Towards a practice-based perspective on transition

Abstract

In this paper we seek to elaborate on earlier work towards a practice-based perspective (PBP) on transition. This can contribute to the understanding of socio-technical transitions, currently mostly studied from a *Multi-Level Perspective (MLP)* or *Technological Innovation System* approach *(TIS).* We discuss how the decision-making process about the building of the first underground parking garage (Vrijthof) was a starting point of a growing urban 'assemblage' around car use and parking in the inner-city of Maastricht, with a signicant level of obduracy. By broadening this historic scenario of growing obduracy as one path in a space of niche extension, we can also include practices that expand but do not become obdurate, or become obdurate but not expand. This helps to acknowledge that there was not just one homogenous regime that was replaced by a new regime, but rather a 'constellation of practices', one regime-practices but also a large-scale practice with a low level of obduracy. By mapping out the different ways a 'constellation of practices' may evolve, including a transition pathway, we deliver the contours of a practice-based perspective (PBP) on transition.

Section 1: Introduction

In this paper we sketch the contours of a practice-based perspective (PBP) on niche extension and transition. We develop this perspective from a historic reconstruction of the introduction and expansion of underground parking in the Dutch city of Maastricht between 1965 and 2005.

In the past two decades a few distinct analytical frameworks to understand socio-technical transitions have been developed, most notably the *Multi-Level Perspective (MLP),* and the *Technological Innovation System* approach *(TIS)* (see Markard et al., 2012 for a more extensive review). Studies from a *Multi-Level Perspective* (Rip and Kemp, 1998; Geels, 2002; Smith et al., 2010) have argued that transitions come about through dynamic processes within and between three analytical levels: 1) niches, which are protected spaces and the locus for radical innovations; 2) socio-technical regimes, which represent the institutional structuring of existing systems leading to path dependence and incremental change; and 3) exogenous socio-technical landscape developments. Most attention has been devoted to the argument that when (1) niche innovations build up internal momentum over time, and (2) landscape changes put the regime 'under pressure', then (3) regime destabilization offers windows of opportunity for niche innovations to be scaled up, displace the old and establish a new regime. In later studies more complicated patterns were elaborated. In the *Technological Innovation System* approach *(TIS)* (Hekkert et al., 2007; Bergek et al., 2008; Negro et al., 2008, Markard et al., 2015) the development of a new technology is understood to result from the positive fulfilment of seven functions: 1) knowledge development and diffusion, 2) entrepreneurial experimentation, 3) influence on the direction of search, 4) market

formation, 5) legitimation, 6) resource mobilization and 7) development of positive externalities (Bergek et al., 2008).

These perspectives have been productively applied on a broad range of cases and delivered a rich insight in socio-technical transformations, such as niche-regime interactions, the role of incumbent regime actors and distinct transition pathways. At the same time, other scholars have voiced disadvantages of these perspectives. The idea of hierarchical (micro, meso, macro) 'levels' has been criticized, especially from a relationist ontological perspective, which assumes a 'flat' world (Geels 2011). Criticism on the TIS approach has pointed at its focus on the emergence of novel innovations or new sectors, more than on the (in)stability of existing systems, which inhibits its explanatory power of regime shift and niche-regime interactions. Further, critique on transition studies in general has been its rather binary view of 'niche or regime' (i.e. a socio-technical ensemble is either a niche or a regime, there seems to be nothing in between[1]), its quiet assumption that regimes are homogenous (Fuenfschilling and Truffer 2014) and the binary view of 'transition or no transition' (and the associated phrase of 'the' transition, as if there is just one type of complete transition that happens or not).

In this paper we seek to elaborate on earlier work towards a practice-based perspective (PBP) on niche extension and transition, which can help to counter some of the criticisms to the MLP and TIS approach. Practice-based approaches to understanding our social world emerged from philosophical (Heidegger, Wittgenstein) and sociological thought (Giddens, Bourdieu) and experience a revival since the 1990s, also in the field of sustainable consumption. Although a unified practice theory is lacking, the works of much-cited authors interrelate and some commonly shared understandings can be distilled. The eponymous notion of practice is generally held to comprise a nexus of "doings and sayings", held together

"(1) through understandings of, for example, what to say and do, (2) through explicit rules, principles, precepts, and instructions; and (3) through … "teleoaffective" structures embracing ends, projects, tasks, purposes, beliefs, emotions and moods (Schatzki, 1996, p. 89).

Other definitions of practices explicitly include objects and the material world as part of that nexus (Reckwitz, 2002; Shove, 2003; Warde, 2005). A distinction is commonly made between practices as spatiotemporal entities and as actual performances (Schatzki, 1996). Practice theorists draw on Bourdieu's notion of habitus and Giddens' theory of structuration to describe how practices require agency and how structure emerges from the routine-like reproduction of practices. There is room for change and variation because practices involve a degree of improvisation according to "local, practical and social conjunctures" (Nicolini, 2013, p. 60). Although a practice-as-entity (Schatzki, 2002) can be questioned and reflected upon, it is "a routinized type of behaviour" when performed (Reckwitz, 2002, p. 249).

Critique has been voiced that practice theories focus on the micro-level of isolated, everyday practices and fail to account for large-scale, systemic change (Geels, 2010). Many studies indeed deal with the advent of new practices in particular communities and less with the wise-spread change of existing practices (Shove, 2003; Shove & Pantzar, 2005). More recent efforts tackle the implications of a practice-based view for the study of entire industries (Schatzki, 2011) or climate

[1] And the associated idea that actors are either regime or niche actor.

change policy (Shove, Pantzar, & Watson, 2012). The focus shifted to how practices form interconnected bundles, what sort of relations tie these bundles together (Schatzki, 2011; Shove, et al., 2012), how change in one or several practices leads to ripple effects throughout the system of interconnected practices (Spurling, McMeeking, Shove, Southerton, & Welch, 2013; Wieser, Backhaus, & Kemp, 2014) and how practices elude targeted change due to the many influences (Hargreaves, 2014). These efforts notwithstanding, practice-based theories of change struggle with conceptualising who or what may bring about systemic change if any practitioner potentially may. Reckwitz (2002) argues without empirical underpinning that change can come about as "pragmatic innovation" during "crises of routines" when an agent is confronted with "interpretative indeterminacy" and inadequate knowledge in a 'situation' (pp. 255-256). Shove et al. (2012) contend that "[p]ractices change when new elements are introduced or when existing elements are combined in new ways" (p. 120).

Shove and Walker (2010:474) specifically propose to employ social practice theory to understand transition. Such an approach should emphasize "the horizontal circulation of elements and argues for a flatter model characterized by multiple relations (rather than hierarchical levels) of reproduction across different scales". Watson (2012) explores how systemic change unfolds from a practice-based approach (for the case of decarbonizing transport systems), highlighting three mechanisms through which practices change: (1) the elements comprising the practice can change[2], (2) the people who are performing the practice may change, and (3) the way the previous two relate to 'neighbouring' practices may change. We will build on these three mechanisms when developing a proposition on how transition can be explained from a practice-based perspective later in the paper.

This paper reconstructs the history of the introduction and expansion of underground parking in the Dutch city of Maastricht between 1965 and 2005. Faced with increased traffic and limited parking capacity, urban planners in the 1960's and 1970's implemented car-accommodating strategies. We discuss how the decision-making process about the building of the first underground parking garage (Vrijthof) was a starting point of a growing urban 'assemblage' around car use and parking in the inner-city of Maastricht, with a signicant level of obduracy. By broadening this historic scenario of growing obduracy as one path in a space of niche extension, we can also include practices that expand but do not become obdurate, or become obdurate but not expand. This helps to acknowledge that there was not just one homogenous regime that was replaced by a new regime, but rather a 'constellation of practices', one regime-practices but also a large-scale practice with a low level of obduracy. By mapping out the different ways a 'constellation of practices' may evolve, including a transition pathway, we deliver the contours of a practice-based perspective (PBP) on transition. Like other systems approaches on innovation, it is based on the understanding that actors normally do not innovate in isolation, but interact more or less closely with other actors and their context, through complex relations that are often characterized by reciprocity (Johnson et al. 2003). In contrast to other practice approaches, our framework balances the role of collectively shared norms & meanings concerning the practice, including physical infrastructures & other hardware, policies and supply side factors, with individual factors (knowledge & skills, values & emotions and financial capabilities).

[2] Here he refers primarility to 'things, meaning & competencies', which Watson (2012), like Shove et al. (2012) hold as key elements comprising a practice.

This paper is organized as follows. After discussing the history of underground parking in Maastricht (Section 2), we develop our PBP on niche extension and transition (Section 3). Section 4 concludes.

Section 2: Underground parking in Maastricht (1965-2005)[3]

The 1960's are remembered as years of population growth and unprecedented economic prosperity in most of the countries in Western Europe. Likewise, this period is associated with a surge in car ownership. In the Netherlands, after the period of austerity in the 1950s, the annual wage increased about 6% (Wielenga & Richards, 2015). As the purchasing power of Dutch society increased, car ownership – a privilege only granted to the high and upper-middle classes before the war – became available also to the labour class (Lundin, 2010).

Dutch governance authorities of that time had the challenging task to set up national and local planning policies that would come to grips with the foreseen growth in private mobility. This was defined in the Spatial Planning Act of 1962, which specifies 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 (CROW, 2004; Verlaan, 2015).

In this context, the municipality of Maastricht, in cooperation with other stakeholders, began a policy process for the construction of parking facilities below and above-ground in the 1960s. The first parking garage in Maastricht, commissioned 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 and 2). At first, all parties involved in the decision-making process were pleased with the results: there was increased parking capacity and the square was cleared of cars. However, in the course of time, also negative effects of the policy started to manifest themselves. Faced with increasing congestion, noise and air pollution of in- and outbound traffic in the following decades, the city government began to question the appropriateness of the decision made decades earlier.

Picture 1 & 2: parking at the Vrijthof square in Maastricht in the 1950s (left) and 60s (right)

[3] More details of this history are provided in Appendix 1

The historic developments leading up to the commissioning of a central underground garage began after the year of 1960 which was one of last years in which cycling was the main mobility practice in Maastricht in terms of total passenger km. Soon it was being overtaken by car mobility, whereas a limited remainders travelled by bus[4]. In the late 1960s, representatives of businesses and entrepreneurs located in the city lobbied for extending parking capacity close to the city centre. 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 the Vrijthof it is a huge disappointment, he cannot resist but to wonder: Yes, why don't they do something about that?"* (Limburgsch dagblad, 1964, p. 1). Attention for improving the quality of life through urban infrastructures (i.e. housing, cultural activities, parking) were still high on the local agenda in 1969 (Jaarboek Maastricht, 1969). For parking issues, a Working group and the City Board were busy with preparing a plan for two years already. The matters of parking issues and quality of life were 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 accommodation (City Board, 1969, p.1).

[4] These estimations for Maastricht are based on data from Berkers (2017), which excludes walking.

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 towards its function as a car park. In order to meet the needs of all parties involved, the local government began the course of action towards 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. Initially, one of the constraints was that the municipality lacked knowledge on traffic planning and on financing the building and operation of underground garages. The first issue was overcome by inviting urban planning colleagues from the city of Delft, the second by inviting an external investor, experienced in investing in underground parking who would bear (most of) the financial risk. In the following years, a number of processes unfolded that (quite literally) cemented underground parking as common practice.

First, after the construction of the Vrijthof garage, the municipality's working group in charge of the Vrijthof garage project continued to operate and conducted research studies for building parking facilities in other locations as well, so the lessons learned became part of the local government organization. The legacy of this group would later (in the 1990s and beyond) suggest PRIS[5] as an (incremental) innovation of underground parking, to mitigate the nuisance of traffic to some extent. Also, the investor (Ruyters bv) was involved in many of the subsequent garages in Maastricht (and later became a multi-national Q-park, with more than 870,000 parking spaces in over 6,300 facilities across ten countries). Thus, the underground parking practice became more obdurate because it got embedded in research, policies and processes of the municipality, new technologies (PRIS) and a growing international parking company.

Second, since parking garages that provided a significant increase of parking capacity were new for Maastricht, implementing parking garages required changes in the existing traffic circulation plan and associated parking policy. The parking capacity of garages became an important factor in the parking balance of the city, and entrances and exits of garages were attuned to the (often one-way) use of streets. Also, the parking tariff paid in the garages triggered other parking 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 and traffic circulation planning: one in which regulations were attuned with the (growing) capacity of underground parking supply. By 2000, the municipality labelled the established parking practice 'indispensable' for the accessibility of the city of Maastricht (Gemeente Maastricht 2001).

Thirdly, the process of establishing the Vrijthof and other parking facilities was realized through integration into the traffic structure and involved a a mental change in car travellers from parking at the curbside for free towards the norm of paying to park in a garage with (at least initially) ample space. With visitors from Belgium and Germany easily accepting to be charged for parking, Dutch drivers soon followed suit. These developments also triggered a change in the meanings citizens attributed to the Vrijthof. Before the 1970, people found the need to provide central parking space more important than having an open square. Since the 1970s, underground garages are applauded as a good way to combine the expectation of travelers to be able to park in the city center (albeit paid) with clean squares. These new meanings helped with the expansion of parking garages in

[5] PRIS – Parking information system, indicating the number of free spaces in the garages to motorist driving at the inner-ring ('singels')

Maastricht and subsequently contributed to the obduracy of the system. After 2000, other interpretations emerged (such as 'Vrijthof parking as money machine', 'Vrijthof parking as obstacle for transition to sustainable city'), but until now they have only been voiced by minorities. It remains to be seen, to what extent these new meanings are able to challenge the obduracy of the current status quo.

The clearest indicator of niche expansion (although only part of the process) is perhaps the number of underground garages and places: between 1970 and 2007 ten (public) parking garages were built, in total about 3,700 public spaces (see Table 1), thereby doubling the total capacity in the city centre of Maastricht to about 7,300 places. The legal embeddedness of the parking garages (most of the operational contracts with Q-park run till 2032) imply a very long-term commitment. This, together with the changed cultural values of historic squares and urban car use, expertise of urban planners, traffic experts and parking operators, parking & traffic policies and regulations, and underground parking infrastructures, resulted in a tightly aligned and obdurate socio-technical ensemble around car use and parking.

Table 1: Public parking garages in Maastricht (see on map in Picture 3)

Name	Year opened	Capacity (spaces)	operator	owner
Vrijthof	1971 (rebuilt 2003)	500 (445)	Q-park	Municipality (leasehold Q-park)
Onze Lieve Vrouwe (OLV)	1977 (rebuilt 1998?)	350	Q-park	Q-park
Entre-deux	1971	270	Now closed as public garage	-
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	2000	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

Picture 3: Locations of the current eight garages (indicated with 'P')

Table 2: From salient elements in the history of car use & parking to a conceptual framework

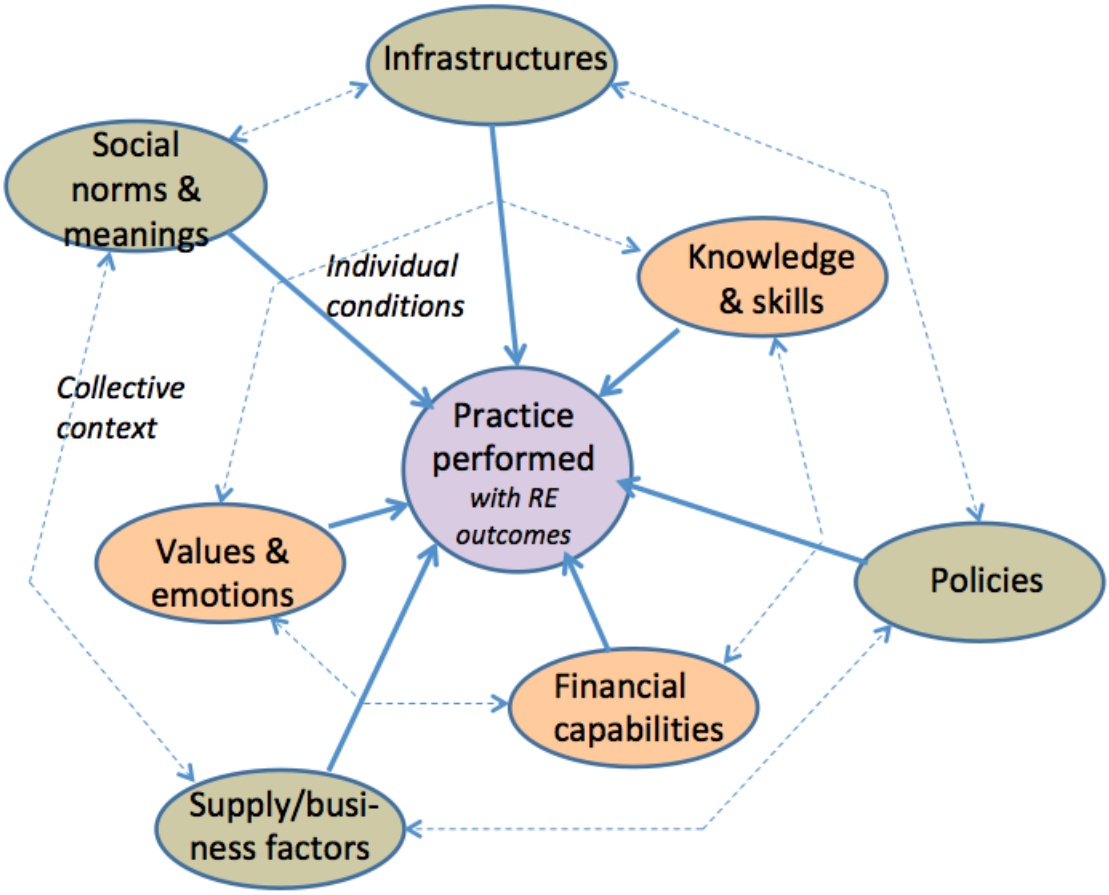
Case study elements of changing car use & parking practices		**Framework elements (see Figure 1)**
1950s	**1970s and beyond**	
		Individual actor conditions
Lack of urban planning knowledge & financing (for underground parking) at munipality	Underground parking management institutionalized in municipal organization	Knowledge & skills
Low individual wages/ purchasing power	Higher individual wages/ purchasing power: car & parking tariffs affordable	Financial capabilities
Habitual tendency to use the bicycle	Habitual tendency to use a car and accept paid parking	Values & emotions
		Collective contextual conditions
Zero parking garages	Many parking garages	Infrastructures
Hardly any parking policy	Car accommodating policies (aiming for more parking capacity in centre + supporting traffic circulation plan, paid parking)	Policies
No revenues /business regarding	A profitable parking business	Supply side/ business models

parking	(Ruyters/Q-park)	
Squares are seen as available parking space	Squares are assumed to be clean (Vrijthof as 'common room'), while sufficient urban parking capacity is expected	Social norms & meanings

Section 3: A practice-based perspective on niche extension and transition

We interpret this history of car mobility in Maastricht with a practice-based framework. Table 2 shows the main elements that were part and parcel of the changing practice of car use and parking in Maastricht (see Section 2) and how these elements can be labelled as either individual actor conditions (knowledge & skills, values & emotions and financial capabilities) or conditions of the collective context of actors (physical infrastructures, the supply side business models, social norms & meanings, policies). Together they form a 'web of drivers and constraints' highlighting the interrelatedness of individual actor and collective factors in practices (see Figure 1). Like other systems perspectives on innovation, this approach is based on the understanding that actors normally do not innovate in isolation, but interact with other actors and their context through complex relations that are often characterized by reciprocity (Johnson et al. 2003). In contrast to other systems approaches, our framework highlights collective and individual conditions in a balanced way, does not set national, sectoral or urban boundaries a priori, and, in line with other practice approaches, suggests that the collectively shared context 'recruits' individual actors with matching characteristics (as elaborated below). While we recognise the ontological tensions and epistemological challenges of our interdisciplinary perspective on 'practices', we opted for this pragmatic approach to ensure that our focus on collective contextual conditions does not imply forfeiting the known importance of personal motivations and limitations.

Figure 1: Practices as shaped by the web of individual conditions (orange) and collective context (brown) (source: developed by authors)

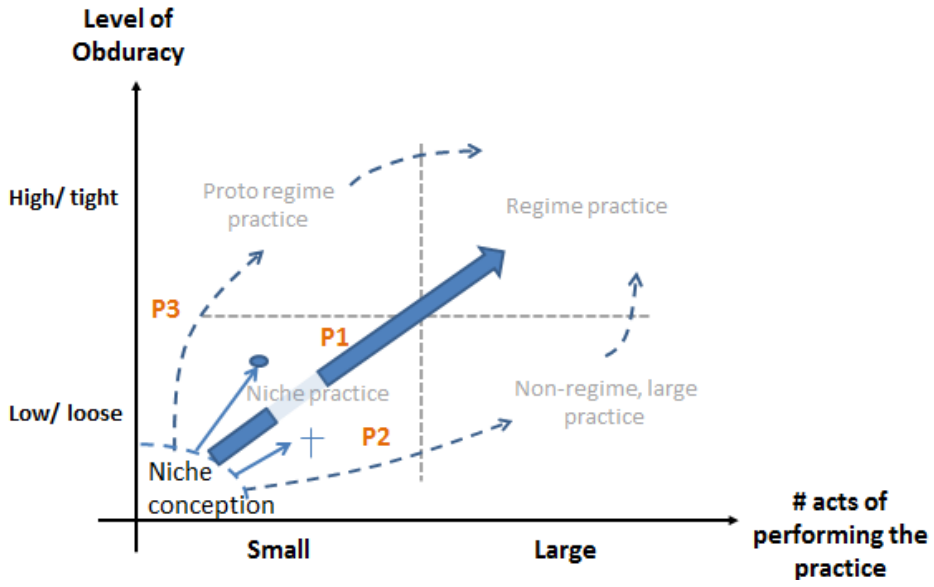


How does this framework help to understand how new practices emerge or established practices change? The framework can help to see the expansion of a new practice like underground parking as a 'niche practice that extends' through feedback effects between individual actors and collective conditions, whilst interfering with previously established urban mobility practices. As Figure 2 depicts, 'niche practice' refers to a practice with few acts of performance and non-obdurate alignment between its elements (social norms & meanings, physical infrastructures, the supply side business models, policies). This contrasts with the definitions of niches as purposeful constructions (typical in the SNM and TM literature). Our understanding of niche development, as extension of a new practice, is relatively close to how Kemp and Grin [2009] and Van den Bosch [2010] define upscaling, but with more emphasis on expansion and without the assumption of (niche & regime) levels[6]. The concept of niche extension helps to understand the expansion of underground parking in Maastricht as the transformation of practices of urban mobility ('ways of travelling in the city'). Figure 2 maps this in a space between two axes: one indicating the (relative) number of times a practice is performed, the other axis indicating the changing collective context: the level of obduracy

[6] For the argument in this paper it is not productive to flesh out the slight differences in defining upscaling, such as between Kemp & Grin (2009), *the emergence of a set of new practices learned from practical experiments, with corresponding new structure and culture elements;* Van den Bosch (2010), *all activities aimed at embedding the experiment in the structure, culture and practices at a higher scale level (the regime);* 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).*

of social norms & meanings, physical infrastructures, the supply side business models, and policies. Niche practices may be extending, which means that the aligning of the network is strengthening and the practice is performed increasingly (possibly indicated with the relative 'share' of a practice, e.g. km's travelled in the total of an area). In addition, there are also established practices in which many acts of performing have dynamically stabilized and became very 'sticky' or obdurate over time.

Figure 2: A framework of niche extension towards regime practice



The reconstructed history of car use and parking in Maastricht showed many clues of how both social meanings of squares and parking, (underground) parking infrastructure, business models and parking policies became increasingly tightly aligned, and how the number of cars parking in the city centre steadily grew, as indicated with the thick arrow (path #1) in Figure 2, which, after a few decades, had led to a tightly aligned 'urban assemblage' (see Farias and Bender 2010), with a significant level of obduracy (Hommels 2005,2010), which we label as 'regime practice'. From the beginning the garage was not regarded as a stand-alone project, but rather as part of a new overall traffic structure for the city. With regard to the forecasted growth of traffic flows, the city government drafted a new Traffic structure plan (1968). It was developed in consultation with business representatives of the city (especially those based in the centre), and intended to secure the economic attractiveness of the city. It proposed an increase of the parking capacity of the centre over the coming decade through a number of parking garages and over-ground facilities in the vicinity of the main shopping area.

In summary, this leads to the following proposition regarding the occurrence of path #1 in Figure 2:

- Proposition: Niche extension path #1 occurs when the increasing alignment of contextual elements (social meanings, infrastructures, business models and policy), leads to an obdurate assemblage, and goes hand-in-hand with an increasing recruitment of people performing the new practice.

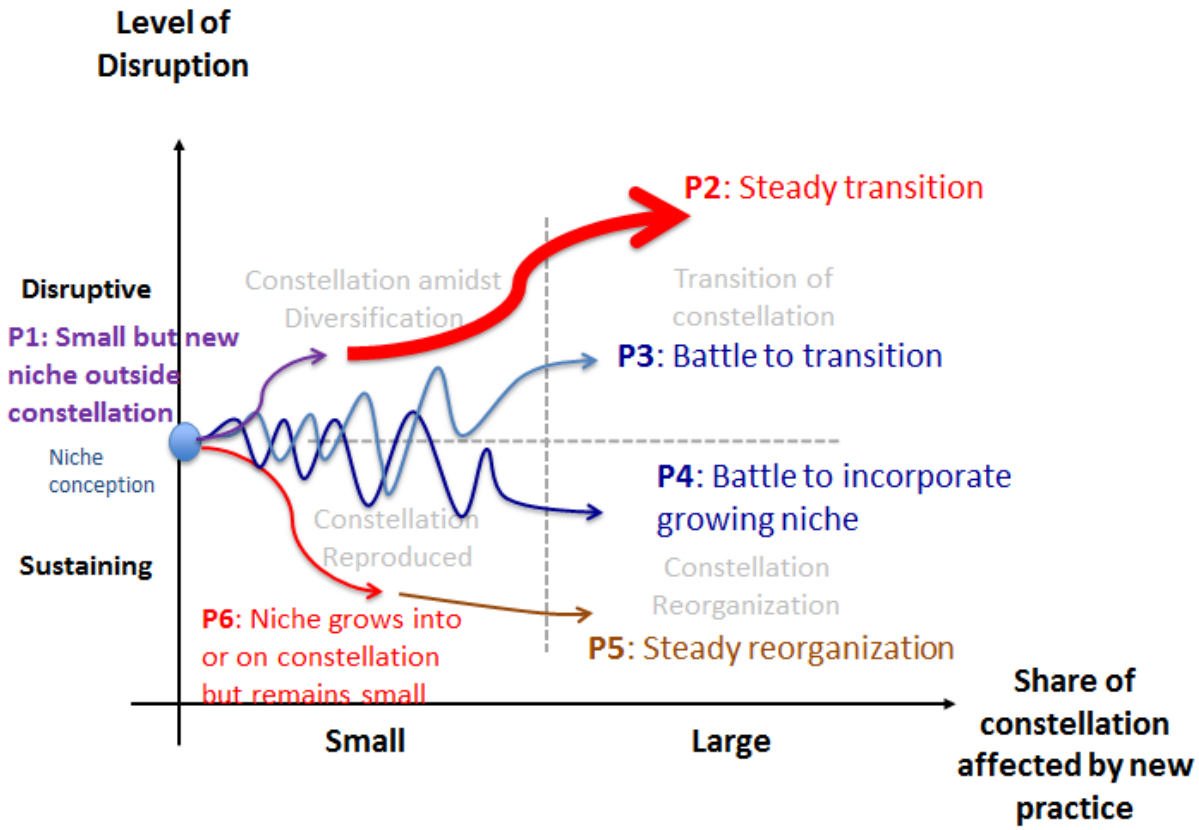
As the dotted lines in Figure 2 are meant to suggest, niche extension may also, initially or permanently, involve only tighter alignment and no expansion, or only expansion and no tighter alignment. In fact, as Shove & Walker (2010: 475) argue that some everyday practices do not become obdurate at all (as the dotted arrow P2 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), or the practice of cycling, is not triggered, constrained or stabilized by some regulation or infrastructure, and so, although widely practiced, has not a high level of obduracy. This leads to two more propositions:

- Proposition: Niche extension path #2 occurs when an increasing number of people are recruited for the new practice, but while contextual changes occur, it does not lead to an obdurate alignment of contextual elements (social meanings, infrastructures, business models and policy).
- Proposition: Niche extension path #3 occurs when contextual changes lead to a tighter and over time obdurate alignment of the 'elements' (social norms & meanings, infrastructures, business models and policy), but this does not go hand-in-hand with an increasing number of people performing the new practice.

Apart from the niche extension process as depicted in Figure 2, there is also the question of how the new practice of underground parking interfered with the established regime practices at the time, the second half of the 1960s. The urban mobility regime at the time was not a homogenous regime, but a 'constellation of practices': cycling (a non-obdurate but large practice with modal share of more than 50%), and the proto-regimes of car mobility with curbside parking and bus mobility. Although these three distinct practices to a certain degree co-existed alongside each other with little direct interference, there was a meta-practice of urban (transport and spatial) planning and governance in which these practices were to some degree coordinated. The introduction and growing accommodation of underground parking disrupted the balance in the constellation by reinforcing car mobility significantly, over time helping it to become the dominant form of urban mobility (with, in Maastricht, cycling reduced to about 20% at the end of the 1970s [Berkers 2017]). Of course there were more innovations in this period, such as bus lanes and separate cycling paths, but underground parking was the one with the strongest impact on the constellation of practices.

A 'constellation evolution framework' (CEF) helps to depict the impact of underground parking on the constellation of practices (see the thick arrow in Figure 3), and also how this was only one 'interference pathway' in a space of various options, of which the framework maps out six stylized ones. For instance, motorists could have rejected the norm of paying for parking, which may had let the niche of underground parking to remain insignificant (P1) or recede. Or, there were council members in 1969 who questioned whether the huge investments for the Vrijthof garage were really justified and suggested building facilities on other, not so centrally positioned, places. This could have evolved towards more P+R type of facilities by then, which could have spurred bus mobility or cycling (as the 'ride'), possibly leading to regime reorganization (P4 or 5).

Figure 3: Constellation Evolution Framework: mapping a space for constellation pathways (adapted from Dijk et al 2015)



The CEF can be used to map how the constellation of practices is affected by extending niche practice(s). The vertical dimension refers to the level of disruptiveness of the niche. Niches may develop with strong links/alignment to the (parts of) constellation network (i.e. sustaining the constellation), or provide an alternative socio-technical ensemble (i.e. practice) with weak or no links to the constellation (i.e. disrupting it)[7]. The horizontal axis of the framework represents the share of the constellation that is affected by the novel practice (e.g. share in total km travelled), which may be small or large.

The way the constellation of practices is affected by niche(s) can then be depicted as a pathway through one of the four quadrants indicating the impact at a particular moment or period of time. The framework assumes four stylized categories: it may be reproducing the constellation, it may put the constellation amidst diversification, it may reorganize the constellation, or it may trigger constellation shift. Underground parking (P2) initially diversified the constellation of practices with a new way of parking that required new skills, meanings, capabilities, policies and one underground garage. But feedback effects between these changing elements occurred, leading to steady expansion of the practice, which fundamentally shifted the balance in the former constellation: cycling dropped to 20% and car mobility growing to the dominant mode, with a majority of parking spaces underground. This can be expressed in a fourth proposition.

Proposition: A transition pathway occurs when a niche practice steadily extends through feedback effects between individual actor and collective conditions (i.e. recruiting more and more people into

[7] The level of disruptiveness of a niche may be further operationalized, e.g. Dijk (2016) scores the following five items on a scale [0-2]: User perspective: (1) New functional attribute(s)? (2) New social connotation(s)? Manufacturer perspective: (3) New competences/knowledge? (4) New business models? Infrastructure: (5) New hardware? Adding up these five components leads to a disruptiveness range of 0-10.

the new practice), whilst interfering with the established constellation of practices in a disruptive way.[8]

Feedback effects may consist of a range of (positive feedback) processes. Figure 4 shows how positive feedback effects between the contextual elements - supply side investments (in new business models), policy incentives, infrastructure and social meanings - further increase the attractiveness of the new practice for more and more individual actors (that is: increasingly matching their knowledge & skills, financial capabilities, values & emotions). The Figure brings together feedback effects highlighted in different scientific fields, while the salience of each of these processes will differ from case to case (and in different phase of a particular case):

- Cultural framing: the emerging framing (meaning) of a new practice (and changing of established ones) includes a level of cultural desirability (fashionable). Cultural dynamics may stimulate performing the practice (in the case of positive stories and connotation) or discourage it (in the case of negative stories and associated meanings), recruiting less or more new people into the frame.
- Increasing returns to scale: costs per unit fall with economies of scale, allowing firms profitably to sell products or services at lower prices, further stimulating sales and scale economies
- Firms learning from practice: growing sales lead to better knowledge about the heterogeneity of demand (who prospective buyers are, their willingness to pay for specific features, what is valued and less valued); knowledge which may be used for R&D and new product offerings, resulting in better products and more targeted marketing efforts that will further stimulate sales
- Users learning from practice: Potential users must learn about the new practice—its existence, characteristics and consequences. The information transfer is endogenous to the diffusion process (Rogers, 1983): the more people have adopted it, the better known the solution, and the more it is recognized as a proven, valid solution.
- Learning-by-doing (at the business side): production experiences lead to improved skills and discovery of cost-efficiencies in production, allowing manufacturers to reduce prices and/or increase profitability.
- Introduction and effects of policy is a messy process, but the introduction is at least partly shaped by the dominant social norms and meanings regarding the practice, with often a significant weight for the interest of businesses. Policy has a major role in most infrastructures, but, through different kind of regulation, informational and economic measures, shapes many individual and supply factors.

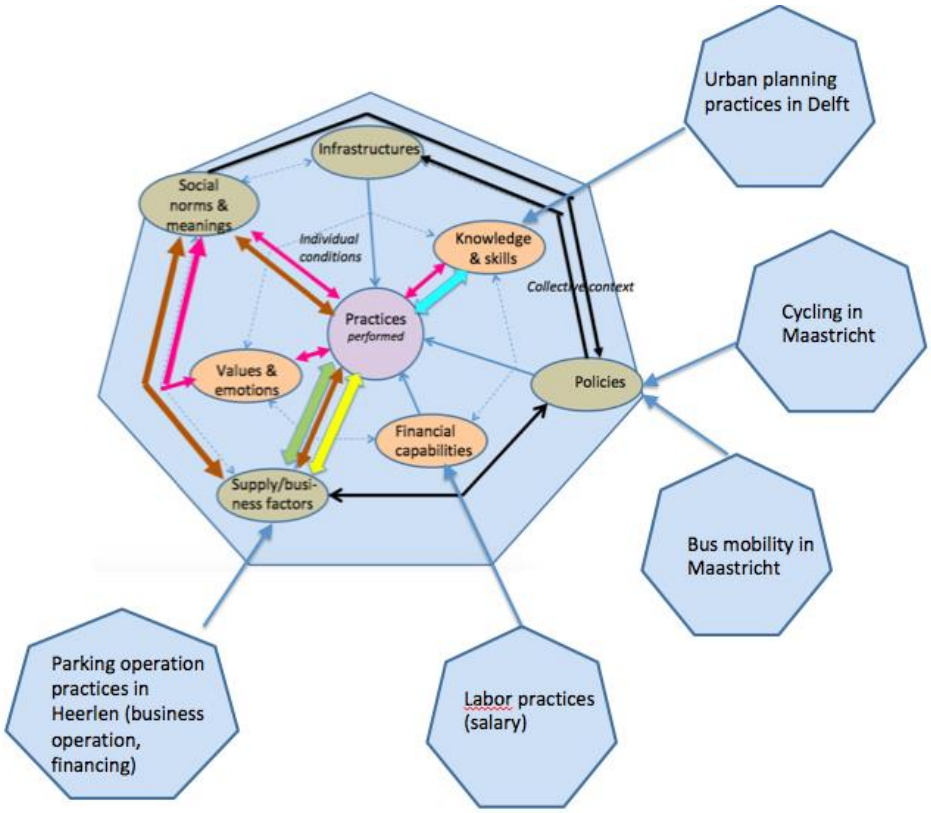
Apart from these endogenous processes (i.e. from within the practice), there are exogenous forces shaping the practice, that Watson (2012) labels as 'neighboring practices'. As depicted in Figure 4, in the case of underground parking in Maastricht these were:

- cycling and bus mobility practices in Maastricht (through the meta-practice of urban planning & policies)

[8] Note that propositions can also be developed for the other pathways of Figure 3, but that is beyond the scope of this paper.

- urban planning practice in Delft
- parking operation practice in Heerlen
- (national) labor practices (collective labor agreements)

Figure 4: Car use & parking practice (Maastricht) amidst neighbouring practices



Section 4: Conclusion

In this paper we have, based on an analysis of underground parking in Maastricht, sketched the contours of a practice-based perspective on transition, along the lines already advocated by Shove and Walker (2010). In doing this we built upon the building blocks offered by Watson (2012) and Shove et al (2012) (i.e. changing elements, changing people, changing neighbouring practices) and indirectly others (e.g. Verbeek and Mommaas 2008; Spaargaren et al 2013; Nijhuis 2013; Hargreaves et al 2013). Such a transition perspective puts practices central stage, referring to transition as the transformation of a (constellation of) practice(s), a new way of doing something, and conceptualizes niche development as the extension of a new practice.

Like other systems approaches on innovation, it is based on the understanding that actors normally do not innovate in isolation, but interact more or less closely with other actors and their context, through complex relations that are often characterized by reciprocity (Johnson et al. 2003). In contrast to other practice approaches, our framework balances the role of collectively shared norms

& meanings concerning the practice, including physical infrastructures & other hardware, policies and supply side factors, with individual factors. Practices recruit individuals when there is a sufficient match with their individual knowledge & skills, values and financial capabilities. While we recognise the ontological tensions and epistemological challenges of our inter-disciplinary perspective on 'practices', we opted for this pragmatic approach to ensure that our focus on collective contextual factors does not imply forfeiting the known importance of personal motivations and limitations.

Whereas current policy is still mainly focused on 'simple substitution of or changes to product & processes, pollution control, energy conservation and finding new energy sources', policies should be focused on influencing consumers and suppliers to adopt sustainable practices (Ashford & Hall 2011: 10). From our PBP perspective, the success of policies for socio-technical change depends on a well-balanced mix of individual intents (as motivating factors) and shared contextual conditions (as a stimulating system of provision).

Next steps for the further development of this practice-based perspective on transition, is to elaborate further the contribution this perspective has for understanding and shaping transition, in addition to MLP and TIS analyses.

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Appendix 1: More details about the history of the Vrijthof garage

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 inner-cities 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 Major and the Aldermen represent the executive municipal body or City Board (College), 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. From the mid-1960s traffic congestion and annoyance with the many cars parked on the main city square (see Pictures 1 & 2) 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 (Interview 1, 2017). 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. In order to both increase parking capacity and clear the Vrijthof square from cars, the municipality searched for an architect to start preparations of a plan of building an underground parking 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 (Public Works, 1967). 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 (Memorandum 1, 1967). 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, but a second issue, the lack of financial resources and related risks were encountered.

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 parking was very costly (at a time when parking revenues were very uncertain) and the Maastricht local government wanted to reduce entailed risks. In that period it was not unusual for local governments to cooperate with private developers on certain projects. Therefore the municipality also invited a private investor and

developer in the Working group, Ruyters, who already had some experience with the parking venture in Heerlen (Interview 1, 2017). 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. Parking regulations were not yet very stringent: on-street parking was mostly free of charge or in some areas regulated by time restrictions and very 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 policy. Amongst others, it required car motorists to prefer 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 (Memorandum 3, 1967). The design was along the line of intention to significantly increase the parking capacity at the Vrijthof square since at that moment, the parking capacity of the Vrijthof square was for 281 cars (City Board, 1967). Regarding the position of the entrance/exit point to and from the garage, it was suggested to position it close to the PTT office and the Woolowich Hotel, north of the Hoofdwacht (Memorandum 1, 1967). After the design of the garage was modified, negotiations entered a new phase that outlined the financial structure. 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 reconstruction of the square would be funded by the municipality. Furthermore, as planned in the beginning of 1967, the archaeological excavation under the Vrijthof had to take place. In that regard, any additional costs due to possible delay would be subject of agreement between the municipality and the state (Memorandum 5, 1967).

The City Board, and the Monumental commission in principle agreed with the preparation plan (Dagblad voor Nederland, 1967a). 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. In that regard, Ruyters suggested two options to make the whole project more manageable. The first part was the arrangement of the company's return of investment since Ruyters 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 (Report discussion, 1967). The city government 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 (in Dutch: onrendabele top) for the garage construction (Interview 1, 2017). Taking into account that those were to be built on municipality land, the City Council had to approve suggested locations and to agree on an exploitation period by Ruyters of 25 years (City Board, 1969).

The second part of Ruyters' proposed financial structure was the suggestion to apply for a state subsidy. In order to obtain subsidies, Ruyters pointed out that the municipality would have to be able to provide manageable plans for Vrijthof and to give priority to the parking garage. Even though

this project was a local endeavor and the financing should be executed as such, at that time the state was providing financial aid 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 ., 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 (City Board, 1967; Dagblad voor Nederland, 1967b). With a majority of votes, the Council in principle agreed to continue 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 a landowner of the garage (Council conference, 1967).

Embedment in traffic policy & 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 in order to connect it with the traffic flow to and from the garage (Memorandum 2, 1967).The assessment (March 1967) showed that the initially planned entrance/exit point was not conducive to the traffic plan. Therefore, to achieve targeted traffic merits, the new plan was proposed encompassing relocation of the entrance/exit point south of the Hoofdwacht, between the St. Jans and the St. Servatius churches. The design of the Vrijthof garage did not change fundamentally in the course of 1968. Besides the ongoing financial related discussions, the emphasis was on the embedding of the garage into the traffic circulation plan and local parking policies.

The main traffic flow was split among two existing bridges: Wilhelmina and St. Servaas. The bridges directed all traffic straight through the city center and were heavily overloaded. According to 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 AM and 7 PM). 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 (Jaarboek Maastricht, 1967).

In 1968 the number of motor vehicles had grown to 49,000, with a forecast of reaching 180,000 by the year 2000 (Verkeerscommissie, 1968). In the light of these forecasts, the Traffic structure plan was drafted by the municipality. 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 business and companies in the broadest sense, the Chamber was of the opinion that the traffic circulation plan has to be in accordance with the socio-economic functions of the city (KvK, 1968). The same view was presented in the reports "Maastricht committee of business and "Interests of Wyck" initiated by the representatives of Maastricht companies, and 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 (Jaarboek Maastricht, 1968; Verkeerscommissie, 1968).

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, administration etc.). 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 (Verkeerscommissie, 1968). 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 mental change of car travelers towards 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 socio-economic attractiveness of the city were 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 (Jaarboek Maastricht, 1968). 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” (Litman, 2006, p. 272). Although time restrictions through parking meters were introduced in 1966 in a few streets (Jaarboek Maasticht, 1966), the City Council decided only two years later to considerably expand their utilization. The total number of parking meters for short parking had increased from 37 to 160 in a two-year period. When paid parking was introduced at the Vrijthof square, it resulted in less interest in parking during the first days.

However, after initial skepticism, especially because parking was still for free in many surrounding streets, the mobility practice of motorists changed. The on-street parking fee (including the Vrijthof square) of thirty cents for four hours was very low at the time, and especially visitors from Belgium and Germany accepted the charge for parking in the inner-city. After a trial period of several weeks, the paid parking (and time restriction) policy on the Vrijthof square proved successful: its capacity of 281 cars could accommodate about 1,200 -1,300 cars a day (Jaarboek Maastricht, 1968).

With the ever-increasing demand for the limited parking spaces, the city started to extend parking regulations, such as shorter time restriction 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 (Mingardo et al., 2015).

Cultural heritage and uncertainty about national subsidies

After the financial structure of the parking project had been negotiated in 1967 and 1968, the next year the City Council faced different circumstances compared to 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 the state subsidy, offered by the Ministry of Social Affairs and Health. The D.A.C.W. subsidy was applicable 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 designated 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, implied that the municipality had to become a partner in building the parking garage. The municipality had to realize the project as its own and in a later stadium to grant renting rights to Ruyters (City Board, 1969). Such a situation affected to a large extent the strong position of the city government of not being involved in the project investments, which was estimated at 6,560,885 guilders.

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 (City Council, 1969a and b), one defining the building rights granted to him (Gemeente Maastricht & Ruyters, 1969a) and one defining the renting rights of the garage, for which a renting period of 50 years was specified (Gemeente Maastricht & Ruyters, 1969b). 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 (De Tijd, 1969). This legally required research affected to some extent also Maastricht‘s parking troubles. 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 a great damage to the city, economy-wise. In order 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. Thereby, a large part of investments in the Vrijthof project could be cost-effective (Jaarboek Maastricht, 1969; Limburgsch dagblad, 1969a) . 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 (Limburgsch dagblad, 1970). Thereby, an annual surplus of 70,000 guilders 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 (Jaarboek Maastricht, 1970). Furthermore, according to an Algemeen Handelsblad article (1969), it seems that the municipality received the positive answer regarding the subsidy around that time .

After the archaeological research under the Vrijthof was done, Alderman De Vries gave the “green light” in February 1970 for the construction of the underground garage (Jaarboek Maastricht, 1970).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 (Jaarboek Maastricht, 1971). The official opening was scheduled for the year after, when the provisional contracts for renting and building were signed (Gemeente Maastricht, 1972a and b).

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 conducted research studies for building parking facilities in other locations as well. For instance, in 1968, the research for building a garage under the city park was conducted (De Waarheid, 1968). The garage was later built (1972-1974) and is today known as the Onze Lieve Vrouwe garage (OLV). 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 (Interview 1, 2017). 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 later was demolished around the year 2000, while the former is still functional. Table 1 gives an overview of all parking garages that were constructed in Maastricht between 1971 and 2007.

Constraints on upscaling and overcoming them

This analysis shows a number of constraints on upscaling the new underground parking practice in Maastricht. The municipality initially lacked the right expertise to make a traffic circulation plan for the city center that would support the presence of a large underground parking garage. Furthermore, the parking garage was considered as a very expensive solution for the municipality and the uncertainty about the availability of subsidies by the national government stalled the process of decision making for quite some time. Also, implementing parking garages required changes in the existing traffic circulation plan and associated parking policy. Existing mobility practices such as parking in the city center streets and on the Vrijthof square, without having to pay parking fees, made a smooth realignment to the underground, paid parking less likely. Finally, cultural values, such as the importance attached to heritage in terms of archeological excavations at the spot of the planned parking garage, delayed the process of decision making. In sum, the constraints to upscaling the underground parking option, in this case, were related to 1) lack of expertise, 2) financial uncertainties, 3) existing mobility practices and parking regulation that did not match the new practice, and 4) cultural values and heritage.

The analysis has also shown how these constraints were overcome. The existing mobility practices were increasingly considered as problematic by the city government: there were too many cars and congestion increased. Furthermore, the cultural meaning of the Vrijthof square as the city's living room was mobilized to support a new function for the square, without cars. To counter the problem of expertise, the city hired external experts on urban mobility and traffic circulation and the uncertainty about the financial consequences of building the garage decreased when the city found a local investor to share the risks and the national government decided to allocate a subsidy for building the underground garage. As the next section will show, overcoming these constraints resulted in an obdurate sociotechnical ensemble.

The obduracy of the garage after successful upscaling

At the beginning of the new millennium, thirty years later, the Vrijthof garage was operating as it was designed, but society had changed. 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. 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 (Interview 1, 2017; Interview 2, 2017). 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), the document that forms the central point in our further analysis.

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. In Maastricht, starting from the 1970s, some measures were taken to make some inner-city streets car-free. As stated in the Traffic circulation plan (Public Works, 1975), "The policy aim is to create conditions which will allow the city to function as the center of urban agglomeration and the region, while preserving its monumental character and a good living environment" (p. 5). 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 whilst regulating parking demand (Mingardo et al., 2015).

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, led to a shift in the transport policy. The parking policy, as its inseparable part, became an integrated part of transport demand management practiced through a "managing demand principle" (CROW, 2004; Mingardo et al., 2015). In that respect, the Accessibility plan for the Maastricht inner-city deserves special attention. Firstly, due to its accent on the city government goal – achieving the optimum between accessibility, liveability and economic functions of the city, and secondly, because it addressed the effects of the Vrijthof parking garage, which began to take their toll.

As stated in the Accessibility Plan (2001) "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" (p. 21). 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 ("singels")), 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 the increased car ownership and use. Moreover, Maastricht is well known as a touristic destination and the number of tourists visiting the city also plays a role in the traffic-related issues. It was estimated that 2,6 million day-tourists visit Maastricht annually, while around 80 % of them are coming to the city with a car. The conducted research showed that the traffic flow during the weekend is 10-20 % higher inside the inner-city ring, especially in the vicinity of Vrijthof and Markt (p. 31). To achieve the desired optimum, and to sustain city attractiveness for the growing number of visitors, it was very important to take measures for preventing increased car traffic in the inner-city.

Rebuilding the garage in the early 2000s: testing the obduracy of the embedded assemblage

In the beginning of the 2000s, the City Council reassessed the function of the Vrijthof parking and its connection to the traffic circulation for 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. In order 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 visitors to stakeholders4 parking place (pp. 31-32). 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. In order 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 function of the city, providing a turnover of approximately 1, 5 million guilders 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 , 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) (p. 32.)

5. Finally, maybe the most important factor is the contractual obligation towards the Q-Park (formerly Ruyters), since the building and operational rights, of the Vrijthof garage, are granted to the company (for 50 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 started to manifest in the Vrijthof garage construction (Jaarboek Maastricht, 2001). 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 (TNO Report, 2002). The city government, together with the operator of the garage, Q-Park, decided to close the garage until it would be completely reconstructed and safe for utilization (Jaarboek Maastricht, 2001).

In that regard, 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 (Jaarboek Maastricht, 2002-2003). 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 euro and once the reconstruction of the garage would be done (City Council, 2003). In order 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 (including all other garages in the city) for the time period of 30 years (Gemeente Maastricht & MB, 2011).

It is interesting to mention that although the construction of the garage and reconstruction of the Vrijthof square in the early 1970s fulfilled desires of the city dwellers, who were to some extent also the stakeholders in that process, public participation in the decision-making process was more explicit this time. Not only that a number of citizens gave their opinion about the Accessibility Plan (2001) in general, but the representatives of citizens took part in the focus group discussion regarding garage rebuilding. During the six weeks of meetings, the focus group was not only informed about the implementation of the project but also worked on the proposal for the parking reconstruction, as well as on the new design of the Vrijthof square (City Council, 2003; Focus group meetings, 2003). The overall design of the garage, in terms of capacity, generally remained the same, leaving the suggestion for implementing 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, the consensus was reached: the additional entrance/exit point was to be constructed north of the Hoofdwacht (Interview 1, 2017), due to its benefits in terms of decreasing the car traffic congestion.

The final decision for the rebuilding, reflect the significant obduracy of underground parking. 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 echoed in discussion of (the success of) Park+Ride Noord after 2013 (Interview 2, 2017): 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. Upscaling had not been considered explicitly in the planning process, mainly because there was only political support for one P+R facility, which was seen one project. The majority political view was that underground parking is essential for the parking balance and that the operational contracts, which run till 2032, do not even allow this. Especially the contracts can be seen as a strong glue that holds the pieces of the urban (car) assemblage together, resisting change of the whole socio-technical “ensemble”. The preference of mitigating nuisance from central parking through a new parking information system, instead of expanding P+R, reflect the tendency to create separate add-on’s, as opposed to more structural changes. Indeed this means that underground parking has become obdurate to such level that it hinders upscaling of P+R as (potential) sustainable innovation.

To conclude, this section shows that parking garages’ embeddedness in a long-term legal contract greatly contributed to its obduracy. Even if the city government would have preferred to close the Vrijthof garage, this would not have been possible 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 term of accommodating visitors), and would also cause a substantial loss in parking revenues for the municipality. All in all, in the reasoning of [specify actors], over time, the Vrijthof garage had become so important that it became perceived as vital for a smooth functioning of the inner-city.