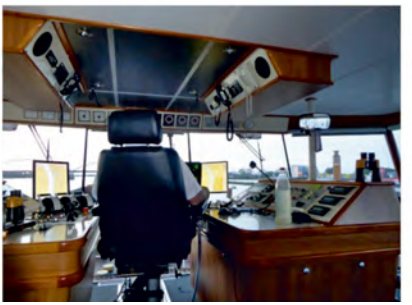
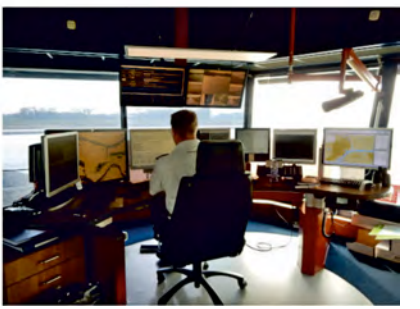
Introduction

Figure 1: (top left) An operator working in the Nijmegen control room, located where the Maas-Waal canal and the Waal, the main Dutch continuation of the Rhine, meet. Figure 2: (top right) A skipper of barge carrying grain photographed in the wheelhouse navigating on the German Rhine. Figure 3: (bottom left) The captain of a push boat transporting iron ore on the Waal. Figure 4: (bottom right) An operator at work in the Tiel control room, at the intersection of the Amsterdam-Rhine Canal and the Waal.





After returning from the field, I realised that it is not easy to tell at first glance whether the photos above were taken in a control room[1] or in the wheelhouse[2] of a ship. They are surprisingly similar. Both are isolated from the outside world. Both rely on detection by sending and receiving radar beams and radio waves. Both the operator and the skipper are surrounded by screens and displays showing radar, nautical charts and CCTV. Precise control of their internal environment is crucial for both. They rely on ergonomics to endure prolonged observation of screens and waterscapes during shift work. As the health risks associated with sitting have become more apparent, both operators and skippers are increasingly able to work while standing. Because of the amount of light brought in by the abundance of windows, both need large (automatic) sun filters to be able to read the surfaces of computer screens and gauges.

Not only are they similar, but they are also deeply interconnected and interdependent. With many operators having been skippers before and often returning to skippering after retirement, they share a culture. One that is passed on informally. Skippers register their cargo in internationally linked databases so that the control room knows what is being carried in the event of an accident; skippers report when they approach the control room territory, known as a 'sector'. They rely on the operator to provide an overview of the intersecting traffic at the confluences of the rivers in the Dutch Delta. This overview is made possible by the elevated position of the control room, but above all by the combination of its superior network of radar antennas, overlaid with AIS (a geolocative system to see which ships are nearby) and projected onto a digital nautical map stretching several horizontally linked screens. The information is exchanged via marine VHF radio. Using a common frequency, all participants in the local traffic are aware of each other's presence and direction.

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1 'Control room' is the most commonly used term to describe a place where it is possible to centralise a large amount of information about external events in order to influence them directly, whilst being physically isolated from them. The focus here is on mobility-oriented control rooms, specifically inland navigation control rooms, known in the nautical world as VTS (Vessel Traffic Services) centres. However, it is also shown that this type of control room exists in a larger continuum with other types of control rooms, not only those focused on different modes of transport, but also infrastructure and even military control rooms (which also have a mobility component, e.g. aircraft). This continuum is shaped by 1) a common tradition of making control rooms public, 2) not only as a pop-cultural trope, but also as an organisational interest in search of legitimacy, 3) and is also constituted by the migration of personnel between different types of control rooms, 4) and by convergence in the use and development of technology. In Dutch, inland navigation control rooms are called 'verkeerspost' or 'verkeerscentrale', in German 'Leitstelle' or more specifically 'Verkehrszentrale' and 'Revierzentrale' are used.

2 'Wheelhouse' means 'stuurhut' in Dutch and 'Steuerhaus' in German. It is the common term for the place from where an inland navigation ship is navigated. The term 'bridge', 'brug' in Dutch and 'Kommandobrüce' in German, refers to a similar place on a seagoing vessel.

Ships cannot stop or remain stationary for several kilometres, so an order has to be established while everyone keeps moving. This is done by consensus. A passing arrangement can easily involve five different vessels, which means that six people, including the operator, have to communicate their agreement or disagreement in time. However, only one person can speak at a time over a marine VHF radio. So, through sociomaterial assemblages, narrow bits of time and space are shared.

But there are also clear differences. Not everyone is equally vulnerable. The operator sits high and dry, static, while others are constantly on the move. Operators represent the state; many skippers who own their ship privately represent only themselves. Compliance also depends on authority, on the unequal distribution of power. But the operators refrain from giving orders, preferring to cajole and nudge the skippers into a temporary arrangement. Furthermore, the operator should locate and track the skippers, for the skippers it is not important where the operators are, as long as they are available to provide an overview.

This study brings the control room and the ship together to understand both better.

It may not matter much to the skipper, but operators are convinced that they need a direct view of the waterways whose traffic they coordinate. Their managers are less convinced, and believe that a central, remote location might suffice. A senior policy advisor at Rijkswaterstaat speculated that in the long term centralisation would reduce the current eleven control rooms to three (Interview 29.4.16). Other infrastructures have already gone through cycles of centralisation: the Dutch railway control centres went from forty-five in 1990 to seventeen in 2000 and are now down to thirteen, the main architect of this process told me (Interview 1.9.16). This has been made possible by automating the execution of the timetable. Unlike schedule-based rail transport, waterway transport is rule-based. There is no timetable to automate.

The comparison made by the Antwerp operator in the prologue with air traffic control has another dimension. The question of whether one should have been a skipper in order to be a competent operator depends on where and how the traffic is observed. For the Antwerp operator, the place of expertise is the interface; for him, his control room could be anywhere, but for the skipper-turned-operator, a direct view of the water is indispensable. In their study of Parisian infrastructures, Latour and Hermant (2006) claim that only the "view from nowhere," from an "oligopticon" instead of a panopticon, provides the "total view" (32). For them, therefore, one should "refrain from looking outside" (11). Places like the air traffic control tower and the control rooms of inland waterways offer grand panoramic views, but Latour and Hermant note that it is not the panorama but the diorama that is used, because "in order to take it all in at once, to 'dominate it at a glance' (…), Paris must first become small". (4) In the case of traffic on Dutch waterways approaching an intersection,

only the operator's screen can see all the traffic coming from different directions. This is what is called a "small whole" (Latour and Hermant 2006, 45).

However, this study shows that the 'small whole' does not exclude a view from anywhere, it shows how control rooms can be understood as local phenomena in a dynamic environment. What matters is local history, tradition and tensions. The latter, a long simmering conflict between management and operators, leads to control room work being made public by the operators themselves via Twitter. They share their view from somewhere with infrastructure publics (professional skippers, recreational skippers, local residents). Furthermore, during the fieldwork it became clear that the operators use the view that the architecture and location of their control room gives them an advantage. There are phenomena that only they can see from a particular position. Irresponsible leisure skippers manoeuvre their yachts where they cannot or should not. The same Antwerp operator was confronted with a yacht on the wrong side of the channel, trying to cross in front of a much larger and faster freighter. The operator grabbed his binoculars, always within reach, to see what this yacht, which was not responding to calls over the marine VHF radio, was up to (Field note 7.4.17).

The three movements discussed in the prologue—from control room ethnography to historiography, back to the control room and out to sea—inform the chapters of this book. The first movement, into historiography, covers two chapters. In the first, I delve into the history of Devil's Island near Dordrecht—taking cues from the operators, but relying mainly on archival sources. It describes the early history of the island through the rivers and canals around it. This provides an insight into the history of infrastructure and its mediated control, which in turn enables a more fundamental understanding of the first Dutch inland navigation control room built on the island. It is shown that a focus on land is insufficient to explain the island's emergence, as it turns out to be a by-product of infrastructural interventions to create new waterways. In the control room, the operators wondered where the name came from. It is difficult to say. What is more interesting, however, is how the name evolved from an informal reference to the name of an official Rijkswaterstaat site, since it was the agency itself that "enrolled" the name (Callon and Law 1982: 622) when it built a control room there. Archival research, supplemented by oral sources, paints a picture of the emergence of the control room: the rise of tanker shipping made the local public demand active protection, and Rijkswaterstaat lost the authority, and soon the funds, to intervene in the dramatic way it had done in previous decades. Surprisingly, given the high-tech reputation of the control rooms, the control rooms built in the early 1980s were not only the more legitimate but also the cheaper option compared to redesigning and creating waterways. The control rooms mark a behavioural shift in infrastructure. Framing these sites historically teaches us that, rather than the revolutionary sites they are made out to be when celebrated at their inauguration or through the persistent representation of state actors, con-

trol rooms are both a reaction to changes in speed, scale and infrastructural complexity that had already taken place, and the facilitators of the continuation of these trends.

The second chapter looks back at the work on Devil's Island at a time when Rijkswaterstaat had already abandoned the island. The work of the outdoor departments that used to be located there was increasingly outsourced and the operators moved to a nearby building on the banks of the Oude Maas. Here, too, they had a direct view of the water they had fought so hard for. Through oral history, supplemented by archival sources, it is reconstructed how the understanding of the basic requirements of the operator's work—experience on the water and a direct view of the water—could diverge between the operators and the management. It is argued that through the mediatisation of work (shifting the scope of observation from the waterscape to a configuration of interfaces), learning could be relocated, making work 'simulatable'. As a result, legitimate access to an ongoing community of practice was no longer controlled by operators and rooted in shipping. This shows how the shift from mobile life to sedentary work changed the intimacy of expertise. It is not so much automation as mediatisation that has changed work, both in the control room and on board ships, and explains a significant part of the botched professionalisation of operators. Another key component is the rise of managerialism in three forms: the transformation of nautical experts in supervisory positions into managers, the internalisation of managerial norms by every member of the organisation, and the promotion of a new type of manager who deliberately has no substantial expertise other than management. Not only was management able to prevent a costly professionalisation of the operators (as part of its own professionalisation strategy), it was also able to mobilise the previously exclusive operator perspective through mediatisation and distribute it to the skippers. Thus, it was not automation but distribution that was a cost-saving strategy, sold as a gain in 'efficiency', used to justify what operators perceived as an understaffed control room.

Throughout these chapters, I keep the notion of field intact and draw on historical anthropology to understand past practices. This allows for an understanding of the past that is almost as rich and reflexive as an ethnographic account of the present. Importantly, it also relies on a media studies-informed sensitivity to the materiality and biography of the sources themselves. Taken together, these chapters show how the present is deeply rooted in questions about the past.

Faced with a shortage of staff, the operators took to the national stage in 2015. They broke ranks by declaring on a prime-time news programme that 'safety on the rivers was at risk'. The odd thing was that control room operators claimed they were out of control. However, the operators were confronted with the perfect reputation of the control room, constructed by their superiors seeking legitimacy regardless of their actual work. More specifically, as long as there were no major incidents, budget cuts could seem justified. Normally, from an organisational perspective, it

is only important to demonstrate that someone is in control, not how it is done. This demonstration, and how it has changed, is examined in two steps. In chapter three, having mapped the visual tradition of the infrastructural control room, including locally, I look at how organisational goals are translated into architectural design. For managers and the organisation as a whole, it may not matter where a control room is located, but it does matter that it is visible. It turns out that this is not just true of nautical control rooms. Control rooms are visible markers of organisational ambition, efficiency, public safety and thus legitimacy in a way that representations of ordinary offices could never provide. The (infrastructural) control room therefore has a dual function by design, physical coordination and organisational legitimacy, which is becoming increasingly explicit, but has been there for a long time.

Then, in the wake of the public phase of the conflict, the operators took to Twitter. They began to make their work visible. These tweets are the focus of the fourth chapter and are compared to the organisational representation of the control room. The operators were able to do four things differently. First, they were able to turn their networked public into a public of professional skippers, recreational skippers and local residents. Second, the operators not only opened up an inaccessible workplace, but also offered a casual route to the visual literacy needed to understand the real situations they faced. Third, by addressing multiple audiences, the operators escaped the insider-outsider dichotomy that characterises most infrastructure work. Fourthly, by persistently presenting the 'near misses' as dangerous but nonetheless non-events, they found a way to legitimise the work of the control room, not just the control rooms, despite their success.

After a massive infrastructure scandal in the early 2000s, Rijkswaterstaat changed course. It now saw itself as a 'network manager', which meant that control rooms became a focal point. In addition, as an extension of the New Public Management dogma, Rijkswaterstaat wanted to be more 'customer-oriented'. Operators are one of the few positions within Rijkswaterstaat that have a serious job and work with tangible results: safe mobility. For this reason, the department's communication department monitors the tweeting operators on a daily basis and organises training sessions. In this context, it is not surprising that the operators engage in a form of symbolic legitimisation reminiscent of classic (military) control room publicity stunts. Operators not only make their work visible, they engage in visibility work. These may be the contours of the changing work of the operators: as the control room perspective is increasingly distributed to the wheelhouses, the operators seem to have their hands free for public relations work, while the communications department itself partly switches to monitoring Rijkswaterstaat employees in the field through a specially designed dashboard.

In the fifth and final chapter, I go on board several ships, urged on by the operators. Going beyond the isolation of the control room means refusing to remain a researcher once inside. It is to connect the operators' experience to the larger whole

of which they want to be a part. Building on the work of the first chapter, it is finally possible to move beyond the land-water dichotomy, and the chapter moves on to combine the land-based experience with the onboard experience. The chapter analyses the interplay between movement and stasis by looking at four different orderings: navigational, regulatory, market and intimate. These orderings are ongoing situated practices carried out by actors in distributed sociomaterial assemblages. In tracking different actors, the key is to follow the action through which they are connected. This allows scaling up without losing sight of the practices. It is shown that the mobilisation and immobilisation of ships is also carried out from land by control room operators, cargo brokers, family members and non-human actors such as radar networks, geolocative AIS applications and water level databases. Leisure skippers in particular would remain unaccounted for if it were not for the operators. It is only through their collective efforts that they can keep an eye on yachts that are navigating erratically. It became clear that often actors need to give market orderings priority and rearrange their position in other orderings accordingly. This results in tangible pressure, which manifests itself in various time problems. Skippers take physical risks to be just in time, to find rest and to mediate the asynchronous rhythms of loved ones ashore. At the same time, they have to maintain critical spatiotemporal separations with the riverbed, the embankment and other vessels. Media play an important role in the assemblages, keeping separate what would otherwise collide, and connecting to deal with separation.

This study is part of a tradition established at the graduate school Locating Media, University of Siegen, where media practices are captured "in situ" (Bender and Zillinger 2015: xxiv) and "in actu" (Dang-Anh et al. 2017: 18). It manages to move between different scales, connecting practices to larger trends and, conversely, rooting larger trends in an empirical everyday. It integrates media archaeology (the topos of mediated control) with historical and media anthropology (the past and present nautical everyday), moves into workplace studies (the ongoing accomplishment of control), and finally into mobilities studies (the movement and stasis of ships, data, operators). This is much more than a linear process. By following operators on Twitter, I study media archaeology in the making, showing how an isolated workplace forms and addresses publics. Practice and representation are intertwined by studying 1) the divergence of practice and representation in parallel with 2) the representation of practice and 3) representational practices. Not only are media understood in motion, enriching media studies with mobilities studies, but motion is also understood as a mediated practice that depends on the mediated control of distance.

This kind of transdisciplinary research might best be understood as what Deleuze and Guattari have called "ambulant sciences" (2010: 31), plural because it cannot be confined to one discipline. Others, inspired by the work of Ludwik Fleck (1935/1981), have defined it as "eine Arbeitsweise, die dem Geschehen folgt, die auf Improvisationen angewiesen ist und einer hohen Aufmerksamkeit für sich bietende

Möglichkeiten von Ort und Situation bedarf." (Arens et al. 2005: 91) It is important to note that in contrast with stationary sciences, conducted under more stable circumstances, it lies "in der Natur des ambulanten Arbeitens – im Ausserhalb, dass es Störungen und Hindernissen unterworfen ist. Das kann zu sehr viel Ärger führen, wir verstehen es aber als Qualität, als die Kunst des ambulanten Arbeitens, Widerstände fruchtbar zu machen und in unsere Arbeit zu integrieren." (95–6) It was precisely this attitude that helped me to constantly find new theoretical grounding in order to follow where my field led me. I found it a companion to my methodological approach to the field.

sInitially, I adhered to Latour's maxim "follow the actor" (2007: 12), which in STS is the established way to scale, as it is rooted in action in the field and not "as one of the many variables" that researchers "need to set up before doing the study" (Latour 2007: 183–4). Latour is adamant that it "is of little use to respect the actors' achievements if in the end we [researchers] deny them one of their most important privileges, namely they are the ones defining relative scale." (184) Indeed, it is often impressive how actors achieve this (cf. Zillinger 2014). In my case, I let the operators define the scale necessary to understand their work, which went beyond the control room and included the shipping itself—the skipper-turned-operator went the other way. Not infrastructure, but the work of "infrastructuring" (Star and Bowker 2006) defined the scale of my research. It is the researcher's focus on scaling, knowing that there is a larger context, that actors operate at different levels, that makes scaling visible in the first place. Scaling is always done by actors in the field, mainly through the media, and again by researchers who accompany them and trace the circulation of references (cf. Latour 1999).

This is how I traversed my field. In the process, the field was constantly redefined: first I went from watching a national news programme to visiting the Dordrecht control room, from where I was propelled in many directions: to other control rooms, back in time, to simulator training and on board ships. The Nijmegen control room took me to their German neighbours, with whom they were linked via a cargo database. Just one trip on board the *Liberty*, which I boarded at a lock on the River Main and ended up in the port of Antwerp a few days later, showed how research into a local Dutch conflict was also part of a transnational life. Even when I actively sought to overlap my various movements—visiting control rooms along the waterways I had sailed and vice versa—the implications of scale surprised me: tracking leisure yachts unaware of surrounding traffic, the logistics and politics of iron ore supplies at extremely low water levels, the physical risk and time pressures of maintaining a family life while on the move. Rather than follow the actors and report here where they took me, I followed the action and show here how it intersects.