The Shaping of Urban Public Transport:
Two Cases of Alternative Leading Objects

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Abstract

This paper investigates the shaping of urban public transport by comparing 'alternative leading objects' to the car in the Norwegian cities Trondheim and Bergen. These have chosen different transport technologies, bus and light rail respectively. I draw on the concept of technological frames and illustrate how interpretations and expectations of sustainable urban mobility guide transport planning. The paper contributes to discussions in STS by exploring technological frames as ongoing practices instead of as outcomes, and as performed by what I identify as two framing coalitions. Both coalitions emphasised that Trondheim and Bergen represented different city identities and topographies. The paper demonstrates the importance of making such identities and representations of public transport systems in particular urban contexts in order to replace a car-dominated transport system. The paper draws on an observational study in two transport offices, interviews with transport planners and politicians and document studies.

Keywords: sustainable urban mobility, alternative leading object, technological frames, public transport

Alternative leading objects of urban mobility

Urban transport systems are multi-modal in the sense that they combine cars, buses, trams, light rails and more; presently, cars dominate nearly all such systems. Lefebvre (1971: 100) calls the car 'the leading object' due to its outstanding ability to shape the physical structure and performance of social life, and to the way in which it functions as a symbol of modern capitalism. However, global climate change discourses challenge its dominant position, particularly with respect to planning urban transport. During the last decade, many actors have positioned cities as promising sites to reduce climate gas emissions (Bulkeley et al., 2015), with transport expected to play an important role in this regard. A major focus and challenge for cities has been to achieve a modal shift from car use to the use of public transport. What kinds of technologies are called for to achieve this shift, and what is the underlying argument for choosing one particular technology above another?

The paper pursues this question by investigating the shaping of public transport in two of Norway's largest cities, Trondheim and Bergen. In Trondheim, buses are the primary focus as the

development of public transport in the city has been and still is an issue of designing and building an attractive and effective bus system. In Bergen, the focus is on the construction of a light rail system, which has gained a hegemonic symbolic position in spite of the quantitative dominance of buses in Bergen's public transport system. The paper analyses the arguments forwarded by what I call the framing coalitions in the two cities, their arguments regarding the technological options and their navigation through these options when trying to increase the use of public transport. Inspired by Lefebvre's (1971) description of the car as a 'leading object' I use the notion of 'alternative leading object' to designate the technology that dominates discussions and investments in public transport.

There is an increasing focus on sustainable transport in Norway, and a main goal of Norwegian transport policy is so-called zero growth. It states that car-based mobility should not increase even though Norwegian cities are growing. Instead, increasing transport needs should be met by public transport, walking and bicycling (White Paper 26, 2012-2013). To this end, the National Transport Plan for 2014-2023 (White Paper 26, 2012-2013) proposes densification of the cities as a means to foster sustainable mobility. However, Berger et al. (2014) point out that there is no accepted definition of a compact city (see also Organisation for Economic Co-operation and Development, 2012) although 'compact cities' are often seen as a solution to problems created by urban sprawl and processes of suburbanisation (Neuman, 2005; Burton, 2000). The lack of a clear and universally accepted definition of the 'compact' city suggests a potentially important relationship between the choice of public transport and of the physical structure of a city, which I also explore in this paper.

Schwanen et al. (2011) reviewed leading transport journals in the 2000s and found that most research on sustainable mobility has addressed the effect of technology on carbon emissions, physical infrastructure provision and behavioral change. The focus on attitudes and personal norms emphasises consumer responsibility, which according to Schwanen et al. (2012) neglect the role of other stakeholders such as

the transport lobby, politicians and the media (see Buchmann et al., 2017 for a review of social science and humanities research in transport decarbonisation). Hodson et al. (2017) claim that previous research on sustainable mobility has focused on efforts to reduce the need to travel, the re-designing of roads for non-car transport and the shifts to other modes of mobility such as walking, cycling, tram and light rail (see also Banister, 2008; Parkhurst et al., 2012).

There is also a growing literature on innovations in sustainable mobility (see Schwanen, 2015 for a review). For instance, Pineda and Jørgensen (2008; 2015) discuss the development of urban transport systems in two cities – the metro in Copenhagen and the Transmilenio in Bogotá (bus rapid transit) – in a sustainability transition perspective. They use the so-called arenas of development approach to highlight the composition of discourses, claims, materiality and visions, arguing that when an arena matures (automobile-based transportation for example) it often materialises in institutions (Pineda and Jørgensen, 2015: 203). This paper is also concerned with how ideas and interpretations 'mature' in the shaping of sustainable transport in two different city contexts, but my paper adopts a somewhat different theoretical perspective (to be discussed in the following section).

A transport system may seem radical in one city and represents the norm in another due to the process of *embedding* an artefact into a local context that comprises various dimensions such as existing transport systems, governance, politics and funding (Hodson et al., 2017: 9, my emphasis, see also Schwanen, 2015). Thus, there is a need for empirical comparative studies of the embedding of transport artefacts in different urban contexts (Hodson et al., 2017). In this paper, I study how particular public transport technologies become 'the norm' in a specific city context by exploring how stakeholders in urban transport develop ideas concerning an alternative leading object in a local context of improving sustainable mobility.

To this end, I draw on concepts from Science and Technology Studies (STS). By contrast to perspectives focusing solely on technological fixes such as the making of low-emission vehicles or facilitating infrastructures for sustainable mobility (see Schwanen et al., 2011 for a review of such

perspectives), STS concepts are particularly suited to explore the introduction and the role of technologies in societies. This includes, among others, how various actors are important in the construction of new technologies (see for instance Pinch and Bijker, 2012[1987]), how some technologies 'win' over others (for instance Latour, 1987) or how technologies become co-produced with identities, discourses, institutions and representations in societies (Jasanoff, 2004). In this paper, I will focus on the concept of technological frames, which is part of the Social Construction of Technology framework.

The rest of the paper is structured as follows: first, I will briefly describe and explain why the concept of technological frames is useful in exploring the shaping of urban public transport. Second, I will give an account for the choice of case studies, the data sources I have used and how I analysed the material. Third, I dedicate the main part of the paper to the exploration of the two cases: the shaping of a (metro) bus system in Trondheim followed by the shaping of a light rail system in Bergen. I conclude by comparing the two frames, and suggest how to develop the concept of technological frames.

Technological frames and framing coalitions

The car remains the leading object in the Norwegian cities of Trondheim and Bergen. However, this domination is increasingly challenged by more sustainable modes of mobility such as public transport. Insights from Social Construction of Technology (SCOT) and particularly the concept of technological frames represent a promising avenue to explore the emergence and stabilisation of technological artefacts. While the original SCOT framework was concerned with how artefacts may be interpreted differently by relevant social groups, a process referred to as 'interpretative flexibility' (Pinch and Bijker, 2012[1987]), Bijker (1995) introduced the concept of technological frames to explain how certain interpretations stabilise over time.

According to Bijker (1995), technological frames consist of goals, ideas and tools that guide a relevant social group's thinking and interaction

with a certain phenomenon – in this case with respect to sustainable urban mobility. Technological frames emerge when interactions 'around' an artefact begin, meaning that the frames are not characteristics of actors but developed in interactions between actors and artefacts (Bijker, 1995). His argument is that technological frames thus contribute in structuring interactions because they constrain freedom of choice in the designing of an artefact. It is important to note that a technological frame is not merely an interpretation of an artefact (such as a public transport technology), because the artefact itself contribute to structure these actions and thereby also constitutes the frame (Bijker, 1995).

The concept is most conducive to the analysis of situations of instability and change (Bijker, 1995: 124) – where there is leeway to destabilise common interpretations. For instance, though the car is presently the leading object of urban mobility in Norway, there is an ongoing destabilisation of the car's leading role towards more sustainable mobility systems. Aibar and Bijker (1997) used technological frames to illustrate how three relevant social groups, defined as architects, engineers and the working class, competed to shape the extension of Barcelona city based on their ideas and interpretations of the city and the extension plans. Here, the relevant social groups had competing interpretations, and the Barcelona case ended with what the authors describe as a compromise between the architect and engineer frame.

The notion of relevant social group has mainly been used to illustrate differences between groups' interpretations and interests and how they may reconcile with respect to a given design of an artefact, like the bicycle. This paper is more concerned with the choice of transport technology and how this choice is framed to make it attractive. For this reason, I use the notion of 'framing coalition' to describe the actors that engage in the framing processes. A framing coalition is a group of people with shared ideas and interpretations of sustainable urban mobility in a particular city context, which through political channels and new media in particular actively promote a particular technology to establish a technological frame in the local context. Though the alterna-

tive leading objects are indeed challenging the car's leading role in the urban transport system, the paper is concerned with the relation between the alternative leading objects and their respective urban contexts. I focus on the content and the effects of the technological frames, rather than how the frames were initially developed. We should expect relevant social groups to be made part of a technological frame in the sense that a successful transport technology needs users or customers, but this gives them a lesser role than in Bijker's (1995) account. Following this, I see technological frames not merely interesting as outcomes – describing why artefacts look the way they do – but also as ongoing practices of generating interpretations and ideas, in this case of sustainable urban mobility. Hence, I use the concept to explore contemporary and future-oriented shaping of urban mobility.

The frames in the Barcelona case (Aibar and Bijker, 1997) included two types of closely intertwined artefacts: the Cerdà plan for the extension of Barcelona and the city itself. This two-fold inclusion suggests that technological frames may implicate actors' design choices and leeway not only with the exemplary artefact itself, in my case public transport technologies but also the local context in which it operates – the city. Pineda and Jørgensen (2015: 202) also point out that in order to nurture new initiatives (such as a transport system) there is a need to understand how the new initiative relates to the context in which it is expected to perform. This point is of highly relevance to this paper, focusing on technological frames in two different city contexts.

With these insights, the paper pursues the following research question: How are alternative leading objects decided upon, what frames do they become part of, and what are the effects of these frames in particular urban contexts? I will explore this by investigating the arguments forwarded by framing coalitions concerning alternative leading objects in Trondheim and Bergen. Before that, I will give a brief account of my methodological choices.

Methods

Bergen and Trondheim are the second and third largest cities in Norway, with approximately 280,000 and 190,000 inhabitants, respectively. Both cities have organised their work with urban transport in a three-party public sector collaboration between the state, county and municipality. In Trondheim, the programme is called Greener Trondheim, and in Bergen, the Bergen Programme for Transport. I chose these cities because they have invested in different alternative leading objects: bus and light rail. The paper focuses on the ideas and arguments forwarded by the main framing coalition in each city concerning this choice. I will identify the coalitions by means of visible actors' shared set of ideas and interpretations of alternative leading objects and the local context where these are expected to operate. The coalitions may include different types of actors with various interests of urban transport, for instance politicians, urban planners and the public in general.

I needed a qualitative research design to identify and to gain in-depth accounts of the framing coalitions' ideas and interpretations of both the public transport systems and their respective city contexts. This design consists of several sources, namely (1) observations in two planning agencies (Bergen and Trondheim), (2) interviews with transport stakeholders in these cities, (3) review of newspaper articles and (4) review of official documents from national and local authorities. I will briefly describe each of these datasets.

The primary source of data is an observational study inspired by Czarniawska's (2007) shadowing technique, carried out over a one-month period in two planning agencies (Bergen and Trondheim). Shadowing as a method lies somewhere between doing observation and participant observation. It is a 'fieldwork on the move' because the researcher carefully follows those being shadowed around throughout their working day (Czarniawska, 2007). During the fieldwork, I participated in and observed internal and public meetings, discussed with the planners and participated in on-site inspections, all of which allowed me to explore how urban planners interpret and negotiate sustainable urban mobility. I recorded the fieldwork in a written diary, on an audio recorder and with a go-pro camera.

The second source is interviews with urban planners working in the planning agencies I shadowed and with regional transport stakeholders and politicians. I conducted twelve interviews in total between May 2015 and January 2016. I selected interviewees partly due to their different areas of responsibility and partly due to their accessibility. Since regional governments in Norway are responsible for operating public transport, I also sought insights from regional transport actors including politicians. Each interview was recorded and transcribed and I have anonymised the interviewees. The combination of shadowing and interviewing in close succession gave me the opportunity to learn more about practices, controversies, ideas and interpretations involved in urban mobility planning.

The third source of data is newspaper articles collected from the online media base Retriever. Newspapers have a wide circulation and large readership in Norway (Østbye, 2008), and they represent an important arena of information and public debate. I used the transport programmes Greener Trondheim and Bergen Programme for Transport as points of entry. My aim was to identify how sustainable transport, in particular the new bus project in Trondheim and the light rail in Bergen, were debated in these cities' regional newspapers (Adresseavisen and Bergens Tidende). The newspaper articles comprised reportages, chronicles and letters to the editor. I did not explicate these differences because I was more interested in the content rather than potential intentions of the newspaper texts. In this way, I see the material from this source as to reflect the arguments of those involved in the public transport debates in Trondheim and Bergen.

The fourth source is official documents from national and local authorities such as the National Transport Plan for 2014-2023 and the websites of Greener Trondheim and The Bergen Programme for Transport. I reviewed these documents to search for national aims and goals of urban public transport and additional information including financials concerning the metro bus project and the light rail.

I analysed the data in a systematic coding procedure inspired by grounded theory methods as introduced by Charmaz (2006). I made open analytic codes of pieces of text, which I further grouped into categories that I compared and explored.

The following analysis focuses on the framing coalitions' arguments in favour of their preferred choice of public transport in Trondheim and Bergen.

Two cases of alternative leading objects

The technological frames in Trondheim and Bergen relate as they both intend to replace the car frame. However, they pursue their objectives with diverging strategies and alternative leading objects. I will to some extent focus on the stabilisation of the frames but, as stated, the paper is more concerned with the content and the *effect* of the frames. My aim is to investigate the elements of the frames and by this how the frames may contribute in the further shaping of urban mobility in these two cities.

Emerging technological frames in Trondheim

The car as leading object of personal transport has been manifest in Trondheim for a long time. In the 1960s, there were even more private cars in Trondheim than the national average car registration per capita in Norway (Thomassen, 1991). The fact that the car is the current and traditionally dominant leading object suggests that there is a strong car frame in Trondheim. The car has remained the answer to most questions concerning urban mobility for a long time and thus obtained a sort of obduracy (Bijker, 1995; Hommels, 2005). However, the car frame is increasingly being challenged. According to a regional politician in Trondheim, matters of land use and congestion will force the car to be replaced by other means of transport in the future:

> Facilitating public transport in cities is a matter of land use. There is not enough land to solve transport issues posed by cars because this boils down to how many people you can transport from point a to b within a city. People have to walk, cycle and/or use public transport. Otherwise, cities will choke in congestion.

Technological frames emerge through interactions with technological artefacts, for instance by publicly performed ideas and arguments. There have been lengthy debates between professionals and policymakers in Trondheim concerning the choice of an alternative leading object. These debates (recorded in Trondheim's regional newspaper) initially concerned the choice of tramlines, a light rail or a bus system. One debate concerned ideas and possibilities for constructing a tramline loop ('Midtbysløyfen') through the city center. The tram in Trondheim started operating from 1901 and occupied an important position in the city from the 1920s to the late 1980s but financial problems led to a shutdown of all except from one line in 1988 (Kjenstad, 2004). Several of Trondheim's local politicians in the Labour Party were part of this emerging coalition advocating the tram option. This coalition also included inhabitants in Trondheim hoping for a new golden age for the tram – celebrating its hundred-year anniversary in 2001 (see Kjenstad, 2004).

The coalition supporting the tram option ('the tram coalition') lacked financial and sufficient political support. For instance, the Minister of Transport refused to allocate the necessary 15 million NOK (today approximately €2.9 million) to build the tram loop (Leirset and Gisnås, 2001). The tram coalition had similarities to another emerging coalition advocating a light rail option in Trondheim. The similarities concerned financial challenges, but also how a rail based transport system invoked issues of localisation and enabled long-term urban development. For instance, the national rail company suggested a light rail for Trondheim in 2001 (NRK, 14.08.2001) and light rail became part of the public debate. Moreover, the Green Party in Trondheim pointed to possibilities of combining a light rail system with Trondheim's railway system (Hegvold, 2007).

The discussion that followed in the newspaper addressed whether Trondheim should create a tramline, construct a separate light rail system or expand the bus network. I understand this as three technological frames of sustainable urban mobility, posing different ideas of alternative leading objects to the car. The frames were constructed by frame coalitions consisting of politicians, planners and the public. However, the

coalitions were not equally strong. The coalition that advocated buses as the alternative leading object consisted of several members from the local Labour Party and the professional planning community in Trondheim. During the last decade, Trondheim has put great effort into developing a public transport system in which buses play the predominant role. Therefore, the next section will focus on how the bus coalition performed what I call the bus frame in Trondheim.

Performing a bus frame in Trondheim

The bus coalition interpreted buses as the alternative leading object of person transport in Trondheim. They developed the bus frame simultaneously alongside efforts to destabilise the tram and the light rail frame. In so doing, they argued that a tram and light rail were unsuitable by pointing to topographical and demographical aspects. An urban planner in Trondheim summarised the bus coalition's view in a local newspaper:

> The choice of public transport technology relates to size and settlement. A light rail is conducive to transporting many people over long distances, like in Bergen, but Trondheim is a circle-shaped and small city. The bus gives greater flexibility because Trondheim does not yet have clear axes of settlement like Bergen. A light rail may be an option in the future, and some politicians are very determined that Trondheim should have a light rail, but I think this depends on the city's development (Kringstad, 2016).

The quote reflects an interpretation of Trondheim that emphasises topographical and demographical elements, and this interpretation was central in constructing the bus frame. Several interviewees in both Trondheim and Bergen claimed that Trondheim's population was clustered in semi-dense areas and needed buses because they could operate in several directions. The urban planner quoted above also pointed to flexibility as an important motivation for choosing a bus system. This relied on an expectation that a bus system would be more adaptable to shifting future settlement, compared to what was considered as a non-flexible light rail or tram solution. The bus coalition interpreted this flexibility as an advantage in terms of replacing the car as leading object in Trondheim.

Moreover, the bus coalition also stressed that due to relatively low costs, a bus system was more likely to give expedient results than a light rail, which would require construction from scratch. A representative from the county authority explained that it was challenging to get financial support in the absence of any convincing results: "if we had started planning for a light rail in 2008, we would not have had any results to show by now". It was seen as beneficial to document immediately how the public transport system contributed to replace the car as leading object in order to procure further trust and financial support from the national government. In addition, according to an urban planner: 'a bus system gives a lot more transport for the money than a light rail'.

The bus coalition found it necessary to make the bus appear as a desirable alternative to the car and was especially interested in recruiting car drivers as bus passengers. To do so they needed to frame the bus as a viable choice while at the same time restricting car use. A regional politician explained:

> The first keyword for a better bus system is 'frequent departures'. This is related to the second keyword, namely 'predictability'. Further, we agreed that the buses had to be 'cleaner' in terms of fewer emissions. If buses are going to compete [with cars], you have to make the bus users feel that they are making an environmentally sound choice. Thus, we invested in buses running on natural gas when we upgraded the system.

The regional politician stressed frequency and predictability but also the fact that bus users needed to feel that they contributed to urban sustainability by taking the bus. In the bus coalition's view, all inhabitants in Trondheim were potential bus users and thus part of all-encompassing social group, even those who normally travelled by car. They saw the bus as a socially inclusive technology that in principle should serve the transport needs of all inhabitants. A representative from the county authority argued that a bus system appealed to all inhabitants in Trondheim: "A light rail only benefits those living close to it. The bus, by contrast, is for everyone, no matter where they live". Users, however, needed to be convinced and pushed to change their travel behaviour. Put

differently, the bus coalition tried to configure potential bus users by "…defining the identity of putative users and setting constraints upon their likely future actions" (Woolgar, 1990: 59). The bus coalition put much effort into the configuration of potential users by considering what measures would cause them to start using the bus.

The bus coalition contributed to 'ordering' urban mobility in their concurrent framing of the city of Trondheim and the bus system. They ordered the elements based on their ideas of topography and demography, the city's transport history and existing transport infrastructure, the importance of flexibility in urban planning to obtain quick results, economic concerns, and not least their user configuration. I understand this ordering of elements as a way of simultaneously producing a city identity for Trondheim and developing the bus frame. By this, they could argue that a bus system was the most legitimate choice of alternative leading object considering the city's unique identity.

With a bus frame also grounded in the city identity, bus technology appeared as the solution to the most pressing transport problems in Trondheim. Working with a bus frame (as opposed to a light rail or tram frame) indeed also resulted in some of the quick results that this coalition considered very important in political terms. For instance, planners and politicians in Trondheim transformed a mixed-use driving lane into a bus lane in the city centre in 2008. This was crucial according to a local urban planner in securing Trondheim the national Sustainability City Prize in 2008. This was also the same year as the establishment of Greener Trondheim, which prioritises and finances work with sustainable transport. Greener Trondheim has made the bus system their main priority in the matter of public transport. A regional transport actor applauded what he considered great success of these efforts:

> What Greener Trondheim achieved in restructuring the bus system was unique. No other city in the Nordic region has made a similar achievement in such short timeframe. Greener Trondheim contributed to an increase in the share of bus travel up 60% between 2008 and 2015. This was an extreme improvement.

Despite the success, the increase of buses began creating new problems of bus congestion during rush hour periods. The planners also expected population growth and by this a correlative increase in bus travel. Thus, their main concern shifted from promotion to the difficulties involved in a further expansion of the bus capacity. A regional transport stakeholder interpreted the situation as follows at a public meeting in Trondheim:

> Our bus success from 2008 is now stifling us. During rush hours, it is almost impossible to get through the city centre by bus. We will now introduce a new technology to solve this problem: the metro bus. The metro bus will be 'the light rail' of Trondheim.

The metro bus was intended to solve congestion problems by introducing vehicles with a significantly larger passenger capacity than regular buses (metro buses would be up to 24 meters long). However, when the alternative leading object, the bus, needed to accommodate technological change it seemed to re-open a debate, in which some again started advocating for a tram and/or light rail solution. When this occurred in 2015, articles in the regional newspaper in Trondheim referred to the metro bus as a 'monster bus' because of its size. There were also letters to the editor written by citizens and politicians that attempted to rekindle a public debate concerning why Trondheim did not invest in a 'real' light rail instead of a metro bus. The bus coalition's reaction to this claim was frequently to repeat the financial reality. For instance, the website of Greener Trondheim (2018) compared the metro bus and the light rail in Bergen, showing that the metro bus was estimated to cost 2.8 billion NOK (approximately €300 million) while the next line for the Bergen light rail alone was estimated to over 6 billion NOK (approximately €630 million).

Despite resistance towards the metro bus, the bus frame had grown obdurate (see Hommels, 2005) in the sense that it was challenging to think of topography, planning flexibility, results, economic concerns and user configurations without considering the bus as the alternative leading object. The bus, including the metro bus,

still appeared to be the answer to all problems of public transport in Trondheim.

Though the bus coalition enrolled the metro bus into the bus frame, they considered it an advantage if the metro bus was capable of evoking a light rail system for passengers, admitting that such system appeared more desirable. Actually, the website of Greener Trondheim (2017) described the metro bus as a hybrid technology with similarities to a light rail in terms of accessibility and reliability, design and frequent departures. The website even called the metro bus "a light rail on wheels". However, this did not destabilise or compromise the bus frame. On the contrary, it contributed to strengthening the position of this frame by including some important aspects of public transport planning, namely frequency, predictability and not least urban densification. An urban planner in Trondheim claimed that the light rail in Bergen had stimulated a densification of settlement along the rail lines and therefore expected that the three main metro bus lines would have a similar effect in Trondheim. As such, the metro bus did not only fit the contemporary city but was argued to be a forward-looking alternative leading object, which would transform Trondheim in the future. Ultimately, the developed bus frame meant that Trondheim should not need to engage in any more debate concerning alternatives like trams and light rail.

In this section, I have shown how the bus coalition in Trondheim performed a bus frame. They used topography and demography to argue why a bus system was a suitable option for Trondheim but they also pointed to the flexibility and how economically sound the bus was compared to the construction of a light rail. Moreover, they made the bus appear as an inclusive technology in the sense that bus travel was meant for everybody – everyone was considered a part of the relevant social group of the bus system. At the same time, it was also an exclusive transport system because the bus coalition did not plan for any other public transport alternatives. Importantly, this coalition stressed how the proposed metro bus technology would help densify the settlement along the bus lines, making this a far-sighted alternative leading object.

Next, I will turn to Bergen, which has a light rail system. With respect to the flexibility and relatively low costs of a bus system, it is somewhat surprising that Bergen chose this technology. First, I will give a brief account of how the light rail evolved as the alternative leading object in Bergen.

Emerging technological frames in Bergen

The city of Bergen is located on the west coast of Norway in a valley surrounded by mountains. Bergen faces severe challenges with respect to local air pollution, particularly during cold winters. This is due to so-called inversion in which polluted air (such as smog) stagnate close to the ground. In addition, there has been a strong car frame in Bergen for a long time, and this car dominance was according to a regional politician among the reasons why it was urgent that Bergen succeed in the matter of public transport:

> Twenty years ago, the city centre in Bergen looked like one huge parking spot. The transport situation was a disaster, and the city kept growing. Bergen would have collapsed if the politicians had not started to make a plan for public transport.

Bergen has a long history of rail transport and the city had a tram system in operation from 1897. However, this system was limited to the inner parts of the city and did not reach the suburbs. Due to high operating costs, the tram was gradually replaced with bus and trolleybus lines and the tramlines were shut down in 1965 (and the tramcars were dumped in the fjord!) (Hodne et al., 1997). The deregulation of the car in Norway in the 1960s paved the way for the establishment of suburbs around Bergen followed by several discussions of alternative leading objects for transport in the city. For instance, in 1973, the city council discussed to introduce a rapid transit system inspired by the successful Oslo metro (opened in 1966) but they did not land on any decision (Meulman, 2000). Bjørn Gullachsen (then Communist Party member, later Left Socialist Party) advocated for a light rail option in the early 1970s and some first planning drafts for a light rail was introduced in this decade (see Vollset, 2007). However, these drafts met resistance from an emerging coalition

aiming to develop highways and bus infrastructure. A prominent actor here was Hordaland Road Department. They initiated the establishment of a toll ring around Bergen in the early 1980s to finance a massive investment in highways and got support from representatives from the municipality and politicians from the local Labour Party, the Conservative Party and the Christian Democratic Party (Lian, 2005: 66). This development was criticised by some local journalists, for instance Rødland (03.05.1993) who argued that this indicated a shift from focusing on public transport towards paving the way for an increase in private car use.

The next possibility for realizing a light rail in Bergen came with a decision from the Ministry of Environment to make Bergen a so-called prioritised environmental city ('Miljøby') in 1993 (Bergens Tidende Morgen, 1992). This status came with 10 million NOK (today approximately €1.6 million) dedicated to environmental projects in the city, in which a study of a city light rail would be a main priority. Articles published in the regional newspaper illustrate that there were disagreement on how to spend the money. There were in particular two coalitions with a different technological focus. One coalition, strongly represented by the bus company Bergen Sporvei AS (former tram company), was especially interested in investing in a new trolley bus system (electric bus system) arguing that trolley buses were a more viable alternative than a light rail system in terms of costs, time and environmental impact (Kristoffersen, 1992). The other coalition argued that a light rail was the most suitable alternative leading object for Bergen. This coalition consisted mainly of the professional planning community and actors from several local political parties, in particular the ruling local Labour Party. Labour Party Municipal Commissioner Anna Elisa Tryti (often referred to as one of the 'Bergen light rail mothers') emphasised that a light rail was highly necessary in order to develop a well-functioning transport system and also suitable considering Bergen's topography and demography (Lindebotten, 1992).

The light rail went through a study phase from 1993, but financial aspects caused conflicts between the political parties as well as Bergen's citizens. However, the light rail secured invest-

ment costs from the state, the county, the municipality and the toll ring when it became a project within the Bergen Programme for Transport established in 2000. Finally yet importantly, all local political parties in Bergen except the Progress Party and the Pensioners' Party voted in favour of the light rail alternative. In March 2000, the City Council decided to go for the construction of a light rail transit line between the city centre and the airport. The construction officially started in January 2008 and the Queen of Norway inaugurated the first line for passengers in June 2010. Even if this enactment was important in developing the light rail frame the further process was not easy according to a regional politician:

> There was a never-ending debate regarding passenger capacity, and I used to say jokingly 'one more passenger and the light rail project will fall apart'. The [city's] politicians really did a good job avoiding this.

The quote points to how apparently settled technology projects still may need to be nurtured in order not to fall apart. In the next section, I will elaborate how the coalition supporting the light rail ('the light rail coalition') did this – or how they performed a light rail frame.

Performing a light rail frame in Bergen

The technological frames discussed in this paper reflect the focus on an alternative leading object; they are not statistical representations. A regional transport actor recounted in an interview that despite the introduction of the light rail in 2010 they still had to consider the existing bus system when planning public transport. Thus, the light rail coalition concurrently upgraded the bus system in 2010 because the light rail could not serve the transport needs of all inhabitants. In fact, 80% of all travels conducted by public transport in 2013/2014 were by bus and only 18% by the light rail (Bentzrød, 2018). Nevertheless, the light rail coalition used a representation of the light rail as the centrepiece of their public transport planning. In so doing, they had to construct a persuasive light rail frame to legitimise this technology's hegemonic role and make the project equally practical and symbolic. The light rail coalition

first pointed to topographical and demographical aspects and a regional transport actor made a comparison with Trondheim:

> The short version of this story [the light rail initiative] is that Bergen has a linear city shape where the inhabitants are mainly concentrated in the Bergen valley, so it is easier to cover our transport needs with a light rail running through this valley. Trondheim, by contrast, does not have a concentrated population and a bus system is a better way to cover their transport needs.

Further, they stressed that the light rail was an inevitable choice due to Bergen's space scarcity:

> It is impossible to travel through the Bergen valley by bus alone. We would need too many buses. There is not enough space and this was an important reason why we chose to build a light rail [regional politician in Bergen].

The light rail coalition emphasised the light rail's potential to help densify the settlement in Bergen because it would become attractive to live close to the line. In this regard, they framed the light rail as an efficient tool to reduce urban sprawl. Topography, demography and densification were all central aspects of their proposed city identity for Bergen in which a light rail was a very desirable element. In addition, they promoted the light rail itself as an identity marker for Bergen signifying a particular urban quality. For instance, the light rail coalition argued that other cities looked with great interest at Bergen's success with the light rail. Accordingly, they framed the light rail as a device that made Bergen appear as a modern and internationally oriented city and claimed that it strengthened the possibilities for Bergen to be included in international networks working towards increased urban sustainability.

Another important framing practice was the repetitive focus on the light rail's attractive components. A regional transport actor put it like this:

> Inhabitants in Bergen are all familiar with the light rail and it has become a visible and important part of the city. People choose the light rail because it has frequent departures, it is very predictable and it is comfortable to use. People even prefer to use the

light rail during rush hours when it is very crowded instead of taking the bus, which runs close by.

The light rail coalition often used buses as a means to compare and demonstrate how attractive the light rail was. An architect involved in the light rail planning stressed that the light rail due to its attractiveness had changed the inhabitants' travel habits as well as their preferences of where to live and where to work – namely close to the light rail. However, the light rail was only in theory an option for everyone. In practice, its relevant social group consisted primarily of those living close to the lines and was less inclusive with respect to passengers living in the parts of the city not served by the system. Accordingly, the light rail as alternative leading object involved a more exclusive user configuration (Woolgar, 1990) than the bus system in Trondheim, which aimed at providing 'public transport for everybody'. The bus frame was exclusive with respect to other technological options since it did not allow for alternatives such as light rail or tramcars. The light rail frame was different by means that it needed to allow for the inclusion of other transport technologies – in this case buses.

The light rail coalition framed the light rail as a non-flexible system. This was overall preferred because it facilitated a long-term planning strategy. Quite the opposite of the bus system in Trondheim, the localisation of the rail gave clear guidance for future city planning and required extensive information about plans for the area under construction. Thus, the light rail raised controversies concerning the localisation of its lines. A proposal to construct a line crossing the cultural heritage site 'Bryggen' provoked significant political disunity in Bergen and even led the Commissioner for City Development to resign. Bryggen is a UNESCO heritage from year 1070 and is an important part of the identity of Bergen's inhabitants. The political disunity indicates a limitation of the light rail frame. While the need to construct a new line was acknowledged, the frame could not prevent the conflict that was generated by strong disagreement between and within the political parties. Still, the outcome confirmed the strength of the frame. The controversial plan to build in the Bryggen area was postponed in

favor of a less politically challenging route to the University hospital. The light rail frame remained effective in guiding transport planning. A regional politician stated:

> A light rail is modern; it is a foresighted public transport system. I am absolutely sure that the number one job in public transport planning in Bergen will concern an extension of the light rail to all the city areas.

This indicates the success of the light rail coalition to embed the light rail as the alternative leading object of Bergen in the future. As with the bus frame in Trondheim, expectations concerning Bergen's future development were an important aspect as well as an effect of the light rail frame. In practice, buses would remain important but the light rail had achieved a symbolic hegemony with considerable consequences for the economic priorities of sustainable transport planning in Bergen.

In this section, I have pointed to how the choice of a light rail system as the alternative leading object in Bergen led to financial concerns and several public and political debates. Despite these issues, the light rail was promoted as in line with but also contributing to the symbolic identity of Bergen as a modern city, and recognised as successful by other cities by means of public transport planning. The light rail frame appeared as more exclusive than the bus frame due to its spatially selective user configuration – main users would live close to the lines. The frame was however less exclusive with respect to other transport alternatives because it needed buses as a complementary transport system. Still, the light rail was the alternative leading object because it attracted the most resources and attention, and because it represented ideas and expectations of an ideal public transport system in Bergen.

Conclusion: Shaping public transport systems through technological frames

In the introduction, I referred to Lefebvre's (1971) description of the car as the 'leading object' of present-day culture due to its outstanding ability to shape the physical structure and performance

of social life. This paper has demonstrated how two public transport systems, the (metro) bus in Trondheim and the light rail in Bergen, gradually have come to inhabit similar practical and symbolic properties as the car within a multi-modal transport system. As alternative leading objects, they contribute to shape the physical place in which they are part and they serve as symbols of a growing environmentally concerned urban planning practice. I was interested in how alternative leading objects were decided upon, what frames they become part of and the effects of these frames in particular urban contexts.

To investigate this, I drew on the concept of technological frames and explored what I called the bus frame in Trondheim and the light rail frame in Bergen. To study the framing processes, I introduced the concept of 'framing coalition' as an addition to Bijker's theory of technological frames. A framing coalition is a set of actors that participate in the construction of a technological frame in a local, use-oriented context. As we saw, the framing coalitions in both cities developed similar problem definitions of urban mobility emphasising issues of topography, demography, space scarcity and local air pollution (especially in Bergen). Despite similar problems, both coalitions emphasised that Trondheim and Bergen represented different city identities and topographies. Trondheim was interpreted as a relatively small and circle-shaped city in which a bus system was suitable, while Bergen was seen as a rectilinear-shaped city in which a light rail was a better choice. Furthermore, this study has shown that the framing coalitions developed their reasoning of an alternative leading object simultaneously alongside an *interpretation* of their respective city identities – presently as well as preferred in the future. These interpretations guided the choice of alternative leading objects and laid the foundation for urban transport planning. Thus, the frames constrained the coalitions' leeway to act in urban mobility planning.

The analysis in this paper has shown that the concept of technological frames may help us understand how ideas about a technology and its potential achievements may guide the development of urban public transport. Furthermore, the empirical observations demonstrate the impor-

tance of making identities and representations of public transport systems in particular urban contexts in order gradually to replace car-dominated transport into more sustainable mobility systems. I have also found the concept of technological frames useful for doing empirical comparisons of urban transport planning in different cities as called for by Hodson et al. (2017).

Still, I have observed the need for further development of the concept. First, I have pointed to the importance of the physical properties of the space in which a technological frame is unfolding. Both the bus frame and the light rail frame emerged from topographical considerations that had strong argumentative effects. Second, the analysis of technological frames needs to consider quantitative properties of the intended users like in the case of a growing population. Third, the stability of technological frames is always precarious. For example, the proposal of the metro bus in Trondheim led to the rekindling of the debate about and the suggestion of a reframing to include some light rail elements. Fourth, technological frames may need to be co-produced (Jasanoff, 2004) with a shared identity among the intended users. In particular, the light rail frame in Bergen became robust because it was made to resonate with the urban identity of Bergen's inhabitants. Fifth, as already mentioned, I have added the concept of framing coalition to identify the framing efforts of actors engaged in the process. This does not replace a concern for relevant social groups as Bijker (1995) pursues, but it suggests that such groups may not always play a front-stage role.

Acknowledgements

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