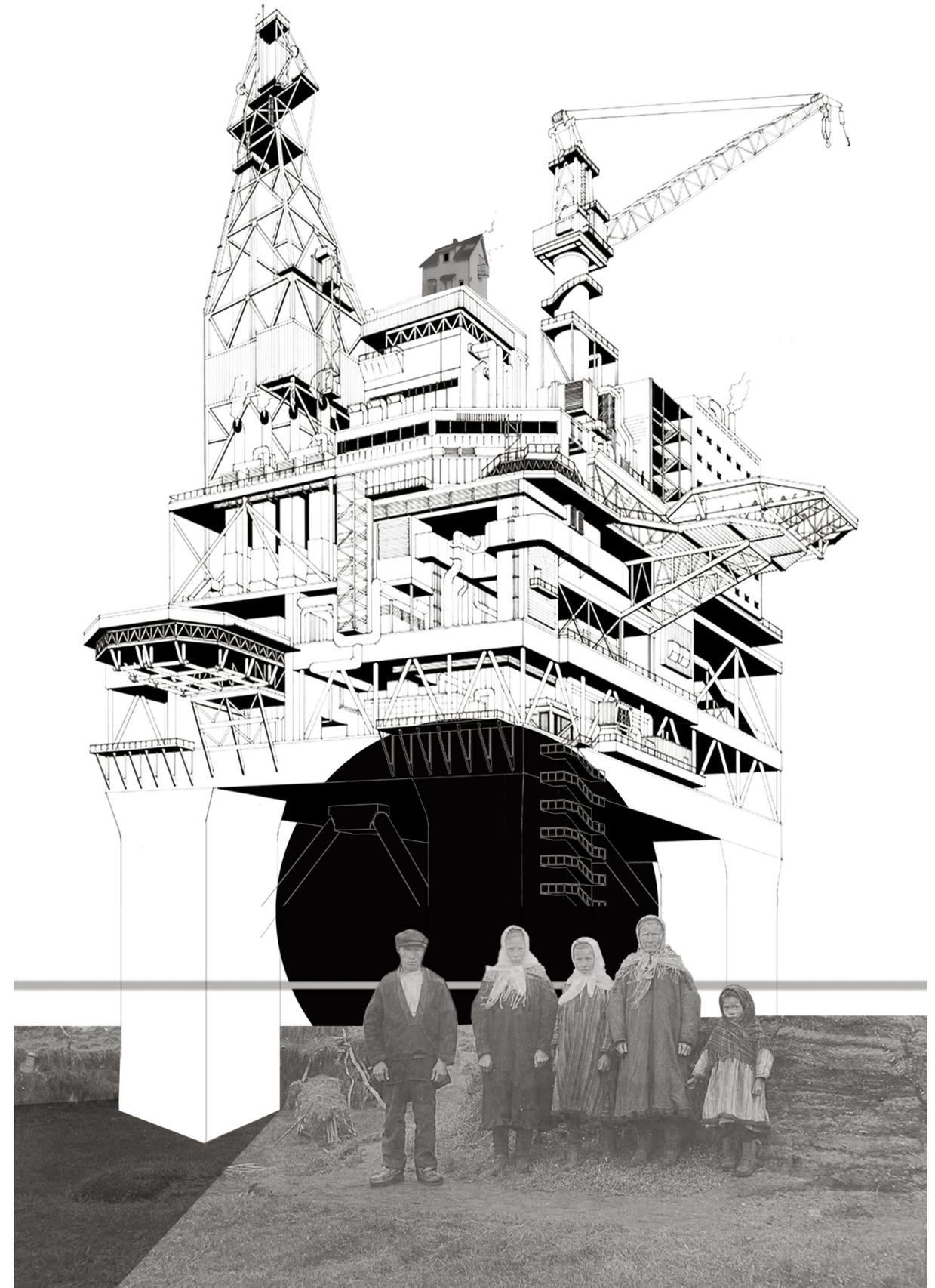How do we relate to these homes? Who is family? Are we proud?
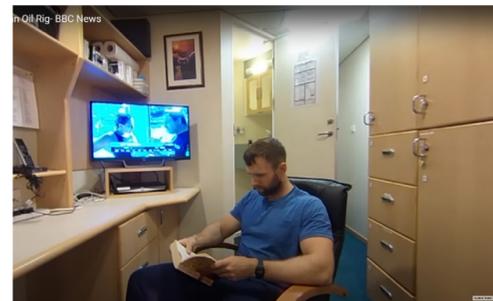
A personal room on an oil rig. Source: BBC News (2018).

Home at sea?

Image / A coastal Sami family posing proudly before their home in Adamsfjord, Laksefjord, Finnmark in 1909. And an architectural drawing of a typical oil rig.

Edited from: (Hanna Resvoll-Holmsen 1909. ; Julien Nolin n.d.); Pen RiG Study (n.d.).

Alterations in the marine environment impact coastal communities. For example, Hammerfest owes its current prosperity to offshore oil and gas industries. Yet, up until 2002, the town's economy relied heavily on fishing and a little tourism. Due to the declining fish industry Hammerfest could offer little livelihood prospects and unvaried job opportunities. This led to severe depopulation and unemployment. The arrival of the oil industry revived Hammerfest, creating job opport-unities and cultural development which attracted a new, younger population. Local interviewees describe the offshore petroleum development as "a blessing" (Loe and Kelman 2016).

The socio-economic benefits of the oil industry in Hammerfest are easy to measure, but the offshore developments did more than just increase local job opportunities. According to the interviewees it also changed the mindset and lifestyle of the inhabitants. Transitioning from a culture where neighbours, family and 'soft' values were important to a society that emphasises status and income (Loe and Kelman 2016). The question remains, if

Hammerfest's current economy is socially sustainable, considering the Snøhvit and Goliat extraction sites are expected to run out within 20 years.

We can conclude that marine industries have a socio-cultural impact on the ocean. Especially in Hammerfest, where the welfare of the population is closely tied to marine industries. Marine spatial planning should acknowledge coastal communities as a group of people that strongly relates to the ocean and is sensitive to its alterations. As agreed upon in 2015 during the UN sustainable development summit in New York, sustainable development should consider the relationship between society and the natural world (UN 2015). To achieve sustainable oceans, social sustainability cannot be forgotten.

Impact of oil on Hammerfest population

The outer ring represents the population decrease and increase in the municipality of Hammerfest from 1980 - 2020 and some milestones in the developing of oil industry off the Hammerfest coast. Note the population rise after the start of construction of Snøhvit in 2002.

The Inner ring represents the short term effects of oil industry on the Hammerfset population. After every two weeks at sea, oil rig workers spend two weeks on land. As such, the popula-tion of Hammerfes fluctuates every two weeks. Pushing and pulling, inland and seawards like the tide.

Source data: Statistics Norway (2013, 2020); Loe & Kelman (2016). Photos by: Axel Lindahl (1889); Oskar Puschmann (2004).
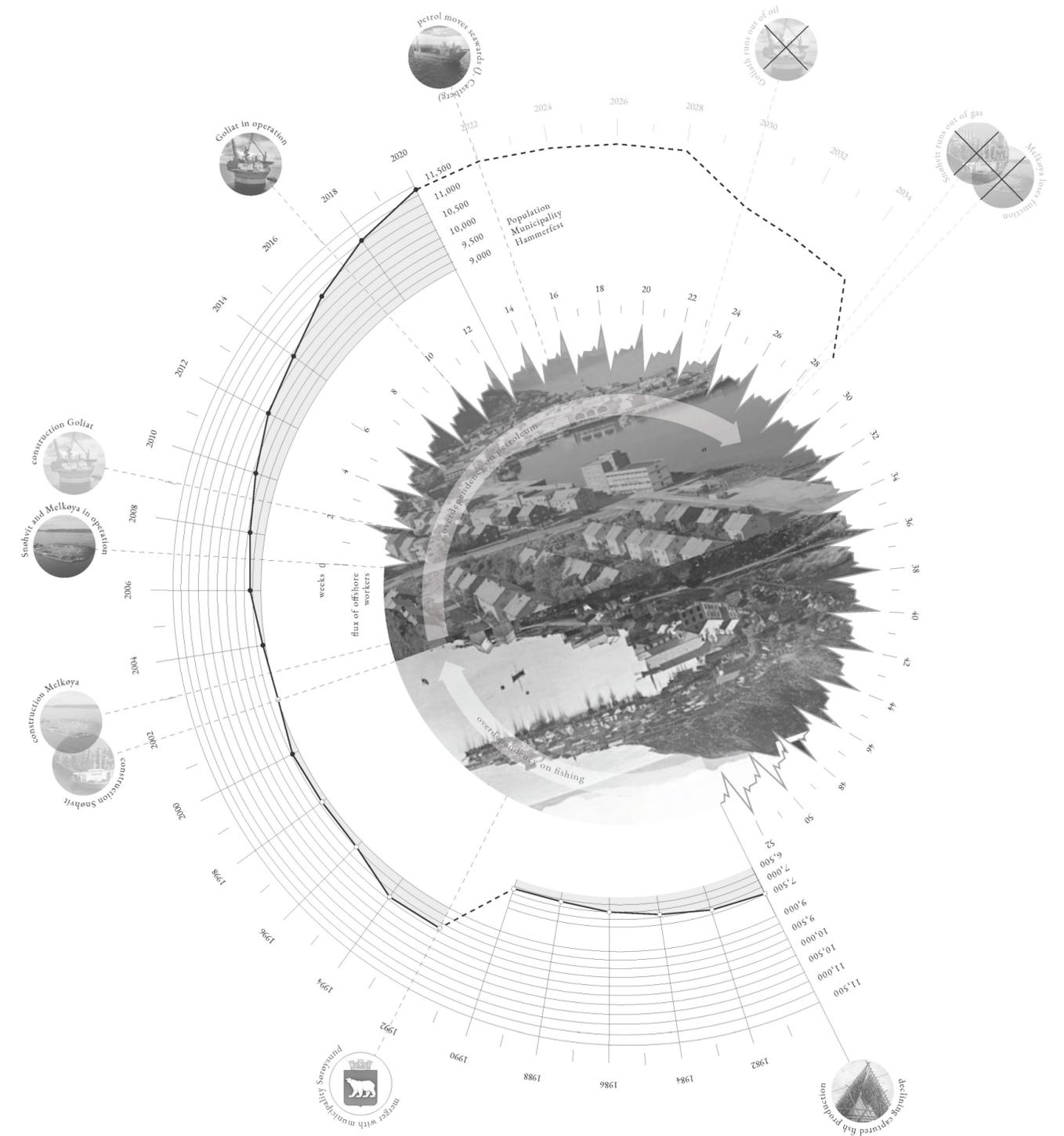
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Climate regime / Ethics / Ownership / Displacement

01. claim
To demand or maintain ownership of property or rights. Ownership indicates that which belongs to someone and to whom it belongs.

02. right
To have the right to something, means to hold privilege or authority and to exersize authority, allocated by law or political processes.

03. intention
Determination or intend to act in a certain way in order to accomplish certain aspirations.

04. management
The control and organisation of a system over a long period of time.

05. extraction
To physically remove, draw out or withdraw something from the larger whole using effort or force. Resource extraction is the act of withdrawing materials from the natural environment for the benefit of human life.

06. restriction
The limitation or prohibition of something by one who has the right to do so. Used as a means for protection, seclusion or control.

07. commitment
The state or quality of being dedictated to a cause and the intention of maintaining this dedictation over a long period of time.

08. responsibility
The state or quality of being accountable for something. To be in a position of authority and as a result of that authority, to have a duty to deal with something.

09. care
The proces of providing for and protecting of something or someone. Also: to have personal interest in, responsibility or consideration for something.

10. marine citizenship
The rights and responsibilities of an individual towards the marine environment, requiring the acknowledgement that we personally influence and are influenced by the ocean.

12. protection
To care for something and guard it from harm. To ensure the safety or health of a person, object or place.

13. borders
Boundaries or edges confining space. Borders can be either physical, such as a fence, or political, such as municipal borders. Geopolitical borders can be both.

Shortlist

01. claim
02. rights
03. responsibility
04. borders

The colonisation of the Barents Sea became a fact as soon as nations laid claim on its water. In 1635, John Seldon developed the doctrine Mare Clausum, the enclosed sea. In principle, Mare Clausum allowed nations to claim the right to resources and jurisdiction over their neighbouring waters up to 200 nautical miles from the coastline. These borders are still applied today to enclose the Exclusive Economic Zones (EEZ). Where the exclusive economic zones overlap, the position of the border needs to be discussed and agreed upon by the nations in question. In the Barents Sea, the border between norwegian and russian ownership remained an area of dispute up until 2014. Before that, both countries maintained their preferred border seeking rights to the precious gas and oil underneath.

Claim always starts by drawing borders on the map. Whatever lies within these borders becomes owned land or sea. In drawing borders you claim both rights and responsibility of the sea.
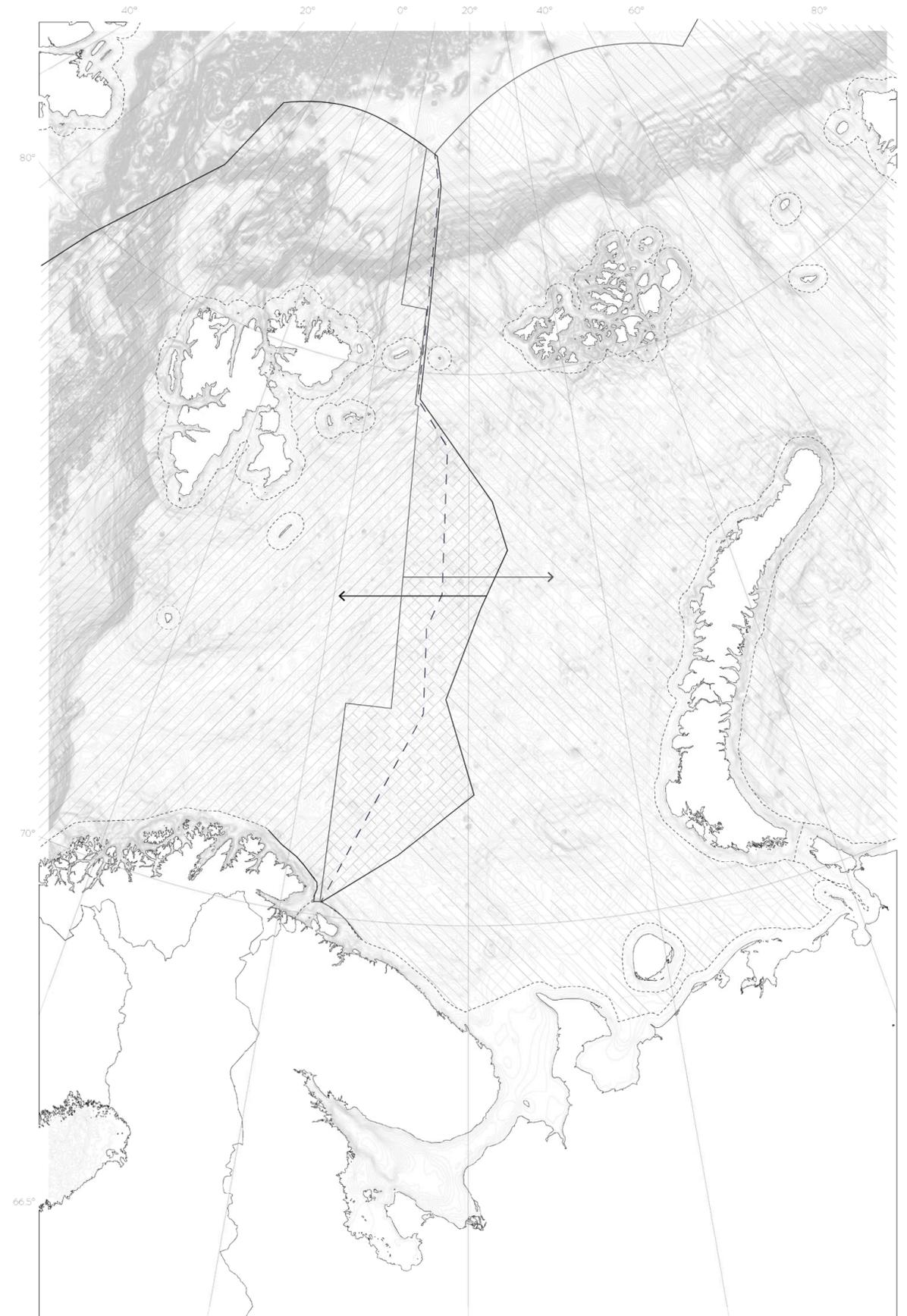
Mare Clausum

Showing the parts of the Barents Sea fall under the EEZ of Norway and Russia and the area of dispute where these two areas overlap in the center.
Source data: Norwegian Ministry of the Environment (2011).

⟋ Norwegian claim
⟍ Russian claim
⤬ Area of dispute

0   200 km   N

Barents Sea scale

More so than land, the ocean is dynamic and ever changing. Maps and planning documents falsely represent the ocean as a static surface, obscuring the constant movement of the water itself (Gee 2019), the people that cross it, and the matter that it carries. In terms of ownership this provides some difficulties, as no particle of water nor anything carried by water stays ever in the same place. Due to its mobility, water cannot be bound by administrative borders and can thus not truly belong to a nation. According to Hugo Grotius, a dutch jurist and philosopher, private or public ownership of the sea is thus impossible if not immoral. A free ocean, Mare Libirum (Grotius 1609), is an ocean that owns itself ("Embassy of the North Sea" 2020). This attitude creates some difficulties for marine planning. How can we represent the constant movement of the ocean in planning, how can we locate anything on sea, and how do we plan for an ocean that we do not own?

Sri lanka coast - 2 million barrels
Mauritius' coast - 17,800 barrels
Shanghai coast - 2.4 million barrels
Tauranga coast - 840,000 barrels
Bay of Biscay - 360,000 barrels
Milford Haven - 1.2 million barrels
Angola coast - 1.9 million barrels
Prince William Sound - 250,000 barrels
Nova scotia coast - 1 million barrels
Cape town coast - 4.5 million barrels
Tobago coast - 2.1 million barrels
Angola coast - 1.9 million barrels
Brittany coast - 1.8 million barrels
Sri lanka coast - 2 million barrels
Mauritius' coast - 17,800 barrels
Shanghai coast - 2.4 million barrels
Tauranga coast - 840,000 barrels
Bay of Biscay - 360,000 barrels
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Mauritius' coast - 17,800 barrels
Shanghai coast - 2.4 million barrels
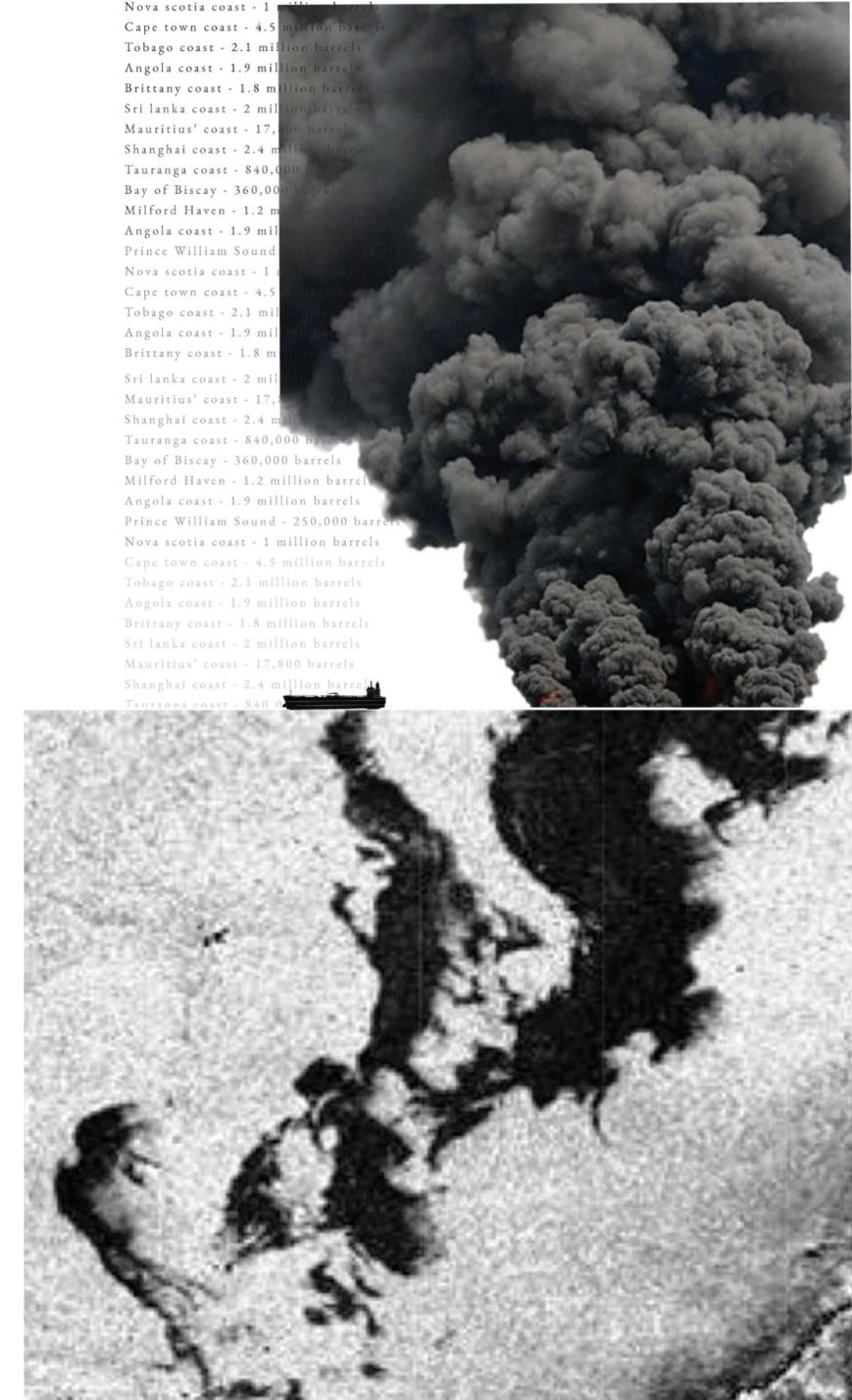Tauranga coast - 840,000 barrels

Mare Libirum

A schematic section representing the Barents Sea, undevided by the border between Norwegian and Russian ownership.

Part of the image are: an infra-red image of spilled oil at the coast of Mexico, a photograph of a fire caused by two colliding oil carriers, and a list of locations of major oil spills in the past and the amount of barrels of oil spillt into the ocean.

Source: Chaturvedi et al. (2020); United States Coast Guard (2010).

This is mine   Not mine

Because of the fluid nature of water and air, the way we approach 'claim' in these domains should be fundamentally different than on land. Of the three domains, soil is the only one where borders of ownership outline both the area of claimed rights and responsibilities.

For both water and air, borders of ownership merely outline the right to the space and the resources in, above and below it. The area of responsibility extends far beyond these borders. Lines drawn on a map cannot contain the water; nor fish populations, or spilled oil. There is but one continuous ocean, which we all share (Santoro et al. 2017). Because of this, offshore urbanism should look beyond national borders, and claim not just rights, but responsibility for the ocean as an entity.
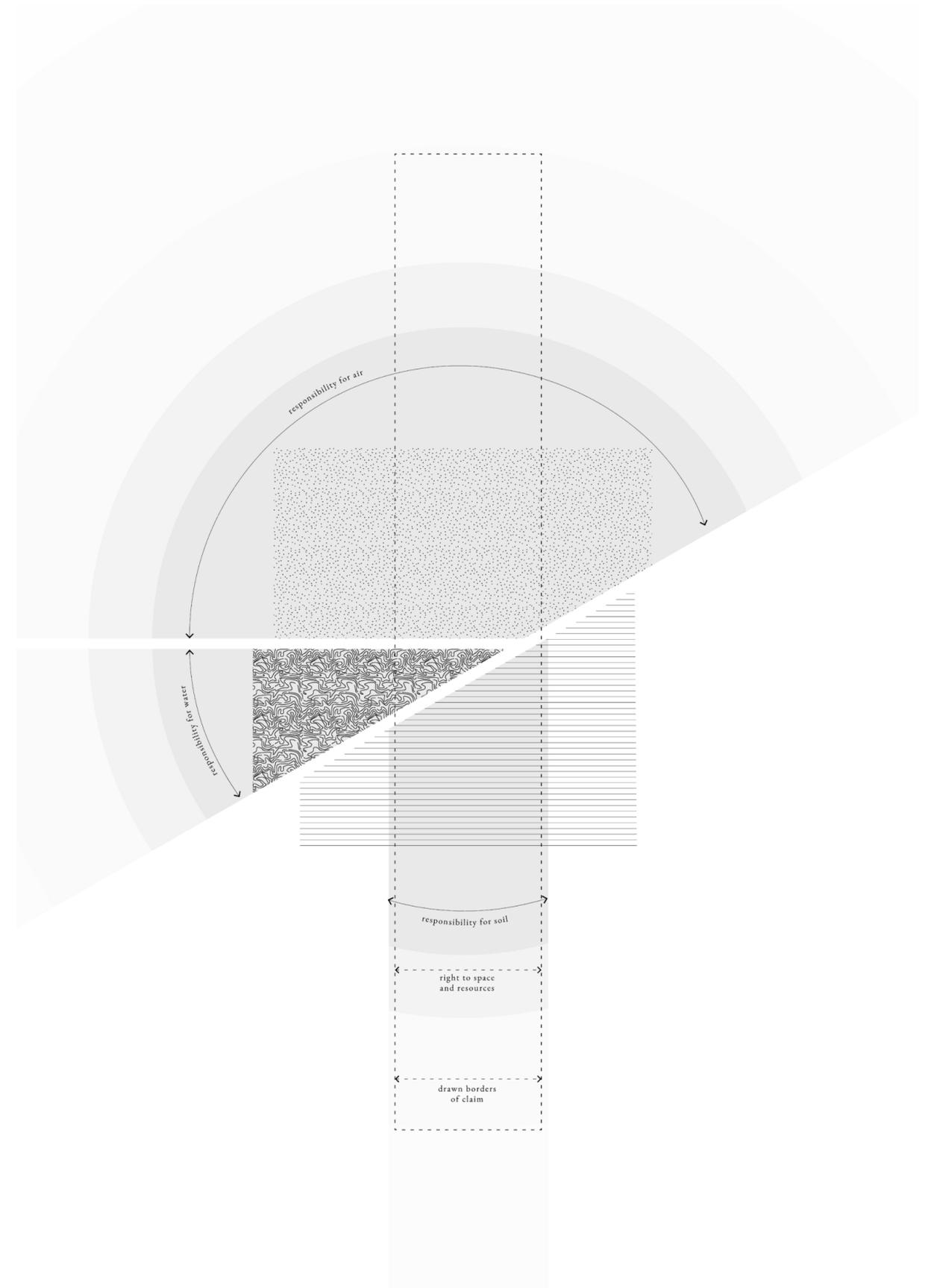
Drawing borders for water, air and soil

A diagram showing the domains of water, air and soil, borders of claim, and the areas of right en responsibility for each of the domains.

⊟ water
⊡ air
◣ soil

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What 'is'

Since the first rafts embarked onto the ocean, humans have been subject to the sea. This human-sea relation has developed ever since, embedding into the local culture and establishing coastal communities that are dependent on and sensitive to marine alterations. The socio-cultural connection between man and sea varies for each community, for every land. Where I am from, this connection is one of defence and safety. In The Netherlands, the fight against water is visible everywhere, in the dikes and the dunes, the polders and the sluices. These architectural traces are a reflection of water management expertise and a reflection of fear. A tradition fear, that comes from the collective memory of flood disasters and lost homes. The continuous struggle against water is carved into our identity.

At the coast of Finnmark a different human-sea relation can be identified. Here, the socio-cultural connection to the ocean is not one of protection, but of production. Since prehistoric times, Norwegian communities have settled in close proximity to the coastline. They were fishing villages. From the coast, the Norwegian land rises quickly into a mountainous topography that does not allow for extensive agriculture. Instead, the ocean is used as a production space. Even now, Norway's main contributing industries are marine industries: Oil and gas extraction, hydraulic energy, aquaculture and shipping.

Perhaps it is because of this strong economical reliance, that marine spatial planning of the Barents Sea is predominantly approached from an economic perspective. As the urbanisation of marine space increases, the reorganisation of marine use at the Barents Sea seems primarily fitted to fulfil national demands. The demands of coastal communities and socio-cultural perspectives are overlooked.

What 'should be'

Yet, the vast majority of marine production is accomplished by the accumulation of local efforts. The operability of the very coastal communities that are essential for marine production are at risk by marine developments. Still, these risks remain unknown and underrepresented in the marine spatial planning process. In order to maintain social sustainability and operability in coastal communities, socio-cultural demands should be represented and taken into account in the MSP decision-making process.

What 'will be' without action

The ocean turns into a patchwork of marine industry, spread out over the waves like agriculture. Underneath, between and above, nature raves on. The ocean surface crowds with vessels and platforms that are wired to the seabed like hospital patients to their hospital beds.

As sea ice retreats, the patchwork spreads north. Once Goliat and Snøhvit run out, the petroleum industry, which Hammerfest so heavily relies on, moves further seaward as well- away from Hammerfest and into global hands. The economy of life in Hammerfest is torn between the shore and the outer sea. With the loss of local job prospects and their strategic geopolitical position in proximity to petroleum, the community falls back into regression.

What 'could be'

By approaching the reorganisation of marine space from a human-sea perspective, the Barents Sea becomes a local project. Local capacities determine production, marine conditions and qualities determine its morphology. Marine space is only claimed temporarily. The fishermen follow the fish and marine traffic changes routes according to weather conditions. Even the oil platform will serve another function, once production is moved elsewhere. Because marine space is only claimed temporarily, no real borders can be drawn. Both the right to resources and responsibility are shared by all users. Production is small-scale and varied, as opposed to massive, un-adaptive developments. Allowing local initiatives and community-led mariculture.

To ensure that the marine landscape is not littered and overgrown with an array of human functions, clear regulations and monitoring on the territorial scale is imperative. The role of urbanism in this scenario is two-fold. At one hand, urbanism must aim to understand and represent socio-cultural demands in order to give them any opportunity to guide marine spatial planning on a local scale. At the other hand, urbanism must design an overarching vision, including spatial regulations that guide offshore development toward a social, environmental and economic sustainable path.

Projection without action

An image projecting a future extremity (what 'will be') in a no-action scenario.

THE OCEAN FROM AN URBANISM PERSPECTIVE

Lines of inquiry

Shore   [to access the sea]
Catalogue   Socio-spatial conditions of shore
Spatial   Maritime access
Social   The body and the shore

Surface   [to traverse the sea]
Catalogue   Socio-spatial conditions of surface
Spatial   Patterns of movement
Social   Community offshore

Depth   [to respond to marine dimensions]
Catalogue   Socio-spatial conditions of depth
Spatial   Inland-seaward
Social   Gradient of human occupation

Seabed   [attitude towards the sea]
Catalogue   Socio-spatial conditions of seabed
Spatial   Resource claimation
Social   Seabed imaginary

FOUR SPACES OF DESIGN

Comparable to the Dutch layers approach (De Hoog, Sijmons en Verschuuren 1998), Offshore Urbanism could distinguish four dimensions: Shore, Surface, Depth and Seabed, that should be studied as an coherent system. "We consider this coherence between the [dimensions] as the domain of spatial planning" (78). Thus, keeping in mind that the conditions of marine space always relate to the other dimensions. For example, maritime access is determined by the depth of the water, sea routes on the surface and the lenght of the shoreline. Maritime access can be improved by dredging the seabed. In short, a condition is never determined by one space alone.

Shore

Surface

Depth

Seabed

Location sections in plan
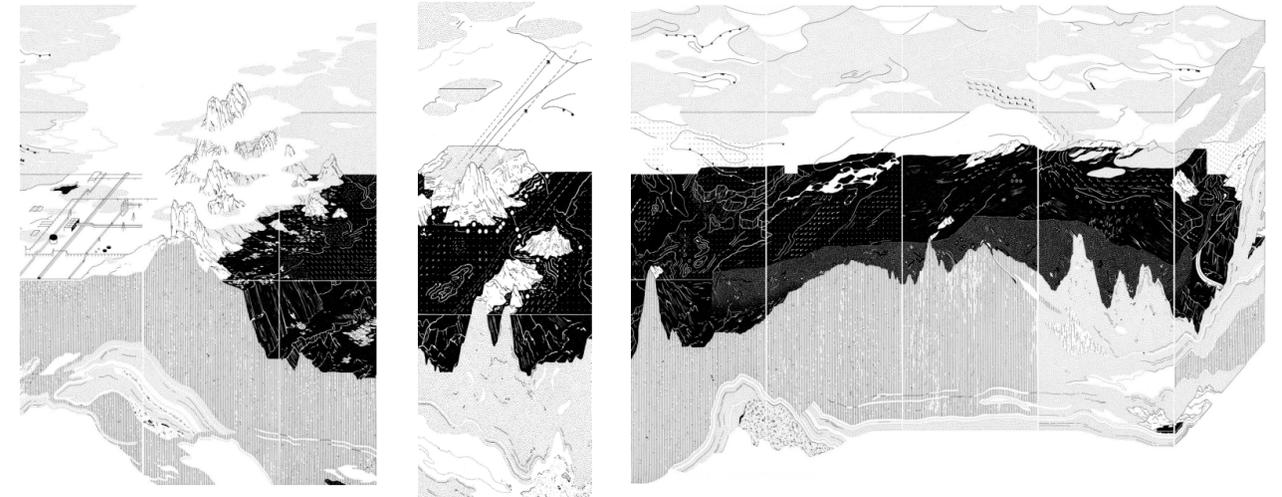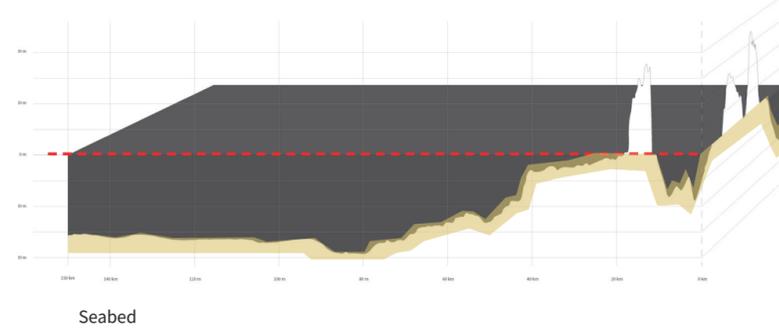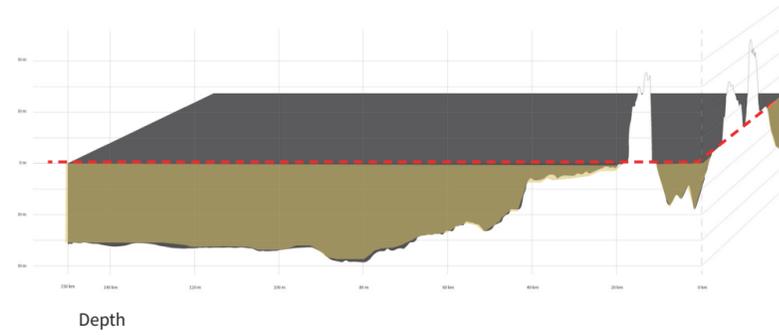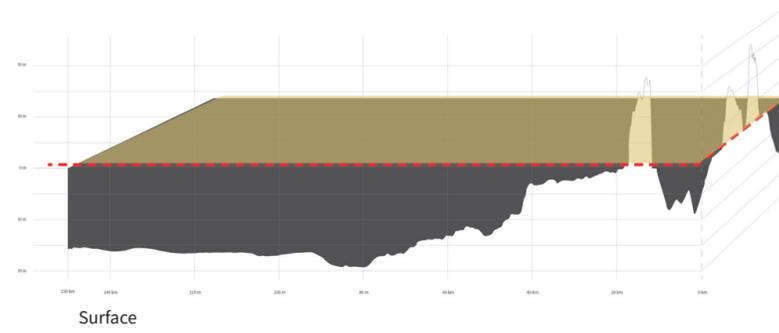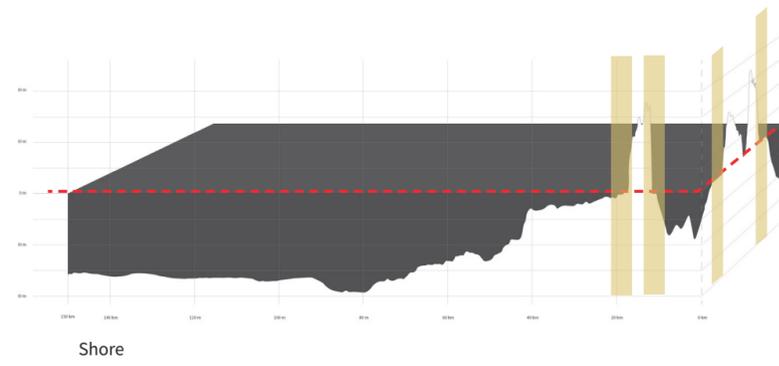
Above / Lithosphere, Hydrosphere, Atmosphere. Source: Eva Le Roi (n.d.).

Left / The four dimensions of marine space as an entry point of the maritorial design depicted in transect.

S H O R E
Catalogue

Spatial conditions

Socio-cultural conditions

01. maritime access
Sedimentation
Ice
Depth
Navigation
Vessels

05. work
Type
Weight
Time consumation
Quantity of workers needed

02. maritime interface
Length shore accessible
Piers and wharf form
Capacity

06. worker
Demographics (nationality, gender, age)
Memory / story
Person (name/portrait)

03. infrastructure and equipment
Cranes
Storage space
Transshipment
Processing

07. the body at the shore
Physical contact or view of the sea
Public access to the shore
Visible marine industry from shore
Role of the body in port operation

04. land access
Infrastructure
Traffic flows (congestion, navigation)
Vehicles (truck, train)

08. community
Historic identity
Places of gathering
Social groups / sectors
Collective memory

Shortlist

01. maritime acces
02. the body at the shore

Spatial condition

Maritime access is defined as the level of accessibility for vessels to reach the shore. Maritime access requires the water depth to be deeper than the draft of the vessel. The draft, the depth of a ship, is measured from surface level and increases with ship size and capacity. Currently, coastal gas carriers export liquid natural gas from the harbour at the southern side of island Melkøya to the market. The draft of these vessels is 16m. If marine industry in the Hammerfest maritory increases, the number and size of vessels coming to shore will increase as well.

This analysis aims to find the limits of Hammerfest's shore in terms of spatial capacity in the scenario of extreme traffic densification.

The largest cargo vessel currently in existence is the Ultra Large Crude Carrier (ULCC) with a length of 415.m and a draft of 35m. Thus, the water depth needs to be deeper than 35 meters for maritime access of a UCLL to shore. To realise this, an area of ca. 300m^2 south of Melkøya needs to be dredged to ensure access.
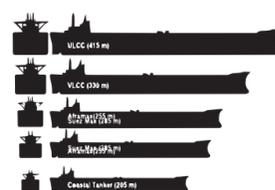
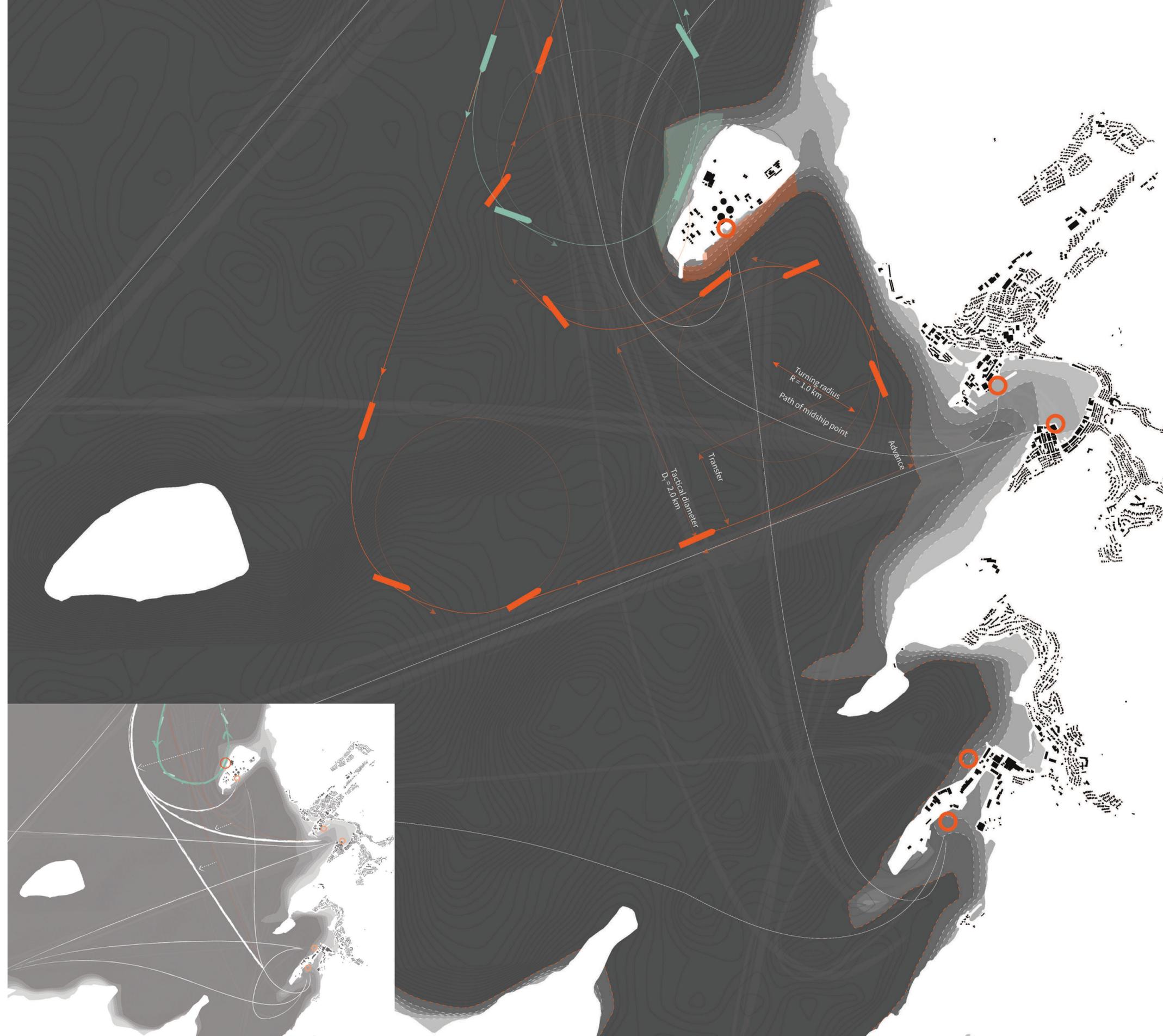SHORE

Navigateability

The turning circle radius of a UCLL ship is 1 km. For a UCLL ship to navigate to the existing harbour at the south side of Melkøya, it needs to fare a complex course (red in map). This is undesirable because of CO$_2$ emissions that increase with complex manouvering, the route compromises the safety of local marine traffic and the limited shoreline that is actually accessible through this route.

As a solution, the harbour could be moved to the north side (green in map). For this alternative, an area of ca. 550m2 needs to be dredged at the north side. Amounting to roughly 9625 m³ displaced soil. The displacement needs a circular solution within the maritory to be feasible.

Maritime access

The spatial capacity of Hammerfest's shore in the scenario of extreme marine traffic densification.
Sources: MarineTraffic (2019); GEBCO (2020); Notteboom, Pallis and Rodrigue (2021).

—— Local marine traffic
—— UCLL course to north side Melkøya
—— UCLL course to south side Melkøya
⊙ Existing harbour
▪ Area to dredge for north UCLL access
▪ Area to dregde for south UCLL access

	Gas carrier	Length	Draft
Depth below -35 m	ULCC	415	35
Depth between -35 and -28 m	VLCC	330	28
Depth between -28 and -23 m	Suezmax	285	23
Depth between -23 and -16 m	Coastal tanker	205	16
Depth between -16 and -1 m	Local vessels		
Depth between -1 and 0 m			

| 0 | 1 km | N

Hammerfest Scale

SHORE
The body at the shore

Socio-cultural condition

We can also view maritime acces from a different perspective: as the ability for humans to visually access the water.
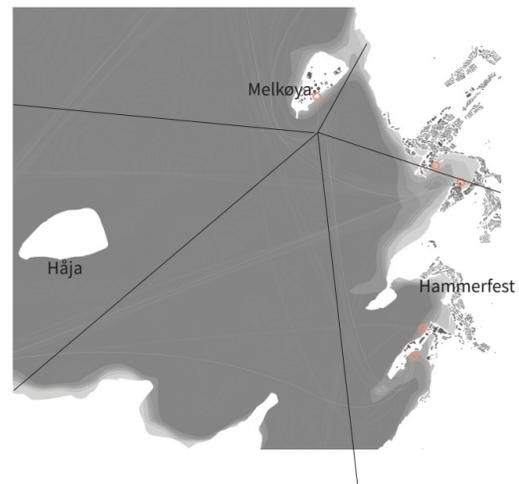
Panorama Melkøya

Note that the view provides a variety of characteristics: water nearby, water from afar, gas industry nearby, island Håja from afar, a ship nearby, Hammerfest from afar.

Soure: Google Maps (2021).

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SURFACE
Catalogue

Spatial conditions

Socio-cultural conditions

01. patterns of movement
Function (occupation of nodes)
Vessels (settlement of nodes)
Density marine traffic
Shipping routes
Patterns of movement

02. cargo
Volume transported
Type cargo
Containers
Transshipment

03. fixed nodes of urbanisation
Function (occupation of nodes)
Architecture (settlement of nodes)
Dispersion / location
Lifespan
Depth
Proximity to shore

04. surface as topos
Sea ice
Surface dynamics
Surface currents
Wave height

05. geopolitical gravitation
Claiming Barents Sea
Borders
International harbour

06. inhabitation of nodes
Number of inhabitants
Flux of inhabitation
Human accessibility of node
Commute and travel distance between nodes

07. worker
Memory / story
Person (name/portrait)
Routine

08. the body at the surface
View of surface from shore
Visual anchors at sea
Role of the body in node operation

09. offshore community
Demographics offshore
Social organisation on board
Legislation on board
Demographics
Collective memory

Shortlist

01. patterns of movement
02. offshore community

Global ship tracking data on marine traffic density (MarineTraffic, 2019) can be used to visualise the patterns of movment on the Barents Sea. The map on the right shows the traffic density measured in routes per 0.61km² in the year 2019. In other words, every line represents the course of a single ship. Warm colours (reds), represent a higher density of courses than cold colours (blues). In the Barents Sea, the following patterns can be identified.

1 / Fishing
Cloud pattern: vessels follow the shoals as they move. Conditions: prawning or feeding grounds, season, water temperature, presence of fish, fishing permit, market demand.

2 / Petroleum industry
Satelite pattern: commute between fixed nodes of urbanisation offshore, such as oil rigs, and a central harbour at shore. Conditions: presence of oil or gas, accessibility of the field (depth field in ocean floor, depth of the ocean itself, distance from shore), extraction permit, market demand, infrastructure.

3 / International transport
Distinct double line: international trading route for cargo ships following agreed upon coordinates. Similar to a highway. Conditions: coordinates, buoys, geopolitical gravitation and position international harbours, safety vulnerable coastal ecosystems, maritime access (depth water and navigateability), economic route (shortest possible).
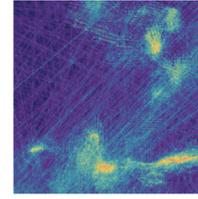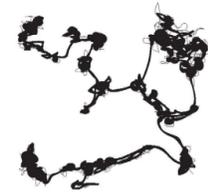
4 / Legislative border
Edge offset from shore: showing high density traffic along the seaward side and low density traffic along the landward side from a set distance from shore. Could signify the location of administrative borders limiting marine traffic within territorial waters without permission. Conditions: Maritime access policy, type vessel, nationality vessel, morphology shore, proximity shore.
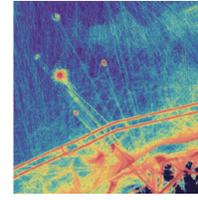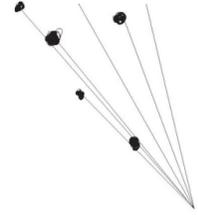
5 / Local traffic
Harbour to harbour network: vessels taking the shortest possible route from one harbour to another within territorial water. Resulting in a dense network of almost straight lines in between islands and w-shaped patterns along shores. Conditions: economic route (shortest possible), maritime access (depth and navigateability), land access of the harbour.
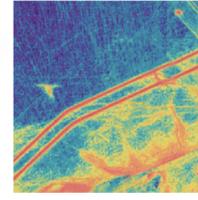
6 / Continental slope
Cloud-like patern along an edge: at the west edge of the Barents Sea signifying fishing activity. The intermediate Arctic waters of the continental slope provide spawning grounds for fish such as Deep-sea Redfish, Haddock and Greenland Halibut. Conditions: Bathymetry, marine landscape, prawning or feeding grounds, season, water temperature, presence of fish, fishing permit, market demand.
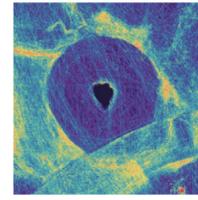

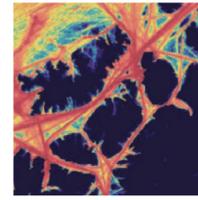
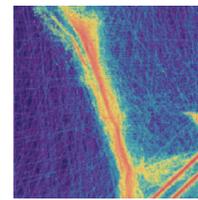**Patterns of movement**

Source data: MarineTraffic (2019).

■ 719 - 285k routes / year
■ 35 - 114   routes / year
■ 23 - 35   routes / year
■ 1 - 23   routes / year

N

0   50 km
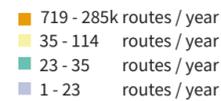
Finnmark Scale
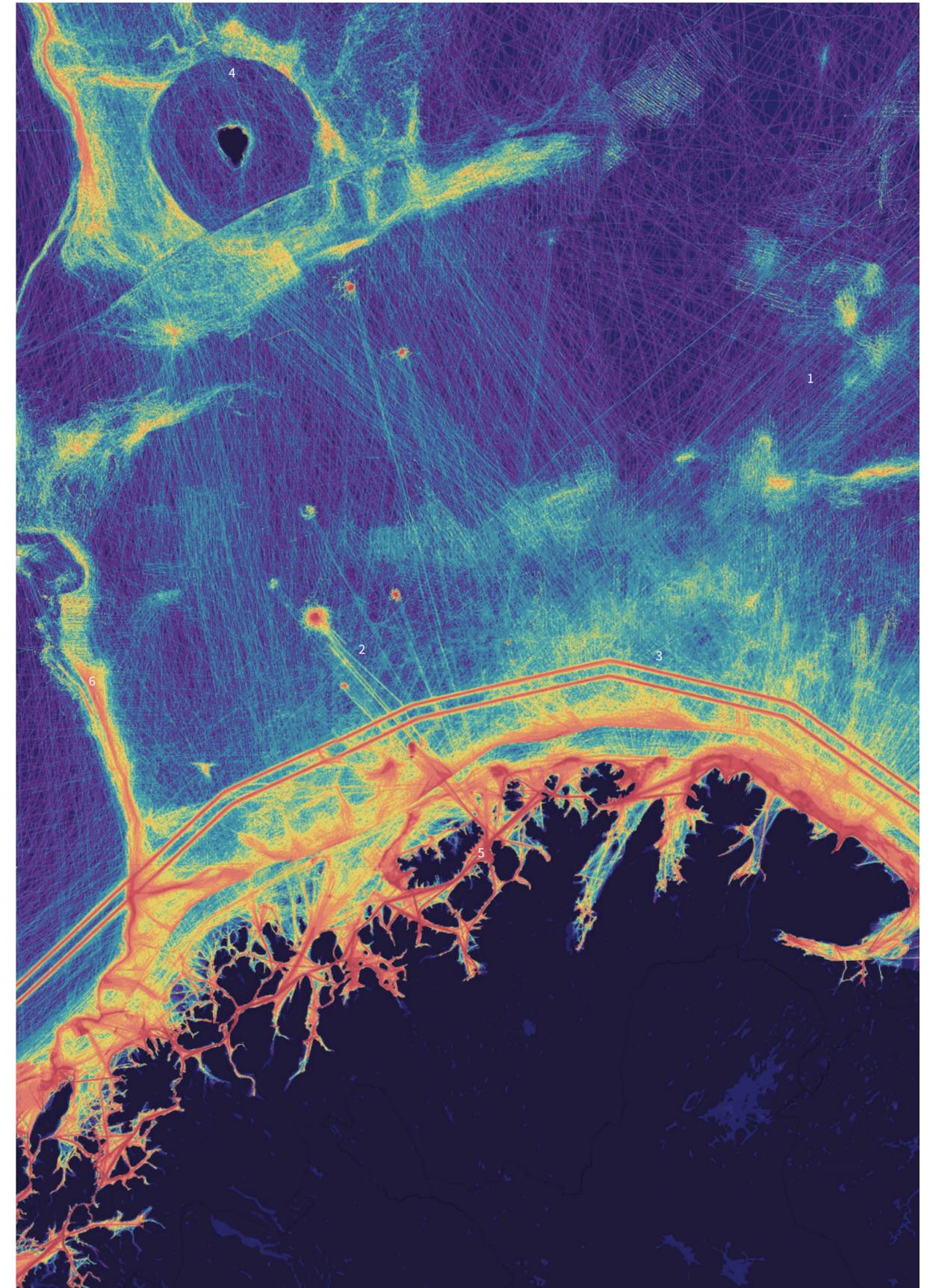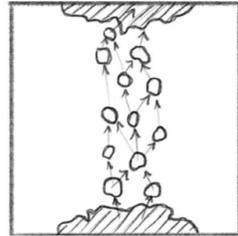
Territorial expansion on land.
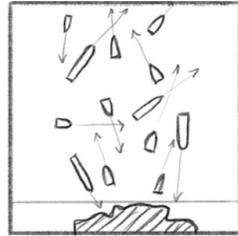
Every ship is an island that could expand the maritory seaward.
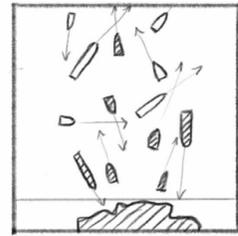
Yet, not all ships that come and go from Hammerfest expand the territory ...
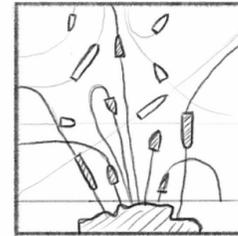
... only those with a reccurent spatial relation to Hammerfest.
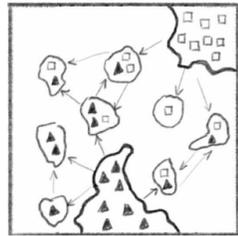
Cross-contamination between two populations on land.
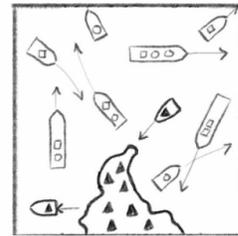
No cross-contamination between populations offshore.
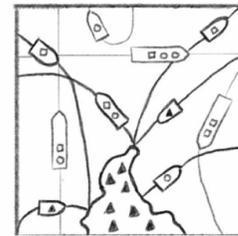
Each ship has its own composite community.

"A scratchy recording of the Norwegian national anthem blares out from a loudspeaker at the Sailor's Church on the bluff above the channel. The container ship being greeted flies a Bahamian flag of convenience. It was built by Koreans laboring long hours in the giant shipyards of Ulsan. The crew, underpaid and overworked, could be Honduran or Filipino. Only the captain hears a familiar melody."
(Allan Sekula, Fish story, p.12)

Map and images sources

Page 65, Patterns of Movement
Sources:
- MarineTraffic. 2019. "Marine Traffic Density in
  2019." https://www.marinetraffic.com.

Page 67, Population Offshore
Sources:
- Sekula, Allan. 1995. Fish Story. Edited
  by Barbera van Kooij, Robin Resch, and
  Ina Steiner. Third revi. Rotterdam and
  Richter Verlag Dusseldorf: MACK

D E P T H
Catalogue

Spatial conditions

01. <u>Vertical depth</u>
Bathymetry
Land form
Platform construction
Vessel accessibility

02. depth as matter
Water temperature
Salinity
Currents direction
Currents velocity
Pollution

03. depth as habitat
Biotopes
Vulnerable biotopes
Type species
Amount species
Biodiversity / species richness
Vulnerable marine ecosystems

04. litter
Aglommerations and mass
Depth of aglomerations
Composition material
Origine

Socio-cultural conditions

05. depth as geopolitical space
Claim and claimee
Resources of the depth (e.g. fish)
Responsibility

06. <u>Horizontal depth</u>
Local scale of influence inland
Local scale of influence seaward

07. Imagined depth
Story
Myth
Creatures
Art
Areas of (un)exploration

08. Depth as other
Sea wrecks
The dead
Unknown

Shortlist

01. Vertical depth
02. Horizontal depth

The spatial manifestation of marine occupation can be found in both fixed forms, such as oil rigs and windfarms, and in flows, such as shipping routes, vessels, piping and cables. Just as on land, the architecture and construction of marine settlement is dependent on the topography, or in the case of the sea: bathymetry.

The tools of a woodman are fitted to the forest and the tools of the miner are shaped to handle rock. Reeds are long and sturdy to emerge from the shallow riverbed and lillys are flat-leafed in order to stay afloat on the water surface. Similarily, the morphology of an oil rig varies for different depths. Offshore construction requires a knowledge of bathymetric conditions.

miner   woodman   hunter   shepherd   peasant   gardener   fisher

terrestrial plants   emergent plants   floating-leafed plants   submersed plants

0 M
-180
-400
-500

-1500

-2000

ship   tilting platform   seasteading platform   fixed platform   semi-submersible platform   sea star platform   flip ship   compliant tower   tension-leg platform   spar

snohvit   goliat
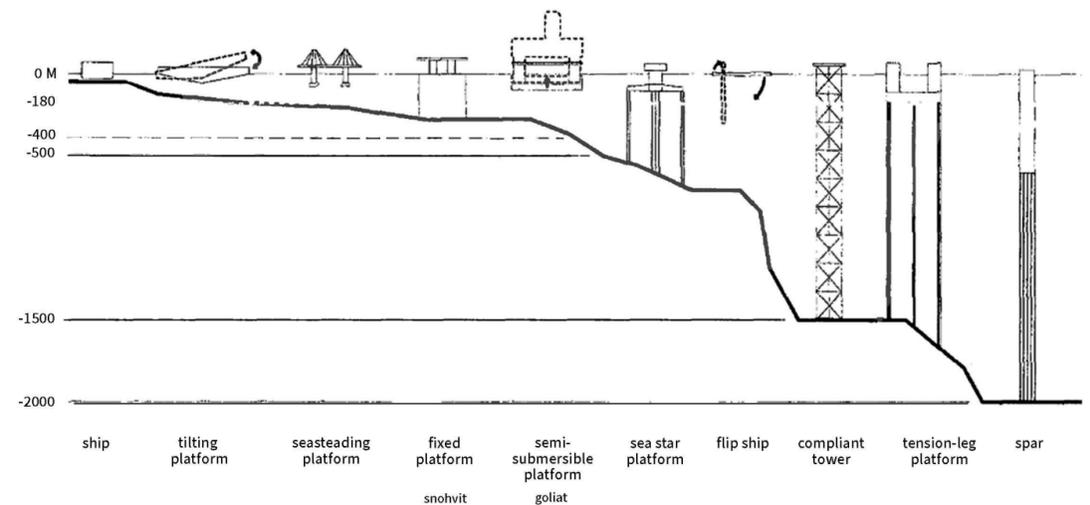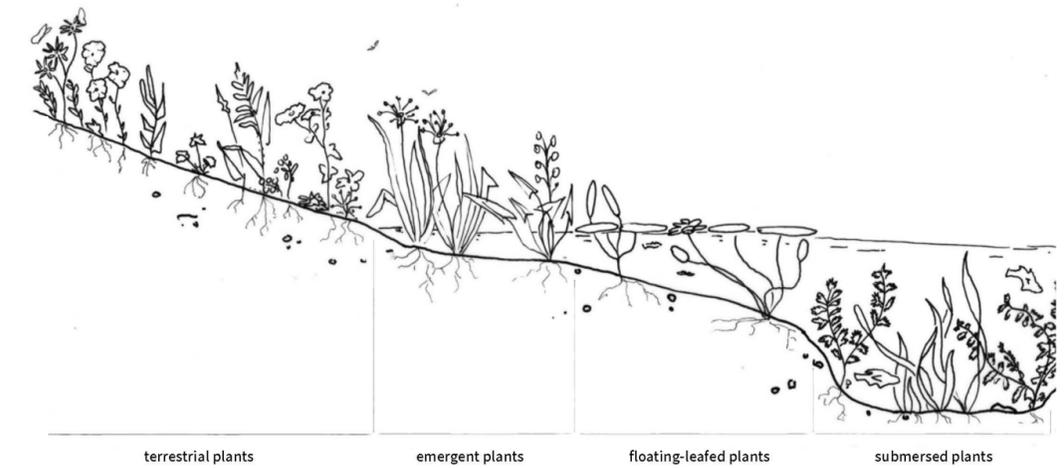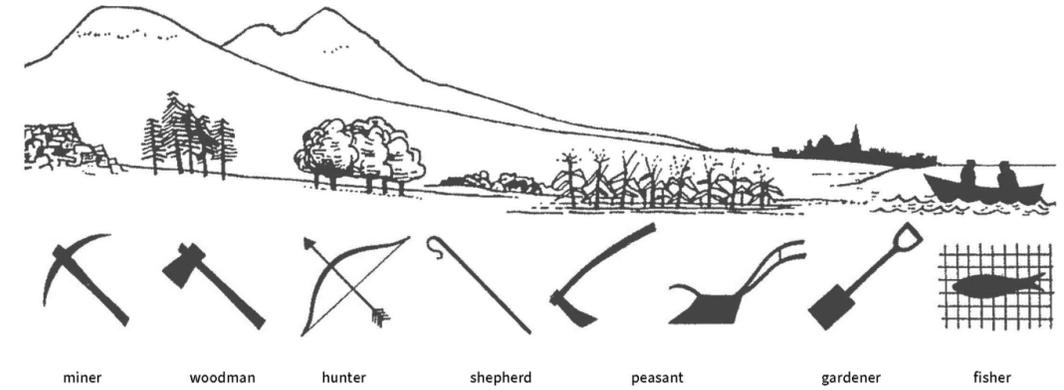
Land use and marine use taking shape

A comparison of three sections that demonstrate the way land use or marine use takes shape in correspondence to topos.

Top / Patrick Geddes, The Valey Plan of Civilization (1909).
Middle / Plant species across a section of a relaxed riverbed slope, by author.
Bottom / different constructions of offshore platforms and water depth, author unknown (n.d.).

Socio-spatial condition

When we view the Hammerfest maritory in terms of depth, we can identify two zones: an inland and a seaward zone. The continental slope, a submarine cliff, seperates the two. Inland, the strandflat (average depth of -80m) and seaward, the continental shelf (average depth of -300m).

The two parts (inland and seaward) should be approached differently in design as they each provide different conditions (deep sea vs internal waters, open water vs islands, local marine traffic vs global marine traffic, etc.).
    Fundamentally they differ in scale and rigidity. In the studies on the right the difference in scale and rigidity of the two parts is visible. Inland morphology is fine grained, organic and dense. Seaward morphology rigid, larger in scale and wide spread. Cross-coastal design should work on both systems, inland and seaward, global and local.
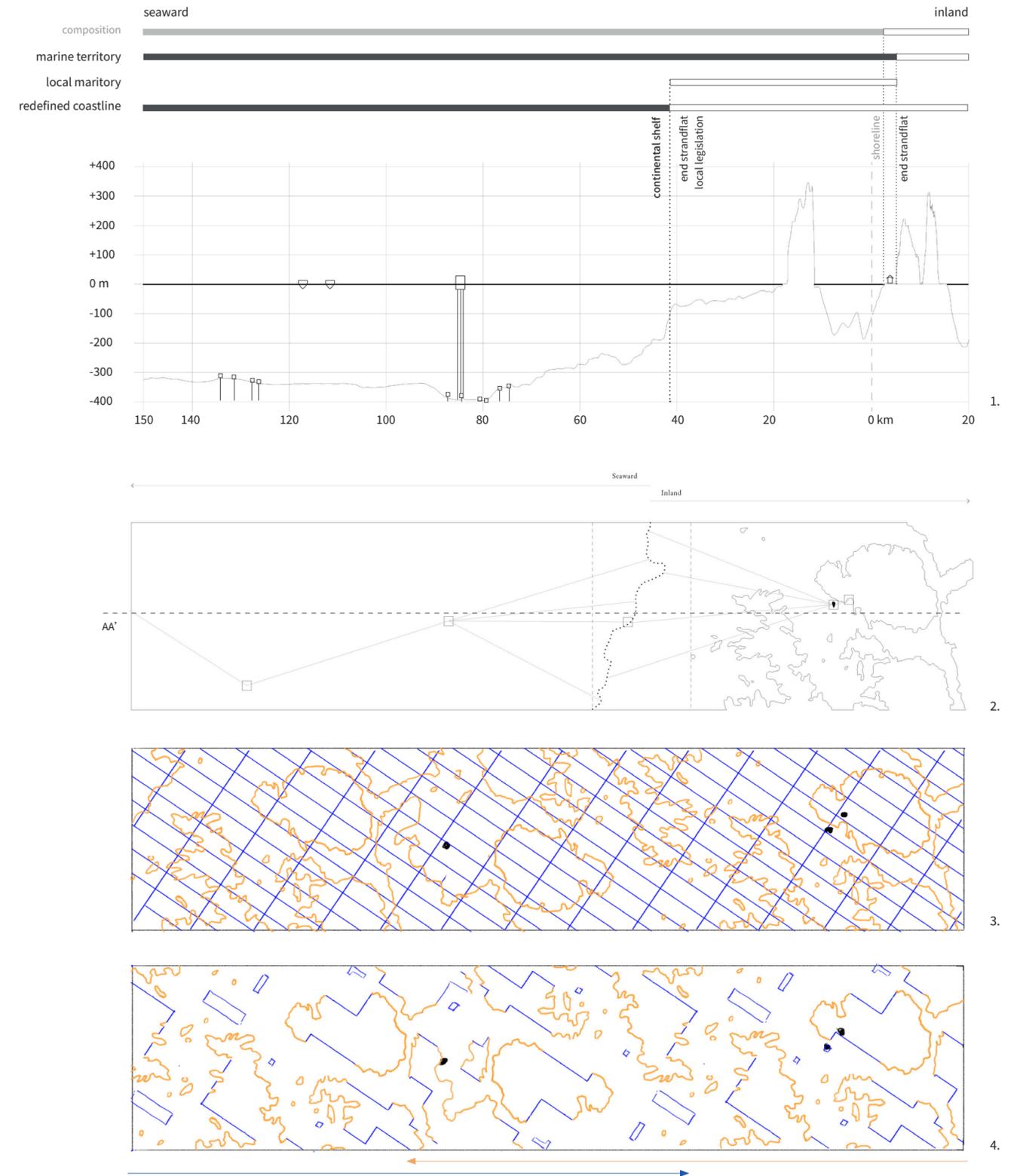
Rigidity

A study on depth, morphology and scale.
1. Simplified composition of edges across the Hammerfest maritory.
2. Extrapolation of inland morphology (yellow) and seaward morphology (blue) accross the coastline.
3. Extraction of the two morphological systems to visualise a new landscape. The new landscap has lost a sense of scale. Demonstrating the value of both systems. Cross-coastal design needs to respond to both systems and their corresponding conditions of marine space.

Source: Google Earth (2021).

1.

2.

3.

4.

Maritory scale

Map and images sources

Page 73, Land Use and Marine Use Takings
Shape
Sources:
- Geddes, Patrick. The Valley Section. 1909.

Page 75, Rigidity
Sources:
- Google Earth. "Profile path." Accessed 2021.
  [computer application].

SEABED
Catalogue

Spatial conditions

01. traces of urbanisation
Trawl marks
Anthropogenic sediment / litter
Ship wrecks
Pipelines and cables
Exploration wellbores
Subsurface installations

02. seabed as matter
Sediment type (tidal deposit etc.)
Grain size (clay, mud, sand etc.)
Characteristics (carbon concentration etc.)
Dynamics (bottom currents, deposition, erosion)
Harder or softer seabed
Pollution

03. seabed as topos
Bathymetry
Structural basins
Marine landscape (strandflat, fjord, etc.)
Landform (ridges, current channels etc.)

04. seabed as habitat
Biotopes
Vulnerable biotopes
Type species
Amount species
Biodiversity / species richness
Vulnerable marine ecosystems

05. seabed as resource space
Areas of prospected oil and gas
Fields discovered
Production fields
Other resources (minerals, sand etc)

Socio-cultural conditions

06. seabed as geopolitical space
Right to resources
Borders of claim
Acts of claim
Ownership and owner
Areas of dispute

07. seabed imaginary
Micro-realities submerged (atlantis)
Bathymetry made visible
Ocean literacy

08. attitude towards marine resources
Societal dependency on resources (e.g. petrol)
Attitude towards petrol (and sustainable resources)
Economic demand for growth
Growth paradigm
Carbon paradigm

Shortlist

01. Seabed as resource space
02. Seabed as geopolitical space
03. Seabed imaginary

Seabed imaginary

Above / Photographs of the seabed on different locations in the Hammerfest Maritory. Source: Mareano (2021).

Right / Location of the photographs in Finnmark with bathy-metric sublayer. Source data: Mareano (2021).

0   200 km   N

Barents Sea scale

Socio-cultural condition

The urbanisation of the Barents Sea became a fact as soon as nations laid claim on its water. In 1635, John Seldon developed the doctrine Mare Clausum, the enclosed sea. In principle, Mare Clausum allowed nations to claim the right to resources and jurisdiction over their neighbouring waters up to 200 nautical miles from the coastline. These borders are still applied today to enclose the Exclusive Economic Zones (EEZ). Where the exclusive economic zones overlap, the position of the border needs to be discussed and agreed upon by the nations in question.

Countries now have a right to claim the ocean beyond their 200 nautical miles from shore up to the edge of the continental shelf (see map on the right). As such, the bathymetry of the ocean floor sets conditions for claim.

Passive acts of claim
Act of Svalbard states that every country that has civilians living on the island co-owns Svalbard. Because of its strategic position, Russia has placed a coal mine on the island that is operated by Russian civilians. Although

the coal mine is far from profitable, it provides the perfect opportunity for Russian settlement on the island, strengthening the nations claim to the Arctic. A museum on Russian culture and communities in the Arctic further affirms this claim.

Passive-agressive acts of claim
In 2007, two submarines were lowered into the Arctic ocean with the purpose of planting a Russian flag at the North Pole, which is submerged under ice and water. As of yet, the Arctic nations have not reached an agreement on the ownership of the North Pole.

Agressive acts of claim
Russia's long coastline creates an extensive military front. Russia has established numerous Arctic military bases for training and testing. Although there is currently no active military conflict, the bases are a show of force that function as an act of claim.
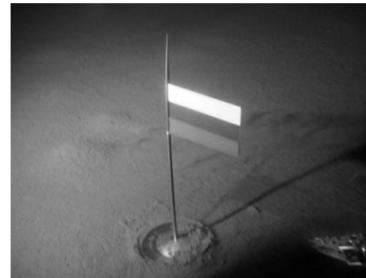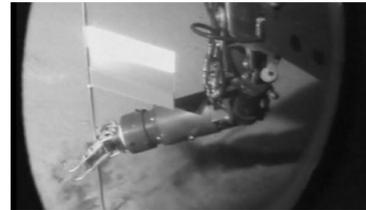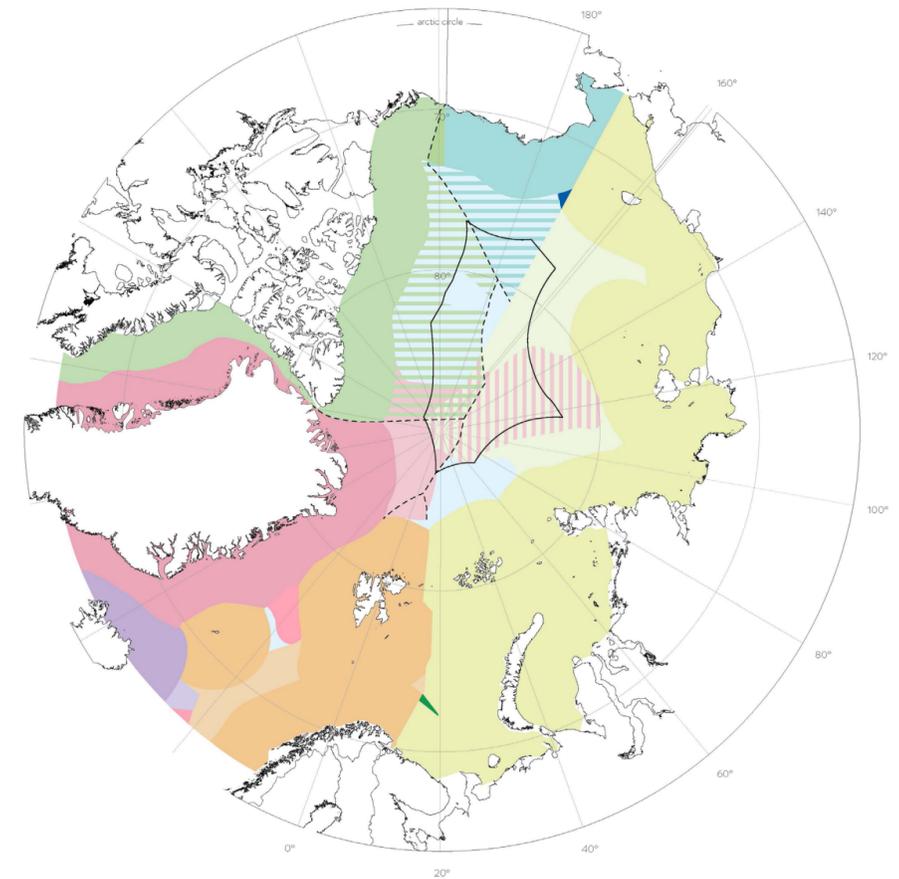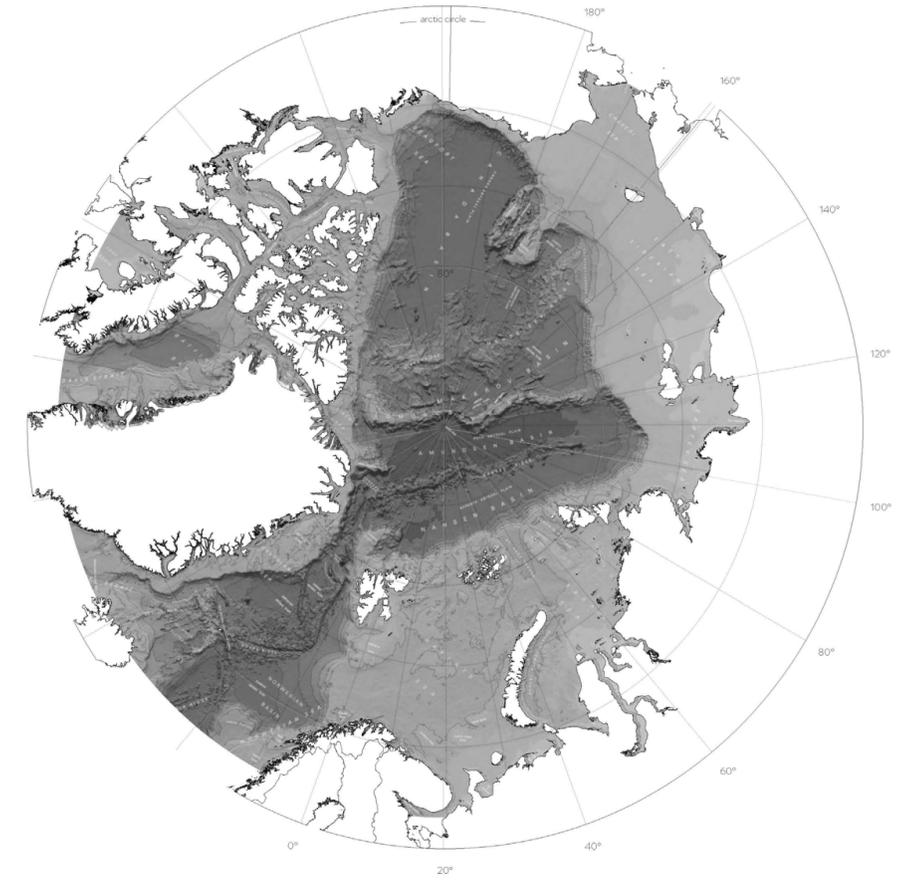
Seabed as a condition for claim

Top / Maritime jurisdiction and boundaries in the Arctic region
Source: IBRU: Centre for Borders Research (2017).

Bottom / International Bathymetric Chart of the Arctic Ocean, in which the edge of the continental shelf is clearly visible.
Source: NOAA (2014).

— 350 NM from shore baseline
···· Median line
▢ Norway territorial sea and EEZ
▢ Norway claimed continental shelf beyond 200NM
▢ Russia territorial sea and EEZ
▢ Russia claimed continental shelf beyond 200NM
▢▢ Denmark   "
▢▢ Iceland   "
▢▢ Canada   "
▢▢ United States   "

|0 |500 km |

N

Arctic scale

Map and images sources

Page 81, Seabed Imaginary
Sources:
- Mareano. 2021. "Mareano." 2021. http://
mareano.no/kart/mareano.html#maps/5676.

Page 83, Seabed As A Condition For Claim
Sources:
- IBRU: Centre for Borders Research. Arctic
  continental shelf claims. 2017. Distributed by
  European Environment Agency. https://
  www.eea.europa.eu/data-and-maps/figures/
  arctic-continental-shelf-claims
- National Oceanic and Atmospheric
  Administration (NOAA). International
  Bathymetric Chart of the Arctic Ocean. 2014.
  Distributed by NOAA NCEI. https://www.
  ngdc.noaa.gov/.

DESIGN PRINCIPLES FOR OFFSHORE URBANISM

The previous chapter mapped conditions of marine space. From these mappings, a set of principles are derived. These principles are meant to be used as a design language, specific for the Hammerfest maritory. In the case-study (chapter 4 and 5), the principles will be applied to form different spatial compositions.

PRINCIPLES
A design language

SURFACE

move | perceive

economic route from anchor A to anchor B

strategic position anchor along most economic route

anchor at surface as guide for movement

manipulating the patterns of movement by adding / (re)moving anchor

coulissen

gate

seamark

wayfinding or visibility infrastructure

'ontsluiting' approaching an anchor at sea

SHORE

move | perceive

maritime access and shorline morphology

interaction across the shoreline

public access to shore

public visual access to water from shore

position marine industry in relation to shore and visibility

DEPTH

depth and species population

depth and human occupation

depth scale occupation

scale and rigidity borders inland and seaward

scales of ownership inland and seawards

discrepancy borders of claim and claimed (resources)

SEABED

resources | biodiversity

quality seabed, biodiversity and catch

SURFACE + SHORE

urban growth along infrastructure

dependency

territorial expansion

human population

SHORE + DEPTH

morphology and depth shore, coast and maritory

maritime access

shore types

DEPTH + SEABED

depth and access to seabed and its resources

edge continental shelf and right to claim

SEABED + SURFACE

pressence of resources in seabed as anchor for movement on surface

SHORE + DEPTH + SEABED

seaward depth and right to resources

dredging and filling

SURFACE + SHORE + DEPTH

height viewer and orientation towards ocean surface or horizon from shore

height viewer andvisible surface and horizon from shore

height object and its visibility from shore

the surface and the horizon

PRINCIPLES
A design language

Principles for offshore urbanism, organised by the scales they operate on and the purpose they serve in the transition.

Plotting the principles of design a schema allows us to reflect on its use and limitations. Naturally, the principles are not complete. One could think of many more. This selection represents the design principles that I have used in the project.

· The column 'nourish' appears somewhat underdeveloped, compared to the other columns. To develop a more elaborate set of design principles for the purpose of nourishing the seabed, in depth knowledge of seabed ecology and restoration is needed. Such an analysis could serve as a valuable addition to the offshore urbanism project or stand on its own as landscape architecture project. Neither fall within the scope and time available for this thesis.

· Instead the focus lies on 'reading the seascape' throughout the different scales, and designing a network composition that responds to it.

· The most prominent scales seem to be: the maritorial scale, on which the network compositions can be understood. The maritorial scale is supported by the macro scale (Finnmark), which shows how the network composition fits into the international network. The micro scale (Melkøya) focusses on maritime access and the shore as a point of arrival and departure.

RESPOND TO THE SEASCAPE   ADJUST THE NETWORK   IMPROVE SEAWARD ACCES   IMPROVE INLAND ACCESS   NOURISH   EMBARK ONTO THE OCEAN   MAKE VISIBLE

MEGA

BARENTS SEA
rights and responsibilities

MACRO

FINNMARK
biophysical

MESO

MARITORY
economies of life

MICRO

Melkøya
built environment

NANO

BODY
phenomenology