Upscaling, Obduracy, and Underground Parking in Maastricht (1965-Present): Is There a Way Out?

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Abstract
This article reconstructs the history of underground parking in the Dutch city of Maastricht by connecting the model of obduracy (i.e., “resistance to change”) with the concept of upscaling, which offers new insights in historic urban transitions. We discuss how the decision-making process about the building of the first underground parking garage (Vrijthof) in the late 1960s was a starting point of a growing obduracy of the urban practice of car use and parking in the inner city of Maastricht. We argue that this obduracy can be explained by the growing interconnections between the cultural meanings of historic squares and urban car use, expertise of urban planners, traffic experts and parking operators, parking and traffic policies and regulations, and underground parking infrastructures. Ironically, the expansion of underground parking in Maastricht can be seen as a pivotal part of the successful upscaling and increasing obduracy of car mobility in this town, but at the same time significantly affects the upscaling of local sustainable mobility innovations forty years later and beyond.

Keywords
urban mobility history, obduracy, upscaling, parking history, sustainable mobility

Introduction: Understanding How Underground Parking Drives Obduracy
After World War II, European planners, road engineers, politicians, and policy makers started thinking about the best ways to plan cities in a context of expected increases in the number of cars. While massive highway construction was well underway in the United States at the time, traffic congestion was not yet a serious problem in European countries. Moreover, in the years after the war, funding went to projects that had higher priority than infrastructural innovation. In the Netherlands, as in most Western-European cities, it was very clear that automobile traffic would significantly increase, and it was necessary to start thinking about the implications of this growth for the city and whether the American example had to be followed.¹ Although visions of massive highways through city centers were explored in the Netherlands, most explicitly in

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Amsterdam and The Hague with plans of David Jokinen, and in Utrecht by Max Feuchttinger, Dutch cities did not opt for such radical plans. However, in most cities, some infrastructural adaptations were made to enlarge the space for cars, such as building new bridges or viaducts, creating new highways around the city, and paving over canals.

The city of Maastricht, in the south of the Netherlands, was no exception in this respect. In the 1950s, Maastricht became connected to Highway 75, a major European motorway running from Amsterdam to Genova in Italy. Maastricht has a medieval downtown area with narrow streets and cobblestone pavements. Parts of the fortifications have been preserved, and Maastricht has been quite strong in promoting its cultural heritage. This made the city a prominent tourist attraction, especially for Belgians and Germans, already in the 1950s.

To anticipate the growth of car mobility, North-Western European cities were the earliest movers in terms of introducing parking regulations. Within this group, the city Maastricht is an exemplar of how many dense and historic city centers with very limited space for parking and high land values have dealt with the “car mobility revolution” after the 1950s. Maastricht was a pioneer in underground parking and there is hardly any other city with more than half of the public parking spots in the inner ring underground. Inspired by American examples, the local operator of the underground car parks introduced higher quality interiors and payment services, to make them safe and convenient places for all types of motorists, which was new for Europe. This laid the basis for it to later become one of the three largest parking operators in Europe.

How cities in Europe have dealt with the car and parking “revolution” has been underexplored. The observation of a general (urban policy) trend of “accommodating car use,” at least until the 1980s, seems broadly accurate but lacks empirical elaboration. Scholarly mobility histories on the Netherlands have addressed the various aspects of the car mobility explosion, such as explaining the surging adoption levels of vehicles, the evolution of national transport policy, the building of highways, discourses in a large automobile club, and the societal role of the only domestically manufactured car, DAF. However, these studies hardly address the specific challenges of growing car mobility in the city (e.g., the spatial challenge to extend car roads or parking space, tensions with cultural heritage, air quality issues) and the way these were addressed (e.g., through parking policies, such as parking disks, meters, garages). How can we understand the transformation from low-car cities in the 1950s to car-based cities today?

As scholars in the field of Science, Technology and Society (STS) studies have argued, urban transformations can best be studied as processes of sociotechnical change. Cities can be conceptualized as large sociotechnical ensembles that grow more and more obdurate and resistant to change over time. In a similar vein, geographer David Harvey acknowledges the tension between fixity and mobility of space. He points out that in capitalist societies, the built environment is enduring, difficult to change, spatially fixed and immobile, and incorporates large investments and capital. He distinguishes infrastructure networks by their level of embeddedness in space. Transport networks, for example, are highly embedded because they form the physical structure of cities, which entails pipes, cables, roads, and so on. Graham and Marvin argue that to that category also belong water and waste networks, while “medium embedded” are energy networks and “high to low embedded” are telecommunication networks. The main line of reasoning consistent with this perspective is that these infrastructures embody heavy investments and capital that are literally sunk in specific locations. Finally, other scholars have highlighted the “sociotechnical” by foregrounding social practices in everyday life, such as eating or traveling, generally referred to as (reproduced) “ways of doing and saying.” Shove et al. take “materials, meanings and capabilities” as key elements comprising a practice, describing how practices require agency and how structure emerges from the routine-like reproduction of practices. This perspective seems promising here for it allows understanding of the emergence and expansion of underground parking in Maastricht between 1965 and the present as a social practice
while addressing both the scale (i.e., the expansion of a practice) and obduracy (i.e., resistance to change) of this new practice.

Underground parking is an important and contested element in the local debate on sustainable mobility in Maastricht today. Park-and-Ride (P + R) sites are a key part of the current sustainable mobility strategy of Maastricht; however, studies in other cities suggest that the success of these sites has a strong (negative) correlation with the underground parking infrastructure in the city center. Maastricht was among the first cities in the Netherlands to build underground car parks in the city center. The history of underground parking in Maastricht reconstructed in this article shows that what, after a difficult takeoff, gradually became regarded as a win/win innovation regarding parking problems and urban space use, ended up as the key source of urban obduracy arguably hindering various sustainable mobility options forty years later and beyond. But how does upscaling relate to obduracy in this process? The research question of this article is therefore:

**Research Question 1:** How can we understand the relation between upscaling and obduracy in the history of parking and car use in Maastricht between the mid-1960s and today?

The 1960s are remembered as years of population growth and unprecedented economic prosperity in most of the countries in Western Europe, also in the Netherlands. The growth of real incomes explains the car mobility “explosion” after the 1950s, because it not only enabled the adoption of the car but this went hand-in-hand with the opportunity to buy a cheaper and better house at some distance of the city (i.e., suburbanization). The travel distance per day increased from 3.9 km (in 1957) to 23.2 at the end of the century. Dutch urban governance of that time had the challenging task to set up national and local planning policies that would come to grips with the foreseen mobility growth. This was defined in the Spatial Planning Act of 1962, which specifies the respective authority of the state, province, and local governments. The role of the first two was to provide a framework for the planning policies, while the local institutions (municipalities) were implementing planning policies rather independently.

In this context, the municipality of Maastricht, in cooperation with other stakeholders, began a policy process for the construction of car parking garages and (on-street parking) facilities in the 1960s. The first parking garage in Maastricht, opened in 1971, was situated below the Vrijthof, the main city square that for a long time had served as an open-air public parking (see Picture 1). At first, the implementation of paid underground parking seemed a good idea: there was increased parking capacity and the square was cleared of cars. However, in the course of time, negative effects of the policy also started to manifest themselves. Faced with increasing congestion, noise and air pollution of in- and outbound traffic in the following decades, various local groups began to question the appropriateness of the decision made decades earlier.

The “History of Underground Parking in Maastricht: Initial Constraints on Upscaling” section reconstructs the history of underground parking in Maastricht. The reconstruction is based on historic local policy documents (both official reports and government internal meeting reports), which were obtained from the City Hall archive and Regional history archive, and historic newspaper accounts found at a digitized archive—Delpher. Documents in the three archives related to parking garages in the 1960s and 1970s were inspected, but we refer directly to ten newspaper accounts, sixteen internal policy documents, five public policy reports, eight local historic yearbooks, and a few non-governmental reports of that period. In addition, two interviews with civil servants, a traffic planner (1970-2000) and a (sustainable) mobility expert (2005-now), and one with a parking business expert (1984-2016) were conducted, which helped to understand the context of the documents better.

The “New Ideas Facing an Obdurate Parking, Planning, and Operating Ensemble” section analyzes the obduracy of car mobility after expansion of underground parking. We discuss how
the decision-making process to building the first underground parking garage (Vrijthof) was a starting point of both a steady expansion of parking in the city center and a steady growing obduracy of three entangled sub-practices of car mobility in the inner city of Maastricht: car driving and parking, car mobility planning, and parking operating. We argue that this obduracy can be explained by the growing interconnections between cultural meanings of historic squares and urban car use, expertise and competences of urban planners and parking operators, parking and traffic policy and regulation, and underground parking infrastructures. We discuss how the path that car mobility took was only one amid a range of alternative pathways. The “Conclusion: Is There a Way Out?” section concludes and explores how the lessons learned from this historic upscaling process (toward car-based urban mobility) can still help the upscaling of sustainable mobility today.

**History of Underground Parking in Maastricht: Initial Constraints on Upscaling**

The year 1960 was one of the last years that cycling was the main mobility practice in Maastricht in terms of total passenger kilometers (excluding Solex\(^2\)). It would soon be overtaken by growing car mobility, with bus mobility (excluding walking) only playing a minor role.\(^2\) In the late 1960s, representatives of businesses and entrepreneurs located in the city, lobbied for extending parking capacity close to the city center. At the same time, citizens of Maastricht shared a vision with the city government: to have public squares clear of cars wherever possible. Their aspirations were particularly manifested in terms of the Vrijthof square, which had served as a public parking space for a long time. An exponent of this sentiment is expressed in a newspaper article from 1964, where a citizen speaks about the Vrijthof as “a beautiful, maybe the most beautiful square in the Netherlands.” However, he acknowledged that his Vrijthof has become an open-air garage, with clouds of dust in the summer, with puddles and mud when it rains. A pedestrian cannot walk, children cannot play there. This supposedly the most beautiful square in the Netherlands is no more than an ordinary chaos. And when some foreigner says Vrijthof

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**Picture 1.** Parking at the Vrijthof square in the 1950s (left) and 1960s (right).

*Source.* Regional Historic Centrum Limburg (RHCL), Photo collection GAM, inventory numbers 20325 and 27055.
Attention for improving quality of life through urban infrastructures (i.e., housing, cultural activities, parking) was still high on the local agenda in 1969. For parking issues, the Working group and the City Board were busy already for two years with preparing a plan. The matter of parking issues and the better quality of life were seen as tightly linked, as noted in the following statement:

Already on several occasions it showed that the quality of life in the city is closely connected with the expansion of parking opportunities and such can be realized most effectively by creation of parking areas and parking garages along or close to the inner-circulation ring . . . the current parking situation on the Vrijthof has been for long enough a source of annoyance for city dwellers and tourists, not only because the attractiveness of one of the most beautiful and pleasant squares in Western Europe is spoiled by a vulgar storehouse for vehicles, but also because car drivers experience the lack of the most basic facilities.

Thus, the Vrijthof’s cultural meaning as the common “living room” of the city, as the locals called it, got linked to a more critical public attitude toward its function as a car park. To meet the needs of all parties involved, the local government began the course of action toward building a garage in the heart of the city and giving the city its square back. However, the planning and decision making about the parking garage met with a few constraints in the early years of its conception.

Lack of Expertise

In accordance with the Spatial Planning Act of 1962, the decision-making process regarding the future of Maastricht’s inner city in the 1960s was executed by the local municipality. The city’s political apparatus consists of the mayor and the aldermen and the City Council. The mayor and the aldermen represent the executive municipal body or city board (college van burgemeester en wethouders [B&W]), with the task to prepare, coordinate, and plan policies, as well as to implement decisions made by the City Council. The City Council (gemeenteraad) has the role of monitoring municipal executives and has the final word regarding any decision that concerns the city.

The city of Maastricht, as many other Dutch cities, was facing increasing pressures from traffic and parking. After the car mobility “explosion” from the 1960s onward, medium and large cities in the Netherlands and Northwest Europe encountered an increasing flow of cars every day, entailing increasing frequencies of traffic congestion. Initially, this was not seen as a serious problem, but more as a sign of long desired economic growth. Most local governments in the 1960s and 1970s took a “car demand-following” approach, aiming to increase the capacity for car use and parking in the city mainly through parking regulations such as time restrictions (using parking disks), paid parking (with parking meters; first in Amsterdam in 1964), and road management (e.g., one-way streets, parking prohibitions). Some cycling paths were turned into road or parking spaces. By the end of the 1970s, after growing concerns about air quality and noise problems, local mobility policies mostly evolved into a “car steering approach” (later called “mobility management”), aiming to restrain car use. This did not so much imply reducing car use, but using the existing capacity most efficiently, so, for instance, preventing “long parking” in city centers, and providing real-time indication of free parking spots to reduce seeking time. After the 1990s, it also comprised activities to fine-tune the combination of private and public transport, such as P+R facilities (of which the first urban facility opened in Groningen in 1995). In other
European cities, these same trends can be recognized as well, but, generally speaking, the further from northwestern Europe, the more these phases took place later in time.\textsuperscript{30} Traffic congestion and annoyance with the many cars parked on Maastricht’s main city square (see Picture 1) intensified, and traffic planning, in particular (increasing) parking capacity, was high on the local political agenda. However, the municipality could not solve those issues alone, for reasons of both expertise and funding. The municipality lacked knowledge on traffic planning.\textsuperscript{31} It wanted to develop a new traffic circulation plan and, inspired by other cities, to build a number of parking garages or other facilities, but faced a knowledge gap. Traffic experts from the city of Delft were invited to share their knowledge and experience in urban traffic planning. To both increase parking capacity and clear the Vrijthof square from cars, the municipality searched for an architect to start planning the construction of an underground car park at the Vrijthof.

The director of Public Works, Van de Venne, was appointed by the City Board to form a Working group that would work on solving the parking issues. The Working group consisted of experts operating within the Department of Public Works and had a task to coordinate, guide, and promote the plans related to the construction of parking garages and other parking facilities.\textsuperscript{32} Specifically for the Vrijthof underground parking (which was planned to be the first one), preparations started in 1967 and the discussions over design, building, and financing lasted for almost three years (1967-1969), while the actual construction took place in 1970 and 1971.

The Working group, together with the architect Groenendijk, started to work on the plan for the Vrijthof garage.\textsuperscript{33} The architect was from an architect bureau from Heerlen and had to come up with a suitable parking design. The city government was determined to solve the parking issues and contributed to the stabilization of the idea of underground parking by mobilizing the expertise needed to prepare the plans. But then they encountered a second issue: the lack of financial resources and related risks.

**Funding Issues**

Apart from expertise, the financial position of the municipality did not allow an investment in underground garages on its own. Construction of an underground car park was very costly (at a time when parking revenues were very uncertain) and the Maastricht local government wanted to reduce the risks involved. In that period, it was not unusual for local governments to cooperate with private developers on certain projects. Therefore, the municipality invited a private investor and developer in the Working group, Ruyters, who already had some experience with a parking venture in Heerlen.\textsuperscript{34} Ruyters was in the real estate business with his company N.V. Ruyters from Sittard (hereafter Ruyters). Investing in building a parking garage was a business in its infancy at that time, so financing such a project bore certain risks, especially because paid parking was still fairly uncommon.\textsuperscript{35} Parking regulations were not yet very stringent: on-street parking was mostly free of charge or in some areas regulated by time restrictions and low parking fees. Since parking garages that provided a significant increase of (paid) parking capacity were new for Maastricht, implementing parking garages required changes in the existing parking regulation. Among others, it required motorists to opt for paying for parking in a garage with (at least initially) ample space, above seeking a free parking place somewhere on street. This challenge, of course, triggered other policy discussions, such as arguments to introduce paid parking in surrounding streets as well, to make the garage more attractive (and financially viable). In that regard, the building of parking garage(s) can be considered as the beginning of a new phase of parking policy.

The garage’s draft plan consisted of a two-floor garage design, with the total storage capacity of approximately 500 cars.\textsuperscript{36} The design reflected the intention to significantly increase the parking capacity at the Vrijthof square since at that moment, the parking capacity of the Vrijthof square was 281 cars.\textsuperscript{37} It was suggested that the matter of financing, construction, and
exploitation should be in the private hands of Ruyters. In other words, every investment under the
ground was supposed to be covered by Ruyters, while the municipality would fund the recon-
struction of the square. Furthermore, as planned in the beginning of 1967, the archeological
excavation under the Vrijthof had to take place. In that regard, any additional costs due to pos-
sible delay would be subject of agreement between the municipality and the state.38

The city board and the Monumental commission in principle agreed with the preparation
plan.39 The approval from the City Council (to continue the preparations of a plan) was yet to be
acquired. Therefore, the Working group held a meeting in which more specific aspects of the
financial structure were discussed. Ruyters suggested two things to make the whole project more
manageable. The first was the arrangement of the company’s return of investment, since Ruyters
was supposed to be the main investor for building the garage. As a result, the company made
contact with two gasoline traders who were interested in building gasoline outlets in Maastricht,
under the condition that they were offered good locations somewhere in the city.40 The city gov-
ernment and Ruyters made an agreement in the later stages, according to which Ruyters was
granted rights for building and exploiting four gas stations in Maastricht as compensation for the
inevitable losses for the garage construction.41 Taking into account that those were to be built on
municipal land, the City Council had to approve suggested locations and to agree on an exploita-
tion period by Ruyters of twenty-five years.42

The second element of Ruyters’ proposed financial structure was the suggestion to apply for a
state subsidy. To obtain the subsidy, Ruyters pointed out that the municipality would have to be
able to provide manageable plans for Vrijthof and to give priority to the car parking garage.
Although the project was a local endeavor paid from local funding, at that time the state was
providing financial aid to local governments to stimulate employment. Since the whole project
required intensive labor, after a number of negotiations between stakeholders, the City Board in
principle agreed that the subsidy, known as D.A.C.W.,43 would be beneficial for the project
realization.

This preparation plan, accepted by the City Board, received the City Council’s approval at the
beginning of October 1967.44 With a majority of votes, the Council in principle agreed to con-
tinue developing the plan in this direction: the design was accepted, as well as the intention to
grant building and exploiting rights to Ruyters, while the municipality would stay the landowner
of the garage.45 Securing government funds for the building of the garage and attracting an inves-
tor both significantly contributed to the momentum of underground parking in Maastricht.

**Embedment in Traffic Policy and Planning**

Besides the proposed garage design, the stress was on the importance of the garage embedding
into the traffic structure plan and overall traffic circulation in the city. It was agreed that the
Department of Public Works, in consultation with the traffic engineer Van Dijk, would assess the
traffic plan to connect it with the traffic flow to and from the garage.46 The assessment (March
1967) showed that the initially planned entrance and exit points were not in line with the traffic
plan. Therefore, to achieve targeted traffic improvements, the new plan proposed a relocation of
the entrance/exit point between the St. Jan and the St. Servatius churches. The design of the
Vrijthof garage did not change fundamentally in the course of 1968. Besides the ongoing finan-
cial discussions, the emphasis was on embedding the garage into the traffic circulation plan and
local parking policies.

Until then, the main traffic flow was split between two existing bridges: Wilhelmina and St.
Servaas. The bridges directed all traffic straight through the city center and were heavily over-
loaded. According to the estimations on traffic loads at the time, more than 35,000 cars and
25,000 cyclists and mopeds were crossing the bridges daily (between 7:00 a.m. and 7:00 p.m.).
To tackle this, the city government started a project for erecting an additional bridge across the
river Maas in 1965. It was supposed to reduce traffic congestion and improve accessibility to the city, by partially redirecting traffic flows away from the city center. The new bridge, named the Kennedy Bridge, was expected to be fully operational by March 1968.47

In 1968, the number of motor vehicles had grown to 49,000, with a forecast of reaching 180,000 by the year 2000.48 With these forecasts in mind, the municipality drafted the Traffic structure plan. The plan was developed in close cooperation with the stakeholders from business, whose reports contributed significantly. It is not a surprise that many businesses situated in the city wanted to participate in the creation of the future traffic and parking policy. In the “Working Group for Traffic Structure” report, initiated by the Chamber of Commerce and Environs for Maastricht, it is stated that the main objective was not to be engaged in the creation of the policy per se but to draw attention to the economic prospects of the city on which the future plan will certainly have an impact. Representing the interests of the businesses and companies in the broadest sense, the Chamber was of the opinion that the traffic circulation plan has to be in accordance with the socioeconomic functions of the city.49 The same view was presented in the reports “Maastricht Committee of Business” and “Interests of Wyck” initiated by the representatives of entrepreneurs located in the shopping area of Wyck. The outcome of this joint effort was the new Traffic structure plan, which was created as a general traffic plan and served as a guideline for policy.50

The traffic plan had a pivotal role in the development of the future spatial structure of the city, which was primarily determined by the functional connections between the residential and working areas, recreation, and the zones of central functions (e.g., businesses, shopping, and administration). In this respect, the importance of increasing overall parking capacity and the locations of the particular parking facilities, one of which was to be under the Vrijthof square, were part of the plan. At that moment, the number of available parking spaces in the inner city was 4,215, while the estimated requisite was 4,700. According to the traffic plan, parking facilities had to be located nearby the main road system and the zones of important central functions—in other words, to be positioned within walking distance from the shopping area and other central functions, or even at locations somewhat further for fulfilling parking needs during the peak traffic days.51 The process of embedding the Vrijthof and other garages or facilities was to be realized, not merely by its integration into the traffic structure but also by triggering a change of attitude of car travelers toward using and paying to park in the garage. Taking into account that the location for public parking at the main square was not to be changed, but situated underground, the socioeconomic attractiveness of the city was considered to be unimpaired.

The city government was aware that solving parking-related issues was going to be a long process. Before the prerequisites for constructing parking garages and facilities were reached, the City Council had made some steps toward a better regulation of on-street parking supply.52 Parking regulations, which represent a core of parking policy, generally consist of time and access restrictions and parking pricing or, in other words, of “controlling who, when, and how long vehicles may park at a particular location in order to prioritize parking facility use.”53 Although time restrictions through parking meters were introduced in 1966 in a few streets,54 the City Council decided only two years later to considerably expand their utilization. The total number of parking meters for short parking increased from 37 to 160 in a two-year period. The on-street parking fee of thirty cents for four hours was quite low at the time, and especially visitors from Belgium and Germany accepted the charge for parking in the inner city (while “long parkers,” that is, those parking the whole day or more, stayed away). After a trial period of several weeks, the paid parking (and time restriction) policy proved successful: every parking spot would be used by five cars on average every day.55

With the ever-increasing demand and limited parking spaces available, the city started to extend parking regulations, such as shorter time restrictions and higher parking fees, from the
most central streets to adjacent areas in the following years and decades. The same pattern can be noticed in other cities.56

**Cultural Heritage and Uncertainty about National Subsidies**

After negotiating the financial structure of the parking project in 1967 and 1968, the next year the City Council faced different circumstances compared with those two years before. The differences related to the financing, operation, and land allocation for the parking garage under the Vrijthof.

The modification of the plan was triggered by the possibility of applying for a state subsidy, offered by the Ministry of Social Affairs and Health. The D.A.C.W. subsidy was available for public projects where the intensive-labor costs fell under the supplementary employment rate. Discussions and consultations regarding the subsidy eventually resulted in a common finding that the project of building the underground parking and reconstructing the square fulfilled one of the preconditions—a labor-intensive project. However, the D.A.C.W. subsidy was not meant for individuals and commercial purposes; only public bodies were eligible to apply for it. In that way, embarking on a race for getting the subsidy, which was estimated at 1.4 million guilders (corresponding to 3.1 million euros today57), implied that the municipality had to become a partner in building the parking garage. The municipality had to realize the project on its own and grant renting rights to Ruyters at a later stage.58 This situation affected the strong position of the city government of not being involved in the project investments, which was estimated at 6.5 million guilders (corresponding to 14.3 million euros today).

The plan was adapted accordingly (to be eligible for the subsidy) and the City Council approved it in March 1969 (although the subsidy was still uncertain). Two contracts with Ruyters were drafted,59 one defining the building rights granted to the company60 and one defining the renting rights of the garage, for which a renting period of 50 years was specified.61 Although the contracts were signed, the building of the garage could not start immediately. Apart from the outcome of the subsidy application being unconfirmed, another reason for the delay was the archeological excavation under the Vrijthof, which lasted for approximately six months.62 This legally required research affected Maastricht’s parking troubles to some extent. As stated by the President of the Chamber of Commerce Mr. Meyer Viol, the building of the garage being on hold and the implementation of the Maasboulevard project, whose second phase was underway, created even bigger parking problems and caused serious economic difficulties. To mitigate the consequences of this, he further added that the on-street parking fees had to be increased, especially for long-term parking. In that way, parking demand would be better regulated and the municipality would have more revenue. As a result of that, a large part of investments in the Vrijthof project could be cost-effective.63 The increased rates for long-term and short-term parking were applied in June 1970. The City Council increased the parking fees from 30 to 40 cents.64 Furthermore, an annual surplus of 70,000 guilders (corresponding to 154,000 euros today) was to be obtained to partially cover the budget burden of 83,000 guilders a year resulting from the ongoing investments for the garage and accompanying facilities.65 Moreover, according to a newspaper article (1969), the municipality received the positive answer regarding the subsidy around that time.66

After the archeological research under the Vrijthof was done, Alderman De Vries gave the “green light” for the construction of the underground garage in February 1970.67 The construction of the garage was finished in fall 1971 and already on the first of December the indication “full” could be seen at the entrance to the garage.68 The official opening was scheduled for the year after, when the provisional contracts for renting and building were signed.69 During the 1970s, the Vrijthof parking did not generate much revenue: the average occupancy rate was too low for this. After 1980, this led to a vicious circle of decreasing maintenance and other
investments; underground parking becoming associated with filth, danger, and darkness; and people avoiding the Vrijthof- and other car parking garages. Only after Ruyters’ son-in-law took over and adapted the business model in the mid-1980s, this changed. He invested in the visual attractiveness of the garages to make parking a (positive) “experience,” something he saw during his studies in Chicago, which was something new for the European context. This made the car parks more attractive, clean, and safe, also for women, and occupancy rates went up and revenues increased drastically.70

As noted above, parking capacity of the inner city was not achieved solely through the construction of the Vrijthof garage, although it was the first project of that kind in Maastricht. The Working group in charge of the Vrijthof garage project continued to operate and conduct research for building parking facilities on other locations as well. For instance, in 1968, the research for building a garage under the city park was conducted.71 The garage was later built (1972-1974) and is known today as the Onze Lieve Vrouwe (OLV) garage. Also, the parking facilities under the shopping mall Entre Deux (1971) and later in Gubbelstraat (1972) were built, although those were entirely privately funded and developed.72 The OLV parking garage was built very close to one of the traffic rings, as it was the case with the parking lot in Gubbelstraat. The latter was demolished around the year 2000, while the former is still in operation. Table 1 gives an overview of all parking garages that were constructed in Maastricht between 1971 and 2007.

To conclude, the negotiations with investor Ruyters, the possibility to apply for a national subsidy, and the archeological excavations at the location of the parking garage temporarily delayed the efforts to build the garage. Yet, after the funding was secured and the excavations were done, the garage was built and became more securely anchored in the urban fabric of Maastricht.

**Constraints on Upscaling and Overcoming Them**

This analysis shows a number of constraints on upscaling the three entangled sub-practices of car mobility: car driving and parking, car mobility planning, and parking operating in Maastricht.73 The concept of upscaling helps to explain the expansion of underground parking in Maastricht as

| Name                        | Year opened | Capacity (spaces) | operator | owner                        |
|-----------------------------|-------------|-------------------|----------|------------------------------|
| Vrijthof                    | 1971 (rebuilt 2003) | 500 (445) Q-park | Municipality (leasehold Q-park) |
| OLV                         | 1977 (rebuilt 1998) | 350 Q-park | Q-park |
| Entre-deux                  | 1971         | 270 Now closed as public garage as Mosae Forum |  |
| Gubbelstraat                | 1972         | 400 Closed and rebuilt as Mosae Forum |  (was BP) |
| Bassin                      | 1998         | 407 Q-park | Municipality (leasehold Q-park) |
| De Griend                   | 1998         | 351 Q-park | Municipality (leasehold Q-park) |
| Bonnefantenmuseum           | 1998         | 303 Q-park | Q-park |
| Plein                       | 1992         | 449 Q-park | Q-park |
| De Colonel                  | 2005         | 297 Q-park | Q-park |
| Mosae Forum                 | 2005         | 1,082 Q-park | Consortium, led by Q-park |

Note: OLV = Onze Lieve Vrouwe; BP= British Petroleum.
not just a wider adoption of an artifact (“garages”) but as part and parcel of the transformation of urban mobility practices (“ways of traveling in the city”) (see Figure 1). The concept of upscaling has not been defined uniformly across different transition studies, and studies tend to be most elaborate on the scale of a (niche) innovation, while hardly operationalizing the aspect of stability or obduracy. In this article, we conceptualize upscaling as a process with two key dimensions: the expansion of a practice, and the stability or obduracy of that practice.75 Figure 2 maps this in a space between two axes: the horizontal one indicating the (relative) level of adoption or share of a practice, the vertical one the level of obduracy of the practice, that is, the resistance to change due to more rigid linkages between the elements of a practice.76 There are widely established practices which dynamically stabilized and became very “sticky” or obdurate over time, and, from time to time, new (or at least not widely established) practices are introduced or re-emerging. These latter “niche” practices may be scaling up, which means that the linkages of the network are still strengthening and the “share” of the practice (e.g., kilometers traveled in the total of an area) is expanding.

The reconstructed history of the Vrijthof showed many clues of the steady entangling of car driving and parking, car mobility planning, and operating car parks, while the number of car kilometers driven and the number of parking activities steadily grew to become the dominant way of traveling in the city.77 Hence, car mobility developed from niche practice to regime practice, as indicated with the thick arrow in Figure 2.78 From the beginning, the garage was not regarded as a stand-alone project but rather as a part of the overall traffic structure for the city. With regard to the forecasted growth of traffic flows, the city government drafted a new traffic structure plan.79 It was developed in consultation with business representatives of the city (especially from the center) and intended to secure the economic attractiveness of the city. It proposed an increase of the parking capacity of the center over the coming decade through a number of parking garages and on-street parking facilities in the vicinity of the main shopping area.
As the dotted lines in Figure 2 are meant to suggest, upscaling may initially also lean more toward either growing obduracy or expansion. Practices may remain small, for instance, motorists could have rejected the norm of paying for parking, which may have let the niche of underground parking to remain insignificant or recede. Also, as Shove and Walker argue, some
everyday practices do not become stable or obdurate at all (as the dotted arrow to the right indicates) but only remain because they are being reproduced. For example, the frequency and duration of showering (i.e., the widely held norm of daily showering) is not triggered, constrained, or stabilized by some regulation or infrastructure, and so, although widely practiced, has not a high level of obduracy.

As the next section will show, underground parking had made urban car mobility so obdurate over time, that new ideas about sustainable mobility started to conflict with its material reality in the early 2000s.

New Ideas Facing an Obdurate Parking, Planning, and Operating Ensemble

The concept of obduracy helps to understand the difficulty of changing urban structures once they are in place. Over time, urban structures tend to become more and more integrated with one another and dis-entangling such sociotechnical ensembles can be hard to achieve. The increasing obduracy of urban artifacts can, for example, be explained by the growing interconnection and interdependence of physical infrastructures with legal and policy arrangements, with mobility practices, and with key actors that try to protect or promote a specific sociotechnical status quo. How obdurate car mobility in Maastricht had become through underground parking became particularly clear in the early 2000s, when new ideas on urban sustainable mobility started to dominate the debates in Maastricht.

New Ideas on Mobility and Accessibility

At the beginning of the new millennium, the Vrijthof garage was operating as it was designed to, but society had changed. Since the 1970s, underground garages were praised as the way to combine the expectation of travelers to be able to park in the city center (albeit paid) with clean squares. As we argued above, this new meaning stimulated the expansion of parking garages in Maastricht and subsequently contributed to the obduracy of the parking system. However, after 2000, other interpretations emerged (such as “Vrijthof parking as money machine,” “Vrijthof parking as obstacle for transition to sustainable city”), although only voiced by minorities. Environmental norms and people’s expectations regarding air and noise pollution from car traffic had become stricter. Having a garage under the “living room of Maastricht” had gone hand in hand with attracting more traffic to the heart of the city. In the course of time, the effects started to manifest themselves. The city government started to wonder whether the decision made three decades ago was a right one and was faced with the question—Could we close it?—but the answer was negative.\textsuperscript{81} Therefore, the city government had to find other ways to deal with the path they had created in the past. Their strategy and the context of it are nicely depicted in the Accessibility Plan for Maastricht inner city (2001-2006)\textsuperscript{82} (see next section).

Furthermore, among urban transport planners, a shift from a “car accommodation” philosophy to “mobility management” had started to take hold. Many cities had adopted a car constraining policy for the inner city while extending pedestrian areas and promoting public transportation. As stated in the traffic circulation plan, “The policy aim is to create conditions which will allow the city to function as the center of the urban agglomeration and the region, while preserving its monumental character and a good living environment.”\textsuperscript{83} Increased use of other modes of transportation, as well as rearrangement of the traffic area on streets and squares, was marked as a desired policy outcome. However, only the very core of the shopping area was really car free at the time.

More concrete measures for meeting the objectives of promoting public transportation and bicycle traffic were introduced in the Mobility Control Framework Plan (1992). Likewise, the
mobility policy aim was incorporating more rigorous parking rules, particularly for the inner city. This change was part of a national trend of mobility management to stop increasing parking capacity while regulating parking demand. In the beginning of the 2000s, the arguments in favor of better quality of life and environment protection, and against the costs for providing more parking capacities, also led to a shift in the transport policy in Maastricht. The Accessibility Plan for the Maastricht inner city now sought to achieve the optimum between accessibility, livability, and economic functions of the city, and, second, because it addressed the effects of the Vrijthof parking garage, which began to take their toll.

As stated in the Accessibility Plan, “We strive for an inner-city where it is pleasant to live, work and stay, with minimal traffic noise, exhaust gases, and insecurity, which satisfy the requirements of accessibility within the given possibilities.” As further elaborated in the plan, in terms of viability and accessibility, the situation in the city was far from ideal. Many days, the inner city (including the inner ring), suffered from immoderate traffic that caused nuisance, air, and noise pollution, especially on Thursday evening and Saturdays, when queues for the Vrijthof garage became common. This was not just a result of the city center expansion and its functional enhancement but rather a consequence of increased car ownership and use. Moreover, Maastricht is well known as a tourist destination and the number of tourists visiting the city also played a role in the traffic-related issues. It was estimated that 2.6 million day-tourists visit Maastricht annually, while around 80 percent of them are coming to the city by car. The conducted research showed that the traffic flow during the weekend is 10 to 20 percent higher inside the inner-city ring compared with during the week, especially in the vicinity of Vrijthof and Markt. To sustain city attractiveness for the growing number of visitors, it was considered very important to take measures for reducing car traffic in the inner city.

These new ideas on car mobility, accessibility, and the role of parking seemed to a large degree incompatible with the presence of a number of underground parking garages in the city center. It remained to be seen, however, to what extent these new meanings were able to challenge the obduracy of the existing status quo. The embedded parking ensemble that had grown over decades, including the building up of expertise, contracts, financial arrangements, traffic circulation plans, and parking policies, had become quite obdurate. This is exemplified in a debate in the early 2000s in which the raison d’être of the parking garage was explicitly put into question (ibid.), in other words testing the obduracy of the embedded ensemble.

**Rebuilding the Garage in the Early 2000s**

In the beginning of the 2000s, the City Council reassessed the function of the Vrijthof car park garage and its role in the traffic circulation in the inner city. The main reason was the congestion caused by the car traffic queuing on the east side, in the direction to the entrance of the Vrijthof garage. To tackle the issue of congestion, a number of measures were suggested. One of them was a possibility to change the garage function by converting it from a visitor’s to a stakeholder’s parking place. The other was building an additional entrance/exit point on the north side of the square. However, considering the fact that the effects of the Vrijthof garage could not be assessed in isolation but only as an integral part of traffic and parking policies, special attention had to be paid to all factors that played a role in its existence. To facilitate discussion and decision making, a “quick scan” was carried out by a consultancy ETIL/BRO. According to the results of the quick scan, which were broadly supported in the City Council and summarized in the Accessibility Plan, the following was established:

1. With more than 500 parking places, the Vrijthof garage is of great importance for the functioning of the inner city. The garage provides sufficient capacity for visitors’ parking
demand and reduces the time for searching a parking place in surrounding streets. The conclusion is that any compensation with an equivalent location, in the case of a functional change to stakeholders, for both short- and long-term parking, is not feasible because it would cause a structural deficit in the parking balance.

2. A change from visitors to stakeholders’ garage is financially unfeasible and not desirable. The Vrijthof garage is of great importance for the economic functioning of the city, providing a turnover of approximately 1.5 million guilders (corresponding to 875,000 euros) on an annual basis.

3. The nuisance, such as air and noise pollution, is manageable and expected to be slightly offset by the realization of PRIS (parking information system), while the environmental standards are not going to be exceeded. On average, there are five hours of congestion per week on the east side of the Vrijthof.

4. A change of the traffic circulation in combination with another entrance/exit point has no obvious advantages and leads to high investment costs (15-25 million guilders; corresponding to 8.7-14.6 million euros).

5. Finally, maybe the most important factor is the contractual obligation toward the Q-Park (formerly Ruyters), since the building and operational rights, of the Vrijthof garage, are granted to the company (for fifty years after 1971).

Despite the above-mentioned factors and their influence on the character of the Vrijthof garage, some actions were required because of unforeseen problems. By September 2001, some cracks became manifest in the Vrijthof garage construction. The municipality had to run a study to establish the precise conditions of the garage. It assigned TNO Bouw to carry out the research to determine technical conditions of the garage. The conclusion was that the roof of the garage was in a very poor condition and threatening to collapse, probably caused by numerous events held on the square over the course of time. The city government, together with the operator of the garage, Q-Park, decided to close the garage until it had been completely reconstructed and safe for utilization.

In October 2002, the City Council made a decision to demolish the parking garage on the Vrijthof and to rebuild it. Already in November, the city government and Q-Park had signed an agreement in which some important arrangements were made. The financing of the garage reconstruction was a responsibility of the private developer, Q-Park. The renovation of the (ground level) square was to be funded from the regular municipality budget of 1 million euros. To cover the risks of investment for rebuilding the Vrijthof and for investing in new garages, Q-Park became not only the operator but also the owner of the Vrijthof garage (as of most other garages in the city) for the time period of thirty years.

It is interesting to mention that although the construction of the garage and reconstruction of the Vrijthof square in the early 1970s was in line with the wish of the public, public participation in the decision-making process was more explicit in 2002. Not only did a number of citizens express their opinion about the Accessibility Plan (2001) in general, but representatives of citizens took part in the focus group discussion regarding garage rebuilding. During six weeks of meetings, the focus group was not only informed about the implementation of the project but also worked on a proposal for the parking reconstruction, as well as on the new design of the Vrijthof square. The overall design of the garage, in terms of capacity, generally remained the same, leaving the suggestion for implementing an additional entrance/exit point as the central point of discussions. It was a very costly modification and difficult to achieve because of the steep slope in the northern part of the square. After a number of discussions, an agreement was reached: an additional entrance/exit point was to be constructed north of the square, due to its benefits in terms of decreasing the car traffic congestion.
The final decision for the rebuilding reflected the significant obduracy that underground parking had triggered in car mobility in Maastricht. Taking into account the contractual agreement(s) and the other results of the ETIL/BRO report (importance of parking balance and parking revenues, the opportunity of parking info innovation to mitigate nuisance), it appears that the final decision was seen as simply inevitable. The same sense of inevitability was echoed in the discussion of (the success of) P + R Noord after 2013\textsuperscript{102}: this P + R site (with 400 cars) was instrumental to skim off car growth in the city center, but was not a stepping stone to shift parking capacity from the center to periphery. Expanding P + R further at the expense of underground parking in the center had not been considered explicitly in the planning process, mainly because there was only political support for one P + R facility. The majority political view was that underground parking is essential for the parking balance and that the operational contracts, which run until 2032, would not even allow closing the garage. Especially the contracts can be seen as strong glue that hold the pieces of urban car mobility together, resisting change of the whole sociotechnical ensemble. The preference of mitigating nuisance from central parking through a new PRIS, instead of expanding P + R, reflects the tendency to create separate add-ons, as opposed to more structural changes. Indeed, this means that through underground parking, car mobility has become obdurate to such a level that it may even hinder the upscaling of P + R as (potential) sustainable innovation.

This observation was recently confirmed in a series of sessions about the future of mobility in Maastricht. In 2018, a participatory visioning project for 2040 highlighted the contested position of car use and parking in the future of the city\textsuperscript{103}. The project invited six types of stakeholders to express their vision for mobility in Maastricht by 2040: residents of the city center, residents of the outer districts, commuters and tourists, entrepreneurs and businesses in the city center, mobility operators (Arriva, Q-park, Swapfiets), and urban planners. The participants worked in the six subgroups and developed a vision each. After this session, facilitators visualized (parts of) the visions in Virtual Reality, and asked practitioners to reflect on the visions regarding cost, accessibility impact, and quality of the living environment. After three weeks, the six groups reconvened and received insight in each other’s visions, the visualizations and reflections. They were invited to reconsider and adapt their vision.

All groups agreed that in the future, more space should be made for pedestrians and cyclists. However, there was a major divergence in the way this challenge was supposed to be tackled. The two resident groups and the commuter group, on one hand, opted for a much larger car free area and significant P + R facilities at the outskirts of the city. The entrepreneur and mobility operator groups, on the other hand, opted for more underground parkings with continued car access of the city center, while redeveloping the overground parking spots into space for pedestrians, cyclist, and urban green. This would clear the streets of parked cars but would continue the need for in–outbound traffic flows to reach these city center garages. The space needed for these traffic flows does compete with the space for cycling and walking.

To conclude, this section shows that parking garages’ embeddedness in a long-term legal contract greatly contributed to obduracy of urban car mobility as whole. Even if the city government would have preferred to close the Vrijthof garage, this was highly unlikely because of this contract (with regard to financial penalties). Furthermore, in the meantime, the garage became considered as a central node in the traffic circulation plan of Maastricht’s city center and its parking policies. The 500 parking places of the parking garage were deemed indispensable for the city (in terms of accommodating visitors) and would also cause a substantial loss in parking revenues for the municipality. Recent debates on the future of mobility in Maastricht have shown that Maastricht’s entrepreneurs and mobility operators favor more underground car parks in the city center, while promoting more space for cyclists and pedestrians. All in all, the Vrijthof garage had become so important that it became perceived as vital for a smooth functioning of the inner city.
Conclusion: Is There a Way Out?

What lessons can we draw from this historic expansion of underground parking to help upscaling sustainable mobility today? The reconstructed history showed that the expansion process triggered upscaling and obduracy of car mobility in the inner city. This claim of increasing obduracy became especially clear during the debate around 2001, when the Vrijthof garage construction showed cracks and something needed to happen. By then its 500 parking spaces were seen as “indispensable for the parking balance in the inner-city.” Moreover, because of large investments—literally sunk in specific locations—the city government engaged in (long-term) contractual agreements with investors and parking operating firms (initially fifty years, and after renovation in 2002 another thirty years; also applied in other public parking garages). Third and finally, there is the physical presence of the eight garages, the stones and concrete, forming the most tangible aspect of obduracy because they would take a lot of time and effort to demolish.

For sustainability efforts today, this article offers an optimistic and a pessimistic note. On the pessimistic side: if earlier decisions lead to an undesirable urban status quo (e.g., considered to be unsustainable), it is hard to undo this process and return to, for instance, a low-car city. The processes of many decades have resulted in a strong alignment.

Nevertheless, as an optimistic note, the analysis of a historic upscaling process (toward unsustainable mobility) can help the upscaling of sustainable mobility today because it reveals the key sources of obduracy: the key linkages in the urban ensemble that constrain sustainable mobility innovations. To prepare for a future “way out,” these crucial elements need to be recognized. Furthermore, the identification of these constraints can help during the design of urban experiments, in the sense that experiments should be designed to learn how such constraints may be anticipated and overcome. For instance, Maastricht could focus their sustainable mobility visions on the year 2032, when the legal concessions expire, and a visioning process could be set up as a joint learning process with stakeholders from the obdurate car mobility regime (such as Q-park, shop owners, urban planners, current car commuters). The step from the identification of sources or factors of obduracy to the design of urban experiments for sustainable mobility is something in need of more study and elaboration, which we recommend for future research.

Our historical analysis suggests that upscaling of (successful) sustainable mobility innovations from urban experiments will not be a matter of simply “rolling out” (vehicles, smart apps, chip cards, etc.) across the city but is tied up with processes of sociotechnical change. This refers to the uptake of lessons and new ways of doing things that interfere with and transform established practices (e.g., changing ways of traveling, ways of operating parking, developing and executing local mobility policies and regulations). The most promising strategy is probably an upscaling strategy that identifies constraints in a particular urban context and seeks to anticipate these from the beginning. At the same time, however, it should be acknowledged that there are contingent factors that cannot be anticipated or predicted.

Appendix

Appraising the Obduracy of Car Mobility by Examining Each Element of the Practice

This appendix gives some more detail on how we conceptualize the various elements of car mobility in Maastricht (in Figure A1) and how this can be used to appraise the obduracy of the ensemble (see Table A1). Clearly, this is only an imprecise proxy, but nevertheless gives some insight in the differences between 1970 and today, most importantly that the underground infrastructure and parking operator is an important source of obduracy, while the social meanings of travelers and the capabilities of urban planners are less so.
**Figure A1.** The collective and individual elements of car mobility in Maastricht.

**Table A1.** Appraising the Obduracy of Car Mobility in 1970 and Today.

| Framework elements (see Figure A1) | Urban car mobility (driving and parking, urban planning, parking operating) in Maastricht | 1970 | Today |
|-----------------------------------|-----------------------------------------------------------------|------|-------|
| **Score (0 = very flexible, 1 = somewhat flexible/rigid, 2 = very rigid)** |
| **Comments (shortly explain score, possibly quotes)** |
| **Collective contextual elements** |
| **Infrastructures** |
| **How flexible or rigid is the infrastructure connected to the other elements of urban car mobility?** | 0 | Sides of the road can be flexibly used for parking (car or bus), driving, or cycling |
| **Regulatory incentives** |
| **How flexible or rigid are regulatory incentives connected to the other elements of urban car mobility?** | 0 | Traffic regulation still in infancy; very mild parking regulation (time restriction and limited parking tariffs) |
| 2 | Underground garages strongly aligned to business models, traffic regulation, and others |
| 2 | Traffic and parking regulation strongly aligned to underground parking infra + to social norms on accessibility (of business community) |

(continued)
Table A1. (continued)

| Framework elements (see Figure A1) | Urban car mobility (driving and parking, urban planning, parking operating) in Maastricht | 1970 | Today |
|----------------------------------|--------------------------------------------------------------------------------|------|-------|
| **Business models** | How flexible or rigid are business models connected to the other elements of urban car mobility? | | |
| **Social norms and meanings** | How flexible or rigid are social norms and meanings connected to the other elements of urban car mobility? | | |
| **Individual actor elements (1): traveler** | Knowledge and skills | How flexible or rigid are knowledge and skills of the traveler connected to the other elements of urban car mobility? | 0 | 0 |
| | Financial capabilities | How flexible or rigid are financial capabilities of the traveler connected to the other elements of urban car mobility? | 0 | 0 |
| | Values and emotions | How flexible or rigid are values and emotions of the traveler connected to the other elements of urban car mobility? | 2 | 2 |
| **Individual actor elements (2): urban planners** | Knowledge and skills | How flexible or rigid are knowledge and skills of the urban planner connected to the other elements of urban car mobility? | 0 | 1 |
| | Financial capabilities | How flexible or rigid are financial capabilities of the urban planner connected to the other elements of urban car mobility? | 1 | 2 |

Score (0 = very flexible, 1 = somewhat flexible/rigid, 2 = very rigid)

Comments (shortly explain score, possibly quotes)

- **Only time restrictions and on-street parking meters. No business involved**
- **High car accessibility (including parking) of the city center expected by most travelers and businesses**
- **Business model of the parking operator strongly aligned to infra and regulatory incentives**
- **High car accessibility (including parking) of the city center expected by most travelers and businesses**
- **Travelers do not have specific knowledge and skills for urban car driving and parking**
- **Travelers do not have specific financial capabilities for urban car driving and parking**
- **Lack of knowledge and skills of urban planners on underground parking**
- **Limited financial capabilities of the municipality were moderated connected to (maintaining) existent car mobility infrastructure, not yet expecting (much) parking revenues**
- **Knowledge and skills of urban planners are fit for underground parking, and also for other mobility innovations**
- **Limited financial capabilities of the municipality moderated connected to (maintaining) existent car mobility infrastructure, also expecting parking revenues**

(continued)
Table A1. (continued)

| Framework elements (see Figure A1) | Urban car mobility (driving and parking, urban planning, parking operating) in Maastricht |
|------------------------------------|-----------------------------------------------------------------------------------------|
|                                    | 1970                                                                                   | Today                                                                 |
| Score (0 = very flexible, 1 = somewhat flexible/rigid, 2 = very rigid) |                                                                                       |
| Comments (shortly explain score, possibly quotes) |                                                                                       |
| Values and emotions | Somewhat flexible because of hate–love relationship with cars in the city: accessibility important, but car also source of many problems | Somewhat flexible because of hate–love relationship with cars in the city: accessibility important, but car also source of many problems |
| Individual actor elements (3): parking operators | Knowledge and skills | Parking operation sub-department of municipality with no own financial capabilities | Knowledge and skills of parking operation is located at multi-national business; their knowledge is critical for current parking operations in the city; also knowledge links with municipality (i.e., the latter partly dependent on the former) |
| Knowledge and skills | How flexible (0) or rigid (2) are knowledge and skills of the parking operator connected to the other elements of urban car mobility? | 0 | 2 |
| Financial capabilities | How flexible or rigid are financial capabilities of the parking operator connected to the other elements of urban car mobility? | 0 | 2 |
| Values and emotions | How flexible or rigid are values and emotions of the parking operator connected to the other elements of urban car mobility? | 0 | 0 |
| Total | 6/26 = 23% | 18/26 = 69% |

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22. Solex is a bicycle with a small assisting motor, originally produced by the French manufacturer Solex, later also in the Netherlands, where it was popular in the 1950s and 1960s, especially with people that could not afford a car (yet).

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28. Geoff Vigar, “Reappraising UK Transport Policy 1950–99: The Myth of ‘Mono-Modality’ and the Nature of ‘Paradigm Shifts,” Planning Perspectives 16, no. 3 (2001): 269-91. Mingardo et al., “Urban Parking Policy in Europe.”

29. This also included the first underground parking garage, opened in 1966 in Breda. The first overground garage had already opened in the 1930s in The Hague.

30. Sjoerd Stienstra, “Parking in European perspective:” In: From parking control to mobility management, part 9 (2004). Ede: CROW.

31. Interview 1, April 2017. Gemeente Maastricht: traffic planner (1970-2000), retired.

32. Openbare Werken. Besluitnota No. 67-1133. January 1967. Secretarie Maastricht, no. 5, inv. No. 1.811.111.7, Archive RHC, Maastricht; that is, concerning parking garages, Vrijthof, Onze Lieve Vrouwe, and Entre Deux were considered; overground parking facilities considered were Gubbelstraat and Boschstraat.

33. Werkgroep ondergrondse parkeergarage Vrijthof. Memorandum 1, Verslag vergadering. January 1967. Secretarie Maastricht, no. 5, inv. no. 1.811.111.7, Archive RHC, Maastricht.

34. Interview 1, 2017. Wielenga and Richards, History of the Netherlands.

35. Interview 3, 2019.

36. Werkgroep ondergrondse parkeergarage Vrijthof. Memorandum 3, Verslag vergadering. March 1967. Secretarie Maastricht, no. 5, inv. no. 1.811.111.7, Archive RHC, Maastricht.
37. College van B&W. Collegebrief. September 1967. Secretarie Maastricht, no. 5, No. 11039-67, inv. No. 1.811.111.7, Archive RHC, Maastricht.
38. That is, the State Agency for Archeological Heritage that would carry out the archeological excavations; Werkgroep ondergrondse parkeergarage Vrijthof. Memorandum 5, Verslag Vergadering. July 1967. Secretarie Maastricht no. 5, inv. no. 1.811.111.7, Archive RHC, Maastricht.
39. “Parkeergarage onder het Vrijthof,” De tijd: dagblad voor Nederland, 1967a, Delpher Archive, 7, http://www.delpher.nl.
40. Werkgroep ondergrondse parkeergarage Vrijthof. Verslag Bespreking m.b.t parkeergarage onder het Vrijthof. September 1967. Secretarie Maastricht, no. 5, inv. no. 1.811.111.7, Archive RHC, Maastricht.
41. Interview 1, 2017. Wielenga and Richards, History of the Netherlands.
42. College van B&W, 1969. Dijk and Parkhurst, “Understanding the Mobility-Transformative”; Litman (2007) Parking Management Best.
43. Dienst Aanvullende Civieltechnische Werken.
44. College van B&W, 1967; “Geen auto’s meer op het Vrijthof,” Dagblad voor Nederland, 1967b, Delpher Archive, 4, http://www.delpher.nl.
45. Gemeenteblad van Maastricht. Raadsconferentie No. 17. October 1967. Secretarie Maastricht, no. 3, Archive RHC, Maastricht.
46. Werkgroep ondergrondse parkeergarage Vrijthof. Memorandum 2, Verslag vergadering. February 1967. Secretarie Maastricht, no. 5, inv. no. 1.811.111.7, Archive RHC, Maastricht.
47. Stichting Historische Reeks Maastricht, Jaarboek Maastricht (Maastricht, 1967), 13-15, http://www.jaarboekmaastricht.nl.
48. Verkeerscommissie der Gemeente Maastricht. Rapport aan burgemeester en wethouders betreffende de ter advies ontvangen commentaren op het verkeersstructurplan ir. Van Dijk en Openbare Werken. Maastricht, 1968, Archive RHC, Maastricht. Hence, the Traffic Plan (TP, by Openbare Werken) was discussed and commented by other stakeholders (KvK, Wyck representatives) and the TP plus comments formed this Report of the Verkeerscommissie.
49. Kamer van Koophandel en Fabrieken voor Maastricht en omstreken. Opmerkingen bij het verkeersstructurplan. Maastricht, 1968, Archive RHC, Maastricht.
50. Stichting Historische Reeks Maastricht, Jaarboek Maastricht (Maastricht, 1968), 10-12, http://www.jaarboekmaastricht.nl; Verkeerscommissie, 1968.
51. Verkeerscommissie, Rapport aan burgemeester en wethouders.
52. Stichting Historische Reeks Maastricht, 1968.
53. Todd Litman, Parking Management Best Practices (Chicago, IL: American Planning Association, 2013), 272.
54. Stichting Historische Reeks Maastricht, Jaarboek Maastricht (Maastricht, 1966), 16, http://www.jaarboekmaastricht.nl.
55. Stichting Historische Reeks Maastricht, 1968.
56. Mingardo et al., “Urban Parking Policy in Europe.”
57. We have converted the value of the guilder at the time (here 1968) to the euro of 2016 throughout the paper with the website of the Institute of Social History, https://iisg.amsterdam/nl/onderzoek/projecten/hpw/calculate.php.
58. College van B&W, 1969.
59. Gemeente Raad. Raadsbesluit voor het bouwen van her parkeergarage onder het Vrijthof, 1969a. no. 1956-69, Archive RHC, Maastricht; Gemeente Raad. Raadsbesluit voor het verhuren van het parkeergarage onder het Vrijthof, 1969b. no. 1956-69, Archive RHC, Maastricht.
60. Gemeente Maastricht en Ruyters. Concept-Overeenkomst voor het bouwen van een parkeergarage onder het Vrijthof, 1969a. Archive RHC, Maastricht.
61. Gemeente Maastricht en Ruyters. Concept-Overeenkomst van huur en verhuur van de parkeergarage onder het Vrijthof, 1969b. Archive RHC, Maastricht.
62. “Oudheidkundig onderzoek op het Vrijthof,” De tijd: dagblad voor Nederland, 1969, Delpher Archive, 7, http://www.delpher.nl.
63. “Parkeernood wordt in Maastricht nog groter,” Limburgsch dagblad, 1969a. Delpher Archive, 14, http://www.delpher.nl; “Maastricht start nog dit jaar bouw van parkeergarage,” Limburgsch dagblad, 1969b, Delpher Archive, 19, http://www.delpher.nl; “Historische week voor Maastricht,” Limburgsch
The City Council requested Ruyters to commence the construction without the subsidy. Since this meant increased financial burden for Ruyters, the company asked for including additional conditions in the financial structure. Besides building the gas stations, Ruyters requested, as a part of the company's housing development program, permission to buy municipality land at the current stock price and to build fifty houses per year for the next ten years.

64. “Raad akkoord voor het hoge parkeertarief,” Limburgs dagblad, 1970, Delpher Archive, 1, http://www.delpher.nl.
65. Stichting Historische Reeks Maastricht, Jaarboek Maastricht (Maastricht, 1970), 17-21, http://www.jaarboekmaastricht.nl.
66. “Parkeergarage onder Vrijthof,” Algemeen Handelsblad, 1969, Delpher Archive, 8, http://www.delpher.nl.

At this stage, the opinions on building the Vrijthof parking garage were divided. Some of the Council members now wondered whether it was really necessary to have a parking garage located under the Vrijthof and whether the increase of parking capacity at this location justified the compensation and huge investment of almost 7 million guilders. Suggestions to build first the parking facilities on other, not so centrally positioned locations could be heard. In doing so, the targeted parking capacity could be achieved and the Vrijthof would be still cleared from cars, fulfilling its societal and economic role (see Limburgs dagblad, 1969c). However, it became clear that erecting first the parking facilities on some of the suggested locations was not feasible at that moment. The discussion on new conditions with Ruyters was overruled by the news of the subsidy.

67. Stichting Historische Reeks Maastricht, 1970.
68. Stichting Historische Reeks Maastricht, Jaarboek Maastricht (Maastricht, 1971), 59-62, http://www.jaarboekmaastricht.nl.
69. Gemeente Maastricht en Ruyters. Huurovereenkomst. 1972a. Archive RHC, Maastricht; Gemeente Maastricht en Ruyters. Bouwenovereenkomst. 1972b. Archive RHC, Maastricht.
70. Interview 3, 2019.
71. “Maastricht studeert op ondergrondse garage,” De Waarheid, 1968, Delpher Archive, 2, http://www.delpher.nl.
72. Interview 1, 2017.

We were surprised how little information we could find in the archives about the sub-practice “driving and parking,” about the traveler and how she or he experienced driving and parking in Maastricht in those days. Interviews with people who traveled then may be a way to explore this further in future research.

74. For the argument in this article, it is not productive to flesh out the slight differences in defining upscaling, such as between Kemp and Grin (2009), ‘the emergence of a set of new practices learned from practical experiments, with corresponding new structure and culture elements’; or Van den Bosch (2010), “all activities aimed at embedding the experiment in the structure, culture and practices at a higher scale level”; or Naber et al. (2017), “four types of upscaling: (1) growing (i.e., the experiment continues with more actors), (2) replication (on other locations), (3) accumulation (i.e., linking to other experiments), (4) transformation (i.e., the experiment shapes wider institutional change in the regime).” Rene Kemp and John Grin, Opschaling van Transitie—Experimenten en Verankering van Systeem—Innovatieve Vernieuwing [Upscaling of Transition—Experiments and Anchoring of SystemInnovative Renewal] (Delft, The Netherlands: TNO, 2009); S. van den Bosch, “Transition Experiments: Exploring Societal Changes towards Sustainability” (PhD Thesis, Erasmus Universiteit, 2010); Rolf Naber, Rob Raven, Matthijs Kouw, and Ton Dassen, “Scaling Up Sustainable Energy Innovations,” Energy Policy 110 (2017): 342-54.
75. Similar as Kemp and Grin (2009) and Van den Bosch (2010) but with more emphasis on expansion. van den Bosch, “Transition Experiments”; Naber et al., “Scaling Up Sustainable Energy Innovations.”
76. As noted in the “Introduction: Understanding How Underground Parking Drives Obduracy” section, there are various conceptions of the elements of “socials practices,” but “materials, meanings and competences” (Shove et al., The Dynamics of Social Practices) is a main one that we adopt here. The appendix provides more details on how we tailor it to this particular case.
77. Eric Berkers, *Fietsgebruik en -beleid in Maastricht en Parkstad in historisch perspectief* (Eindhoven: Stichting Historie der Techniek, 2017).
78. More details about a way to make the y-axis (“level of obduracy”) more explicit are provided in the appendix.
79. Verkeerscommissie, *Rapport aan burgemeester en wethouders*.
80. Elizabeth Shove and Gordon Walker, “Governing Transitions in the Sustainability of Everyday Life,” *Research Policy* 39, no. 4 (2010): 471-76, 75.
81. Ibid.; Interview 2. 2017.
82. Gemeente Maastricht. *The inner city within reach. Accessibility plan for the inner-city of Maastricht, 2001-2006* (Maastricht, 2001), Archive Gemeente Maastricht.
83. Openbare Werken, 1975. *Traffic circulation plan for the inner-city of Maastricht* (Maastricht, 1975), 5, private collection of Interviewee no. 1.
84. Mingardo et al., “Urban Parking Policy in Europe.” Interview 1, April 2017. Gemeente Maastricht: traffic planner (1970-2000), retired.
85. Ibid.; CROW, 2004.
86. Gemeente Maastricht. *De Binnenstad binnen bereik*, 2001, 21.
87. Ibid., 31.
88. Ibid., 31-32; The document does not specify who would be the stakeholders.
89. Interview 2. 2017, that is, the majority of the City Council was happy with the arrangement with Q-parking: they found Q-park was operating the garage well, while the Council had (and has) the final say on hourly rates.
90. The document does not specify who would be the stakeholders.
91. PRIS—Parking information system, indicating the number of free spaces in the garages to motorist driving at the inner ring (“singels”)
92. Gemeente Maastricht. *De Binnenstad binnen bereik*, 2001, 32.
93. Stichting Historische Reeks Maastricht, Jaarboek Maastricht (Maastricht, 2001), 17, http://www.jaarboekmaastricht.nl.
94. TNO. Nederlandse Organisatie voor toegepast-natuurwetenschappelijk onderzoek. *Staat van zaken diverse onderzoeken*. Delft, 2002, Archive Gemeente Maastricht.
95. Stichting Historische Reeks Maastricht. Jaarboek Maastricht (Maastricht, 2002-2003), 31, http://www.jaarboekmaastricht.nl.
96. Gemeente Raad. Klankbordgroep Vrijthof, Veranderingen, 2003. Archive Gemeente Maastricht.
97. Or more precise: as leasehold relation with the municipality. The other seven garages have the same form and also span a period of 30 years.
98. Gemeente Maastricht en Maastricht bereikbaar. *P + R terrein Maastricht-Noord, raadsvoorstel*. Maastricht, 2011.
99. Gemeenteraad. Klankbordgroep Vrijthof, 2003.
100. Interview 1, 2017.
101. Interview 2, 2017.
102. Dijk et al., *Report on Living Lab Experiment Maastricht*, 2018. Dijk and Parkhurst, “Understanding the Mobility-Transformative”; Litman (2007) *Parking Management Best*.
103. See ETIL/BRO report in *De Binnenstad binnen bereik*, 2001.
104. See Author Biographies

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