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Maps in Translation: Following Maps Through Maritime Search and Rescue Operations in Northern Norway

"…Before Christmas we had problems with a satellite compass. Map or the radar also uses data from the compass, and the compass was not good. <...> 5 or 6 or 7 times we had two headings, and one time in the night, we got into <a city port> and it was snowing, so I could not see the lighthouse. It was bad weather, so the radar wasn't very good, and the map then was unreliable. But that was not because of the map, it was because the satellite compass…"

[B1, 2021][i]

I start my exploration of maps with this account, where digital maps onboard a rescue cutter became useless due to an overflow of incoming information. It was dark, thus the navigator had to rely on lights from a lighthouse, dampened by the falling snow. The weather was poor, making the radar suboptimal. In harsh weather, the radar can capture and visualise weather effects, clustering its display. With other navigation tools unable to aid, the error on the map display became a concerning issue. The two-headed representation of the ship's heading rendered the map "unreliable," even though it is supposed to be a navigational aid. Later it was concluded that interference between the antenna and other equipment onboard caused the compass to provide faulty readings.

This anecdote immerses us into the complexity of digital maps. On this particular rescue cutter, they are visualised through an in-built system, ECDIS[ii], connecting information from numerous tools onboard and beyond. Usually, information for these maps is collected through a satellite compass, gyroscope-based compass, radar, and other sensors [B1, T2[iii]]. All in addition to encoded data provided by the Norwegian Mapping Authority (NMA) – "the only authorised producer" of sea charts for Norway's sea territories (NMA 2021a). For Search and Rescue operations (SAR) additional input regarding a search area can also be provided by the Joint Rescue Coordination Centre (JRCC). Therefore, maps used for navigation by the crew entail a network of actors, some of which are in the perimeter, onboard the vessel, and others are remote, dispersed throughout different spatio-temporalities of production.

It also shows how a map can fail, putting a navigator in a dangerous situation. Changes in entanglements or additional data inflow can render maps unreliable or dysfunctional. This could complicate time-sensitive maritime Search and Rescue efforts. With this article, I explore how digital maps gain functionality within SAR context by interrogating maps as processes. I start with a brief introduction on how SAR operations are organised in Norway, followed by an overview of research design choices. I use the concept of *translation* as an analytical tool to discuss my findings, focusing on processes allowing sea charts to obtain certain functions necessary for SAR responders. The discussion of findings is divided into sections analysing how the seabed of Norwegian waters is mapped out; how drifting entities help define search areas; and how a real-time movement is translated onto maps. I finalise with a discussion about mapping processes and conclude with how the concept of translation can contribute to analysing maps.

Search and Rescue in Northern Norway and Maps

There are two Joint Rescue Coordination Centres in Norway, in Bodø in the North and Sola in the South, which coordinate SAR efforts (SAR Cooperation Plan 2019, 3). Along with police districts, JRCCs are the main organisations of the SAR management system in Norway (Andreassen et al. 2019, 15). The JRCC is mainly concerned with air and sea incidents [JRCC1, 2021[iv]], while local centres overtake land rescue missions (Andreassen et al. 2019, 17). The JRCC's operations are divided by 65⁰ N, resulting in about 80 per cent of Norway's search and rescue region falling under the responsibility of the Northern centre (Elgsaas and Offerdal 2018, 9). Despite this, the JRCC in Bodø deals with fewer incidents per year than in Sola, respectively 2795 (943 in the sea) and 5359 (1796 in the sea) in 2021 (HRS 2022).

Depending on the incident, the JRCC is authorised to use all available public and/or private resources and utilise health, meteorological, map, and volunteer services, as well as the Fire department, Civil defence, Armed forces, Coastal Administration, Police, and Coastal Radio (Organisation plan for the Rescue Service 2019, 2-3). In maritime operations, this would be the Norwegian Sea Rescue Society (RS), a humanitarian association [B1, 2021]. In this article, I focus on the mapping practices within the JRCC in Northern Norway, the RS, the Norwegian Mapping Authority, and the Norwegian Meteorological Institute (MET).

Research Design: Maps – What Do They Do?

There is no one agreed perception of what a map is or how it should be interrogated. For centuries maps were perceived as "objective, truthful representations of the spatial relations of the world" (Kitchin et al. 2011, 3). In recent decades cartography started asking about the role of maps in shaping the world with power-knowledge production and their objectivity, calling to look into maps as an intricate process, where a map is only "one stage" (Cosgrove 2008, 155-156). Kitchin and Dodge expand this by suggesting inquiring about the process of creating maps *and* how the maps are practised further by users (2007). They criticize perceiving maps as ontologically secure representations. Instead, the scholars suggest investigating their ontogenesis – how maps become (Kitchin and Dodge 2007, 335). Thus, instead of asking, what maps are, it is worth it to investigate *what they do*.

When taken for their functionality, maps are informing, shaping, re-shaping, and suggestive. They can still act as representations; however, current studies are more interested in their ability to depict different realities (Awan 2016, 116) or embody situated knowledges (Propen

2009, 115). Maps can perform, for example, shaping a state (Wood 2012, 298) or biopolitics through enacting borders (Barua 2014). Maps bring out a connection between what is symbolised and territorial happenings, thus acting as propositions (Wood, Fels, and Krygier 2010, 52-53). The functionality of digital maps can be examined through their navigational capabilities, shifting their interpretation from mimetic to navigational, emphasising that "everything is on the move" (November et al. 2010, 596). Thus, there are numerous ways of investigating the roles of maps. Yet the common denominator is that maps are not to be perceived as mirrors, detached and external from the very thing they are mirroring. Maps are to be analysed together with what they depict, including how they depict.

There is a significant body of critical cartography and critical GIS literature turning its focus onto mapping practices, investigating how maps are made, their role, and what power dynamics are at play (see Crampton and Krygier 2006; Wood, Fels and Krygier 2010). It is not my intention to focus on power dynamics in this article. Therefore, I take from critical cartography its attention to mapping processes from creating a map to its use. To study them means to follow mapping practices, without focusing on the "end product" of what a map is or is not. In this article, I investigate digital maps as a series of processes, entanglements of heterogeneous actors, which involve depths of the seas, winds, waves, and navigational practices. I employ the concept of *translation*, which draws attention to interactions. Focusing on these processes reveals how certain functions of maps are enabled and what can affect their differences.

Entanglements

My research is situated within New Materialism, which suggests viewing humans as fluid beings continuously becoming due to their relations to other entities. As Braidotti wrote, a subject is not something or someone static, it is rather "constituted in and by multiplicity" (2013, 49). This is the relentless "becoming with" that Haraway talks about: the material-semiotic world in becoming, where subjects, objects, natures, and cultures "do not pre-exist their intertwined worldings," rather – they are constantly *becoming with* each other (Haraway 2016, 13). Hence the attention is put on dynamic entanglements, where human and more-than-human actors are entangled in messy ways. Because entanglements are the constitutive force, it means that entities gain their characteristics through interactions ("intra-actions") (Barad 2007, 128). This makes discourse and materiality ontologically inseparable, instead of being external to each other (Barad 2007, 128). Thus, it allows for heterogeneous entanglements to interact on the same ontological plane.

I find the posthuman approach fitting because to simplify a map into a dichotomic reference of object-subject, or matter-mind would be to cut short the processes of mapping. Maps heavily affect decision making when planning and carrying out SAR operations. They provide (or not) certain information and visualisation, carefully navigated through numerous processes of knowledge production and translation. Therefore, to emphasise the processual happenings of maps, my point of departure is looking into maps as entanglements, networks, and assemblages. These terms emphasise heterogeneous relations between entities, stemming from different branches of posthuman thought. In this article, I will use the term "entanglement" when referring to entanglements and interactions in general, whilst assemblage is to specify structured entanglements for a purposeful outcome.

Actor-Network Theory

To investigate the interactional capabilities of maps, I lean on Actor-Network Theory (ANT) for methodological inspiration. The approach urges the inclusion of more-than-human actors without focusing on the intentionality of actions. Attention here is focused on actor-networks – entanglements, where actors, whichever entity they might be, are enabled to act through interactions (Law & Mol, 2008, 74). In the same manner as in Barad's works, here networks are not the same as context; they are in the same "flat" dimension as actors (Latour 2005, 180).

In the introduction, I demonstrated how a map can interact with actors from various places. Thus, exploring practices of maps within SAR operations means looking into different sites where they are "in becoming with" through a series of transformations – translations. In this article, I analyse perspectives from maritime activities where sea charts are employed. When focusing on entanglements, it is possible to attend to differences, making maps function one way or another. Thus, following the posthuman approach in my project, I can practice the art of noticing, as Tsing puts it: "to appreciate the multiple temporal rhythms and trajectories of the assemblage" (2015, 24).

Translation

In this article, I use *translation* as a lens to comprehend transformations within entanglements. My angle of inquiry draws inspiration from explorations like Latour's examination of soil sampling in the Amazon Forest (1999) or Mol's study about how atherosclerosis is defined (2002). The concept is connected to ANT, previously called "the sociology of translation" (Law 1992, 380). For Law, this is a core term in understanding actor-network interactions, implying transformation and "the possibility that one thing (for example, an actor) may stand for another (for instance, a network)" (1992, 386).

However, translation *per se* neither provides answers to how links between actors are made nor assumes the links to be similar (Law 1999, 8). This term in ANT is used as a lens for exploration, not as a tool for explanation (see also Latour 1999). Latour emphasises the lack of causality in the process of translation – it allows for "traceable associations" between actors rather than transporting causality (2005, 108). Hence the term can be used when emphasising a happening, for example, when Mol invoked it to analyse a laboratory technician's actions: "The technician translates a velocity increase into a loss of vessel lumen with a pen" (2002, 80). In this case, translation appeals to other human senses rather than linguistic abilities. The term "translation" refers to relational outcomes between actors, whether it is a process of displacement, modification, negotiation, ordering configurations, or any other action arising from interactions (Callon 1984, 19). Thus, it entails actions of transformations.

A translation is not bound to (only) linguistic properties of transformation and does not offer an explanation or causation. Thus, I use this term as a *mean of inquiring*. What translation offers is an invitation to the art of noticing, exploring entanglements and assemblages through interactions, scrutinising differences, and allowing for critical inquiries. Inquiry into the ontogenesis of maps in this case means following data inflow into maps, from mapping out the seabed to confining a search area to adding visualisations of real-time movement, and how these features are practised.

Data

Looking for mapping practices within Search and Rescue operations means looking into how maps are used for everyday navigation. Many involved professionals, for example, pilots on board ships or helicopters, have to navigate in the surroundings not only when responding to a distress call. Thus, I start exploring mapping from everyday practices and move to their use in SAR efforts. In this article, I am only referring to mapping practices where digital maps – sea charts – are included, due to their overwhelming presence in maritime SAR operations.

I base my analysis on interviews with professionals and volunteers who are involved in map modelling/mapping processes, complemented by observations and document analysis. At the time of writing, I have conducted 27 semi-structured interviews (and follow-ups) with professionals and volunteers from various sites, related to SAR response and mapping: rescue cutters, firefighters, volunteers, map modelling institutions, coordinators, and police. Of them, 12 are with those involved as responders, 10 with map production, and 2 with teaching. While the interviews informed my research and helped articulate the mapping practices, this article is based mainly on interactions with participants involved with maritime incidents and navigation. This includes six people working at the Joint Rescue Coordination Centre, a rescue cutter operated by the RS, Norwegian Mapping Authority, Norwegian Coastal Radio, a Maritime School, and the Norwegian Meteorological Institute. This selection was based on data saturation.

Due to the Covid-19 pandemic, most of the interviews were conducted remotely, in English, except for specific terms in Norwegian. Participants were recruited through referrals and purposive sampling. Observations were carried out on separate occasions in a maritime school and onboard the mentioned rescue cutter. The former provided me with insights into how ECDIS works as a system and the use of simulators by future seafarers in training, while during the latter I could observe live navigation practices (diurnal and nocturnal). Complementary document analysis includes mapping standards for sea charts, standards for navigational aid, and yearly reports by the JRCC.

Findings

In the following sections, I discuss my findings, focusing on processes allowing sea charts to obtain certain functions. I analyse the revelation of the seabed, the delineation of a search area for responders, and the depiction of a real-time movement. Thus, I start by inquiring how the general information about contours and depth points, essential for safe navigation, is mapped. I continue with an analysis of how possible drift areas, helping to narrow down and save time in future search operations, are defined. I finish by exploring how the movement of other vessels or navigational lights, essential for situational awareness and communication, is translated onto a map. These processes stood out the most from interviews and could be connected through different perspectives.

Measuring the Invisible

For safe navigation, seafarers must have an idea of what lies hidden underneath their vessel. Mapping out the intricate coastline with accurate depth points is a long and challenging process, entailing chains of translations from various spatio-temporalities. From the 1970s, when attention was first brought towards mapping Norwegian shorelines, to the year 2020, only around 27.3 % of the Norwegian Exclusive Economic Zone was mapped out (Thorsnes et al. 2020, 103, 114). Even with the capacity of private organisations, the navy, and large-scale government-funded projects, it might still take up to "20-30 years to complete the whole coast" [MM5, 2021][v]. For mapping out the Exclusive Economic Zone and the international waters which are a part of the Norwegian Continental Shelf, it might take up to 80 years (Thorsnes et al. 2020, 114). Here I discuss how the seabed comes to be enacted through points and lines in digital sea charts.

Mapping out the seabed requires specific technology and detailed regulations. The Norwegian Mapping Authority is responsible for official map production for Norway's territorial waters. Its role is to gather depth information of the bottom – a process called bathymetry – with the help of multibeam echo sounders [MM5, 2021]. NMA have specialised ships for surveying in addition to hired vessels from other governmental institutions or private companies. Echo sounders enable the creation of high-resolution terrain models (Thorsnes et al. 2020, 108). In addition to echo sounders, vessels need to monitor their position and movement and "the velocity of sound in the water, both close to the sonar transducer and through the water column" (mareano.no, 2022). The process of collecting soundings is highly regulated, providing, for example, specifications of how the sensors should be aligned or calibrated, allowances for data gaps or resolution of acquired data (NMA 2017).

The next step is filtering through the many pings – points of sound wave disturbances. From the echo sounders NMA gets pings, "millions of small points" [MM5, 2021], also called soundings. With the help of algorithms, the point clouds must be "cleaned" from "noise" as whales or other entities can be recorded through echo sounders [MM5, 2021]. After the filtering process, the raw data is uploaded to the database, ready for "moulding" [MM5, 2021]. Thus, translation in this case entails shedding information about sea creatures to isolate pings referring to the seabed.

The creation of a terrain model entails georeferencing of the soundings. It is achieved by utilising "squares," each of which pinpoints a geographical reference [MM5, 2021]. These squares are matched with one specific sounding. Depending on a mapping model, it can be a sounding referring to the shallowest or the medium point. Selection of the data relies on specifications telling the purpose of the map, its scale and form (paper or digital) [MM5, 2021]. With provided instructions, an algorithm goes through the points again, minimising the number of pings to one per square. This stage of translation allows for the readability of data. With geographic references, the points now carry meaning within the geographical positioning systems and can be read accordingly.

When contours are drawn, map producers need to merge the depth information with the land information, so the coastline would not have missing gaps [MM5, 2021]. MM5 simplified their work in the department and expressed that the main task "is to reduce the data" [2021]. The data they get from echo sounders are too detailed, thus for safe navigation purposes NMA needs to generalise and smoothen the contours, so the seafarers would not get the impression that it is deeper than in real life [MM5, 2021]. While this is a process of perfecting a line, it also influences navigators' decisions. Each depth point delineates the possibilities of movement for vessels. Sometimes these points can lead to unfit route choices for one's ship – for example, there was a case when a ship hit something where the path was virtually clear, since "the map said it should be ok" [B1, 2021].

Translation of the Norwegian seabed depends on multiple interactions of different scales. Seafarers occasionally ask for more data, especially in areas where they must navigate on small margins [MM5, 2021]. However, access to denser data depends on governmental regulations and is also a matter of national security [MM5, 2021]. If maps convey authority (Wood, Fels and Krygier 2010, 52), then in this case, they relay dynamics between whose security is to be exposed through the number of depth points. Furthermore, it is also a matter of organisational capacity, funding and other factors interfering with mapping assemblages. In addition, the seabed is too diverse, not allowing itself to be translated through automatic processing.

Following the chain of translations reveals a series of decisions in a mapping process. Information about the seabed changes its form from material to semiotic, until finalising it as a proposition for material movements in the sea. Mutability is the core of translations since information is collected and transformed through interactions. For example, depth points refer to where sound waves bounced off. Seabed enactment changes its form to become a mapped proposition, arising from a set of decisions and controlled assemblages.

On the other side of mapping, onboard the rescue cutter, depth points are taking part in decision making. "I have to see, maybe like in an area there are four numbers, four numbers telling the depth, but I have to know, where is the bank, or where is a knob or something" [B1, 2021]. The points provide crucial information about what to expect while navigating the seas. B1 mentioned that they use maps every time they go out, especially in lesser-known areas with small margins of error – as a vital part of navigation, informing where to steer the vessel.

Sea charts are also employed when planning possible routes. "When I come to a new place like this, the first thing I do, I make routes in the map" [B1, 2021]. The map then is used to decide where the undersea is crossable and design possible ways for safe navigation with the RS cutter. In this case, it is also about being able to respond to a call as fast as possible, because "sometimes we don't have so much time, of course. In rescue operations" [B1, 2021]. The navigator assesses provided information and steers the ship with due diligence to avoid certain points. Thus, the soundings translated into depth points are capable to participate in a decision-making process, as notifiers of risk or a borderline, where one should go or avoid.

I have noticed a similar route "control" via depth points when observing future seafarers learning how to use the navigation system, ECDIS. It is a widely used intricate system, regulated via international standards – "all navigational officers must now have thorough knowledge of and ability to use ECDIS" (STCW 2017, 23). The seafarers are taught to be aware of diverse inputs that go into the system. When students plan for a route, they read maps and plan in points with coordinates. These points can be entered into ECDIS, which automatically lays out the route, assessing its compatibility with certain parameters of the ship. ECDIS translates given coordinates, pairs them with the ship's capacities and provides a warning if the route is incompatible with the vessel's measurements. Here the soundings, translated into contours and depth points, function as compatibility measurements which could result in a warning or a failure to compute the route. With additional interaction from another data source – the vessel's technical information – points and contours are capable to regulate possible routes.

Essentially, the sea charts used by seafarers gain functionality through entanglements between heterogeneous actors. When developing readable, user-friendly, and otherwise usable data sets for sea charts, NMA uses modes of measurements to capture a piece of information crucial for further transformation. The final visualisation of undersea terrain only gains its functionality through contact with a seafarer and the vessel where it is used. Sea charts, when employed for decision making, can become propositions, suggesting how to navigate, and perform as a safety regulator, automatically cross-referencing provided data points.

When soundings interact with decision making for planning possible routes, they are entangled into another actor-network. Callon wrote that translations are where "the identity of actors, the possibility of interaction and the margins of manoeuvre are negotiated and delimited" (Callon 1984, 6). In this case, possible manoeuvres of a ship are negotiated through readings of soundings. Pathways are in the making in accordance with compatibility with written numbers on a map display, tackling possibilities of routes, a movement reduced into lines or numerical meanings. When revealing the invisible, the chain of translation also allows for a delineation of risks.

The Floating

Here I discuss a specific tool used for SAR operations, concerned with what is happening on a sea surface – a leeway model. The term means calculations of an object's drift trajectories, where leeway is a drift of an object exposed to wind above water (Breivik 2008, 100). Knowing a probable location of a missing person or an object helps delineate a search area, suggesting where responders should focus to save time. It is calculated through leeway models, which are produced by MET and used by the JRCC. JRCC's responders – controllers – calculate leeway straight at MET's website [JRCC1, 2021], where they can choose the object's properties, start and end time, last known position, radius and the length of the search. Calculations get visualised when downloaded into a Search and Rescue application (SARA) used by the controllers.

The challenge of a leeway model is that the feedback system is not in place. People from MET cannot learn in practice how the drift calculation works in real situations: "in short I would say there are very few observations of how people have drifted" [MM2, 2021[vi]]. And from the JRCC perspective, controllers would contact MET when they "experience a lot of differences between where the objects were found and the drift simulation" [JRCC1, 2021]. Hence the feedback is provided mostly due to a significant lack of efficiency.

For these calculations to work, people from MET must resort to actual fieldwork [MM2, 2021]. Researchers release various entities to float on a sea surface (e.g., Allen et al. 2010). In the 2009 experiment, three objects, a sailboat, a container, and a manikin were released to drift in Andfjord – Northern Norway (Allen et al. 2010, 17). All floating parcels were equipped with tracking devices – AIS[vii] transponders, providing information on movement (Allen et al. 2010, 13). The number of signals referring to distinct locations helped track the displacement of the objects in the water and recreate movement trajectories. All floaters were equipped with anemometers – wind speed measuring devices – and current measuring devices for measuring the sea currents. Both measuring devices use the deviation of sound waves as a tool for measurement, translating it into numerical meanings. Collected data provided affordance to modify a drift trajectory model and make it more precise at predictions. The experiment's temporal assemblages enabled movements of the parcels, wind, and waves to be translated into a readable form for algorithms, improving their capability to predict drift trajectories.

The leeway model is also used for accident prevention. Among other information, controllers at the JRCC must plot in their system search areas and leeway [JRCC1, 2021]. They calculate the risk of ships running aground and inform responding vessels accordingly. As the responder from the RS cutter commented, with leeway calculations provided by the JRCC, they get more insight into how dangerous the situation is: "of course, we respond as quick as we can, but then we know, that time is an issue" [B1, 2021]. Interestingly, this type of leeway model use initially was unplanned by the developers: "we never really thought about that as a possibility that they would use it pre-emptively" [MM2, 2021]. The leeway model was aimed towards being able to say something about a search area *after* the fact. But with the experience of controllers, it gained another use – to make risk assessments. Thus, the pre-emptive use of drift calculations enables maps to also visualise risk, while delineating the time of response.

Capturing moments of movement in a continuous flow of signals is a method of translation of what is otherwise uncontrollable – one could take water from the storming sea, but taken out of context, it would lose the momentary features. Measuring the velocity of things affords translation of an effect that wind and water have on an entity in water. Even with meticulous computations, the information does not allow for generalisation or external truth. When modelled into calculations, measurements can, at most, provide *probable* trajectories of a drifting object [MM2, 2021]. For JRCC1 this is "just a tool to help us make a search area. This isn't the truth."

The leeway model calculates possible movement and delineates it following a given time frame, providing multiple enactments of a drifting object. Translations of real-time movements also provide affordance of time and its assessment. Calculations are used to foretell a drift trajectory and speed, providing responders with an idea of how much time they have on their hands. Additionally, having a mapped-out search area when searching for the missing can help save time, which is essential in search efforts.

Translating Movement

One evening I joined a rescue team onboard an RS rescue cutter. When we were out at sea, the vessel was rocking from side to side, making it difficult to read signs and symbols on a map display. Echoes from waves cluttered the radar and because it was dark, one could not see much through the window, except for lights from lighthouses and buoys – navigational aids. It is an old system established centuries ago, where lighthouses' white means a clear path, while green and red lights can refer to which side should a seafarer stay on [observations at RS, 2021]. Navigation was based also on *when* the lights changed. This was reflected in the map display – whenever we would sail into the pathway signalled by the white light, white-coloured lines would light up in the ECDI system. They would convey a message – stay between these lines to sail safely. When we would sail out, lines disappeared from ECDIS, depicting the change of the light in real time. These changes helped the navigator to confirm our location.

The navigational aid system is an important part of the charts [MM5, 2021], and is entangled with local and international standards. In sea charts one can read about lighthouses in each location, how they flash, in what colour(s) and in what length, width and height they can be seen (NMA 2020, 55-62). Currently, this system is being changed following standards defined by the International Association of Lighthouse Authorities (NMA 2021b, 35). Whenever anything changes in navigational aids, NMA includes it in the Notice for Mariners, released twice a month for paper charts, while digital charts are updated daily [MM5, 2021]. NMA takes care of the accuracy of navigational aid on sea charts, whilst its visualisation is regulated internationally. The way lighthouses appear in maps, along with other visualisation, is not NMA's choice – International Hydrographic Organisation (IHO) has released standardized specifications to ensure safety for operating ECDIS (IHO 2014, 1). Among other symbols and features, standards refer to the way lighthouses have to be coloured, how and at what rate buoys flash the lights, and how sections of alternating lights should be drawn and named (IHO 2018, B-400). ECDIS contains a symbols library, thus, when NMA provides seafarers with files containing sea chart information, a map is formed. Digital sea charts gain their visualisation only when processed in a machine with preinstalled symbols, heavily regulated by international standards.

Translation of navigational aid adds to seafarers' situational awareness. The capability to integrate it into the display and visualise its movement eases navigation, for a seafarer can confirm their location when cross-referencing what they see outside and on maps, especially at night or low visibility. When interacting with international regulations, maps acquire readability for a wider audience. This can provide for better information communication regarding location. As well, continuous mapping updates of navigational aids add to the map's participatory and performativity capabilities.

Digital maps onboard the RS were capable to depict the movement and trajectories of other vessels in the area. Maps with the ability to integrate the movement of other vessels contribute to the navigator's situational awareness, while the lack of it can provide difficulties for rescuers. Usually, the vessels are tracked through AIS, which provides details about the ship – their whereabouts, trajectory, and speed, among others, and can be seen on the ECDIS display. However, some boats are too small to be required to have the tracker. Other vessels, such as the Coast Guard, can switch off their AIS due to security reasons [JRCC1, 2021]. Lack of a possibility to translate movement can hinder planning and executing a SAR operation.

An example could be an incident in the High North, where the Governor of Svalbard, the Norwegian Coast Guard and the JRCC were involved in the response. When the controllers at the JRCC usually deploy a vessel to an incident, they initially provide a position and a course [JRCC1, 2021]. If a search is due, controllers estimate a search area for responding vessels and provide it either through positions or via screenshots [JRCC1, 2021]. This is because the JRCC and the Coastal Radio use a stand-alone mapping platform for situational awareness, which does not communicate with other platforms [JRCC1, 2021; R1, 2021[viii]].

While several vessels and helicopters were sweeping the accident area, responders encountered difficulties with sharing geographical information. During the search, dozens of emails "were sent between the Governor of Svalbard, the JRCC and the Coast Guard. All containing different screenshots" [JRCC1, 2021]. Screenshots would contain information which had to be mapped out manually as the responding institutions at the time did not have interoperable mapping platforms. JRCC1 commented on this issue that in the end "we don't have the time, we don't have the accuracy to plot all this information. That means that we don't have shared situation awareness during the incident" [2021]. With more agencies involved in a response, maps are not always able to communicate with each other. Thus, translation is hindered. If one map provides the capability to integrate the search area and current oversight of vessels in one location, the other might not have the same level of data translation.

Sending screenshots was a way to share changes in movements, yet it had its downsides, as it added additional layers of translation. When sending a screenshot to a vessel in the sea, one must be aware of signal limitations and that the picture could take time to be uploaded and downloaded [JRCC1, 2021]. Additionally, manual plotting takes time and lacks accuracy. This type of translation between different mapping platforms does not provide the same functionality for maps. Even though assemblages of maps provided the affordability to plan and carry out a search operation, and communicate the information, they did so at the expense of time – and time in SAR efforts is crucial.

Maps in Translation

In the mentioned cases, sea charts are assembled throughout various sites. If an RS cutter is responding to a search effort, then its map display on ECDIS is at least connected to datasets acquired and processed by the NMA. If a search area is dictated or sent, then navigation within the given perimeter entails connections with the experiments about drift trajectories. Albeit actors are interacting through different spatialities and temporalities, when immersing maps into complicated series of events, translations allow for simplified entanglements between these events.

Translations entail a chain of decision making, where what remains visible or invisible is adjusted step by step. The seascape, under and above the sea, deconstructed into millions of points, measured through glimpses into events, becomes portable entanglements of algorithms, symbols, standards, decisions, risk, computers, compasses, and other actors. The same goes for navigational aid, the search area, and real-time movement. Mapping out these processes requires ordering translations between various material-semiotic forms. Visualisations of a map are enactments of interactions between, among others, decisions, regulations, filtering processes, national and international standards, navigational needs, the question of national security, and weather conditions.

These heterogeneous interactions are where digital maps gain functionalities. Bouncing waves from objects do not immediately become representations of the sea bottom, nor does the tracking signal of a floating object. It is through the interaction of expected elements and purposely placed tools that the information on certain spatial and temporal characteristics can be collected and later processed. Because maps are designed with the possibility for the end user to add more information to the platform, mapping is not over with the production line. Maps are not external to the material world they are enacted through, rather, they are embedded in entanglements, through which actions such as representation or negotiation of possible routes are afforded.

Translations within digital maps entail a provision of meaning. For example, visualisation. Soundings neither possess information about the contour of the seabed, nor their colour. Meaning is negotiated through a string of interactions – from recognising underwater features to encoding them in a manner suitable for local and international regulations, to visualising them through globally recognised signs and symbols. In the case of navigational aid, international standards negotiate the meaning of symbols in sea charts. Colours, lines, symbols, and measurements are integrated into one assemblage from elsewhere when it comes to the map display through ECDIS. The same goes for geographical reference. For vessels, pings, and floating objects, it is negotiated by taking them out of their local context, estimating position in accordance with global units of reference to places such as the North Pole and Greenwich, and putting them back to their now-referenced *locale.* Sea charts are the place where these negotiations happen.

Digital maps can provide affordability of time and risk mitigation. They provide information for planning safe routes before responding to a call. They can delineate movement for search operations, allow for estimation of risk, and ease communication of information regarding situational awareness. However, mapping platforms can also disrupt communication when they do not allow translations between separate assemblages. Thus, depending on entanglements, translation may both enhance digital maps' functionality as well as render them "lost in translation."

Conclusions

With this article, I presented a series of processes or chains of translations that happen when sea charts are employed during maritime SAR operations. I inquired into seabed mapping, the creation of calculation models for possible drift trajectories defining a search area and mapping the movement of other vessels and the navigational aid. Throughout, I braided map production and its use in the navigation into one narrative to emphasise that mapping does not stop with producing a map. In each case of map employment, assemblages were unique to the event, granting maps with capabilities to represent, assess, propose, perform, and (mis)inform. Within them, maps could provide affordability (or not) of time and spatial accuracy when responding to a call – crucial elements for a successful SAR operation. Using translations as a mode of inquiry, it was possible to see alternative assemblages entangled in the mapping process.

Maps employed during maritime SAR operations in Northern Norway are dynamic and enacted through different spatio-temporalities, including actors of different scales. Some translations, such as contour lines, happen in more stable assemblages than others, for example, when relaying a situational picture from one mapping platform onto another. Stability allows for less time consumption while navigating and for risk assessments for possible routes. However, because the assemblages are in flux, it is not "a given" that a map will represent what is outside, provide accurate means for planning, or relay movement, leading to an unexpected mutability of maps. In maritime SAR operations, where location and time are paramount, a lack of functionality can be fatal. Therefore, it is crucial to focus on maps as ongoing practices and explore how certain features arise while others can be lacking.

Visualisation of undersea, estimation of probable drift trajectories, and translation of movement are only a few processes that allow digital maps to gain their functionality. A depth point on a map, then, is a filtered reference of where rock-sound wave interaction took place, enacting intricate navigation between civil and national risks and securities. Maps are entangled in a constant mapping and depend on interactions with international standards, and national regulations, including questions of national security, funding, weather conditions, personnel capacity, and dialogue between NMA and seafarers. Analysed examples reveal several actors influencing what will be visible and what is to remain invisible within the sea charts. Knowing more about these interactions can provide a better understanding of what one can expect from digital maps.

Structured mapping entanglements can interact unexpectedly with alternative assemblages, resulting in deviating maps. Following translations helps to maintain a focus on more-than-human interactions within mapping practices without simplifying them and to spot their differences. Furthermore, analysing maps through translation processes allows inquiring into the ontogenesis of maps – the "unfolding practices" – and to question the ontological security of maps (as in Kitchin and Dodge 2007). They are not connected to objective truth, nor do they exist independently of the process of becoming. Exploring digital maps within their entanglements reveals their capability to calculate and delineate risks, enact securities and diverge worldings – world-making practices.

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[i] The seafarer, B1, works on a rescue cutter in Northern Norway with the Norwegian Sea Rescue Society (RS), interviewed on 2021-03-23.
[ii] ECDIS stands for Electronic Chart Display System; more about this is written further in the text.
[iii] T2 is a research participant, who works with training seafarers, interviewed on 2021-09-17.
[iv] JRCC1 – research participant, working with Joint Rescue Coordination Centre, interviewed on 2021-07-13.
[v] MM5 is a research participant, working with the modelling of sea charts at the NMA, interviewed on 2021-05-06.
[vi] MM2 – research participant, working at the Norwegian Meteorological Institute, interviewed on 2021-03-10.
[vii] AIS stands for Automatic Identification System.
[viii] R1 – a research participant, working at the Norwegian Coastal Radio North Norway, interviewed on 2021-12-03.