Environmental Innovation and Societal Transitions 40 (2021) 521–535

Contents lists available at ScienceDirect

Environmental Innovation and Societal Transitions

journal homepage: www.elsevier.com/locate/eist

Mobility protests in the Netherlands of the 1970s: Activism, innovation, and transitions

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ARTICLE INFO

Keywords:
Social movements
Transitions
Innovation
Netherlands
Cycling

ABSTRACT

With the Netherlands having the world's highest cycling rates, many see its current cycling policies as a model for the transition to sustainable transportation systems. Understanding these high cycling rates, however, requires understanding the geographic, historical, and institutional context in which social movements, working with government actors, helped stop a rapid decline in cycling rates between the 1950s and the 1970s in the Netherlands. This article uses historical sources and interviews with activists and government actors to show how social movements supported cycling by helping reverse the negative effects of rapid motorization. These social movements worked with government actors to implement three specific innovations: the woonerf, the bottleneck memorandum, and the car-restricted city center. This article contributes to transitions literature by looking beyond the relationship between enterprise and the state and demonstrating how social movements within a specific institutional context and with broad public support can advance sustainable transportation innovations.

1. Introduction

Many scholars consider the Netherlands' current cycling policies and infrastructure a model for other countries looking to increase cycling rates as part of a transition to sustainable mobility systems (Harms et al., 2016; Pucher and Buehler, 2008; Pucher et al., 2010). In the Netherlands, an average of 23% of trips of any distance are made by bicycle. These high cycling rates extend beyond the urban centers. Of the 12 Dutch provinces, the one with the lowest average cycling rates, Limburg, still has a cycling mode share of 17%. The cycling mode share of the province with the lowest population density, Drenthe, is equal to the national average (CROW, 2012). When combined with public transportation, where nearly half of all trips to the country's expansive train network are made by bicycle (KiM, 2019), the Netherlands' high cycling rates allow for a national transportation system that provides a more sustainable alternative to driving (Ploeger and Oldenziel, 2020). The high cycling rates that make this system possible, however, were largely established in the 1970s when a steep decline in cycling rates occurring across Europe and other parts of the world was halted in the Netherlands (see Fig. 1) (Oldenziel et al., 2016; Reid, 2017). This stabilization of cycling rates occurred after broadly supported social movements, formed to protest the increasingly severe effects of rapid motorization, worked with a responsive government to introduce a series of innovations that supported cycling. If Dutch cycling policy is to serve as guide for sustainable mobility transitions elsewhere, these

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https://doi.org/10.1016/j.eist.2021.10.001
Received 16 April 2021; Received in revised form 15 September 2021; Accepted 1 October 2021
Available online 30 October 2021

innovations that supported the change in cycling rates must be identified along with the conditions under which they were implemented. This requires understanding how innovations shaped Dutch cycling rates in a specific geographic and historical context.

Our paper contributes to the understanding of the geographic and temporal dimensions of sustainability transitions by examining the 1970s mobility protests in the Netherlands to address the following question: How can social movements develop and advance sustainability transitions in the long term? Our paper answers this question by examining the role that the Dutch mobility protests of the 1970s played in sustaining high cycling rates over the long term. Connected across Dutch cities and linked by a common legal and planning policy framework, we show that the urban-based protesters worked with government actors to advance three cycling-supportive innovations: (i) the w*oonerf*, a low-speed traffic environment discouraging through-traffic and eliminating distinctions between pedestrian and car space; (ii) car-restricted central business centers designed to limit car access while prioritizing pedestrians and cyclists; and (iii) the bottleneck-memoranda, a tool that relied on community participation in reporting obstacles to cycling. We argue that activism and protest provided critical support to development and implementation of these innovations. We also claim that these innovations helped stabilize cycling rates by making cycling more convenient than driving and integrating consideration for cycling into local and national transport policies.

Our article shows that social movements can provide critical support for innovations not yet fully accepted by the public in a manner analogous to how strategic niche management can protect promising sustainability innovations from potentially damaging market pressures (Kemp et al., 1998; Raven et al., 2010; Schot and Geels, 2008). It examines how Dutch protests in the 1970s led to a collaboration with government actors that facilitated the implementation of innovations that restricted car mobility. In other countries and in other contexts such implementation has been politically challenging (De Groot and Schuitema, 2012; Gärling, 2007; Keizer et al., 2019; Loukopoulos, 2007). We also analyze how this support for the car restricting policies has declined as the conditions that led to the social movement support, high pedestrian and cyclist injuries and deaths from car collisions, have changed. We will outline how this has led to a situation in which "for most Dutch, cycling is not remarkable enough to pay a lot of attention to" (Stoffers, 2012, p. 93). This has resulted in a shift in how the national government approaches cycling policy: while the social movement supported innovations of the 1970s placed restrictions on cars, later government-led policies have focused on promoting cycling without interfering with car mobility.

Even with cycling rates in the Netherlands having largely been stable over the past 50 years, concerns over car dependency have grown (Jeekel, 2011) and the Netherlands, like many other countries, has looked for ways to increase the mode shift from driving to cycling (Harms and Kansen, 2018; Kado, 2017; ter Avest, 2015; Van Boggelen, 2010). Our article concludes with a discussion of whether the Netherlands can achieve its own goal of increasing cycling rates by 20 percent (Tour de Force, 2017) without additional

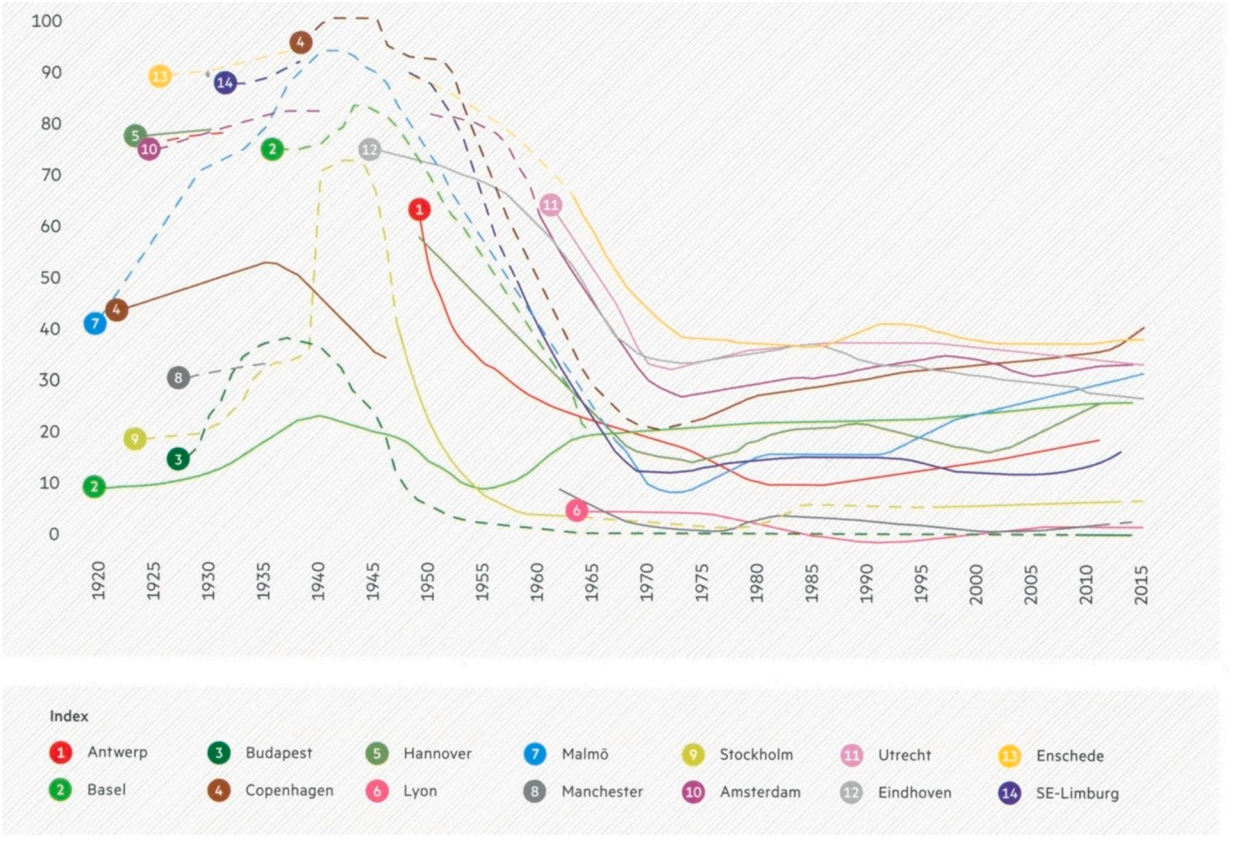


Fig. 1. Cycling rates across select European cities between 1920 and 2015 (Albert de la Bruhèze and Veraart, 1999; Oldenziel et al., 2016).

car restricting policies. It also discusses the challenge of using the Netherlands as a model for increasing cycling rates in countries with a low cycling mode share.

2. Methodology

Our research draws from ten in-depth interviews with key actors in the Dutch mobility protests of the 1970s, using a semi-structured format. The subjects reflected on their past experiences and shared their perspectives on their actions' outcomes (see Appendix A for an overview of the interview questions).

To identify subjects that could inform our research about the activism from the 1970s to the present, we conducted a stakeholder analysis from a list of 37 potential subjects. The list was based on scholarship (Duizer, 2005; Valenta, 2013; Berkers et al., 2018) in combination with the Cyclists' Union Department Archives and recommendations from the interview subjects themselves. To select subjects for interviews, two basic criteria were defined: that they were active in the period considered and had at least ten years of experience in mobility activism or policies in the Netherlands. (See Appendix B for details). We initially aimed for gender balance among subjects to broaden the perspective of activists beyond the male-centered views. In our final stakeholder analysis, however, the majority of subjects were male (80%) and only one of the women listed agreed to an interview (See Appendix C for subject list). The other women either did not agree to be interviewed for personal reasons (e.g., indicated that did not remember because it was too long ago) or were not found (contact information was unavailable or outdated).

For the historical context and results sections, we also draw on scholarship, policy documents, and archival material that provide evidence of the relationship between cycling activism and 1970s Dutch cycling innovations.

3. Theoretical background

Scholars have argued that social movements can advance sustainability transitions independent of technological innovations (Cresswell, 2006; Roberts, 2020; Temenos et al., 2017). For instance, Ploeger and Oldenziel (2020) demonstrated how activism shaped the innovation of shared mobility since 1960. Rather than focusing exclusively on innovation development, our article examines how social movements have been instrumental in the implementation and expansion of innovation. In much the same way that strategic niche management scholarship shows government and industry's role in the creation of protective spaces to foster the spread of sustainability innovations (Barrie et al., 2017; Smith and Raven, 2012; Verhees et al., 2012), we argue that 1970s social movements played a similar role in providing protection and support for sustainable mobility advancing innovations in the Netherlands. This allowed government actors to rapidly implement and integrate them into the Dutch mobility landscape.

Geels (2007) has already examined how these social movements transformed the Dutch highway system, with demands for increased citizen involvement in highway planning leading to the delay or cancelation of multiple major highway projects. Our article expands on this analysis by examining how social movements, connected across Dutch cities and regions, not only transformed highway planning but also advanced innovations that improved cycling conditions. We discuss how specific aspects of the Dutch transportation policy and planning facilitated the rapid spread of these innovations. This relevance of geography to sustainability transitions has received increasing attention (Coenen et al., 2011; Norcliffe, 2009; Raven et al., 2012; Truffer et al., 2015). Members of the Sustainability Transitions Research Network have highlighted the need for more research on the relationships between geography, history, and innovation concerning sustainability transitions (Köhler et al., 2019).

Köhler et al. have argued that the potential role of social movements in sustainability transitions can be approached from different perspectives: politics and governance, grassroots innovations, or broader cultural change (Köhler et al., 2019). Our contextual historical account combines all three to show how social movements have historically contributed to the transition toward a more cycling-friendly environment. Others have documented the discursive struggle social movements engage in Geels and Verhees (2011). Our paper, although attentive to the framing of traffic safety issues, does not take the approach of discursive analysis, but rather takes up the remark by Köhler et al. (2019) that there is not enough research on how and why certain social movements succeed. Ornetzeder and Rohracher (2013), who analyzed three successful cases of grassroots innovation, point among other factors to the importance of locally rooted (personal) networks, strong ideological commitment, and the (pragmatic) connection of (radical) niche innovations to more traditional practices and systems. Yet they also concluded that we need "to better understand the starting conditions for grassroots innovations" which are very locally specific. In a 2014 article, Smith, Fressoli, and Thomas similarly analyzed the conditions of success of grassroots innovation going back to the 1970s, concluding that there are three such conditions: being "locally specific, yet widely-applicable"; "appropriate to yet transforming situations"; and providing "project-based solutions, yet seeking structural change" (Smith et al., 2014, p. 120). The contribution of our article is to provide a detailed case study of one grassroots social movement which successfully applied these principles in a specific geographical and political context.

While innovation and transitions scholars have only recently begun to look towards the role of local conditions in shaping the success of innovations, historians have already contextualized the role of social movements in shaping cycling rates across major cities in different countries (Oldenziel et al., 2016). Other scholars call for more research on the role of social movements over time and how historical analysis can help with understanding the long term impacts of protest (Amenta et al., 2010; Giugni, 1998). Bringing these two strands of scholarship into conversation with each other in this paper will lead to a richer understanding of transitions. Innovation scholar Shove (2012) argues that transitions literature needs to give more attention to "disappearance, partial continuity, and resurrection" (p. 363). Garud and Gehman (2012) argue that "our journeys to a sustainable future may imply going back to practices that were shelved, abandoned or even stigmatized as mistakes" (2012, p. 986), what they refer to as "durational perspectives" (p. 980). Specifically, they outline the need for more research on the temporal aspects of sustainability transitions. Our paper accomplishes this

through interviews with key actors that reflect on their past work in relation to present circumstances.

Our historical analysis suggests that the large number of existing cyclists, and their pressure on the government for better cycling conditions, provided critical support for the widespread implementation of innovations that resulted in car-restricting infrastructure, an approach that has been shown to politically unpopular and difficult to implement in other contexts (de Groot and Schuitema, 2012; Gärling, 2007; Keizer et al., 2019; Loukopoulos, 2007). It provides a counter-narrative to the often alluded to axiom of cycling infrastructure "if you build it, they will come" (Félix et al., 2020; Krizek et al., 2007; Lugo, 2013; Porter et al., 1999). The substantial number of cyclists still present in the 1970s (see Fig. 1), and the social movements that they supported, were critical in developing the woonerf, the car-restricted city center, and bottleneck memoranda. These three cycling-supportive innovations spread across the Netherlands around the same time.

Finally, we discuss the implications of the decline of those social movements' influence as policymakers look for innovative ways to increase cycling rates further. This contributes to the discussion begun by Shove and Walker (2007) on the complexities of citizen involvement in sustainability transitions and the limits to shaping transition processes.

4. Historical context

With a mode share of approximately 27 percent (BOVAG and RAI Vereniging, 2016), the Netherlands has the highest cycling rate in Europe (European Cyclists' Federation, 2015). Historically, however, many European cities had comparatively high cycling rates that declined rapidly between the 1950s and the 1970s, with rates in Dutch cities dropping later and less dramatically than other European cities (see Fig. 1). Historians have identified multiple causal factors for this divergence, including differences in the urban landscape, the availability of alternatives to cycling, how cycling was integrated into traffic policy, and differences in the cultural status of cycling, but also the differing impact of social movements across countries (Oldenziel et al., 2016). This section provides a brief overview of the role the role that the Dutch social movements of the 1970s had in shaping mobility in the Netherlands.

As elsewhere, in the late 1960s, protest movements against the negative effects of capitalism on issues like the environment and traffic emerged in the Netherlands. Provo (1965–1967) and the Kabouter (Gnome) movement (around 1970) were among the earliest organizations involved in these protests (Kennedy, 1995; Mamadouh, 1992; Otten, 2017; Pas, 2015; Van Duyn, 1985). The Kabouter movement objected to the amount of space given to the car and the resulting air pollution. Provo activists were the first to bring

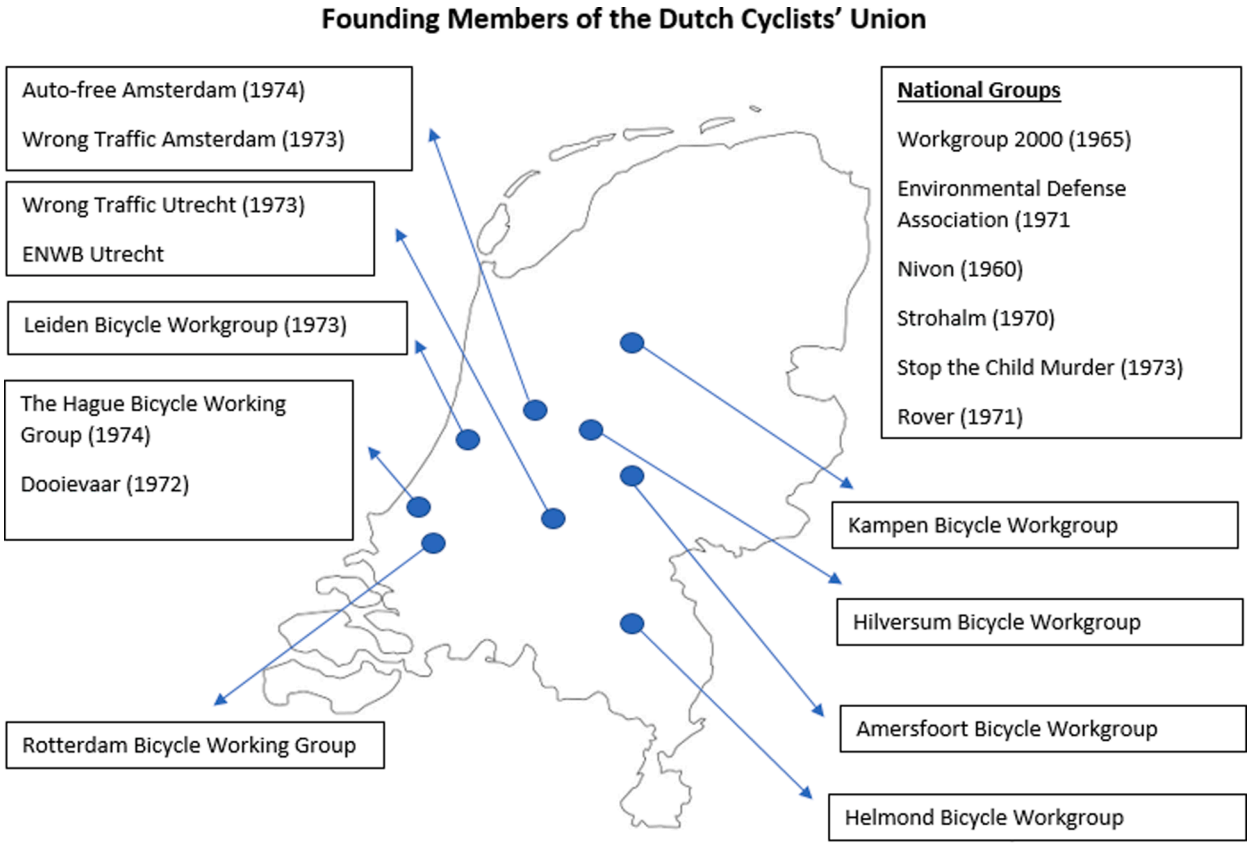


Fig. 2. Founding Members of the Dutch Cyclists' Union. Information compiled by Henk-Jan Dekker for his dissertation Cycling Citizens: How Cycling Survived Politically in the Netherlands, 1880–2020, forthcoming. When noted, the year given denotes the earliest year in which evidence of activity is available. In some cases, the official founding may be a year later and the origins may be earlier.

attention to traffic problems and safety in the Netherlands (Furness, 2005). Their White Bicycle Plan, considered the first shared bicycle scheme (Ploeger and Oldenziel, 2020), was created to criticize the car's polluting and space-consuming role in the city (Feddes and De Lange, 2019; Furness, 2010; Mamadouh, 1992; Van Duyn, 1985).

The critical values that Provo, Kabouter, and other similar movements represented were the same ones that later action groups took up in the 1970s: an emphasis on self-governance; livability; the small (neighborhood) scale, which prioritized walking and cycling over driving; and opposition to unrestricted economic growth and city center redevelopment to accommodate big business and cars (Mak, 1992; Schumacher, 1973).

Broad support for protesting the car was directly related to the rapid motorization occurring in the Netherlands and the resulting danger and disruption to cycling. While present-day Dutch car ownership levels are in line with other European countries, before the late 1960s, the levels lagged behind those of surrounding countries. In 1960, the Netherlands had 45 cars per 1000 inhabitants, half that of Belgium (82) and Switzerland (89). By 1970, however, Dutch car ownership reached similar levels to those of Belgium and Switzerland: about 200 cars per 1000 inhabitants (Filarski and Mom, 2011; Wolf, 2010). This increase in Dutch car ownership is partly attributable to the relatively late abandonment of the postwar policy of controlling salaries in the Netherlands in the early 1960s, creating a sudden increase in the purchasing power of many households (Oldenziel et al., 2016). The sudden rise in car ownership in the Netherlands brought changes in traffic injury rates, land use, and air pollution into strong relief for Dutch citizens (Mom and Filarski, 2008). Moreover, the late rise in Dutch car ownership, occurring in the late 1960s, coincided with a wider cultural movement of increased calls for democratization and participation. As Geels (2007) has argued, these social movements formed a landscape factor that impacted the development of the Dutch transport system around 1970, which "led to institutional changes in procedures for decision making, giving citizens and societal groups more participatory power" (p. 138).

This alignment of rapid motorization with a new political culture of citizen participation resulted in broad support for Dutch social movements directed towards countering the negative effects of motorization, as we describe in the analysis section. The sudden rise in motorization in the Netherlands also took place within a context of a large (urban) cycling culture, creating pressure on public space in cities. While the high cycling levels of the 1950s dropped in the 1960s and reached a nadir around 1970, in many Dutch cities, the bicycle still had a substantial mode share of roughly 30 percent (see Fig. 1).

One consequences of high cycling rates combined with the rapid increase in car ownership was a substantial growth in the number of people, specifically children, being killed or injured by cars. Between 1950 and 1970, the number of children under 14 suffering from car related injuries annually almost doubled from 278 to 460 [see Fig. 2]. The number of cyclists of any age killed in traffic saw a similar rise within the same period, going from 332 in 1950 to 512 in 1970 [see Fig. 3].

In response, activist groups began to form to oppose the increasing risks brought about by the car's transformation of the city. In 1971, the Dutch journalist Vic Langenhoff lost one of his children in a traffic incident and then dealt with another being injured just a few months later. He published a piece in a national publication called Stop the Child Murder [Stop de Kindermoord] describing his own experience and relating it to what was happening throughout the Netherlands (Langenhoff, 1972a, 1972b). A group of activists in Amsterdam took the name for their organization and promoted actions to bring awareness. They occupied sites where people had been killed in traffic incidents, organized street traffic closures to create play space for children, and held demonstrations on bicycles (Van der Zee, 2015).

Around the same time, in 1970, a group of architecture students at the Rotterdam Architecture Academy started a working group in the nearby city of The Hague. They criticized the plans to tear down the city's existing fabric to make room for highways and parking garages (The Hague City Archives, 1985). The group called themselves Dooievaar, a pun that combines the Dutch word for dead, *dood*,

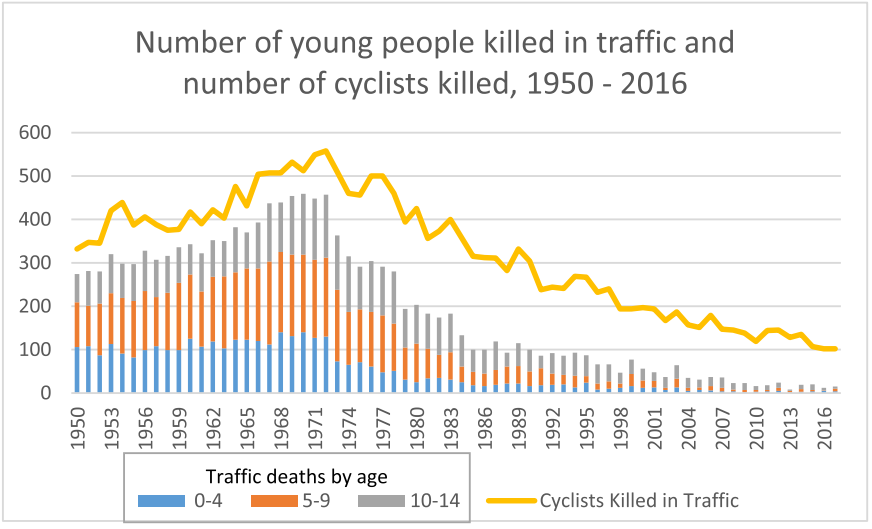


Fig. 3. Number of young people and cyclists killed in traffic, 1950–2016. Data from Stichting Wetenschappelijk Onderzoek Verkeersveiligheid SWOV. See: https://www.swov.nl/feitenencijfers/verkeersveiligheidscijfers-verkeersongevallen [accessed 02–12–2019].

with the word for the Hague's symbol, the stork, *Ooievaar* (Hoogland, 2017), into "dead stork" (Berkers et al., 2018).

Dooievaar believed in citizen participation: community members should be allowed to comment on already developed plans and be included earlier in an open discussion about the plans' underlying assumptions and objectives (Oorschot, 2014b).

In mid-1970s, the formation of a progressive ruling coalition in the Dutch parliament coincided with a transnational wave of environmental activism brought into action in part by the publication of the Club of Rome report "The Limits to Growth" and the oil crisis (Cramer, 1989; The Club of Rome, 2021). As a result, multiple groups formed in the Netherlands dedicated to cycling advocacy, demanding safer streets, a more responsive government, more attention to environmental concerns, and improved cyclists' facilities. In 1975, these groups united to form a national Cyclists' Union [see Fig. 2].

In the interview excerpts in the sections that follow, the activists involved with these groups and the civil servants who responded to their demands describe their experiences and the long-term impact of this period on cycling in the Netherlands.

5. Results

The social movements of the 1960s and 1970s fought against the negative effects of motorization and for the reclamation of space for other road users. Understanding how this climate of activism during a period of rapid motorization led to long-term changes in Dutch cities requires an explanation of a third historical element: the development of specific innovations in policy, design and governance that made streets safer for pedestrians and cyclists by reversing policies implemented to improve car mobility. Using information from interviews alongside supporting sources, the subsections that follow outline three issues: the development of these innovations, how activists were able to work with institutions to implement them, and the implications of the decline in activism that supported these innovations.

5.1. Innovations in reclaiming car space for cycling

5.1.1. The bottleneck memoranda

One of the broader movements' goals, including Dooievaar, was to find ways to shift the balance of power back to cyclists by reclaiming road space for cyclists. As Hans van Beek, a founding member of Dooievaar, described in his interview:

> *We wanted to give [cyclists] the rights which they had before and the more [the city] facilitated the car system, the less the space there was for the bike.*

Practically, this meant addressing the numerous small obstacles to cycling that the expanding car infrastructure had created. Dooievaar did this through the bottleneck memoranda, a social innovation (Henderson, 1993) in the form of a governance tool that begins with a report based on users' information. This activist group of young architects and engineers encouraged cyclists to report problems on their cycling route. Later, the group compiled all the reported obstacles into a document that became the basis for a bicycle plan for the Hague.

The plan included redesigning the traffic system to accommodate cyclists better, removing parking for bike lanes, and changing signal timing to prioritize cyclists at specific intersections (Dooievaar, 1973). They also devised a do-it-yourself manual for local activists who wanted to design cycling path networks (Stop de Kindermoord, 1975). It demonstrated how an ideal cycling route network could be created with everyday cyclists' input and included a detailed breakdown of the workings of local city bureaucracy and politics. In this way, other activists received valuable pointers on engaging the local citizenry and politicians in a conversation about better cycling facilities.

Leo Hamer, another of Dooievaar's founders, described the processes behind the original bottleneck memoranda. He noted that the governance innovation of listening directly to cyclists also resulted in policy innovations, for example, the differentiated rule for cyclists on one-way streets:

> *There was a bridge over the canal. And that was one direction… so we suggested to make it one way for the cars but not for the bicycles… so it was easier to move by bicycle [across the cities] and, on some streets, there were blockades for cars.*

This proposal allowed cyclists to ride both ways on one-way streets, with two-way traffic for bicycles on streets that had one-way for cars. It became a broader policy of exempting cyclists from one-way street regulations, including official traffic signs that designate where this practice is allowed (VVN, 2021).

In 1974, Dooievaar worked with a community group to implement the ideas from a bottleneck memoranda on two streets in the Hague (Oorschot, 2014a) By 1976, the cyclists' unions in the Dutch cities of Amsterdam, Arnhem, Amersfoort, Delft, Enschede, Haarlem, 's Hertogenbosch, Maastricht, Rotterdam, and Utrecht had produced similar reports (E.N.W.B. Utrecht, 1976). Since then, bottleneck memoranda have become a standard part of the toolkit for the Dutch Cyclists' Union (Stichting Fietsersbond, 2021). As part of an initiative to increase the safety of people biking, in 2012 the national government came to an agreement with Dutch cities to create a bottleneck memorandum for every municipality in the Netherlands (Trouw, 2012).

5.1.2. The woonerf

In the late 1960s, Niek De Boer, an urban planner working for Emmen's city, created a street design based on the co-existence between cars and other road users (Schoorl, 2015). The woonerf prioritizes pedestrians and creates a low-speed traffic environment by eliminating distinctions between pedestrian and car space and using non-linear street designs, plants, and street furniture to prevent

high-speed traffic (Appleyard, 1980).

Maartje van Putten, who founded Stop the Child Murder in Amsterdam as a young mother, pointed out that the woonerf was a concrete result of their actions as parents demanding safety for their children. Because the design "combined outside space to stay, to play and to move where traffic was secondary to the residential function" (Ploeger, 2020, p. 2), it offered public areas for some of the reproductive labor done primarily by women (Duffy, 2016). For example, finding new playground sites was the motivating factor in 1969, when the city of Delft began experimenting with De Boer's woonerf concept as part of a redesign project for streets in the city's low-income neighborhoods (Ben-Joseph, 1995).

André Pettinga, a former civil engineer for the city of Delft who worked on the woonerf concept at the time of its introduction in the city, discussed how the woonerf arose out of the growing concerns around the externalities of motorization. He noted that woonerf had be done with permission from local residents and, in Delft, they started on an ordinary street with a school and the intervention resulted in a more livable street. He also asserts how the rather simple concept reflected a fundamental change in thinking about street design:

> *The hook to do something in political terms… was road safety. The speedbump was invented, was introduced in Delft, before the woonerf, but later it became a standard part of the woonerf. The same with the chicanes and the narrowing of the streets, the narrowing of the crossings and the junctions. In all standard books for engineers, there were big junctions… with wide streets and wide curves. It was really revolutionary to make it small.*

As Steven Schepel explained when describing the original report that outlines the principles for woonerfs, reducing car speeds was not the only goal. Those advocating for more pedestrian and cyclist-friendly neighborhoods also recognized that their goal of shifting the balance away from car mobility could not be achieved if everyone could park directly outside of their home:

> *The report on traffic calmed residential areas went further in addressing parking… as a street that was completely full of parked cars could never be considered traffic calmed… This meant that you would probably have to park at some distance from where you lived.*

Having a bicycle immediately accessible and a car some distance from the house increased the bicycle's comparative efficiency. This became more common after the woonerf was incorporated into the national Dutch traffic code in 1976. By 1990, there were over 3500 woonerfs in the Netherlands and neighboring Germany (Ben-Joseph, 1995). Cycling became particularly efficient when traveling to city centers, where another innovation was also shifting the balance between cars and bicycles.

5.1.3. Car restricted city centers

In the mid-1970s, around the same time that the woonerf was being incorporated into the Dutch traffic code, another dramatic change was occurring in many Dutch cities. Municipalities ceased to turn their historic squares into parking lots and began restricting cars' movement through city centers. For example, in 1974, the city of Utrecht began a long term incremental approach to create car-free cycling routes by gradually decreasing the number of through routes for cars (Oldenziel et al., 2016). In 1975, the city of Groningen developed a similar plan that included the innovation of dividing the city center into quadrants that bicycles could move between but cars could not (Dijksterhuis, 1976). In 1975, the Enschede city council voted to remove cars entirely from their city center, in part due to the advocacy of a local urban planner who had been influential in implementing woonerfs throughout the city (Oldenziel et al., 2016). The Netherlands largest city, Amsterdam, adopted its own set of car restricting policies in 1978 (Oldenziel et al., 2016). Presently, each of the 20 largest Dutch cities have implemented various plans to limit or discourage car use in the city center (Voermans, 2019).

Several interview subjects discussed how this change came about. They noted that the initial push for restricting cars in city centers came from a similar source as the support for the woonerfs, a desire to counter the negative effects of motorization.

As Jan Ploeger, a member of the Cyclists' Union in the 1970s, recalled:

> *[The idea for limiting car access to the city center of Groningen] was introduced by the PvdA, the social-democratic party. There were very young deputies and they said "We want to sit in the market and we don't want that smell of cars and the noise of cars and we like to drink our glass of beer and have a good talk."*

While the initial push may have come from a frustration with the air and noise pollution, Hugo van der Steenhoven, a former city alderman for city of Utrecht and head of the Dutch Cyclists' Union from 2003 to 2015, argued that continued support of the car restricting policies in city centers has come from the economic success of the businesses in these areas. He stated that:

> *The city centers that are more or less car free, they are booming economically… Utrecht, Amsterdam, Den Bosch… they are the best shopping cities because people like to walk around, and it's not only the shops, it's the atmosphere in the city. You can eat, drink coffee, go to the movies, go to theater.*

City centers where it was difficult to drive and neighborhoods where it was safe to cycle produced conditions that encouraged even people who had access to a car to continue to cycle.

Hans van Beek explained that cars' limitations are not the same as banning them entirely or compelling everyone to ride a bicycle. Car restricting policies allow cities to shift the modal split in areas where large amounts of car traffic are considered undesirable:

> *Of course, some people will never ride a bike and never use public transport because they only want to use the car…in fact, it's a system. The use of the bike is easier, and the good use of the car is …difficult, especially if you go to a very concentrated area.*

Creating a transportation system where the bicycle remained useful, even as the car's influence grew, required the support of institutional actors. The next section describes how activists worked with State actors, leveraging broad public support and particular

aspects of Dutch transportation planning to support a rapid spread of these innovations across the country.

5.2. Institutional support for public space innovations

As described by the interview subjects, the new concepts for reclaiming public space were implemented and institutionalized within the Netherlands with State actors' assistance. The study of planning documents from 1960 to 1980 by the historian Verlaan (2021) found that planners and traffic engineers in the Netherlands had more ambivalent feelings about changing cities to accommodate cars than their counterparts in England, France, or the United States. Nearly all the interview subjects reflected on the willingness of institutional actors to both consider and support activists' ideas for mitigating the negative effects of increasing auto ownership:

As Maartje van Putten explained

> *Can you imagine in those days that we, as young parents and me still being a student, were asked by the Ministry of Transport and Traffic Safety to come to meetings with officials to talk about [the need for safer streets] and to design draft legislation?…We were invited by members of the national parliament so we went to the Hague sometimes, with 30 children outside singing songs, and we were getting a cup of coffee or tea with members of parliament and discussing with them the situation and that something had to change. And it was all very open.*

Similar to what Pettinga recalled for the woonerf design process, Maartje van Putten also points out that traffic safety was perceived as relevant regardless of political orientation:

> *We realized we were rather popular because everybody recognized it [the need to drop children traffic fatalities]. The issue was non-political. So, we were not made into a sort of struggle between left and right or what have you. Everybody was agreeing on the issue…*

André Pettinga also experienced a government's willingness to fund groups opposing the negative effects of motorization. He describes how the issue of traffic safety motivated people in the government to work with activists:

> *It started with traffic safety because… there was an urgency. You could no longer ignore it… If there is no problem, they don't spend money… but there is not any politician, local, regional or central who can ignore people killed or wounded.*

Jan Ploeger explained that the large number of people who continued to cycle provided broad enough support for groups that proposed to reclaim space from cars:

> *In Delft we had contact with the local parties who joined [the cyclists' union] and who liked to have our support… and we organized this voting power as people who wanted back space for cyclists… it was from all parties, they joined us because they liked cycling, it was handy in Delft to have a bicycle and the focus was pollution, and loudness and all the disadvantages of the car.*

Steven Schepel, who worked on the original woonerf project in Delft before chairing Stop the Child Murder in Amsterdam, recalled that the Dutch government was open to listening to their concerns and funding their group. Schepel recalled that Stop the Child Murder advocated lowering the speed limit in neighborhoods and that there were specific aspects of the Dutch traffic code that made that change surprisingly easy to implement. For example, he pointed out that the existing legal framework for implementing a 30 km/h speed limit during road repair allowed the speed limit in neighborhoods to be dropped from 50 km/h to 30 km/h. He also stressed that ease of the process:

> *A 30 km/h limit was for temporary circumstances but then we thought it might be possible in residential areas…to implement that lower limit there. To our surprise, the ministry quickly latched on to our idea and said, "Yeah, that's great, good plan." And from that moment it became possible, it was a relatively simple change. It didn't have to go through parliament as it was something the minister himself could set as policy.*

The woonerf was more complicated than a simple lowering of the speed limit because of the functional elements and the legal aspects. The way streets are governed in the Netherlands, made their rapid introduction and spread relatively easy. As Steven Schepel described:

> *The Netherlands has a tradition that the government agency responsible for a road can determine for themselves how that roads will be laid out and there aren't many restrictions on how that can be done. Certainly for national highways and the national agencies there are indeed rules and as the provinces want to have uniform roads, they have more or less the same rules, but when it comes to neighborhood streets, the city can decide how they will look…and that means that some things are easier to implement in the Netherlands.*

This freedom of municipalities to redesign local roads enabled the spread of car restricting innovations in the Netherlands. Additionally, in 1990, in the context of a proposal to implement a comprehensive decentralization process planned for the mid-90 s, the Ministry of Traffic and Water Management launched the Bicycle Master Plan (Directoraat-generaal Personenvervoer, 1997). After this project, which received the equivalent of approximately 15 million Euros in funding and was supported by the Dutch Cyclists' Union, bicycle planning would primarily become the responsibility of provincial and city governments (Directoraat-generaal Personenvervoer, 1998). The national government wanted to ensure that, even after it was decentralized, cycling policy would still receive sufficient attention at other government levels (Ministry of Transport, 1992). The plan had four main objectives: encourage people to bike instead of drive; expand the connections between public transportation and cycling; improve the safety of people cycling; and create secure bicycle parking locations in order to reduce bicycle theft (Directoraat-generaal Personenvervoer, 1997). By the end of the plan's implementation, cycling fatalities in the Netherlands had dropped to nearly a third of what they were at their peak in the 1970s

[see Fig. 3].

These investments, along with the implementation of the innovations discussed in this paper, resulted in general improvements for cycling, particularly in increases in safety, expansion of spaces to cycle, and the improvement of connections to transit through easy access to secure bike parking at train stations (Directoraat-generaal Personenvervoer, 1997). This progress, however, ultimately resulted in a decrease in activism, thus less support from civil society, and in a corresponding decline of institutional support for these types of innovations, which is discussed in the next subsection.

5.3. The decline of institutional support for placing restrictions on car mobility

In Duizer's (2005) description of the history of the Dutch Cyclists' Union, the period between 1979 and 1988 is denoted as one of declining membership and declining activism. Membership dropped from nearly 20,000 to 13,000. At the same time, the Union chose to work alongside government actors to develop and implement bicycle policies. This collaborative approach resulted in a drop in confrontational tactics (Tilly, 2006) and a reduction in the protests against the effects of increasing car traffic.

Several of the interview subjects pointed out a connection between the increase in cyclists' safety and the general decline of cycling activism in the Netherlands. For example, Peter Plantinga, a founding member of Eindhoven chapter of the Dutch Cyclists' Union, said:

> *Although stable, certainly [the Dutch Cyclists' Union] is not growing now. You can see it in two ways. Young people don't join so many of these organizations anymore. It could also be that we have been relatively successful. Most people joined [in the 1970's] because they were annoyed about how things were going, so if there is less annoyance…*

Koos Louwerse, a cycling consultant who worked on the Bicycle Master Plan in the 1990s, articulated a similar idea:

> *Now [cycling in the Netherlands] is still a bit unsafe, but there are not nearly so many deaths [as before], so the feeling of not being safe is there, but it is not so great that it's leading to the creation of activist movements.*

Several of the interview subjects also noted that the decline in activism has also been accompanied by a decline in government money spent on cycling policies and projects. As André Pettinga stated:

> *There is only research money [for a certain issue] in the cities if there is a political reason for that. If there is not a political issue, they don't spend money on research.*

The government's current national cycling policy project, Tour de Force, aims at coordinating cycling policy at a national level. It has a stated goal of increasing the number of kilometers cycled by 20% between 2017 and 2027 (Tour de Force, 2017). The project includes innovations such as traffic signals that give cyclists shorter wait times without disrupting car traffic flow (Hendriks, 2018) and bicycle highways that allow for faster travel by bicycle (Liu et al., 2019). Koos Louwerse made a more specific comparison between Tour de Force and the Bicycle Master Plan, particularly about the difference in public funding for cycling:

> *If you look at the size of a program like Tour de Force from the perspective of the Bicycle Master Plan… there is no comparison[…]. The Bicycle Master Plan received millions in funding, yearly, for an incredible number of projects (research, pilots, campaigns), all subsidized by a very active ministry. With Tour de Force… the contribution to the program is much smaller: about a quarter of a million yearly. And when we compare the annual investments on infrastructure by the ministry … what is 25 million for the bicycle in comparison to billions for public transportation and cars?*

In addition to the decline in funding, Koos Louwerse also argues that the lack of car-restriction policies will also hamper cycling goals. He argues that restraining car use is also necessary to increase cycling rates:

> *The best bicycle policy is ultimately anti-car policy. There are a number of pro-bicycle and various things with the bicycle that are really great but… you are not going to get anywhere without making car use less attractive. That means where you can drive and the price of parking.*

Car-restrictions and reclaiming the streets were central goals of activists in prior decades. Nevertheless, many interview subjects described the present-day situation as one in which the broad political support for cycling measures does not extend to those that may interfere with automobility. As Hugo van der Steenhoven stated:

> *On a national level, even the right-wing parties are in favor of cycling but when it comes to cars, then it's over. As long as it isn't a problem for car mobility, they are in favor of cycling. The prime minister is always on his bike. And he's very "I'm for cycling" but they don't want to do something against car mobility.*

Wim Bot, a former city councilor in Delft and current senior policy advisor for the Dutch Cyclists' Union, described how this political dynamic is reflected in the current approach of the Dutch Cyclists' Union:

> *In the Netherlands, there are no political parties that are against the bicycle… Sometimes they are not particularly for it and more for the car but ideologically it is not a point of contention. That is an enormous difference between the 1970s but also with the situation in most other countries. [In other countries], the cyclists' unions are often a part of the alternative environmental sustainability movement and in the Netherlands, we always keep a certain distance from that.*

It is also noteworthy that the Dutch Cyclist's Union currently also seeks a non-contentious position. As Wim Bot indicated, the organization tries to avoid conflict that could cost political support:

> *We work together where we have positions in common, but we also take great care that we don't weigh in on the left/right scale because that would not do us any good. In addition to the environmental movement and air quality, we also co-operate on issues like providing more playing space and green in the city, but we don't take part in any primitive anti-car positions.*

Hugo van der Steenhoven discussed how the relationship between car mobility and cycling is central to bicycle policy, but one that has become more difficult to address:

> *The big discussion is always, can you push car mobility back? Can you get more space for cyclists and pedestrians instead of space for cars? … Holland is … a cycling country but it's also a car[-oriented] country. And a lot of people are in their cars when they travel… small distances. You can easily cycle but it's very difficult to persuade those people to leave their cars and take up cycling.*

While the demands for cycling policies were initially well aligned with other issues such as safety, particularly concerning children, as traffic-related deaths dropped, the issues lost this alignment. Consequently, the funding and the openness for car-restriction policies were also reduced. As the discussion section describes, this has had implications for achieving the cycling rates that the Netherlands hopes to realize.

6. Discussion

The outcomes that followed Dutch activism in the 1970s suggest that car-restricting policies have a significant role in facilitating cycling. Following this period, the interview subjects noted that as the number of traffic-related injuries and deaths declined so did civil society's political commitment to engage in activism and of State actors to provide funds and implement car-restricting policies.

Interviews with people directly involved with the development of car restricting innovations in the Netherlands indicated their implementation was only possible under a particular set of historical and institutional conditions: a remarkably high number of cyclists in the country and a near-universal concern over the high rate of car-related injuries and deaths. Innovations that addressed these issues became integrated into Dutch planning even as the political support for car-restricting policies declined.

The Netherlands is currently working on a nationally funded plan to complete the cycling network across the country, grow cycling rates by 20%, and use cycling to advance national goals related to health accessibility, sustainability, safety and livability (Tour de Force, 2021). The narrative described in this article raises two crucial questions in relation to these and other ambitious plans to increase cycling rates: (1) if car-restricting innovations played a key role in sustaining the current high rates of cycling in the Netherlands, can the Netherlands grow its cycling rates without further restrictions on car mobility; and (2) if having a large number of existing cyclists allowed Dutch activists to implement critical innovations in the 1970s successfully, can countries that have already experienced a substantial drop in cycling rates use the Netherlands as a model for how to grow cycling rates through similar car restricting innovations?

The study presented in this paper shows that the process in the Netherlands was based on a robust civil society, had broad public support, and a favorable institutional context. Reflecting the call for more research on the historical and geographic aspects of innovations that support sustainability transitions made by Köhler et al. (2019), further research is necessary to understand the historical and geographic conditions that allow for implementing car-restricting innovations and whether or not mature cycling countries (Harms et al., 2014), such as the Netherlands, can expand their cycling rates if there is a diminished level of support for car-restricting approaches.

Further, the Netherlands' cycling rates are currently high not from a growth in bicycle use but rather from the halting of a substantial decline that ended in the 1970s. There has been a modest growth in cycling rates over the past two decades in the country but this slight increase still came from a position where bicycle use was already substantially higher than in other countries (Harms et al., 2014). Given this, it is not clear if the cycling policies of the Netherlands in the present can serve as a helpful model for countries with very low cycling rates that want to increase bicycle trips to support a transition to sustainable mobility.

Those advocating for cycling policies worldwide often invoke the motto "If you build it, they will come" (Félix et al., 2020; Krizek et al., 2007; Lugo, 2013; Porter et al., 1999). The idea is that simply offering safe cycle infrastructure will lead to an increase in cycling rates. The implementation of cycling supportive innovations throughout the Netherlands and the corresponding high cycling rates (Harms et al., 2014) seem to demonstrate this principle. However, an examination of how these cycling innovations became widespread suggests that the process is more complex. The demands from activists when cycling rates were already high – thus with cyclists on the streets to support their demands – led to the development and expansion of innovations, rather than the expansion of innovations leading to high cycling rates. Also, the history of cycle activism in the Netherlands suggests that creating cycling infrastructure is just part of the solution and that cars' restrictions were crucial for the outcomes because it made cycling more convenient than driving, particularly for nearby trips to city centers.

Understanding the successful implementation of innovations in sustainable mobility demands further attention to local activists' role in shaping these innovations. The debate presented in this paper raises questions about whether countries looking at the Netherlands as an example should only copy the infrastructure that the Netherlands has built or also look for ways to support their own activists' groups that are demanding better cycling conditions and who may be advocating for novel approaches entirely different from those found in the Netherlands.

7. Conclusion

In the 1950s, the high rates of cycling in the Netherlands and other parts of Europe began to drop rapidly. The process originated in the growth of auto ownership and investments in policies for automobiles. The negative externalities – e.g., air pollution, traffic-related deaths, and city-altering infrastructure projects taking space from cyclists – mobilized local civil society to challenge this course of action. Our paper contributes to the understanding of the geographic and temporal dimensions of sustainability transitions by answering the question of how social movements can develop and advance sustainability transitions in the long term. By detailing the

role activists in the 1970s played in stopping the steep decline of cycling as a form a sustainable transportation, our paper showed that the Netherlands maintained bicycle trip rates higher than the surrounding European countries through the support and development of innovations by social movements. The activists provided support for two car-restricting innovations – the woonerfs and the car-restricted city centers – and proposed the bottleneck memoranda – a social innovation that aided the planning process. These measures halted automobility policies' advancement, countered its negative effects, and helped reclaim space from cars. By creating safe spaces to cycle, these innovations promoted cycling and contributed to the long-term stabilization of cycling rates.

Funding

Matthew Bruno is supported by the VerDuS programme Smart Urban Regions of the Future with project number 438-15-160 which is (co)financed by the Dutch Research Council.

Henk-Jan Dekker is supported by the Bicycle Challenges: Past, Present, and Future of Sustainable Urban Mobility program funded by Eindhoven University of Technology, Rijkswaterstaat and Pon Holdings.

Letícia Lindenberg Lemos received a Fellowship from FAPESP (São Paulo Research Foundation), process number 2017/11198-7, for carrying out this research at Eindhoven University of Technology as part of a more extensive Ph.D. project at the Department of Architecture and Urban Planning, University of São Paulo.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors would like to express our appreciation to our interview subjects for their willingness to discuss their work and their experiences with us. We would also like to thank everyone who provided support in the development and revision of the article, including all the members of the Sustainable Urban Mobilities research team. The authors assume responsibility for all errors.

Appendix A. List of Interview Questions

Personal background

1. Could you describe how you became active in issues of mobility?
2. How long did you remain active/why did you leave?

Activism

1. What were the main goals you wanted to achieve?
2. What were the forms of action you chose to achieve this? Why those and not others? Range of action: Were they more protest- or more expertise-based? Proximity politics? Occupying offices?
3. Were you in contact with other activists?

Governance

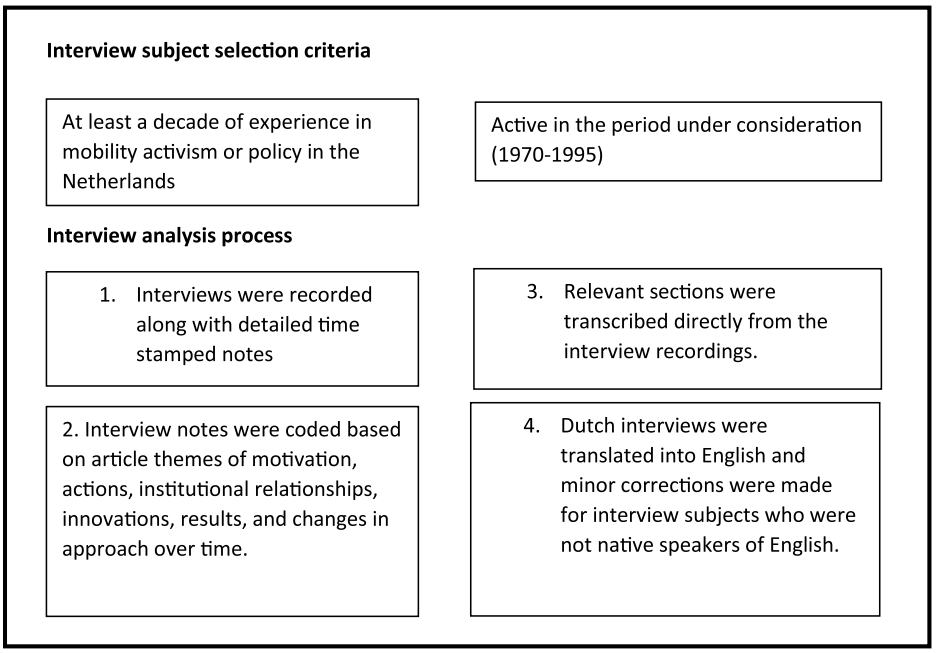
1. With what level of policymaking did you interact? Local or also national?
2. How easy/difficult was it to be heard? Did you feel taken seriously by engineers and policymakers?
3. How much power did you have in your estimation? Did the talks with policymakers have any concrete results?
4. We know several activists became active in the government: E.g. Steven Schepel (Stop de Kindermoord) told us he became governmental employee. Eisse Kalk (Werkgroep 2000) the same. Do you know more examples like this? How was doing this perceived by the movement? Were these people used as access to the government?

Other questions

1. How do you think the current climate for activism around traffic (safety) compares to that of the 1970s? Would a similar movement be possible today? Is it necessary?
2. What were the major turning points? How was the political climate in the 1980s different than the 1970s?
3. Do you know anything about the 1990s until now?
4. What do you see as the legacy of your work? Was it a success? What still needs to be done?

Appendix B. Interview selection and analysis process

1.1 Interview selection and analysis process



Appendix C. List of Interview Subjects

Name	Interview Date	Mobility Policy/Activism Role	Years Active in Mobility Policy/Activism
André Pettinga	January 8, 2018	Civil engineer for the city of Delft in the 1970′s where he worked on implementing the woonerf; Worked on cycling in Utrecht from the 1990s; presently a cycling consultant	1974-present
Hans van Beek and Leo Hamer	February 5, 2019	Leaders in the Dooivaar movement in the 1970s to improve livability in The Hague by restricting car traffic and improving conditions for pedestrians and cyclists	1974–1981
Hugo van der Steenhoven	January 17, 2019	City alderman that developed the first bicycle street in the Netherlands in the 1990s; head of the Dutch Cyclists' Union from 2003 to 2012; currently cycling policy consultant.	1994-present
Jan Ploeger	December 10, 2018	Member of the Dutch Cyclists' Union since 1975. Worked on the Dutch Bicycle Master Plan in the 90 s.	1975 - present
Koos Louwerse	August 12, 2019	Worked on the Dutch Bicycle Master Plan in the 1990s. Currently works as a bicycle policy consultant for cities in Belgium and the Netherlands	1990 - present
Maartje van Putten	June 5, 2020	Founder of Stop the Child Murder in Amsterdam	1974 - 1982
Peter Plantinga	January 15, 2019	Founding member of Eindhoven chapter of the Cyclists' Union.	1974 - present
Steven Schepel	November 13, 2019	Worked on the Woonerf project in Delft in the 1970′s. In 1982, he became chairperson of Stop the Child Murder in Amsterdam and was later responsible for safety at the Ministry of Transport and Public Works. Currently works with MENSenSTRAAT [People and Street]	1970 - present
Wim Bot	June 9, 2020	Member of the Dutch Cyclist's Union since 1990. City councilor in Delft from 1994 to 2008. Since 2008, policy advisor and lobbyist for the Dutch Cyclists' Union	1990 - present

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.eist.2021.10.001.

References

Albert de la Bruhèze, A.A., Veraart, F.C.A., 1999. Fietsverkeer in praktijk en beleid : overeenkomsten en verschillen in fietsgebruik in Amsterdam, Eindhoven, Enschede, Zuid-Oost Limburg, Antwerpen, Manchester, Kopenhagen, Hannover en Basel [Bicycle traffic in pratice and policy: SIMILARITIES AND DIFFEREN. Ministerie van Verkeer & Waterstaat, Den Haag 169. Retrieved from. http://library.wur.nl/WebQuery/clc/965514.

Amenta, E., Caren, N., Chiarello, E., Su, Y., 2010. The Political Consequences of Social Movements. Annu Rev Sociol 36 (1), 287–307. https://doi.org/10.1146/annurev-soc-070308-120029.
Appleyard, D., 1980. Livable Streets: protected Neighborhoods? Ann. Am. Acad. Pol. Soc. Sci. 451, 106–117. Retrieved from. https://www-jstor-org.dianus.libr.tue.nl/stable/1043165?seq=1#metadata_info_tab_contents.
Barrie, J., Zwandie, G., Joao, E., 2017. Leveraging triple helix and system intermediaries to enhance effectiveness of protected spaces and strategic niche management for transitioning to circular economy. Int. J. Technol. Manage. Sustain. Dev. 16 (1).
Ben-Joseph, E., 1995. Changing the residential street scene: adapting the shared street (Woonerf) concept to the suburban environment. J. Am. Plann. Assoc. 61 (4). Retrieved from. https://search-proquest-com.dianus.libr.tue.nl/docview/229640651.
Berkers, E., Botma, F., Oldenziel, R. (2018). Cycling Cities: the Hague Experience. The Hague: Foundation for the History of Technology.
BOVAG and RAI Vereniging. (2016). Mobility achievement of the Dutch: bicycle. Retrieved November 18, 2020, from http://bovagrai.info/tweewieler/2016/en/1-16-mobility-achievement-the-dutch-bicycle/.
Coenen, L., Benneworth, P., Truffer, B., 2011. Towards a spatial perspective on sustainability transitions. In: DIME Final Conference. Maastricht.
Cramer, J., 1989. De Groene golf: Geschiedenis En Toekomst Van De Nederlandse milieubeweging [The Green wave: History and Future of the Dutch environmental Movement]. Van Arkel, Utrecht.
Cresswell, T., 2006. On the Move: Mobility in the Modern Western World. Routledge.
CROW. (2012). Fietsgebruik in Nederlandse gemeenten [Bicycle Use in Dutch Cities]. Retrieved June 28, 2021, from https://kpvvdashboard-6.blogspot.com/2011/09/fietsgebruik-in-nederlandse-gemeenten.html.
de Groot, J.I.M., Schuitema, G., 2012. How to make the unpopular popular? Policy characteristics, social norms and the acceptability of environmental policies. Environ. Sci. Policy 19–20, 100–107. https://doi.org/10.1016/j.envsci.2012.03.004.
Dijksterhuis, R., 1976. Het verkeerscirculatieplan Groningen en de bereikbaarheid van de stadswijk Noorddijk [The Traffic circulation plan for Groningnen and the accessbility of the Noorddijk neighborhood]. Verkeerskunde 27 (8).
Directoraat-generaal Personenvervoer. (1997). Evaluatierapport Masterplan Fiets [Evaluation Report Bicycle Masterplan].
Directoraat-generaal Personenvervoer. (1998). Eindrapport Masterplan Fiets [End Report Bicycle Masterplan].
Dooievaar, W., 1973. Weg fiets? Nee fietswegen! [Bicycle away? No bicycle-ways!]. Verkeers Techniek 24 (11).
Duffy, M. (2016). Doing the Dirty Work: gender, Race, and Reproductive Labor in Historical Perspective. 21(3), 313–336. doi:10.1177/0891243207300764.
Duizer, B., 2005. "In Het Nut Van Actie Moet Je geloven": Dertig jaar Actievoeren Door De Fietsersbond ['You Must Believe in the Use of action': Thirty years of Activism By the Dutch Cyclists' Union. Wetenschapswinkel Letteren, Utrecht.
E.N.W.B. Utrecht, 1976. In: Verslag ledenraad dd. 1 mei 1976 E.N.W.B. te Utrecht [Members Council Report from the Utrecht E.N.W.B. meeting on May 1, 1976] https://doi.org/IISG ARCH0969.
European Cyclists' Federation. (2015). ECF Cycling barometer. Belgium. Retrieved from https://ecf.com/resources/cycling-facts-and-figures/ecf-cycling-barometer.
Feddes, F., De Lange, M., 2019. Fietsstad Amsterdam: Hoe Amsterdam De Fietshoofdstad Van De Wereld Werd [Bicycle City Amsterdam: How Amsterdam Became the World Cycling Capital]. Uitgeverij Bas Lubberhuizen, Amsterdam.
Félix, R., Cambra, P., Moura, F., 2020. Build it and give 'em bikes, and they will come: the effects of cycling infrastructure and bike-sharing system in Lisbon. Case Studies on Transport Policy 8 (2), 672–682. https://doi.org/10.1016/j.cstp.2020.03.002.
Filarski, R., Mom, G., 2011. Shaping Transport Policy: Two Centuries of Struggle between the Public and Private Sector: A Comparative Perspective. SDU Publishing, The Hague.
Furness, Z., 2005. Biketivism and technology: historical reflections and appropriations. Social Epistemol. 19 (4).
Furness, Z., 2010. One Less Car: Bicycling and the Politics of Automobility. Temple University Press, Philadelphia.
Gärling, T., 2007. Effectiveness, Public Acceptance, and Political Feasibility of Coercive Measures for Reducing Car Traffic. Threats from Car Traffic to the Quality of Urban Life 313–324. https://doi.org/10.1108/9780080481449-017.
Garud, R., Gehman, J., 2012. Metatheoretical perspectives on sustainability journeys: evolutionary, relational and durational. Res. Policy. https://doi.org/10.1016/j.respol.2011.07.009.
Geels, F.W., 2007. Transformations of large technical systems: a multilevel analysis of the Dutch highway system (1950-2000). Science Technology and Human Values 32 (2), 123–149. https://doi.org/10.1177/0162243906293883.
Geels, F.W., Verhees, B., 2011. Cultural legitimacy and framing struggles in innovation journeys. A cultural-performative perspective and a case study of Dutch nuclear energy (1945–1986). Technol. Forecast. Soc. Change 78 (6), 910–930. https://doi.org/10.1016/j.techfore.2010.12.004.
Giugni, M.G., 1998. Was it Worth the Effort? The Outcomes and Consequences of Social Movements. Annu. Rev. Sociol. 24 (1), 371–393. https://doi.org/10.1146/annurev.soc.24.1.371.
Harms, L., Bertolini, L., Brömmelstroet, M.Te, 2016. Performance of Municipal Cycling Policies in Medium-Sized Cities in the Netherlands since 2000. Transport Rev. 36 (1), 134–162. https://doi.org/10.1080/01441647.2015.1059380.
Harms, L., Bertolini, L., te Brömmelstroet, M., 2014. Spatial and social variations in cycling patterns in a mature cycling country exploring differences and trends. J. Transp. Health 1 (4), 232–242. https://doi.org/10.1016/J.JTH.2014.09.012.
Harms, L., Kansen, M. (2018). Cycling Facts.
Henderson, H., 1993. Social innovation and citizen movements. Futures 25 (3), 322–338. https://doi.org/10.1016/0016-3287(93)90140-O.
Hendriks, R., 2018. Fietser Profiteert Nu Nog Beperkt Van Intelligente Verkeerslichten [Cyclists Currently Gaining Limited Benefits from Intelligent Traffic Lights], 43. Fietsverkeer. Retrieved from. https://www.fietsberaad.nl/Kennisbank/Fietser-profiteert-nu-nog-beperkt-van-intelligente.
Hoogland, J. (2017). Mysterie: waarom staat er een ooievaar op ons stadswapen? [Mystery: why is there a stork on our city weapon?]. Retrieved August 24, 2020, from https://indebuurt.nl/denhaag/genieten-van/mysteries/mysterie-waarom-staat-er-een-ooievaar-op-ons-stadswapen~9307/.
Jeekel, H. (2011). De autoafhankelijke samenleving [The Car Dependent Society]. Retrieved from https://www.bol.com/nl/p/de-autoafhankelijke-samenleving/1001004011212918/.
Kado, A. (2017). Den Haag Bicycle Mobility Policy Benchmark Upscaling the Bicycle, (April).
Keizer, M., Sargisson, R.J., van Zomeren, M., Steg, L., 2019. When personal norms predict the acceptability of push and pull car-reduction policies: testing the ABC model and low-cost hypothesis. Transp. Res. Part F: Traffic Psychol. Behav. 64, 413–423. https://doi.org/10.1016/j.trf.2019.06.005.
Kemp, R., Schot, J., Hoogma, R., 1998. Regime shifts to sustainability through processes of niche formation: the approach of strategic niche management. Technol. Anal. Strategic Manage. 10 (2), 175–195. https://doi.org/10.1080/09537329808524310.
Kennedy, J., 1995. Nieuw Babylon in aanbouw: nederland in de jaren zestig [New Babylon under construction: the Netherlands in the], 1960s. Amsterdam: Boom.
KiM, 2019. Mobiliteitsbeeld 2019 [Mobility Overview 2019]. Kennisinstituut Voor Mobiliteitsbeleid.
Köhler, J., Geels, F.W., Kern, F., Markard, J., Onsongo, E., Wieczorek, A., Wells, P., 2019. An agenda for sustainability transitions research: state of the art and future directions. Environ. Innov. Societal Transit. 31 (January), 1–32. https://doi.org/10.1016/j.eist.2019.01.004.
Krizek, K.J., Poindexter, G., Barnes, G., Mogush, P., 2007. Analysing the benefits and costs of bicycle facilities via online guidelines. Plann. Practice Res. 22 (2), 197–213. https://doi.org/10.1080/02697450701584386.
Langenhoff, V., 1972a. Pressiegroep Stop de kindermoord [Pressure group Stop the child murder]. De Tijd.
Langenhoff, V., 1972b. Waarom laten wij kinderen bij hondereden van de weg rijden? [Why do we let children ride by the hundreds ride on the roads?]. De Tijd.
Liu, G., te Brömmelstroet, M., Krishnamurthy, S., van Wesemael, P., 2019. Practitioners' perspective on user experience and design of cycle highways. Transp. Res. Interdiscip. Perspect. https://doi.org/10.1016/j.trip.2019.100010.
Loukopoulos, P., 2007. A Classification of Travel Demand Management Measures. Threats from Car Traffic to the Quality of Urban Life. Emerald Group Publishing Limited, pp. 273–292. https://doi.org/10.1108/9780080481449-015.
Lugo, A.E., 2013. CicLAvia and human infrastructure in Los Angeles: ethnographic experiments in equitable bike planning. J. Transp. Geogr. 30, 202–207. https://doi.org/10.1016/j.jtrangeo.2013.04.010.

Mak, G., 1992. Anatomie Van Een Romantische Stadsrebellie [Anatomy of a Romantic City Rebellion]. NRC Handelsblad.
Mamadouh, V., 1992. De Stad in Eigen hand: provo's, Kabouters En Krakers Als Stedelijke Sociale Beweging [The City in Their Own hands: Provo's, Gnomes and Squatters as City Social Movement]. Sua, Amsterdam.
Ministry of Transport. (1992). Bicycles First. The Hague.
Mom, G., Filarski, R., 2008. Van transport naar mobiliteit: de mobiliteitsexplosie (1895-2005) [From transport to mobility: the mobility explosion (1895-2005)]. Zutphen: Walburg Pers/Stichting Historie der Techniek.
Norcliffe, G., 2009. G-COT The Geographical Construction of Technology. Technol. Human Values 34 (4), 449–475. https://doi.org/10.1177/0162243908329182.
Oldenziel, R., Emanuel, M., Albert de la Bruhèze, A., Veraart, F. (2016). Cycling Cities: The European Experience. R. Oldenziel, M. Emanuel, A. Albert de la Bruheze, & F. Veraart, Eds.. Eindhoven.
Oorschot, L., 2014a. Conflicten Over Haagse stadsbeelden: Van Willemspark Tot Spuiforum [Conflicts over City Visions in The Hague: From Willemspark to the Spui Forum]. TU Delft.
Oorschot, L. (2014b). Geschiedenis van het haags architectuur café HaAC [History of the The Hague architecture café HaAC]. Retrieved August 24, 2020, from https://www.haacs.nl/geschiedenis-van-het-haags-architectuur-cafe/.
Ornetzeder, M., Rohracher, H., 2013. Of solar collectors, wind power, and car sharing: comparing and understanding successful cases of grassroots innovations. Global Environ. Change 23 (5), 856–867.
Otten, M., 2017. Provo: De Ludieke Opstand Tegen Bom En Regentendom [Provo: The stunt Rebellion Against Bomb and Regent Rule]. Het Boekenshcap, Doetinchem.
Pas, N., 2015. Provo! Mediafenomeen 1965-1967 [Provo! Media Phenomema 1965-1967]. Wereldbibliotheek, Amsterdam.
Ploeger, J., Oldenziel, R., 2020. The Sociotechnical Roots of Smart Mobility: bike Sharing since 1965. J. Transport History 41 (2).
Porter, C., Suhrbier, J., Schwartz, W., 1999. Forecasting Bicycle and Pedestrian Travel: state of the Practice and Research Needs. Transp. Res. Rec.: J. Transp. Res. Board 1674 (1), 94–101. https://doi.org/10.3141/1674-13.
Pucher, J., Buehler, R., 2008. Making Cycling Irresistible: lessons from The Netherlands, Denmark and Germany. Transp. Rev. 28 (4), 495–528. https://doi.org/10.1080/01441640701806612.
Pucher, J., Dill, J., Handy, S., 2010. Infrastructure, programs, and policies to increase bicycling: an international review. Prev. Med. 50, S106–S125. https://doi.org/10.1016/J.YPMED.2009.07.028.
Raven, R., Schot, J., Berkhout, F. (2012). Space and scale in socio-Technical transitions. Environmental Innovation and Societal Transitions. https://doi.org/10.1016/j.eist.2012.08.001.
Raven, R., Van Den Bosch, S., Weterings, R, 2010. Transitions and strategic niche management: towards a competence kit for practitioners. Int. J. Technol. Manage. 51 (1), 57–74. https://doi.org/10.1504/IJTM.2010.033128.
Reid, C., 2017. Bike Boom: The Unexpected Resurgence of Cycling. Island Press, Washington D.C.
Roberts, C., 2020. Into a Headwind: canadian cycle commuting and the growth of sustainable practices in hostile political contexts. Energy Res. Social Sci. 70 (June), 101679 https://doi.org/10.1016/j.erss.2020.101679.
Schoorl, J., 2015. Wat is Er Over Van De Idylle Van Het woonerf? [What Remains of the Idyll of the woonerf?]. De Volkskrant.
Schot, J., Geels, F.W., 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. Technology Analysis & Strategic Management 20 (5), 537–554. https://doi.org/10.1080/09537320802292651.
Schumacher, E.F., 1973. Small is Beautiful: A Study of Economics as If People Mattered. Blong and Briggs, London.
Shove, E., 2012. The shadowy side of innovation: unmaking and sustainability. Technol. Anal. Strategic Manage. 24 (4), 363–375. https://doi.org/10.1080/09537325.2012.663961.
Shove, E., Walker, G., 2007. CAUTION! Transitions ahead: politics, practice, and sustainable transition management. Environ. Plan. A. 39 (4), 763–770. https://doi.org/10.1068/a39310.
Smith, A., Raven, R., 2012. What is protective space? Reconsidering niches in transitions to sustainability. Res. Policy. https://doi.org/10.1016/j.respol.2011.12.012.
Smith, A., Fressoli, M., Thomas, H., 2014. "Grassroots innovation movements: challenges and contributions.". J. Clean. Prod. 63, 114–124. https://doi.org/10.1016/j.jclepro.2012.12.025.
Stichting Fietsersbond. (2021). Welkom bij de Stichting Fietsersbond [Welcome to the Dutch Cyclists' Union Foundation]. Retrieved February 12, 2021, from https://stichting.fietsersbond.nl/#over-de-stichting.
Stoffers, M., 2012. Cycling as heritage: representing the history of cycling in the Netherlands. J. Transport Hist. 33 (1), 92–114. https://doi.org/10.7227/TJTH.33.1.7.
Stop de Kindermoord., 1975. Handleiding Voor Inspraak en Aktie [Guide for Consultation and Action]. Amsterdam.
Temenos, C., Nikolaeva, A., Schwanen, T., Cresswell, T., Sengers, F., Watson, M., Nikolaeva, A., 2017. Theorizing Mobility Transit. Transfers 7 (1), 113–129. https://doi.org/10.3167/TRANS.2017.070109.
ter Avest, R., 2015. Fietssnelwegen, een nieuwe succesformule [Bicycle highways, a new success formula]. Goudappel Coffeng (3), 57–58.
The Club of Rome. (2021). About The Club of Rome. Retrieved February 8, 2021, from https://www.clubofrome.org/about-us/.
The Hague City Archives. (1985). Werkgroep Dooievaar [Working group Dooievaar]. Retrieved August 24, 2020, from https://www.archieven.nl/nl/zoeken?miview=inv2&mivast=0&mizig=210&miadt=59&micode=0772-01&milang=nl#inv3t1.
Tilly, C., 2006. Regimes and Repertoires. Chicago: The University of Chicago Press.
Tour de Force. (2017). CONCEPT-UITVOERINGSPROGRAMMA TOUR DE FORCE 2017-2018. Retrieved from http://tourdeforce2020.nl/wp-content/uploads/2017/07/Concept-Uitvoeringsprogramma-2017-2018.pdf.
Tour de Force. (2021). Nationaal Toekomstbeeld Fiets op hoofdlijnen [National Bicycle Vision in Outline].
Trouw, 2012. Gemeenten Gaan Fietspaden Veiliger Maken [Municipalities Will Make Bike Paths Safer]. September 21. Trouw. Retrieved from. https://www.trouw.nl/nieuws/gemeenten-gaan-fietspaden-veiliger-maken~b8b8d6bb/.
Truffer, B., Murphy, J.T., Raven, R., 2015. The geography of sustainability transitions: contours of an emerging theme. Environ. Innov. Societal Transit. https://doi.org/10.1016/j.eist.2015.07.004.
Van Boggelen, O., 2010. "Met De Fiets Minder file" Vooral Een Succesvolle Lobby [With the Bicycle Less Congestion Primarily a Successful Lobby], 26. Fietsverkeer, pp. 16–20.
Van der Zee, R., 2015. How Amsterdam became the Bicycle Capital of the World. The Guardian. Retrieved from. https://www.theguardian.com/cities/2015/may/05/amsterdam-bicycle-capital-world-transport-cycling-kindermoord.
Van Duyn, R., 1985. Provo. De geschiedenis Van De Provotarische Beweging 1965-1967 [Provo: The History of the Provocative Movement 1965-1967]. Muelenhoff, Amsterdam.
Verhees, B., Raven, R.P.J.M., Veraart, F.C.A., Smith, A.G., Kern, F. (2012). Interrogating protective space : shielding , nurturing and empowering Dutch solar PV (Vol. 201204).
Verlaan, T., 2021. Mobilization of the Masses: dutch Planners, Local Politics, and the Threat of the Motor Age 1960-1980. J. Urban Hist. https://doi.org/10.1177/0096144219872767.
Voermans, T., 2019. Steden leggen heilige koe aan banden: auto's moeten wijken voor fietsers en voetgangers [Cities implement restrictions on a holy cow: cars must give way to pedestrians and cyclists]. AD. Retrieved from. https://www.ad.nl/auto/steden-leggen-heilige-koe-aan-banden-autos-moeten-wijken-voor-fietsers-en-voetgangers~abc74a07/?referrer=https%3A%2F%2Fwww.google.com%2F.
VVN. (2021). Verkeersborden en tekens [Traffic Signs and Symbols]. Retrieved March 5, 2021, from https://verkeersregels.vvn.nl/verkeersborden-en-tekens/ob52.
Wolf, H. (2010). "Following America? Dutch geographical car diffusion, 1900 to 1980." Eindhoven University of Technology.

Further reading

Bruno, M., Nikolaeva, A., 2020. Towards a maintenance-based approach to mode shift: comparing two cases of Dutch cycling policy using social practice theory. J. Transp. Geogr. 86 (April), 102772 https://doi.org/10.1016/j.jtrangeo.2020.102772.

City of Amsterdam., 2020. Amsterdam maakt ruimte. Agenda Amsterdam autoluw [Amsterdam makes space. Amsterdam low car traffic agenda]. Amsterdam. Retrieved from. https://assets.amsterdam.nl/publish/pages/921204/iv1248-agenda_autoluw-22tpdf.

Fuenfschilling, Lea, Truffer, Bernhard, 2016. The interplay of institutions, actors and technologies in socio-technical systems — An analysis of transformations in the Australian urban water sector. Technol. Forecast. Soc. Change 103, 298–312. https://doi.org/10.1016/j.techfore.2015.11.023.

Hansen, T., Coenen, L., 2015. The geography of sustainability transitions: review, synthesis and reflections on an emergent research field. Environ. Innov. Societal Transit. 17, 92–109. https://doi.org/10.1016/j.eist.2014.11.001.

Oosterhuis, H., 2016. Cycling, modernity and national culture. Soc. Hist. 41 (3), 233–248. https://doi.org/10.1080/03071022.2016.1180897.

Rapid Transition Alliance. (2019). From oil crisis to energy revolution - How nations once before planned to kick the oil habit. Retrieved February 8, 2021, from https://www.resilience.org/stories/2019-04-17/from-oil-crisis-to-energy-revolution-how-nations-once-before-planned-to-kick-the-oil-habit/.

Wardlaw, M.J., 2014. History, risk, infrastructure: perspectives on bicycling in the Netherlands and the UK. J. Transp. Health 1 (4), 243–250. https://doi.org/10.1016/j.jth.2014.09.015.