AMSTERDAM 2049

story-driven scenarios to prepare the city for autonomous vehicles

Thesis P5
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Msc4. P5 | 2020
Design of the Urban Fabric

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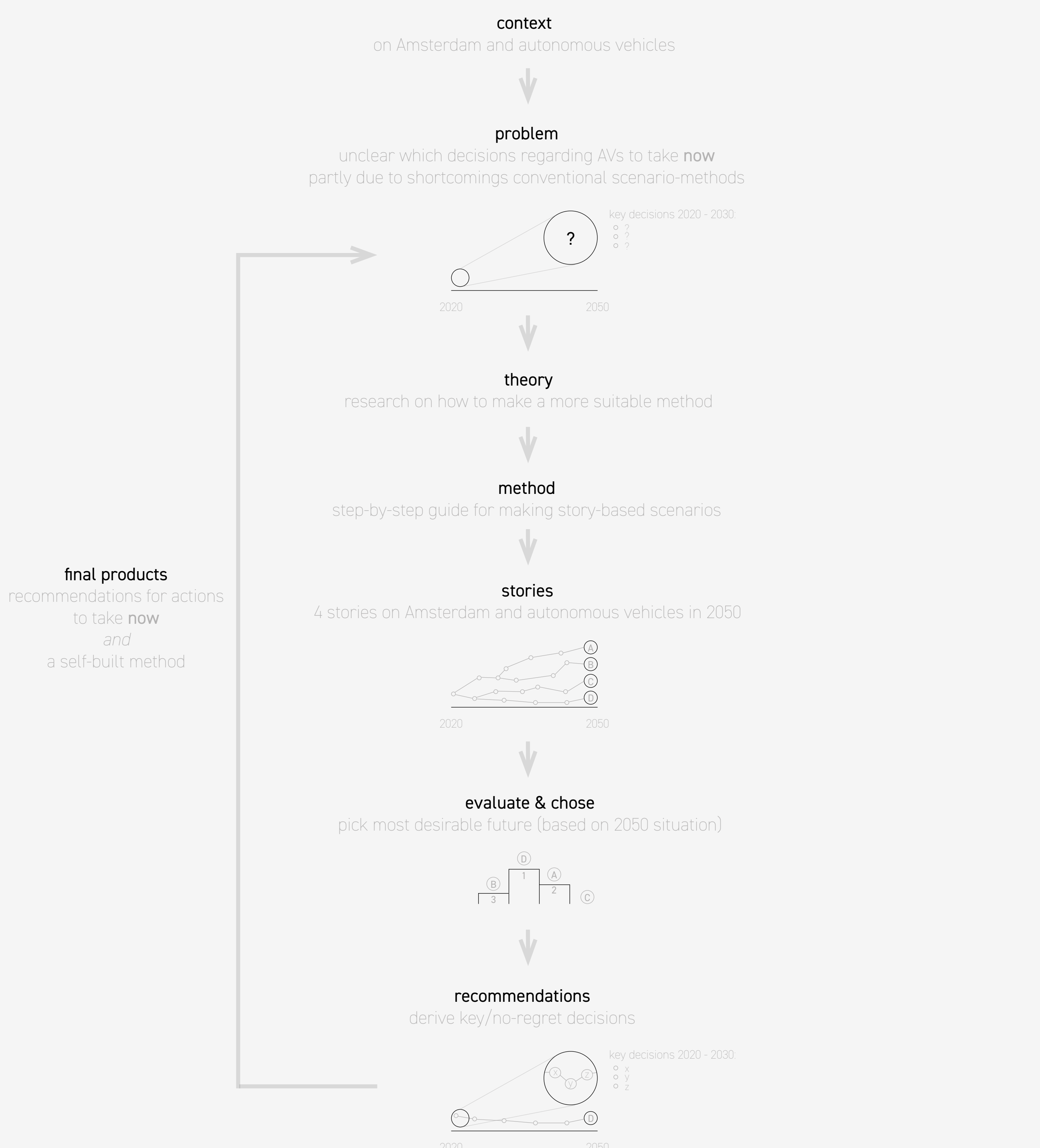
The future of autonomous vehicles is uncertain and largely unpredictable. In uncertain periods like these, I believe speculative stories about the future can fulfil the important task of sparking much needed debates about if and how this technology should get place in our cities. Debates which should not be held by technology or traffic experts only, but by as much people as possible..

Therefore this project presents four accessible but informative stories that show and explain how the city of Amsterdam could shape the driverless future. Plus, a storybuilding method, to support the creation of more stories told from other perspectives.

CONCEPTUAL OVERVIEW THESIS



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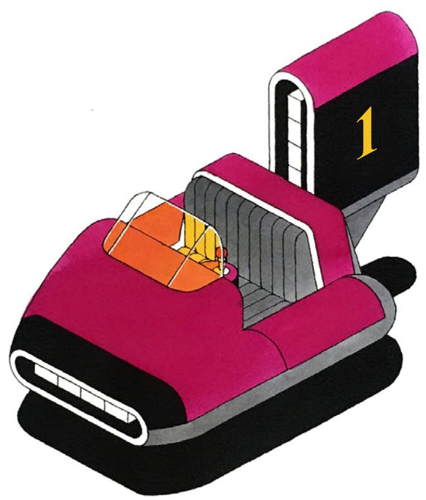


CHAPTER I:

UNCERTAINTY

Amsterdam, autonomous vehicles and an uncertain future

CHAPTER 1 | UNCERTAINTY

Out of all the countries in the world, the Netherlands has the most 'autonomous vehicle'-ready road network (KPMG, 2019). It is the result of years of investing in state-of-the-art technologies and putting in place the needed policies, and it seems to pay off: our country is likely to be amongst the early adapters as soon as these vehicles enter the market.

Claiming this desired role of a frontrunner comes with many large challenges and responsibility, however. Being one of the first to be able to put autonomous vehicles on the roads, means that we should be one of the first also to have the right policies in place - there is no luxury of waiting and learning from mistakes made elsewhere.

But what are these 'right' policies then? And what other kind of - perhaps unexpected - moments of choice might appear? Do we, for example, allow private autonomous vehicles into our cities, or do we keep them on the highways? Do we leave a large role for the market to experiment freely, or do we claim a proactive role as a public sector? There is still so much uncertain about the driverless future, it is hard to understand what actions are required now. However, action *is* needed.

Amsterdam 2049 is a project that aims to generate insights into these required actions, through constructing and providing future scenarios that give an idea of the potential implications of autonomous vehicles on the city of the future. By doing so, it hopes to both establish a sense of urgency amongst policy-makers and planners, as well as to provide them with recommendations on how to act. Structural behind these future scenarios is the development of a unique storytelling-scenario method, which will in its own way combine several useful theories and urbanism insights to produce informative, imaginative and compelling stories about Amsterdam and autonomous vehicles, that will hopefully both inspire and inform those involved in decision-making.

STRUCTURE OF CHAPTER 1

1.1 Background

This first paragraph will consist of three parts. The first will introduce the background of the research, as it discusses autonomous vehicles and the importance of decision-making during this experimental period these vehicles are in (1.1.1). In the second part, the dawn of the autonomous vehicle is put in the context of our area of focus; Amsterdam and its metropolitan area. Here we discuss what the arrival of the autonomous vehicle could mean for the city and the region, both in a positive and negative sense, as well as what the current visions are of the city, the region and different private actors form the market regarding autonomous vehicles (1.1.2). The third part then highlights the current trend of public authorities (worldwide) putting proactive decision-making regarding autonomous vehicles in the hands of private actors, and discusses the importance of figuring out 'no regret decisions' to, at least, prevent the 'lock-in' of a problematic future (1.1.3).

1.1.1 Autonomous vehicles: important decisions in a 'formative phase'

We are probably on the brink of major transformations in urban mobility, as many changes in urban dynamics and city form could be triggered by autonomous vehicles (hereafter: AVs) (Duarte and Ratti, 2018). However, there is still a lot uncertain about AVs and the implications they could have on the way we live, move and, subsequently, design our cities. Nor is it possible to decidedly say whether these implications will be positive or negative.

As Fabio Duarte and Carlo Ratti put it in their impact review of autonomous vehicles, there are still many fundamental things unclear about the AV. Illustrative of this fact are the following five questions they pose, which are all still unanswered as of now: (1) will the AV turn out to look like a car, or will its form be radically different than that of other vehicles? (2) Will AVs lead to more or fewer vehicles on the road? (Alessandrini et al., 2015, Fagnant and Kockelman, 2015). (3) Will AVs require more or less parking? (Zhang et al., 2015) (4) Will AVs lead to more or less urban sprawl? (Miliakis et al., 2017) (5) Will AVs require more or less road infrastructure? (Duarte and Ratti, 2018). These are just five questions, amongst many that can be asked, which gives a good sense of the uncertain future we are heading towards.

We do not need, or should, passively wait for the AV to be dropped into our city to see how these questions will answer themselves however. In fact, many of the outcomes to these kind of uncertainties can be steered by decisions we make as city/government (these are primarily 'public' choices/not the market's to make). Decisions about, for example, how much space should be given to AVs on existing roads/in relation to other forms of traffic, or about who gets priority (the pedestrian or the self-driven vehicle? - which could translate to crossings/separation of lanes or mixed/high speed and effient or slow speeds) or about access, whether an inner-city is a place for AVs, or whether they should be limited to highways and, perhaps, rural areas (Miliakis et al., 2017). Then there are questions about the purpose of the vehicle; should it become a part of the 'car culture', i.e. become available for privately ownership and individual rides, or should it become shared only, or perhaps even part of the public transport system? Making the right choices here will be incredibly important (Cohen and Cavoli, 2019).

Besides having to make the *right* directions, there is also the urgency to make them *now*. In fact, many of these decisions, whether materialized in the form of policies or spatial interventions, will need to be put in place/realised before we leave this current phase of experimentation. A moment which will happen inevitably and eventually, and perhaps even within a decade from now. The challenge is thus to act quickly and proactively, in this period where the dominant design of the autonomous vehicles is not fixated yet/where the vehicle has not become established in the market yet. We need to make the most out of this formative phase[1], or the critical juncture, and make sure to have everything in place before the 'future will be locked-in (Elzen et al., 2002, Urry, 2016, Wilson and Grubler, 2011).

1 The formative phase and critical juncture are practically the same thing. The first term is derived from technological innovation systems (TIS) literature, the second from socio-technical systems literature. They both stand for 'a period in the early stages of the development of a new technology, characterised by many uncertainties surrounding its formation'. It is, thus, a crucial period in which the conditions for a technology to emerge and to become established in the market will be set up (Wilson and Grubler, 2011).

1.1.2 Autonomous vehicles in the context of Amsterdam/AMA

Accorinding to the KPMG Autonomous Vehicles Readiness Index, the Netherlands might be one of the first places in the world where large leets of fully autonomous vehicles can take over the highways (KPMG, 2019). Being such a frontrunner, with a state-of-the-art highway network and mobility system could be a unique opportunity for the country and for its most important regions such as the Amsterdam Metropolitan Area (hereafter: the AMA). Leading the world also means however, that the country will be one of the first to undergo the consequences of any mistakes. There is no opportunity to learn from earlier mistakes made elsewhere, - like how European cities were given a bit of time to rethink the role the private car should get, after American cities were completely transformed by it. The urgency of getting the decisions right is thus large, and so are the potential implications, both positive and negative, for Amsterdam and its metropolitan area (Boston Dynamics, 2016, Deloitte, 2017, KPMG, 2019)

In a positive scenario, autonomous vehicles could turn out to be a blessing for the region. More efficient traffic (platoons perhaps) and less vehicles on the road could greatly reduce the contemporary issues regarding existing and forecasted bottlenecks such as the ring of Amterdam, and important connections with satellite cities. Additionaly, space could be freed up in existing cities, e.g. through less parking needs/less infrastructure needs, allowing former parking lots/roads to be regenerated, repurposed into housing/facilities/public space. Especially for Amsterdam, the reclamaition of traffic space for transformation projects would greatly help in its desperate search for housing-[23] and work-locations[4] within the ring.

In a less optimistic scenario, however, autonomous vehicles could turn into a nightmare for the region. The autonomous vehicle, especially as a private vehicle, bears a dangerous potential to lead to the demise of existing public transport system (reference here) and an intensification of the 'car culture'. This could lead to many more vehicles on the road, incentive urban sprawl and lead to more fragmentated cities. If on top of that it turns out that the transition towards AVs results in a mishmash of poorly interoperable vehicles that can't figure each other out, large congestions can be expected. Additionaly, AVs could form a major threat to the liveability of inner cities as they might claim the little space that is left, and push other modes of transport, such as biking and walking, away.

Making right decisions in the coming 5/10 years, depending on how long this formative phase/critical juncture will last, will thus be pretty essential. Thankfully, the municipality of Amsterdam, and the metropolitan region, are already taking a clear stance regarding private mobility (which is now primarily targeting the private car, but this could be translated to the private self driving vehicle as well). Let us have a quick look at this stance, which we can derive from a couple of recently published vision documents.

Noteworthy are the Actieplan Schone Lucht, Mobiliteitsaanpak Amsterdam 2030, Programma Smart Mobility 2019-2026 and the Ontwikkelvisie Havenstad - most of which fall under the broader, long-term vision document Structuurvisie Amsterdam 2040. The selection of these vision documents give a strong indication of where city and region want to head regarding mobility and regarding urban planning. Restricted access, limited parking, transit-oriented development and transformation over expansion are, for example, good indicators of an overal anti-private and anti-car course striving for less car-domination and -dependency.

These vision documents and their fundamental 'values' can be brought together an overview, which will be called the core values of Amsterdam/AMA. (see figure on the following page). As can be seen, this overview is based upon three main themes; socio-economical goals, mobility-related goals and spatial/urban development related goals. With each main theme having a couple of 'core values' to support them. These 12 values together make up how the city and its region would like to develop/grow in the future. Autonomous vehicles should thus, ideally, also work to enhance these values/it should be prevented that they will hurt these values.

2 Bevolkingsprognose Noord-Holland 2019-2040. An estimated 216.000 people will move to Amsterdam within the coming twenty years.
3 MRA Agenda. Between now and 2040, 250.000 new dwellings will need to be built, of which 100.000 in or around Amsterdam.
4 Actualisatie Vraagraming MRA 2019: 138.000 new jobs are expected between now and 2040.

Structuurvisie Amsterdam 2040

"Autonomous vehicles can play a role in the improvement of public transport and its last mile component. They should also support the realisation of other goals such as the energy transition, the improvement of blue and green spaces and the densification of the existing city."

Mobiliteitsaanpak Amsterdam 2030

"We need to create room for the growth of traffic in the city and protect the quality of the public space, whilst finding a way to deal with decreasing financial recources. Cost-efficient choices by the municipality and mobility innovations by market are needed."

Amsterdam Schone Lucht 2030

"We need to create room for the growth of traffic in the city and protect the quality of the public space, whilst finding a way to deal with decreasing financial recources. Cost-efficient choices by the municipality and mobility innovations by market are needed."

Havenstad Ontwikkelstrategie

"A major modal shift is absolutely neccessary to make this project work. We will need to invest in existing public transport, as well as in a fine-mazed infrastructure network for cyclists and pedestrians. Car-restraining urban design will be needed too. Additionaly, we count on new mobility services to help in the transition away from the car."

	Core Values Amsterdam	Elaboration
Socio-economic	SOCIAL EQUITY & INCLUSIVENESS	Improve inclusive mobility options; make existing systems more accessbile, affordable and reliable
	HEALTHY - ACTIVE SOCIETY	Incentivize active lifestyles and limit excessive traffic. Walking and biking should remain attractive options in the city
	ECONOMIC PROSPERITY	Ensure important districts, mainports and hubs remain well accessible - provide high frequency PT and good road connections
	SOVEREIGNITY & PARTICIPATION	Involve citizens in the city's future: encourage local entrepreneurship and support bottom-up initiatives
Mobility	RESILIENT & DIVERSE MOBILITY (ECO)SYSTEM(S)	Preserve an open and innovative climate in which a diversity of actors can constantly improved and experiment
	HIGH QUALITY SERVICES AND INFRASTRUCTURES	Invest in making local and regional infrastructures (and systems) future proof (smart, AV-ready)
	TRANSPORT EFFICIENCY	Improve traffic management, reduce congestions, make smart use of data, allow for AV platoons and high frequency public transport
	TRANSPORT CONNECTIVITY	Offer digital (app/platform) and physical (HUB) integration of modalities, payment schemes, traffic information etc.
	SUSTAINABLE MOBILITY	Ensure future mobility becomes emission-free and environmental friendly
Spatial	URBAN QUALITY	Make urban quality and liveability a top priority. Protect public space and connect green/blue infrastructures
	LAND-USE SUSTAINABILITY	Preserve open space (limit urban- and infrastructural expansion), focus on densification & transformation of existing city
	TRANSIT ORIENTED DEVELOPMENT	Develop mixed use, transit-oriented, car-restraining urban areas, use new mobility innovations in line with these goals
	PEOPLE ORIENTED DEVELOPMENT	Values of people should go before those of traffic (in the city). Focus on walkability, bikeability and liveability

However, in reality the municipality and the region will need to work closely together with/rely on a variety of different actors from the market that are involved in developing (for) these autonomous vehicles. In an ideal world, these private actors would, to some extend, incorporate the same 'core values' in their visions. To which extend is this the case? And how do municipality/region conflict with the market regaring their AV visions.

A quick stakeholder analysis helps to get a better understanding of this. To make matters clear, the analysis has divided the 'autonomous vehicle market' into four distinct groups of actors; the 'local mobility providers', the 'public transport providers', the 'car industry' and the 'mobility service providers' (see figure on the right)

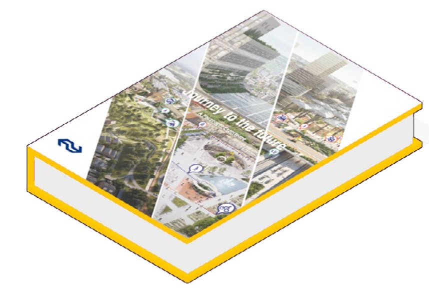
The first group, the 'local mobility' providers, consists of the GVB (the transport provider of Amsterdam) and local intiatives, startups (Smart City Platform, Smart Mobility Platform), which work closely together with local knowledge institues (AMS, de Waag Society) and local authorities; municipality and region. This is thus a collection of actors both public-private, and fully private market groups. We take the MRA-Agenda Smart Mobility as the lead example of the 'local vision', which is made for the AMA and Amsterdam, in collaboration witih the local authorities, Vervoerregio Amsterdam, province North Holland, the AMS Insitute, Economic Board of Amsterdam and some local private actors.

The second group, the 'public transport providers' consists of natoinal transport provider NS and Prorail (public-private and fully private). Which have a close relation to the national government. As a lead example we take the Journey of the Future document by NS, Prorail, Bureau Spoorbouwmeester and Mecanoo architecten. It provides a good overview of their vision for mobility, including the potential role of autonomous vehicles, improvementes in the last-mile, and developments around stations.

The third group, the 'car industry', consists of car manufacturers. Private actors thus, such as Mercedes, Ford, Audi, Honda, etc, that are putting more and more effort in development of autonomous cars. Most these companies remain their focus on private ownership and individual rides, and feeding into the 'car culture'. Also in the City of Tomorrow document by Ford Foundation, which is taken as the lead

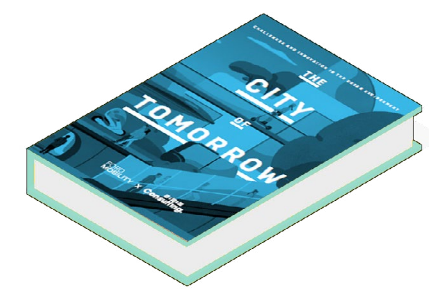
MRA Agenda Smart Mobility, Platform Smart Mobility

The MRA Agenda seeks to bring together local providers such as the GVB and other local intiatives (many coming from the Smart City platform) under a platform monitored by the city. There should be room for local entrepreneurs and citizen participation in this 'bottom-up' process as well. Goals such as liveability, diversity of mobility solutions and inclusivity are said to be central in any technological development/experiment.



Journey of the Future, NS

The journey of the future takes the reader through a series of door-to-door journeys using the public transport system of the future. We encounter autonomous trains, selfdriving last-mile modalities, new forms of micromobility, and ideas about the hierarchy of stations and accompanying transit oriented developments. Increasing the capacity of PT, becoming more sustainable, improving connectivity and integration and TOD are core values.



The City of Tomorrow, Ford Foundation

Ford states there are four major transitions that will need to happen to get to the City of Tomorrow. All mobility needs to become electric/emission-less, new modes should improve the last-mile in cities, ridesharing should be the norm in cities, and the entire car-fleet should be converted to smart and selfdriving cars. The vision admits there is a limited role for selfdriving cars inside the city (though other forms of private transport are suggested, e.g. SAV shuttles), but still sees a large role for 'smart and selfdriven cars' outside of it - see 'the Suburb of the Future' by Alan Berger

Sidewalk Mobility Plan, Sidewalk Labs (Alphabet)

The vision of Sidewalk Labs for its Sidewalk Toronto project is an ambitious plan presenting the Silicon Valley take on 'future urbanism and mobility'. It is full of the latest IT technologies, including the self-driving pods (which comes in the shapes of a pod and shuttles, individual and shared), adjustable curbs and smart pavements. The AV is presented as an integral part of the daily life, and is envisaged to mix with traffic at all speeds/all street types. A bit like Barcelona's Superblocks, but then with AVs everywhere.

- Market Group 1: Local Mobility Providers (e.g. GVB, local companies)
- Market Group 2: Public Transport Providers (e.g. NS, Prorail)
- Market Group 3: Car Industry (e.g. Ford, GM, Mercedes)
- Market Group 4: Private Service Providers (e.g. Google, Uber, Lyft)

example: a good example of how the car industry aims to stay relevant/dominant during the transition towards self driving cars.

The fourth group, the 'service providers' consists of relatively new actors in the mobility market/actors that see in autonomous vehicles the ideal opportunity to join this market/make a profit. Think of actors that come in with new 'services', Mobility as a Service concepts, etc. Google, Uber, Apple and Baidu. Mostly tech companies that are active in quite a wide range of sectors besides mobility. These actors are not only able to provide a fleet (the vehicles) but often also the neccessary additional 'service'; the platform and softwarre through which booking/planning/information can be done, as well as the whole data management part. From this group we take the Sidewalk Mobility Plan by Google/Sidewalk Labs, which is a plan for a stae of the art development in Toronto, full of Waymo-pods and additional urban design suggestions.

That these different groups and their visions are not always in line with the core values/vision as set out by Amsterdam becomes clear when we put the four different groups against the cities core values (see figure). What becomes clear at a glance is that especially the visions of the car industry and the mobility service providers show the potential to be large threats to the core values of Amsterdam and the AMA. It can thus be concluded that Amsterdam should prevent carelessly following these private visions or blindly adopting the decisions that these kind of companies propose/try to convince us of, as that could lead to a future in which important public values are damaged.

Amsterdam will need these same actors, however, in order to successfully develop any mobility system. And it is not as if there is no possibility to do so; many of the actors have undecided factors that can still be tipped in the right way; meaning, under the right steering even the car industry and the service providers can turn into actors supportive of most core values.

1.1.3 Reactive decision-making

This brings us to the problem of who leads the decision-making. Is it the public sector (national government, municipality), or is it the market that sets out the lines?

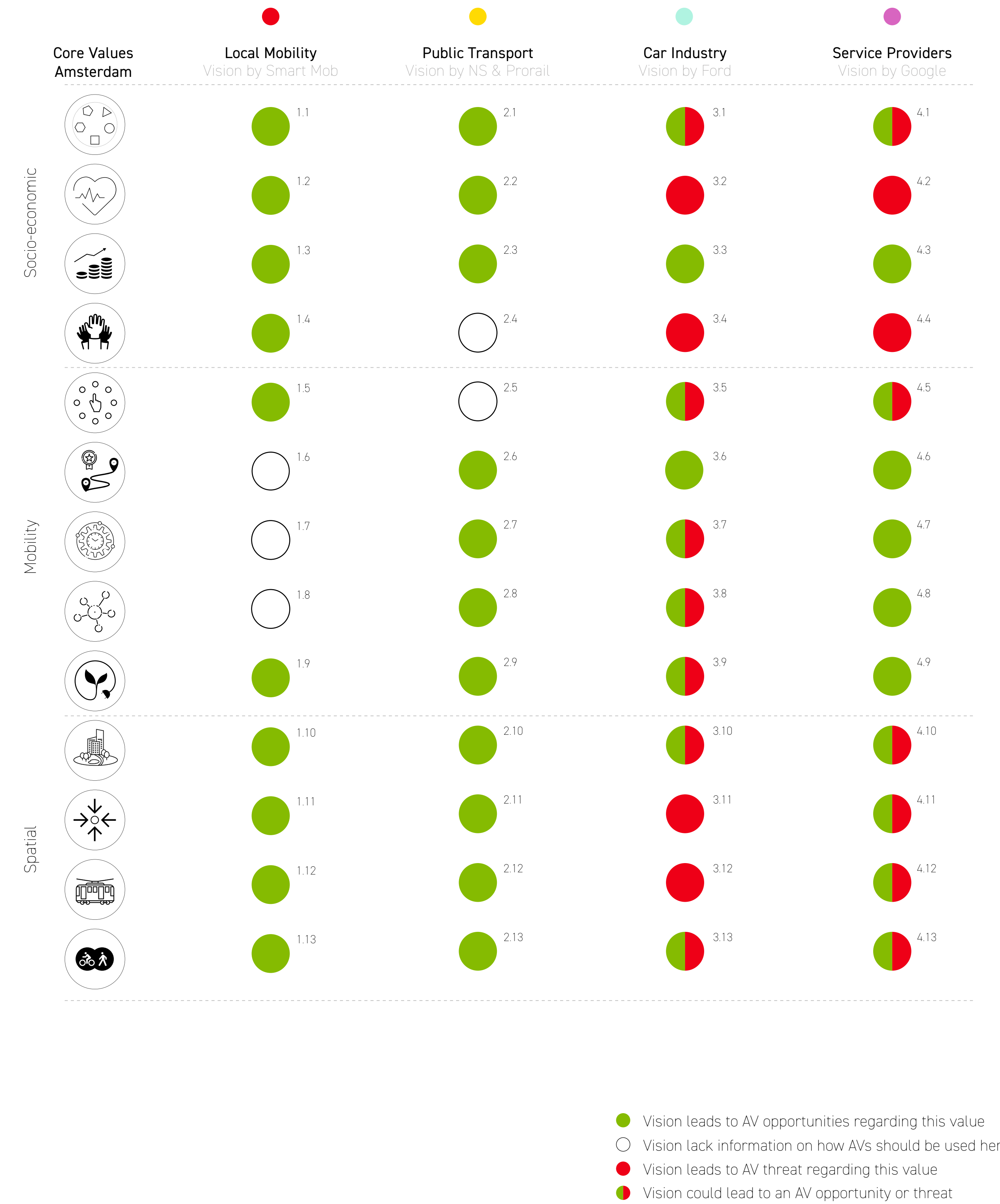


figure 1. The core values of Amsterdam in relation to different market groups.

This very question is in fact illustrative of a problematic trend. Instead of stepping up and steering actors like the car companies through proactive decision-making, the public sector is increasingly letting the market decide on important questions (Morozov and Bria, 2018). Questions such as (give examples here), that used to be made by a public authority are now left to the private sector (Picon, 2010, Sennett, 2018) In other cases, the public sector makes no choices at all, allowing the market to experiment, only to then intervene afterwards (Dotson, 2015). In its fear of making the 'wrong' direction/or becasue they are convinced even to let go of initiative, it becomes reactive, passive and running behind the facts (Dotson, 2015).

It can be stated that in the light of the aforementioned formative phase/critical juncture of the autonomous vehicles, which implicits a limited timeframe to get the right decisions in place, we have a true urgency for getting out of this passive and reactive stance. What would greatly help would be an overview of important decisions to make to ensure a positive future regaring autonomous vehicles. We need to, to borrow from socio-techincal literature once more, an understanding of so-called 'no-regret' decisions that help to 'lock-in' a positive future that is in line with the core values, irregardless of any unexpected/ uncertainties along the way (KIM, 2017).

1.2 Problem Statement

The reactive/passive stance and lack of decision-making, in times where making no decisions is practically making the wrong decision, is the larger problem. A problem which can lead to the wrong kind of implementation of autonomous vehicles/the wrong systems (of AVs) to lock in and determine the future. However, this problem is, as we have discussed partly mainly the result of a more fundamental problem; the lack of understanding which choices to make, which is a direct result of a lack of a diversity of 'future visions'/'a lack of 'knowing how things can/should be different'.

This 'fundamental' poblem is partly caused by the inadequence/unsuitable of conventional foresight and scenario methods to deal with ucertain futures/revolutionary technologies such as the autonomous vehicle (Elzen et al., 2002, Wangel and Gustafsson, 2011, Townsend, 2014). For a large part, we still rely on a range of methods developed in the second half of the 20th century, that have been developed to

figure 2. In absence of our own compelling foresight methods, it are corporate ones which are dominating the future debate. Google/Sidewalk Labs are one of the best at telling (and visualizing) appealing future stories - just look at this impression of their tech-paradise Sidewalk Toronto. Persuasive stories like these, complete with visuals, are not to be found in any of the municipal documents. Drawing by: Andrew Edwards (Sidewalk Labs), Vision, 2017. Source: Sidewalk Toronto

formalise and structure anticipation efforts. Such as 'trend extrapolation and curve fitting, computer modelling, cross impact analysis, Delphi methods, scenarios and foresight exercises.' (Elzen et al., 2002). These methods have some fundamental problems that make them unsuitable for providing the public sector with the information they need in this phase, however.

(1) Too much attention for quantitative, reductionist methods, and a lack of attention to qualitative aspects. (Coates 1989, 17). Under this we can put the technocratic scenarios by companies, consultancies, traffic planners (Townsend, 2014). Little room for social-aspects, or social-technological cross-influence/co-evolution.
(2) Forecasting methods assumed that the future would be too much be like the past. Forecasts were too much based on extrapolations and the assumption of incremental change. There was too little attention for discontinuity and radical change. (Sapio 1995, 114). Ruptural change, as may happen with autonomous vehicle, happens far from linear, but in a far more exponential way, as did the private automobile (Elzen et al., 2002, Urry, 2016).
(3) Forecasting methods focused too narrowly on specific topics, without looking at the broader system. (Coates et al. 1994, 24). Many use only two-axis/two parameters method (as pioneered by Shell in 1970s) which is limited and quickly renderes obsolete especially in situations with large uncertanties (PBL, 2019, Townsend, 2014).
(4) Scenarios are failing to provide insights in decision-making processes/importance of early decisions/show processes of lock-in (Elzen et al., 2002, Urry, 2016).

1.3 Story-driven scenarios to gain insight in decisions

The hypothesis is that by using a different, more story-driven, qualitative, socio-techincal scenario method, it will be easier for the public sector to derive/come to a list of important no-regret decisions. The idea is that this, in its turn, will help the public sector to return to a position of proactive decision-making where it matters,

1.4 Scientific/Design/Practice Gap

Within the body of available foresight and scenario methods we thus start searching for a specific type of story-driven/socio-economic variations that are applicable to our situation/goal: exploring no-regret choices in future scenarios regarding autonomous vehicles and urban development. Within the extensive plethora of scenario methods, there are two directions/types which are worth considering./potentially helpful.

Firstly, there is socio-technical based scenarios (such as STSc, a method originally developed by Geels). Part from the sociologists/policy-transition/corner (Sheila Jasanoff, Frank Geels, John Urry). These type of methods give a good insight into socio-technical dynamics, processes such as lock-ins, ciritcal junctures, path dependency, that are playing a large role on decision-making during transitions towards new technological paradigms (Elzen et al, 2002, Jasanoff and Kim, 2015). This makes them suitable for applying them to our situatoin regarding autonomous vehicles. However, they are very policy-oriented. Limited attention is given to the physical/spatial consequences/implication of the scenarios (socio-technical say it too, there is no real 'spatial' component). The basis/the dynamics/theory is thus very interesting, suitable, but the spatial component, as well as a visual/visualising component is not present here. (addressing point 1,2,4)

Secondly, there are more storydriven scenarios, such as the ones by Anthony Townsend and PBL, both on potential autonomous vehicle futures, do contain a bit more of these spatial components and visualisations (Townsend, 2014, PBL, 2019). They also show the great potential of taking worldviews as a starting point (addressing point 3, 1). However, in these methods the theoretical underlay/support that was included in methods such as the STSc method is missing; they might be telling engaging stories, but lack to give insight in how processes of lock-in and path dependency work.

A point that can be made about both types of foresight methods is that they miss a urbanism/urban fabrics component, whereas an urban design and spatial planning perspective, exploring autonomous vehicles as a spatial project, would be an important addition to the discourse (Ionescu et al., 2019). There is a minimal use of maps/sections/drawings, and if they are present, only at a very conceptual level. None of the methods are really grounded in the level of the city either - they provide more of a general idea about implications nationwide, or are not tied to any context whatsoever. Showing what the implications/scenarios can meet for a concrete city and its region, such as amsterdam, from a urbanist perspective (maps/sections/impressions) is something that has not been done yet. Whereas creating/envisaging the impact for such a specific case could add to the richness of the scenario/add new insights.

The goal is thus to make a combination of the two method directions and add the urbanism/spatial/context component to it. Perhaps, elements of the first method can play an important role in providing the needed theory, the second can play an important role in providing the starting point/way of writing and the third part can serve the purpose of adding visualsiation/immersion and location specific insights. To use an overarching term for this method to be, I propose the use of 'storytelling-scenario' method.

1.5 Research Questions/Research Aim

- MRQ "How can a storytelling-scenario method provide Amsterdam with important no-regret decisions regarding autonomous vehicles."

- RSQ1: *"How is storytelling used for planning, and is it suitable for envisaging uncertain futures?"*
- RSQ2: *"How can storytelling be turned into a method for making alternative stories on autonomous vehicles?"*
- RSQ3: "What are potential future stories regarding autonomous vehicles in Amsterdam and the AMA?"
- RSQ4: "How do the stories relate to the core values of Amsterdam?"
- RSQ5: "What are the key recommendations/no-regret decisions that we can derive from these stories?"

1.6 Methodology

RSQ1: *"How is storytelling used for planning, and is it suitable for envisaging uncertain futures?"*

This first research sub-question is essentially a two-in-one; the first part of the question is meant to explore the usage of storytelling as a way to think about futures and shape future worlds. Through a literature review on the usage of storytelling in urban planning, and through the examination of two case studies, stories by IBM and Google, this first part is answered. The second part is answered through a search for other story-driven scenario methods.

methods: literature review, case studies

RSQ2: *"How can storytelling be turned into a method for making alternative stories on autonomous vehicles?"*

This research sub-question asks 'how' the method could be built. Through using different theories, analysing different scenario- and foresight methods and materializing this knowlegde in 'methodological steps' the method is built. It is essentially an iterative process of 'designing a method', with a cycle of theory, testing, analyzing, and refining.

method: literature review, 'design'

RSQ3: "What are potential future stories regarding autonomous vehicles in Amsterdam and the AMA?"

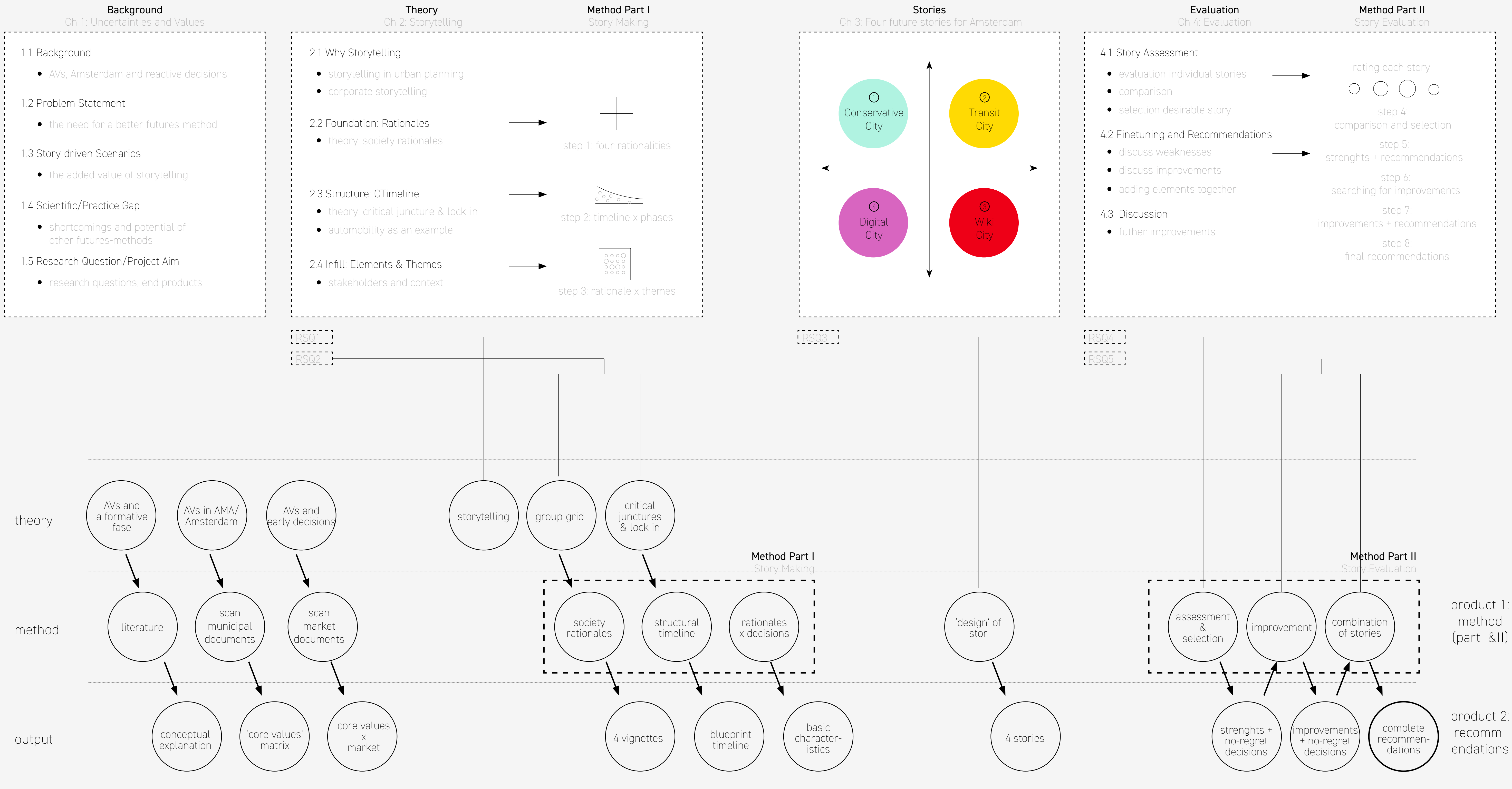
This third research sub-questions is all about the writing of the future stories based upon the method. Writing the stories is also something more of a design than conventional 'scenario-construction', as it involves a more creative process of writing/constructing a fictional/speculative future Amsterdam/AMA.

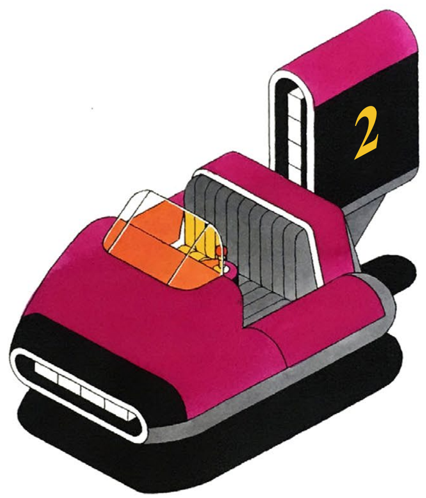
method: design/scenario-construction

RSQ4: "How do the stories relate to the core values of Amsterdam?"
and
RSQ5: "What are the key recommendations/no-regret decisions that we can derive from these stories?"

method: evaluation

1.7 THESIS OUTLINE





CHAPTER II:

IMPORTANCY OF FUTURE STORIES

(and how to make them)

theory & method

CHAPTER 2 | IMPORTANCE OF FUTURE STORIES
(*AND HOW TO MAKE THEM*)

As stated in the previous chapter, it is our goal to find the so-called no-regret choices through writing future stories on autonomous vehicles in Amsterdam. But before we can start writing these stories, we will need some kind of a method that will provide us with a basic structure, a step-by-step guide so to speak. One that will help us to write the stories in a consistent manner, so they can become comparable and form the basis for a proper evaluation in the end. A "storytelling method" is what we are looking to create, thus, which we will try to built in this chapter.

Therefore, this second chapter has the purpose to explain *why* and show *how* this method is to be built. This brings us to the following two research sub-questions that will be addressed: *"Why is future storytelling used by planners?"* and *"How can (this) storytelling be turned into a method for making alternative stories on autonomous vehicles?"*

These two questions mean we essentially have two different parts in one chapter. A first one which has the purpose to answer the 'why' questions of storytelling, such as 'why is it being used?', and 'why should we use it ourselves?'. And a second part, which aims to address the 'how' questions of storytelling; ' how do we write useful future stories' and 'how can storytelling be turned into a storytelling method?' A bit of theoretical explanation and a bit of applying.

This translates into the following structure as can be seen in the overview on the right. In 2.1, we will address the 'why' questions by doing a short literature review on the relation between storytelling and urban planning, followed by a brief discussion of the potential use and misuse of storytelling to create ideas about future scenarios. In 2.2, 2.3 and 2.4, the 'how' question is addressed. By making use of different theories three 'methodological steps' are built, which together constitute the first part of the methodology (which contains all the steps needed to get into the writing part of the future stories).

STRUCTURE OF CHAPTER

2.1 Why Storytelling

This first part will focus primarily on the 'why' of storytelling, as we try to answer the first research sub-question *"Why is future storytelling used by planners?"*. By answering this question, we can get an idea of why storytelling would be a useful method for our own research.

We start with an introduction on storytelling, in which we briefly highlight the relation between storytelling and urban planning. Then we discuss the different actors and how they make use of storytelling for different purposes; from the urban planner to the IT corporations. We conclude with an argument on why storytelling matters, why there is an urgency to diversify and balance current stories on autonomous vehicles, and why it is worth to built a method around it.

Storytelling: a universal tool for planners, companies and citizens

Since the 1990s, there has been wide recognition within planning theory of the role of storytelling (Van Hulst, 2012 as cited in Soderstrom et al., 2014). Stories about the future are then also often used by politicians, policy-makers and private actors to influence decision-making regarding urban planning (Verheul, 2012). Without persuasive future stories about the city that are at the basis of large investments/large urban planning projects. Think for example about how city officials make use of events like the Olympic Games to give shape to a story that can be used to gather actors and investments to push through radical urban developments (Rio de Janeiro). Or think of local counselors making use of ambitious future stories about their city to realise their desired 'prestige projects' (M van Marnix). (Verheul, 2012). Future stories are thus found everywhere, in large plans at a national level, and in small plans for a neighbourhood center (Verheul calls this macro and micro-narratives). For Throgmorton (1996, 2003), stories are then also the very stuff of planning, which, fundamentally, is persuasive and constitutive storytelling about the future.

We also see many future stories being produced around the autonomous vehicle, most of which are being told by the developers of these vehicles themselves. Embedding autonomous vehicles in appealing future stories about prosperous societies and utopian cities, such as the ones told by market leaders such as Ford and Google, is then also a useful way for them to legitimize their product. Surely, if one wishes to live in that beautiful, lush and liveable future city as envisioned, getting a self-driving car is mandatory. The product plays an integral role in a much larger story which helps to sell it. (which is not too surprising)

What *is* remarkable to notice, is that the rise of this kind of 'corporate storytelling' happens simultaneously with the decrease of stories told by the traditional planner (Soderstrom, 2014). It seems as if the tables have been turned. Where, in the era of centralised planning the private sector had to follow the planner's top-down vision (as materialized in the nota ruimtelijke ordening, for example), it now looks like our national government and municipalities are, by a lack of convincing stories of their own, letting themselves be persuaded by private companies to take a step back and leave the initiative to them. Thing go thus further than companies telling convincing stories to sell products - we are seeing the rise of companies to gain control over planning in general (which in the end helps to sell products, too).

The shift in who tells the stories about the future, is thus, in essence, a shift in power. Because, to use the words of Throgmorton, the one who tells the stories is in fact also the one 'who has the power to give meaning to things, to name others, to construct the character of collective identities, to shape the discussion of urban politics ' (Throgmorton, 2003, 132 as cited in Soderstrom et al., 2014).

Storytelling might thus be at the very basis of our problem as we described in the previous chapter. It is the plethora of convincing stories about autonomous vehicles on the private side, and the lack thereof at the planners' side that causes a problematic imbalance, a narrow-minded understanding of possibilities regarding the vehicle and a warped sense of what the public role could/should be (Stayton, 2015). This poses the question if there is any way to counter this shift. If there is a way recapture storytelling as planners - or, at least, a way to re-balance and diversify private and planners' stories. The following sections will continue to underpin the urgency for this re-balancing/ diversifying of stories on autonomous vehicles, and subsequent, the relevancy for providing a storytelling method that allows planners to tell different stories on autonomous vehicles. A fist start will be made by further analysing the problems of 'corporate storytelling', by looking at the stories by IBM and Google.

How technocratic, profit-driven stories have dominated the AV-debate

As stated in the previous section, we see the emergence of so-called 'corporate storytelling'; private companies making use of persuasive stories about the future in order to convince others to not only buy their products, but also to get themselves in a position of power. In this section, we take a look at two of these corporate stories to illustrate what makes these stories so convincing, but even more so, what makes them potentially dangerous.

The first case of corporate storytelling is the 'smart city story' by IBM. Or, as we could perhaps re-frame it, a story of how a "'sick city' is transformed into a 'smart city'" (through IBM's technologies).

The story is basically built up out of three parts: the city's past, present and future, and reads like a utopian story. Starting with a 'diagnosis' of a 'sick city', through a process of 'healing' and ending with a healthy and prosperous 'smart' city.

IBM starts the story by constantly emphasizing the problems and shortcomings of the contemporary city. The company argues, for example, that with 'rising urban populations, ageing infrastructures, and shrinking tax revenues today's cities demand more than traditional solutions'. The city is in other words a 'sick city' permeated by a series of pathologies. To confront them, municipalities are hampered by 'inadequate systems to serve basic needs', 'obsolete' or 'broken technologies, 'benefit frauds' and 'wasted time' (Soderstrom et al., 2014). In short, the picture is grim and cities appear close to fatal breakdown.

Then there is IBM, with its products and services. Within the story it appears as the perfect candidate to 'heal' the city. By having purposefully diagnosed the city through a 'machinic lens' in the previous part, resulting in all the cities problems being translated into the language of systems and data, the actor can now present itself as having the perfect and legitimate solutions to solve all. As a matter of fact, IBM presents itself here as the quintessential and indispensable one to take charge and make things better (Callon 1986, 180-185 as cited in Soderstrom et al.)[1].

1 Callon (1986, 180-185) writes this kind of strategy used by actors that want to become 'obligatory passage points' or unavoidable. He states that the first step is the problematization of a situation in order to become indispensable actors in that network.

That brings us to the last part, the future. Here, IBM sketches the blissful future that would be achieved if it was given control. Though the utopia it envisages is different from the traditional utopian stories. Rather than promising paradise on earth, suggesting a revolution in urban morphology such as Howard's garden city, or Wright's broadacre city, the promise of perfection is transposed from the physical to the virtual space. (Vodoz 2013 as cited in Soderstrom et al., Picon 2015) Not the city will be given a radical make-over, but the digital realm, with extreme efficiency, optimization through data, interconnectedness and automatic steering mechanisms being the promised land (Soderstrom, 2014, Picon, 2015).

What makes stories like IBMs so convincing is that is it is such a straightforward story, in which technology plays an unambiguous role of 'panacea'. Nowhere in the story do other approaches or solutions to urban problems appear, nor are they deemed necessary. The story is thus a univocal one; a very coherent and simplified story, with clear problems and a single actor with the perfect solutions to achieve the desirable future (Vodoz, 2013, 52). Additionally, the story is purposefully apolitical; for that reason, the solution this story proposes can be sold to anyone. From democratic regimes such as the Netherlands, to less democratic ones such as Syria. A bit like how Le Corbusier thought of 'functionalist urbanism as an apolitical model that could be replicated from post-colonial India to Stalinist Russia' (Soderstrom, 2014).

2.2 Foundation: Societal Rationales

After addressing the 'why' questions of storytelling, and showing the urgency and relevance of using it as a method for this project, the remainder of this chapter will focus on building this method - with the second research sub-question as its guide: *"How can storytelling be turned into a method for making alternative stories on autonomous vehicles?"*

In the coming three sections, each leading to a 'methodological step', we will discuss a bit of theory and then apply it to build a part of the storytelling method. In the upcoming section, called the Group Grid Theory, the 'society rationales' of anthropologist Mary Douglas are introduced, which will form the starting point of our future stories on autonomous vehicles.

2.2.1 Group Grid Theory

This first section revolves all around the Group Grid Theory and the society rationales that are derived from it. First, the reason for choosing the Group Grid Theory is discussed, then the theory and how it can be used are elaborated on in more detail.

To explain the reason for choosing the Group Grid Theory, a bit more information on what it is we desire, and what it is we *do not* desire to incorporate into our stories is required first.

Looking back at the corporate stories a couple of obvious pitfalls can be identified right away. They were often too technocratic, too techno-optimistic and too univocal (focused on a single actor). Moreover, they left little room for uncertainty and complexity, and had the tendency to ignore the role of society and societal change. Furthermore, the stories were often apolitical and ahistorical, they were pretty much 'contextlessness'. All these characteristics may have helped to create persuasive stories, as discussed, but are not things that we should aim to replicate in our own stories. However, also when looking at other publications on autonomous vehicles, we discover many of the same pitfalls. Many of the scenario- and assessment studies and technical forecasts, often conducted by transport experts, technologists and consultancy firms, seem to fall for the same 'technocratic' perspective (Townsend, 2014). It seems as if a majority of the work on autonomous vehicles, whether than being by companies or planners, relies primarily on quantitative, reductionist methods with a lack of attention to qualitative aspects (Elzen et al., 2002).

There are some exceptions to this however. Worth mentioning are three different publications that have been thoroughly read for this research, which each use their own 'scenario/story building method': the Socio-Technical Scenarios by Geels (Elzen et al., 2002), used to write scenarios on electric vehicle adaptation, the Alternative Futures Method by Townsend (part of which is adopted from Jim Dator) (Townsend 2014, Dator 2009), used to write speculative narratives on autonomous vehicles in the US in 2030, and the Group-Grid based scenario-stories by PBL (PBL, 2019), used to write stories on autonomous vehicles in the Netherlands in 2050.

What makes the publication of Geels and others special is that they propose a kind of scenario or story-building that is aimed specifically at exploring and envisaging (technological) transitions. A lot of attention goes out to the interaction between, and the co-evolution of technology and society, as well as the role complex systems (interconnected technologies, interconnected systems) play in this. This leads to so-called Socio-Technical Scenarios (STSc). Scenarios, thus, that purposefully add a more 'social' component to scenario-building. For our first methodological step, this STSc method will not be used. It will, however, make its appearance in the second step, where scenario timelines, phasing, as well as transitions and complexity are discussed and made.

The publication of Townsend also makes an effort to incorporate more complexity and uncertainty into the scenarios. Rather than using the two-axes method to establish the starting points of four unique scenarios, as is common in most scenarios studies, Townsend uses the 'alternative futures method' by Jim Dator. In this method, rather than picking two variables, such as, e.g. 'access of autonomous vehicles' and 'ownership of autonomous vehicles', one takes four 'archetypes' as starting points: 'growth', 'collapse', 'constraint' and 'transformation'. Archetypes that have characteristics such as 'failing of critical systems', 'disruptive technological growth' and 'emergence of sustainability regimes', which give each scenario a rich layering of social, technological, and economical trends, and helps to think from the perspective of broader 'worldviews' rather than from two small parameters. However, also this method has not been used for step one, although it greatly inspired the storytelling itself.

The method that has been chosen in the end, based on the Group Grid Theory, comes from the PBL publication called 'Scenario's voor stedelijke ontwikkeling, infrastructuur en mobiliteit'. Here, the first step of the methodology - after gathering input through conducting expert interviews and doing media- and literature reviews - is the selection of four 'society rationales', which are derived from the theory originally developed by Douglas (Douglas and Wildavsky, 1982). Her Group Grid Theory leads to rationales, essentially 'inner logics' representing different groups of society, that form the starting points from which a 'coherent complex world' can be constructed. Essentially, the rationales/inner logic is a guide for deciding how society will respond to all kinds of decisions (also the unpredictable ones) that will come on their path. By creating such a starting point, these stories are given a similar 'social' aspect to the scenarios as the STSc method by Geels, and a similar richness/complexity/ambiguity/ability to deal with unexpected events as the method by Jim Dator. Therefor, the Group Grid theory will be the basis for the first step of the methodology.

2.2.2 Method step 1: four society rationales

The group-grid theory divides four different inner-logics, also named society rationales, according to two dimensions of interaction; group and grid (Thompson 2008).

Group can best be described as the extend to which interaction happens within a group, or as the extend to which individual choices are influenced by the solidarity to the group; for example, a high group could be a community that collectively decides on what kind of vehicles they would like in their neighbourhood, or a national government which, through policies, decides what is best for the society as a whole. A low group could be a neighbourhood in which everyone chooses his or her own private vehicle without letting their choice be influenced by what others do, or a national government that does not interfere in the personal freedom (of choice) of its citizens.

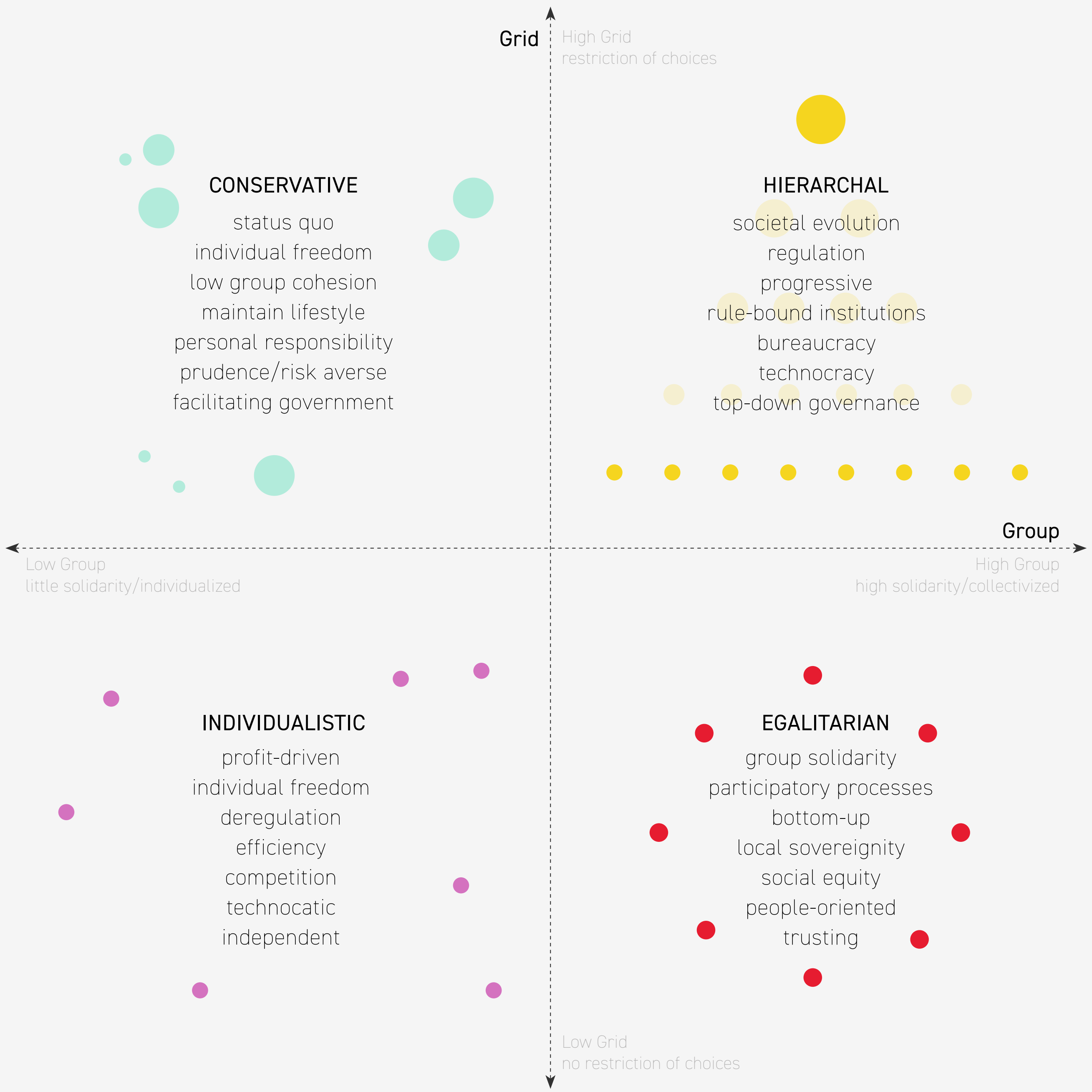
Grid can best be described as the extend to which strategies and interactions are based upon rules, or the extend to which choices of individuals are influenced by their position in society; for example, a high grid could be a national government taking control over development and operation of a top-down mobility system, whereas a low grid could be a loosely regulated free market of private autonomous vehicles and all kinds of privately offered mobility services.
Now, when combining these two variables, we get four rationales;

Hierarchy	(high grid, high group)
Individualism	(low grid, low group)
Egalitarianism	(low grid, high group)
Fatalism	(high grid, low group)

The society rationale determines, thus, for a large part what is perceived as 'desirable', 'acceptable' and 'thoughtful' within its corresponding society (Thompson 2008). It offers a consistent logic that forms the basis throughout the events and decisions that appear in the respective 'world'.

To give an example, the group-grid can be used to think of different responses to risk. In their study, Douglas & Wildavsky, figured that the 'individualism' rationality corresponded with willingness to take risks, whereas an egalitarian rationality corresponded with risk-aversion (Douglas and Wildavsky, 1982). Relating this to autonomous vehicles, this could translate into the individualists probably being be more inclined to start experimentations early, whereas the egalitarians would be more precautions and reluctant to experiment before safety is guaranteed. Another example would be the decisions regarding desired lifestyles and subsequent urban morphology; a hierarchal society is more likely to prefer top-down planning by a national government, whereas a conservative society could be seen preferring more suburban or rural lifestyles.

In the spreadsheet on the following page, the Group Grid theory is used to make the four society rationales that will be the foundation to our future stories. Next to the first diagram, which shows the rationales and characteristics as derived from Douglas (Douglas 1970) and Hartmann (Hartmann 2012) an additional step is made by turning these rationales into 'vignettes'; small 'personal profiles' to illustrate what could be a 'typical example' of the respective rationale.



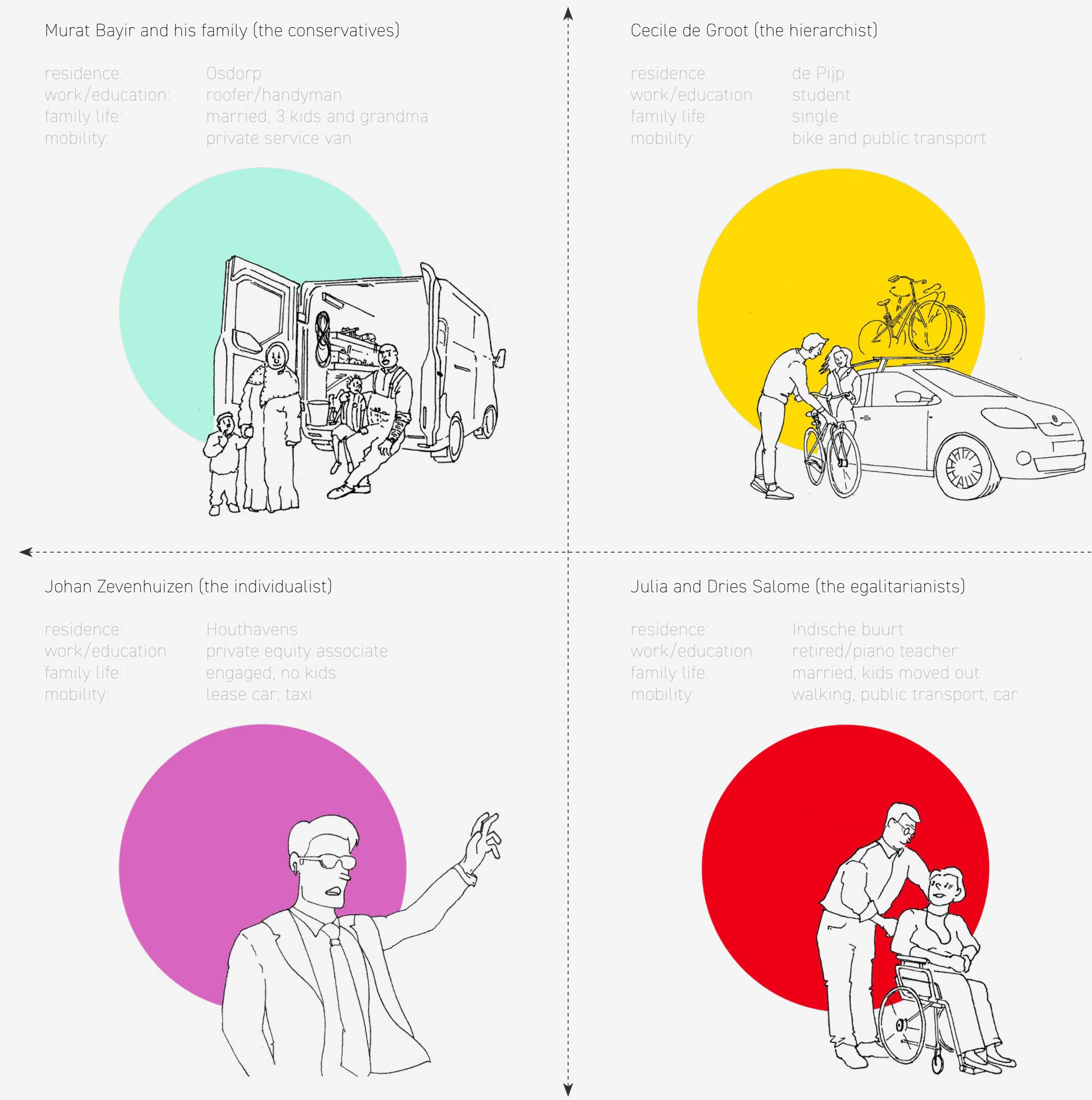


figure 5. Group Grid scheme, adopted from Douglas (Douglas 1970) and Hartmann (2012)

figure 5. Vignettes (by author), interpretation of the group grid scheme

2.3 Structure: Critical Junctures & Lock-In

By deciding on the societal rationales, we have laid down the foundation of the stories in the form of four different starting points with each their own characteristics and internal logic. In this second paragraph, we will continue by adding a structural framework on top of that foundation. In other words; this second step will provide the structure of the stories in the form of a timeline, important phases and patterns.

In order to built this structural framework, this paragraph will make use of theory on 'socio-technical systems' and 'systemic transitions'. To further explain this theory, and to show how it can be used to derive a structure from it, we will use a (brief) historical analysis of automobility (in 2.3.1 and 2.3.2). By analysing the emergence and growth of the 'system of automobility' through this specific lens, we will get a bit of an insight into where important moments of choice appear during the early stages of a new technology. Insights which are helpful for our own stories on the autonomous vehicle as they give an idea of where, when, and what kind of choices to expect at certain moments in the transition to (semi-) autonomous vehicles. In 2.3.4, this boils down to the second step of the methodology; which proposes a timeline x phasing scheme.

2.3.1 The critical juncture of the car: important early choices

We rarely question why the car is the way it is. Perhaps because questions like 'does a petrol-engine make sense?' might seem a bit weird to ask about a vehicle that, despite all the technological progress and innovation over the last decades, has managed to stay practically unchanged. If the same design has been around for so long, and spread worldwide, then surely, it must have gotten things right? Right?

Well, as this brief history analysis of the 'early days' of the car will show, there is nothing natural, or logical, about the way in which our cars, powered by petroleum and made of steel, haven taken over the planet (Urry, 2014, Urry 2016, p126). Nor does the fact that we drive around in vehicles powered by petrol have anything to do with being the 'logical' or 'best' choice out there. In fact, that we have ended up with car as we know it has a whole lot more to do with a combination of 'historical accidents', unpredictable events and seemingly innocent decisions, than common sense and logical decision-making.

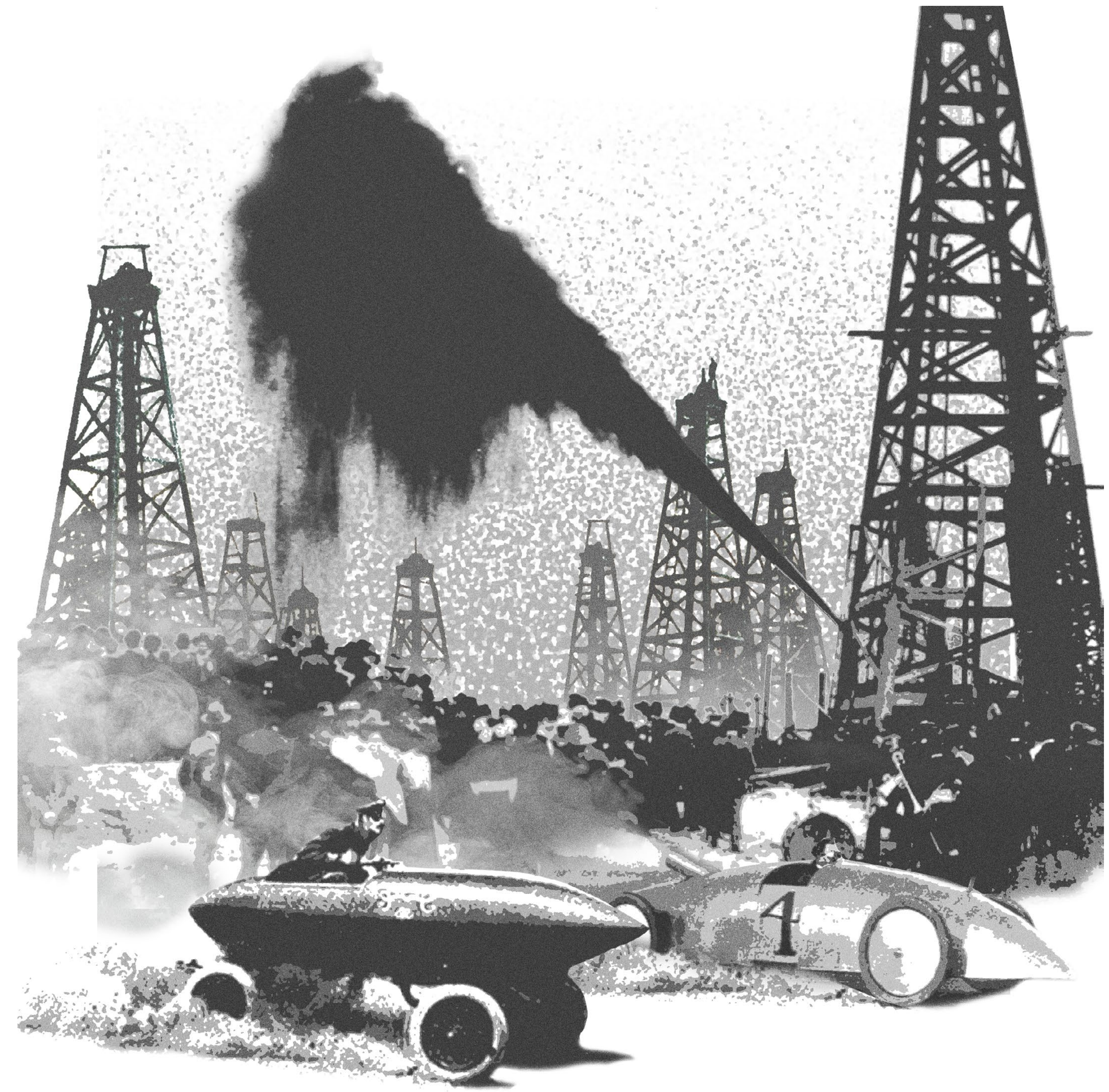


figure 3. a collage of multiple historic events that occured during the 'formative phase' of the automobile: the discovery of the first oil gusher at Spindletop, USA, the subsequent boom of the oil industry, and the experimentation with different engines in the 'speed machine races'. Image by author

Let us zoom in on this interesting and important period that were the early days of the car. A period also known as the 'critical juncture' (Urry, Geels). A period full of experimentation, variation and extremely important decisions with potentially long-lasting and irreversible implications.

Dawn of the Automotive Age 1900 - 1910

Around 1900, the car was in a similar experimental phase as we see currently with the autonomous vehicle. Much like the wide variety of forms and shapes of self-driving pods, cars and shuttles we have now, the early 'horseless carriage', as the car was still called back then, varied greatly in form and function. It was clear that a 'dominant design' was yet to be found, or decided upon by its manufacturers. The main decisions were to be made regarding the propelling technique; there were battery-powered, steam-powered and petrol-powered engines, and they all had their own strengths and weaknesses (Motavalli, 2000, Hanlon, 2017).

In order to test these engines, there were so-called 'speed machine races' being held, so the rich aristocrats to test their latest little 'toys' against each other. Resulting in dangerous situations on the paved roads of the US and Europe between 1895 and 1910, as these vehicles, that closely resembled cigarettes on wheels (see image on previous page), flew by at speeds above 100 km/h. It were these races that formed a good indication of how the different engine types compared on criteria such as durability, reliability and, obviously, top speed.

The finish results were precarious, however. Sometimes none of the vehicles would finish, most of the times only a handful. Practically all three engine types had their own pitfalls - where the electric batteries had the tendency to be unreliable, the petrol-engine was capable of exploding at any given moment, for example (Black, 2006). It was all part of the fun, and the experimentation process, so to speak; all the three technologies were in their early days still, and had the potential to be improved further. However, as time passed by, the pressure on car manufacturers (and all of those involved in inventing and building the required technologies) started to grow: in which of the three technologies should they put their time, effort and money? Especially in the anticipation that this 'horseless carriage' could become the next big thing, entrepreneurs wanted to prevent investing in the 'wrong' thing. How would they go about choosing with which technology, which engine-type, to continue?

Surprisingly enough, this decision would not be made on ground of technological qualities or the achievements of the engine/vehicle, but on two, seemingly less important aspects. The first being the discovery of the first oil gushers in the US (the first in 1904, in Spindletop, with many following shortly after), which resulted in a major drop in oil- and petrol-prices. The second being the emergence of a 'tipping point', which had to do with the phenomenon of 'path-dependency' (Sorensen, 2015).

Let me explain that a little further. What happened what that the low petrol-prices had tipped the odds slightly in favour of the petrol-car. However, this alone was not enough to convince the whole industry to make the shift to petrol (for context, Thomas Edison was still busy improving the battery-powered car, and up until this point, it was good for 30 percent of the car fleet in the US). It did, however, got some manufacturers to make the decision in favour of the petrol-car, which got a little momentum going. After person one had chosen for petrol, it was more appealing for person two to do the same, as they could share knowledge, and perhaps also research costs. For person three the same principle of 'economies of scale' played a role in his decision for the petrol-car, perhaps more so than if the petrol-engine performed better than the alternatives. For person four, five, six...and so on, the advantage of joining the larger group started to outweigh the other criteria even more, turning a seemingly 'free-choice' into a largely predetermined one. Or, to paraphrase the words of Paul David; 'each stochastic decision in favor of the [petrol-car] would raise the probability that the next selector would favor the [petrol-car] as well' (David, 1985) In other words; choices became predetermined by previous choices, and a 'tipping point' in favor of the petrol car was reached quickly (Dennis and Urry, 2009, Urry, 2014, Urry 2016).

It was thus in fact far from a completely rational choice made by car manufacturers to continue with the 'best' technology available. It were instead a series of 'historical accidents', such as the oil gusher in the US, that had tipped the odds only slightly, but enough, towards the petrol-engine to get a small momentum started. And from there, it was a whole different mechanism taking over, which had nothing to do with 'free' or 'logical' decision-making, and more with 'market-thinking'.

This story, by the way, is also a strong argument against an often used claim or saying by technocrats/companies that technology best 'benefits humanity if it remains nearly unregulated', as one of their foundational beliefs is that in a completely free market the best technology should always come to dominate. As this story shows, this is in fact far from the reality - which thus forms an argument for intervening in this experimental process to, at least, prevent an 'undesirable' technology from becoming the next big thing.

Also, and especially, now. The autonomous vehicle is in a comparable stage - and again, we hear the claim that tech companies should best be left to experiment and figure out 'the best solution'. Whereas in reality it is more important than ever to get involved in this experimental progress to prevent repeating the 'petrol-car' situation.

Ford Model T and the democratization of the car 1910 - 1920

Where in the first ten years of the new century the petrol-car started getting some momentum, it was in the decade that followed that the 'future of petrol-cars' was truly starting to become 'locked-in'. With the arrival of the Ford Model T in 1909, of which fifteen million would be sold by 1929, it became clear that cars powered by petrol-engines where the next big thing.

The success of the Ford Model T, and thus largely the success of the petrol-car, can be partly explained by two important innovations introduced by Henry Ford. The first being the assembly line. This new way of producing, introduced in 1913, essentially made employees into parts of a highly efficient production machine, which greatly helped to reduce the production cost and time. The Model T, which had cost around $550 in 1912, therefore only cost $260 by the mid '20s (Georgano 2000). The second 'innovation' was the increase of workers wages. Due to the high turnover rates of his employees, likely a consequence of the monotonous work they had to do, Ford saw himself forced to increase the wages of his workers. Besides convincing workers to stay working at Ford, this had another effect, however. By increasing the wages, the workers of Ford became able to afford one of the Model T's themselves. The working class was thus able to afford a private car, which was something truly revolutionary - the car was becoming *democratized*. It was illustrative of a period of unprecedented economic prosperity the United States was going through, which saw living standards improving for many, and subsequently the rise of the consumer economy.

The car and the city: make way for the future 1920 - 1930

In the following decade, the millions of new car-owners would start demanding more space for their vehicles and their new lifestyles made possible by the car. Others had to make way for the technology that was becoming synonymous with 'the future'; from pedestrians to cyclists and from streetcars to trains - and the city had to accommodate for it. The decade would be characterized by the private car aggressively claiming space and exerting dominance over other forms of transport. Meanwhile, decision-making/standing up to the car became increasingly difficult with the emergence of a powerful car-lobby, and with citizens becoming attached to their new vehicle and an unprecedented sense of freedom (Urry 2014).

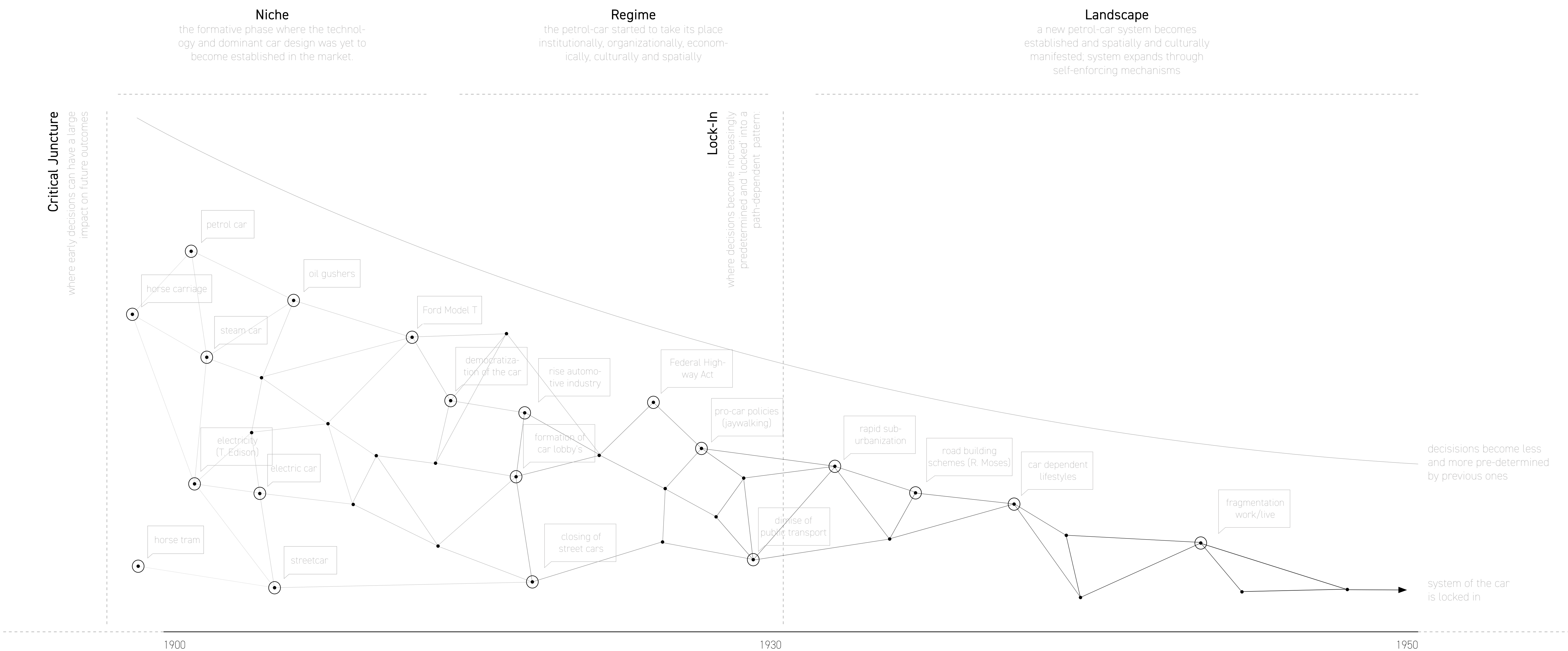
A strong example of how decision-making became increasingly harder/steered by the pro-car sentiment is the 'invention' of jaywalking. In 1928, the Model Municipal Traffic Ordinance law was made, in response to the drastic increase in car-related casualties (Norton 2007, Norton, 2008, 11). Something had to happen, as cars were carelessly blasting through the cities' streets claiming the lives of many pedestrians, including children, that were used to be able to use the streets as a public space. However, instead of proposing speed limits or other safety measures that would keep the car under control, the law instead turned to the pedestrians and blamed *them* for the casualties. The surface became 'regimented into crosswalks, where pedestrians were legally protected' and other parts of the road, which became the sole domain of the automobile (Stayton, 2015, 108). Under support of the American Automobile Association, national safety campaigns were launched at schools - and elsewhere - to teach parents and their children to stay of the streets, and to stick to the sidewalk (Wollen and Kerr, 2002, Stayton, 2011, 108). The message was clear; no one should stay in the way of the future!

2.3.2 The lock-in of the car system (path-dependency)

Whilst the pre-war city was struggling with the arrival of the car, the new post-war expansions of American cities would be carefully planned with the car in mind. Most of these suburbs started to be build as a result of the National Housing Act of 1934, which was part of the New Deal, a program aimed to recover and reform after the Great Depression which had crushed the American housing market in '29. It became a true housing boom, with people being stimulated to buy a new house, helped by the Federal Housing Agency, outside of the existing city. The lay-out for these suburbs, inspired by English garden cities, was originally designed with pleasant, quiet pedestrian routes and car-friendly roads in mind (see: Radburn, New Jersey, 1929). But it did not take long before this balanced design was tipped in the favour of the car, partly due to the leading FHA's 'Planning Profitable Neighbourhoods' document, which ranked suburbs according to their characteristics. Suburbs that focused more on the car were given higher ratings and were labeled as 'good' and 'desirable neighbourhoods', whereas designing for pedestrians was thought to be of less importance for a good rating. The urban planning of these neighbourhoods became thus more and more car-oriented, as developers could leave out pedestrian-oriented design without consequences, to a point where the automobile was all they paid attention to (Ross, 2014).

This meant that those who lived in a suburb were practically obliged to own a car in order to get around. This was further stimulated by car-oriented land-use planning and the resulting unbundeling of the urban environment into 'fragmented territorialities' (Rogers 1997, 35 as cited in Urry, 2016, 128). Distances increased between housing and other functions, such as town centers, business districts, leisure sites and urban amenities. If you add to that the fact that in between most of these districts public transport services were largely lacking, it becomes apparent that people were starting to be coerced into a car-dependent lifestyle. A lifestyle of longer and more complex daily movement patterns. Simply walking to the nearest grocery was no longer an option; the car had to be taken for even the most mundane, little trip.

figure 4. The enormous popularity of the car made urban planners rethink the way cities had to be built. Plans, such as the renowned Algemeen Uitbreidingsplan for Amsterdam by van Eesteren ('34), had become outdated - a new, more modern and car-oriented planning was thought neccessary to keep up with the rapid growth of automobility. Image by author.



Examples
Some illustrative inventions, visionairy projects, built projects, publications and more

figure 5. The emergence and expansion of the system of the car conceptualized according to 'socio-techincal dynamics', such as 'critical juncture', 'lock-in', 'path-dependency' and levels of innovation. At the bottom, a selection of visionary and built projects and publications are shown to give an indication of how the car started shaping planners' ideas of the city. made by author.

2.3.3 Method Step 2: a 'structure, timeline and decision'-scheme

The historical analysis of the transition towards the system of automobility has given us a bit of insight into how a transition towards autonomous vehicles might unfold. Two phases were highlighted, a phase of openness and experimentation, called the critical juncture, and a phase of systemic expansion and path-dependent choices, called the lock-in. Although these phases do not have a strict timeframe, it became clear that they both had some obvious differences. Especially the type of decisions/decision-moments differed: we saw, for example, that most 'technological' choices were made in the early formative stages of the car, whereas later on, more 'spatial' choices had to be made. We also saw that the early choices were made in a relatively 'free' manner, where choices later on where largely predetermined by previous choices.

A way to operationalize this information is to turn it into a structural- and logical framework that will support the writing of the future narratives on autonomous vehicles. The structural framework being the timeline, the phasing, the critical juncture and the lock-in - moments in time that give a certain order to how things unfold/a certain explanation for why certain decisions appear at certain moments. And the logical framework being the underlying processes/phenomenon at work, such as the 'tipping point' and 'path-dependency'. Intangible, but with a large impact on how decisions are made.

The result of this process can be found on the following spreadsheet; a schematic representation of the lessons we drew from the analysis of the car system turned into a structural- and logical framework for our future stories on autonomous vehicles.

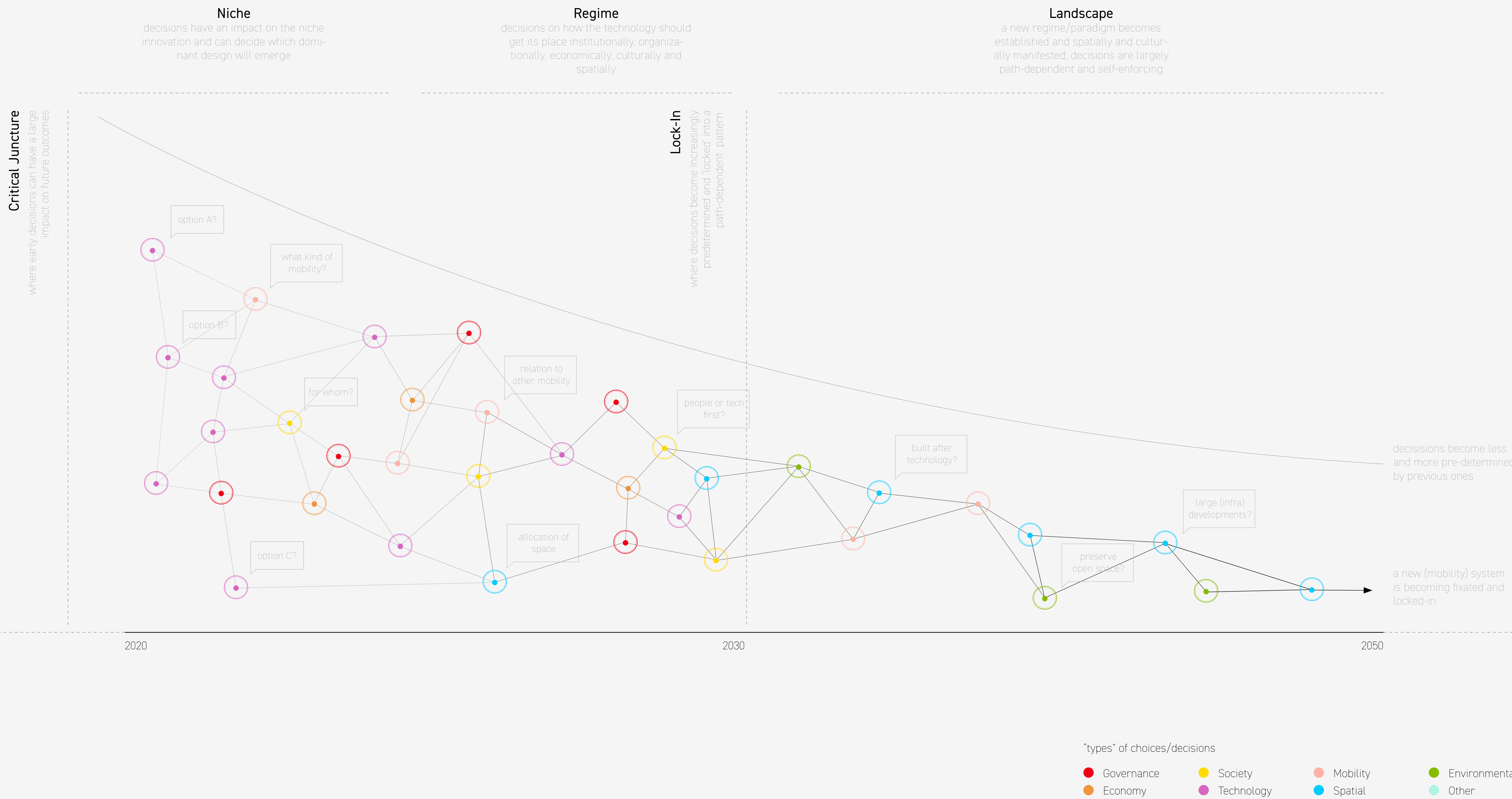
On the x-axis, there is the timeframe/timeline, stretching from now (2020) to 2050. A period of thirty years, which should be long enough to include the full 'systemic transition', which is what we want to focus on, and short enough to keep the end-point within the range of the realistic and understandable. After all, it was a period of roughly 30 years also, in which American cities 're-organized their streets around the capabilities and needs of the automobile' whilst the constructing the Interstate Highway system and new car-oriented suburbs (Townsend 2014).

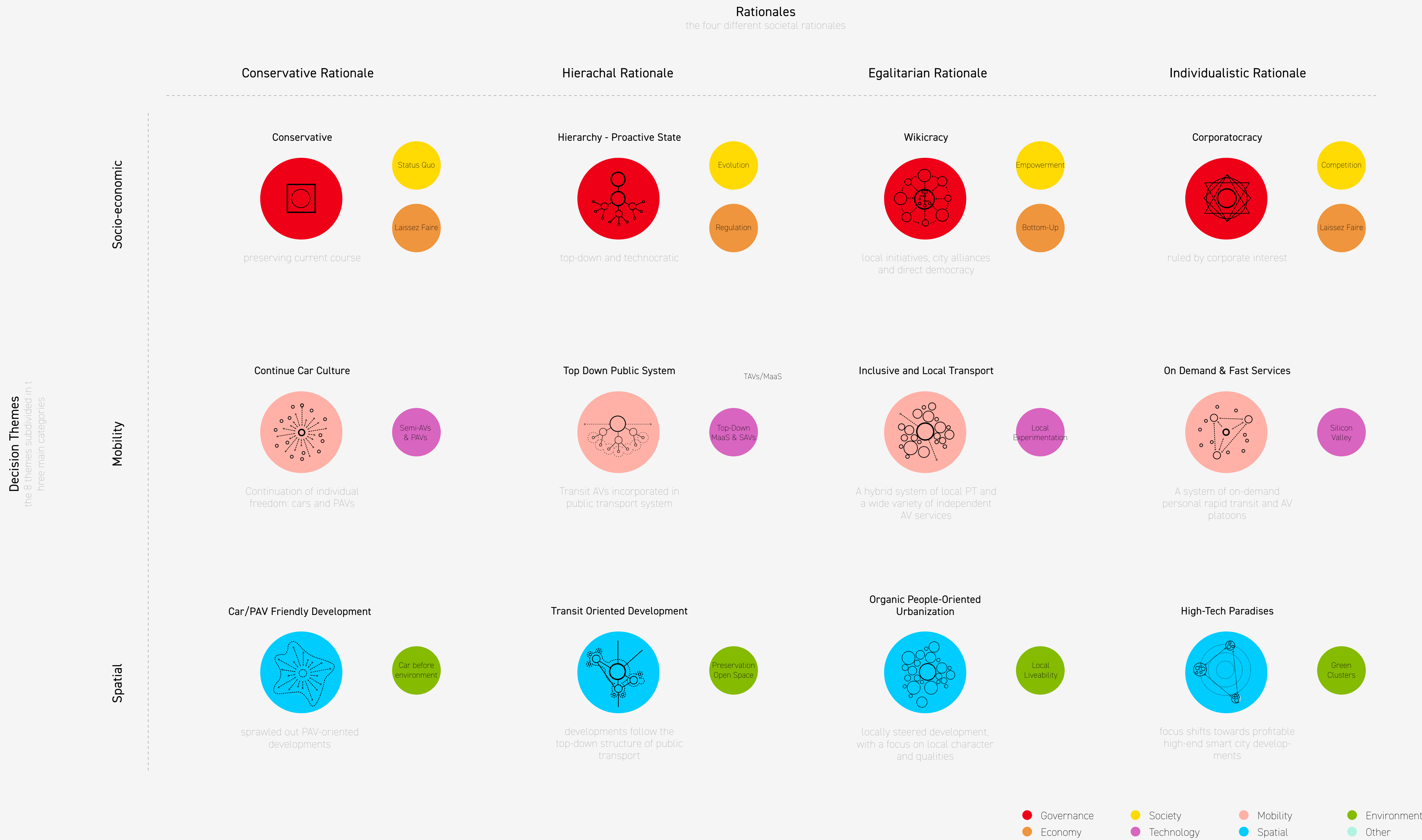
The x-axis is further completed by three types of 'development-stages of socio-technical systems'; the niche, the regime and the landscape stage. In this scheme these are purely used to give a little extra information about the kind of decisions are to be expected at the respective moment in time. For a further explanation one should look at the Multi-Layer Perspective by Frank Geels (Geels, 2005).

These stages of development are connected closely to the two phases we discussed in our analysis in more detail; the critical juncture and the lock-in. Roughly put, the niche stage take place during the critical juncture, the regime stage corresponds with the closing of the critical juncture and the appearance of the lock-in, and the landscape stage appears when the lock-in of the new system has taken place.

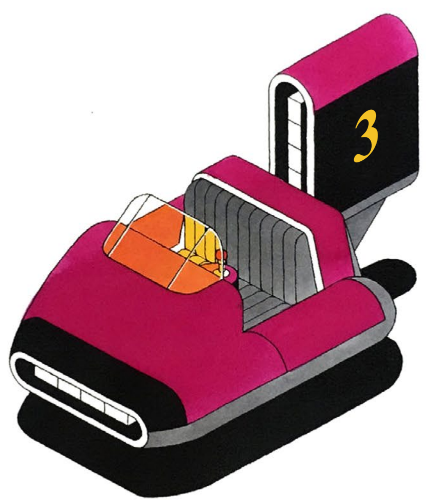
Within the scheme itself the different types of decisions are put for illustration/explanation purposes. This gives an idea of where *certain types of decisions* are expected to take place, as well as *how many decisions* are roughly to be expected, and lastly, to which extend these *decisions are 'free' or 'path dependent'* (which is shown by the intensification of the interconnected network that links the decisions.

METHOD STEP 2: STRUCTURE, TIMELINE & DECISION





Rationales
the four different societal rationales
Conservative Rationale
Hierachal Rationale
Egalitarian Rationale
Individualistic Rationale
Decision Themes
the 8 themes subdivided in t hree main categories
Socio-economic
Mobility
Spatial
Conservative
Status Quo
Laissez Faire
preserving current course
Hierarchy - Proactive State
Evolution
Regulation
top-down and technocratic
Wikicracy
Empowerment
Bottom-Up
local initiatives, city alliances and direct democracy
Corporatocracy
Competition
Laissez Faire
ruled by corporate interest
Continue Car Culture
Semi-AVs & PAVs
Continuation of individual freedom: cars and PAVs
Top Down Public System
TAVs/MaaS
Top-Down MaaS & SAVs
Transit AVs incorporated in public transport system
Inclusive and Local Transport
Local Experimentation
A hybrid system of local PT and a wide variety of independent AV services
On Demand & Fast Services
Silicon Valley
A system of on-demand personal rapid transit and AV platoons
Car/PAV Friendly Development
Car before environment
sprawled out PAV-oriented developments
Transit Oriented Development
Preservation Open Space
developments follow the top-down structure of public transport
Organic People-Oriented Urbanization
Local Liveability
locally steered development, with a focus on local character and qualities
High-Tech Paradises
Green Clusters
focus shifts towards profitable high-end smart city develop-ments
Governance
Economy
Society
Technology
Mobility
Spatial
Environmental
Other



CHAPTER III:

STORIES

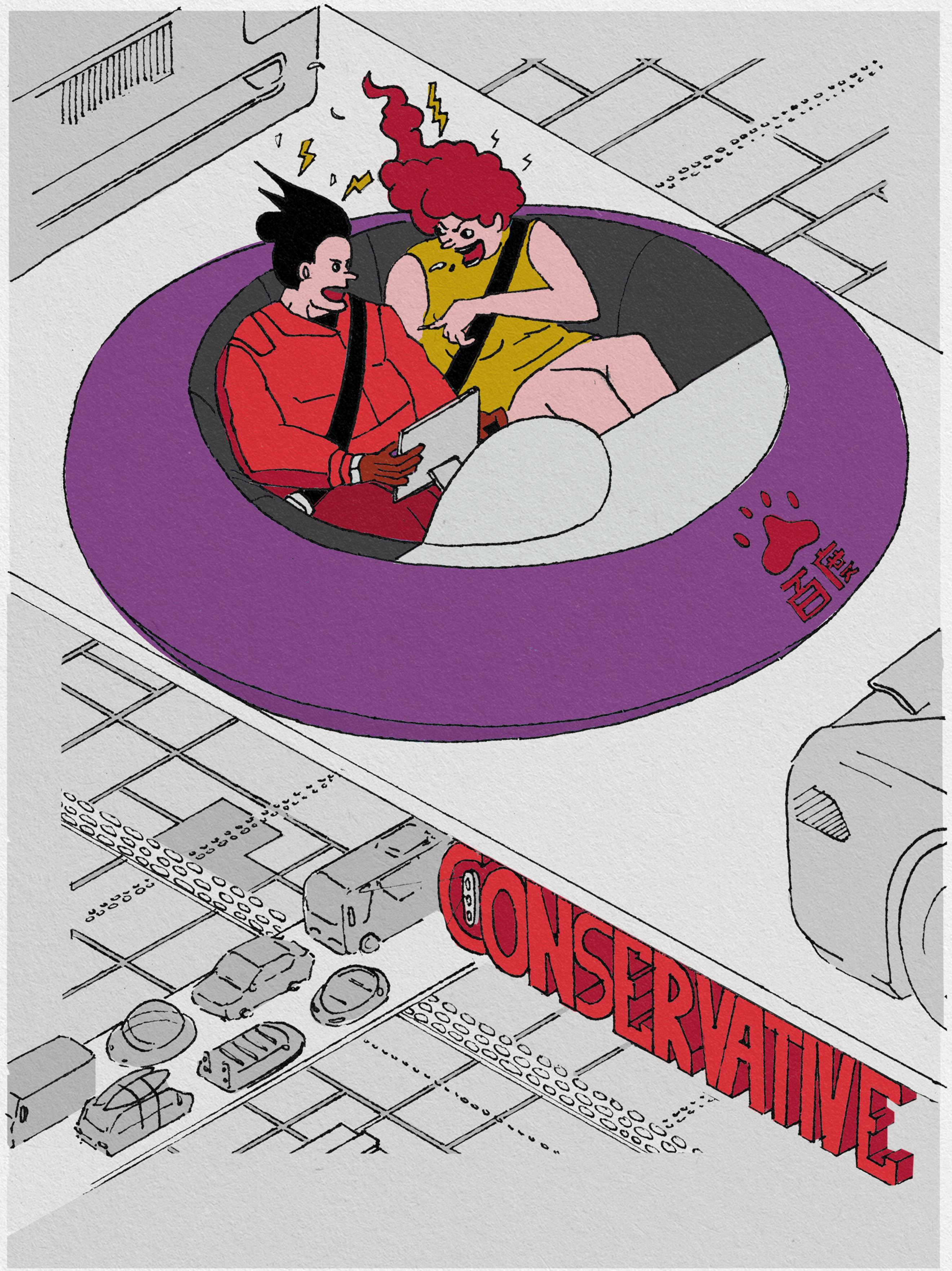
four potential futures for Amsterdam

STRUCTURE OF CHAPTER

structure of each story:

written story part I	critical juncture	written story part II	envisioning AMS/AMA in 2050

2020 2030 2050



THE CONSERVATIVE CITY

This narrative explores what could happen if a conservative approach is chosen. What could be the impact on our cities if we hold on to the values of the 'car culture', such as individual freedom of movement and private ownership, when new forms of mobility arrive?

The plot:

After decades of stagnating car usage - the so-called 'peak-car' - automobility seems once again on the rise as a wave of various new innovations comes through in the mid '20s. Assisted and self-driving cars are entering the market and new production techniques make the vehicles cheaper than ever before. Especially in these early years, this formative phase, the public sector gets to play an important role in deciding whether these innovations will lead to a radical reinvention or a reinvigoration of automobility. As conservative citizens and politicians decide to hold on to the 'values of the car-culture' (such as private ownership of vehicles) whilst being reluctant to stimulate alternative usage of cars (such as ride-sharing or the introduction of new pricing schemes), it appears as if there will be not much of a re-organisation, but rather a continuation and intensification of already existing car-based habits.

Within years a giant mishmash of manual, semi- and fully-autonomous vehicles are fighting for space on the country's road network. The call for more car-oriented planning is answered by planners who want to make sure people can sustain their car-dependent lives. New plans are made for suburban and exurban developments - in the spirit of Frank Lloyd Wright's Broadacre City - and massive road network expansions and inner-city transformations - reminding some of Robert Moses' approach in New York in the '50s - are forcefully put through to keep the dream of the 'driverless autopia' alive.

But despite the planners' best efforts, a decade later the Dutch AV-owners find themselves stuck in a permanent gridlock. As traffic comes to a halt, it becomes painfully clear how much they all have become 'locked' into a car-based lifestyle. The Dutch government and planners, who have been obeying the wishes of the pro-car citizens for decades, are now finding themselves forced to look for alternative solutions to solve the problematic situation. However, many alternatives have disappeared, and the newly created landscape appear unsuitable for any other kind of transport. Will there be a way out of this mess?

Conservatism
Conservative citizens and politicians are dominating future decision-making

Direct Democracy
Citizens are given the power of the corrective referendum, ie. ability to prevent change

Lobbying and Planning
Car and AV lobby gains more influence over planning (mainly data-driven planning)

Public-Private Developments
Government privatizes services and depends on the market for large developments and investments

Capitalism
Economic growth remains the main goal. Liveability, sustainability and equity come second

Neo Liberalism
The market is only marginally steered/ intervened with. Goverments responsibility is limited to ensuring stability.

Car Companies
Car companies stay powerful and keep on leading the way regarding the future of mobility

Consumerism
People still desire to own things. Owning gives status. Sharing is limited.

Individualism
Individual interests go before those of the collective. Freedom of choice is a sacred value.

Low Group Cohesion
Society is divided regarding its future vision - initiative is left to the market

Status Quo
People prefer minimal change, are aversive to disruption and want more of what they already know

Incremental Innovation
Technological innovation should improve current lifestyles - not disrupt them

Technology for Corporate Goals
Technology is used to stimulate the economy, increase efficiency, and improve comfort

Deregulated Tech
Powerful car lobbies ensure technology is left marginally regulated

Freedom of Movement
Society holds on to its individual freedom of choice and freedom of movement. Flexible and unrestricted mobility is important

Complex Movement Patterns
Extensive AV use leads to daily movement patterns that are complex and spread out

Speed & Efficiency
Efficient and fast-moving traffic flows are more important than other public values

Personal AVs (PAVs)
Most citizens prefer a personal ride over shared vehicles or public transport. PAVs become cheaper and affordable for many.

Road Network
Large investments are made in the expansion and improvement of the national road network

Dedicated Lanes
PAVs are given priority over other modalities in the form of dedicated lanes, allowing for efficient movement

AV Mishmash
Many types of AVs are allowed onto the roads. Also semi-assisted vehicled.

AVs First
AVs are given priority over other forms of traffic, when it comes to space, speed and safety

Sprawling City
Cities are expanding rather than densifying - leading to a new wave of PAV oriented suburban expansions

Suburb of the Future
Low density, plenty parking options and well accessble by PAV are the new norms

Fragmentation
Distances between functions grow; housing, facilities and working districts are coming further apart/fragment.

Mono-Functional
Areas become more mono-functional leading to large 'boring' residential, commercial or business districts

Traffic Space
Much of the public street space becomes space dedicated to traffic (dedicated lanes and parking)

Autonomous Zones
AVs parking facilities/campuses/ industry areas lead to large zones on the outskirts of the city only accessbile by AV

Less Green Space
Open (green/blue) space in the region is rapidly absorbed by urban expansions

Sustainable Traffic
Car Companies do stimulate emission-less traffic, and co-develop required energy-grid - thoug vehicle fleet increases

Less Active Travel
Comfortable door-to-door mobility decreases walking and biking

Governance · Economy · Society · Technology · Mobility · Spatial · Environmental · Other

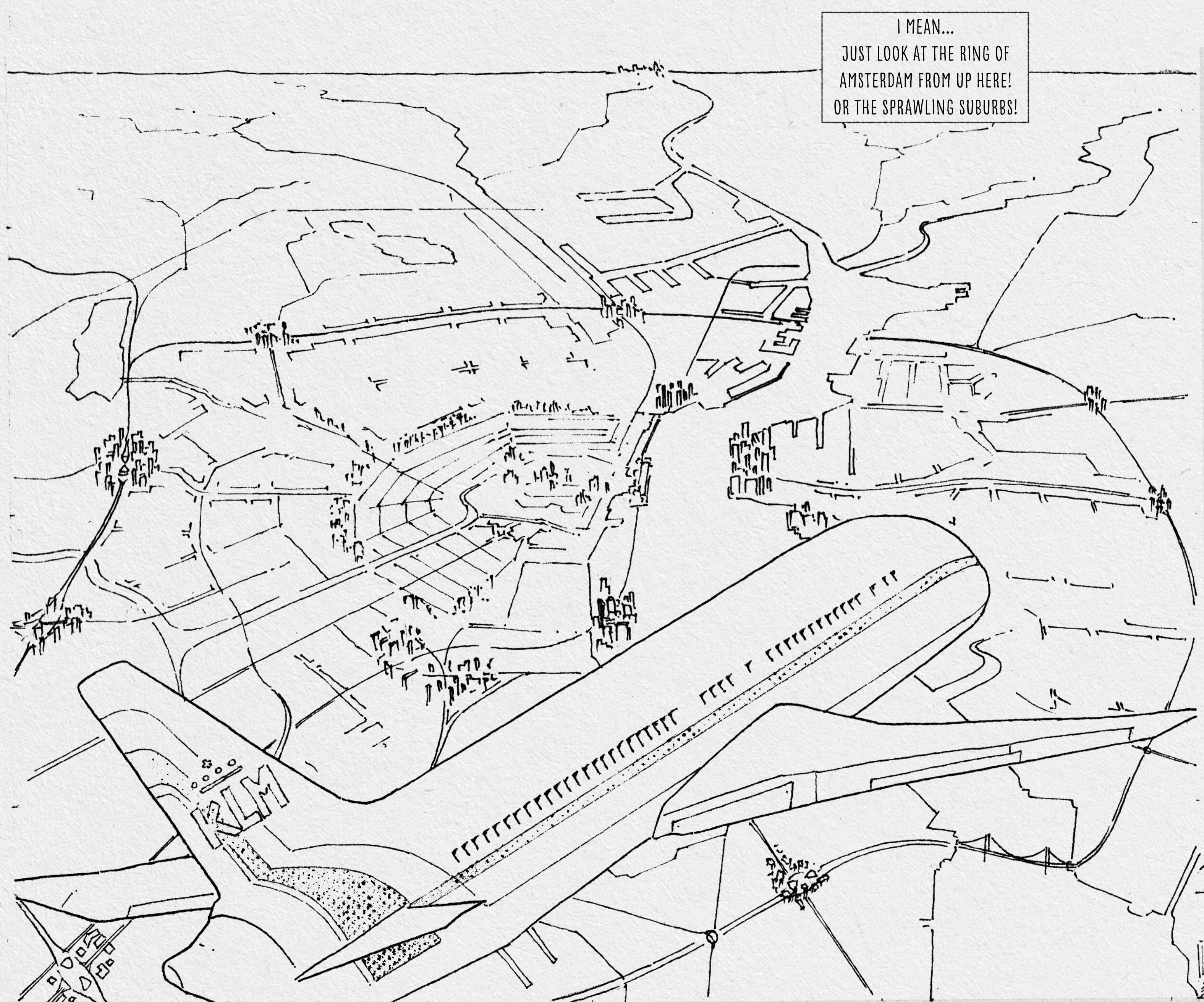
Metropolis Amsterdam | **Situation 2050**

It may be hard to believe, but in the course of thirty years the city of Amsterdam, once the domain of the cyclist, has turned into the kind of car-dominated city one would previously only expect in countries such as the US and Australia. Think of cities such as Los Angeles, or Melbourne. Think of sprawling suburbs that make up a metropolis the size of an entire Dutch province. Think the Amsterdam Metropolitan Area as a region that has become practically a single city, in which remainders of the Green Heart and Waterland have turned into large 'urban parks'. Think of all that, and what you imagine will come close to what has become a reality in 2050; the capital of the Netherlands has turned into a true metropolis of un-Dutch proportions.

In this 'metropolis of Amsterdam', it is the next generation of the car which has taken over; the autonomous car. Through allowing individual freedom of movement to be combined with unprecedented comfort and the ability to allow one to continue whatever activity one desires whilst on the road, this new kind of car has catalyzed, and made possible, extremely vehicle-dependent lifestyles characterized by long daily commutes and other kinds of extensive movement between daily destinations. Living in a suburban home, with mandatory parking for the private autonomous car (PAC) of course, in a neighbourhood of identical other suburban houses and an the occasional shopping mall, has become standard for most of the AMA's citizens.

It thus seems as if, to a certain extend, the dream of the automobile industry, as sketched out in for example Ford's 'City of Tomorrow' campaign, has been realised. There are a lot more PAC's on the road then there have been cars, for example. Plus, they make more kilometers and are used more frequently than ever before. It is thus to no surprise, that the automobile industry has claimed a position of power it only dared to - secretly - dream of. The Ford's and Mercedes' of the world are no longer just in control over the private vehicle market, their political influence and economical position - at least here in the Netherlands, is stronger than ever too.

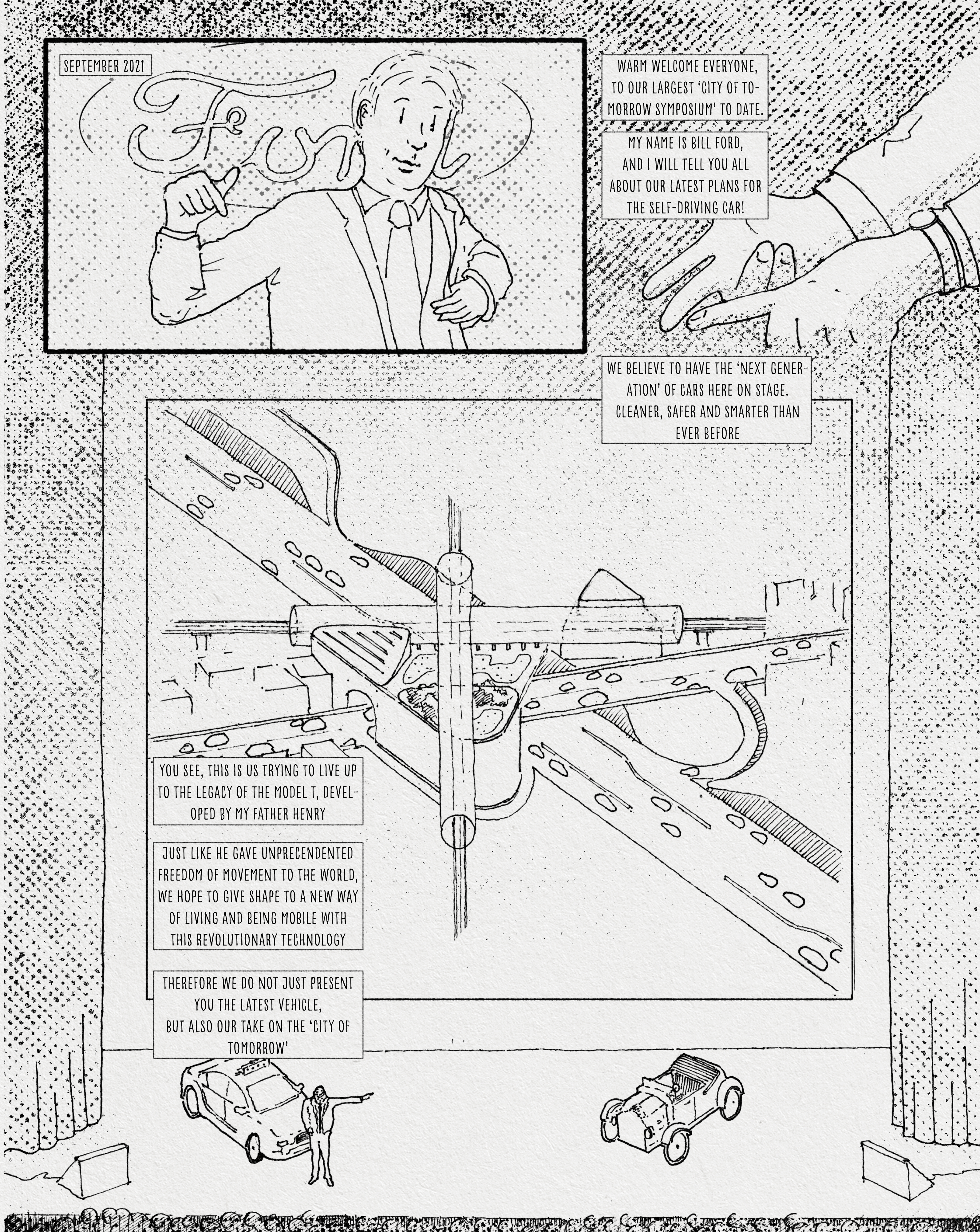
The story of how the metropolis of Amsterdam came to be, is then also full of insights in what the potential dangers could be of allowing current,conservative ideas about self-driving mobility to persist, without challenging these or considering alternatives.



New Opportunities, Same Habits | **Critical Juncture 2020 - 2030**

It is early september 2021, and we find ourselves in the RAI convention center in the south of Amsterdam, about to enter the 'City of Tomorrow' symposium hosted by the Ford Foundation. The coming days the automotive giant will take over the place with its latest car models, motor shows and presentations about their vision on mobility *and* urbanism. In a brief moment, the event will be officially opened by a few of the companies leading technicians, who are eager to express their confidence in the progress the company has made in the development of its 'level 5' vehicles over the last year. If we have to believe Ford, or the automotive industry in general, the arrival of the fully self-driven car is now truly just around the corner. With 5G about to arrive, and with the large preparations that have been made by the governments worldwide (the Dutch in particular) to make their road network 'autonomous vehicle-ready', the world might be witnessing, the first fully self-driving cars - by Ford - on their roads in the coming years. And the Dutch might be amongst the first.

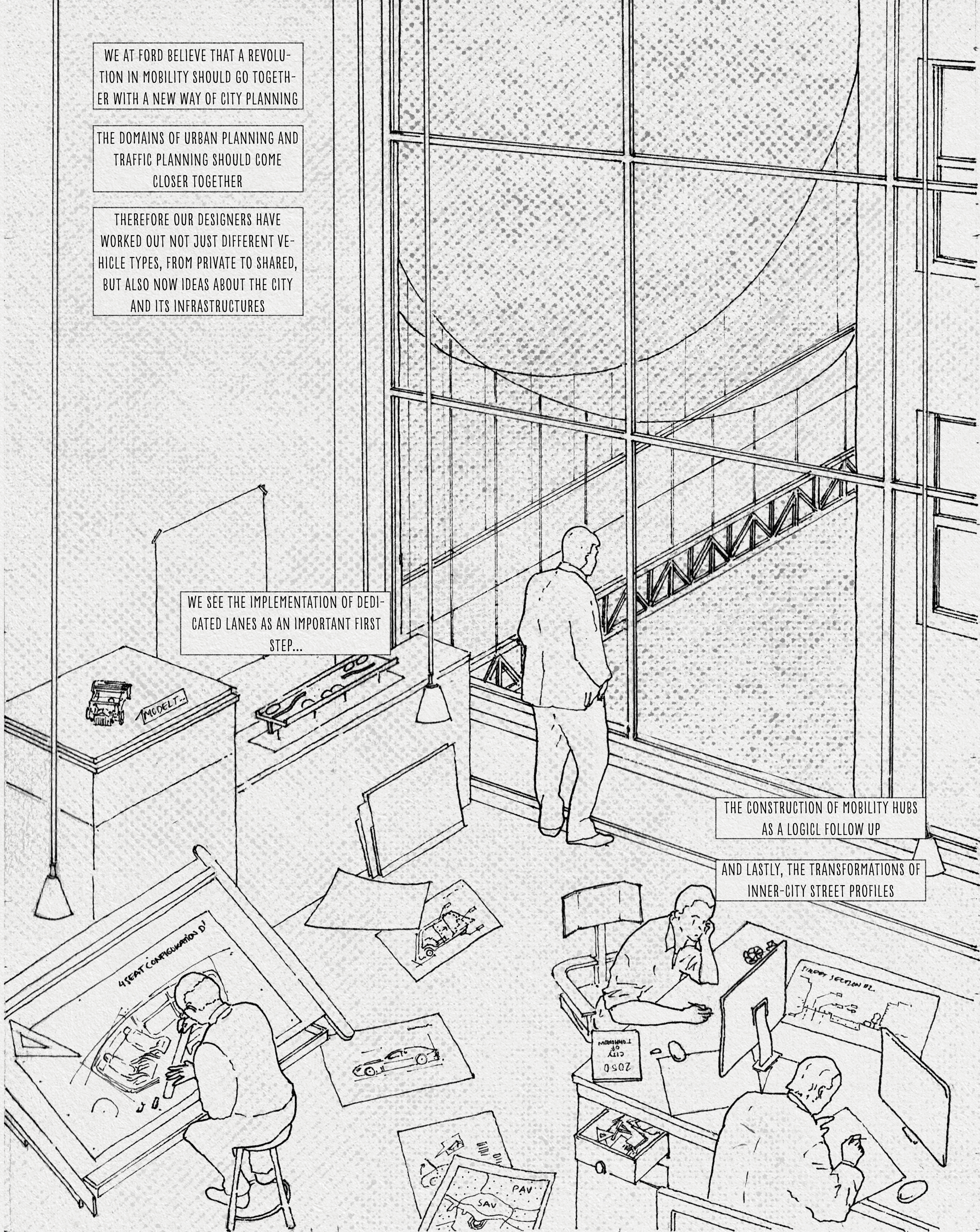
Directly after this promising opening, the audience it treated with another large announcement. This time by presented by Bill Ford (former CEO, and great grandson of Henry Ford). As he enters the podium, he briefly rests his hand on the Ford Model-T that has been put on stage, next to the latest self-driving Ford Fusion. 'It is not an easy task' he opens, 'to live up to the legacy of our Henry Ford'. Especially knowing that we are, a hundred years later, in a comparable revolutionary period he was in, in the early 1900's. We believe that, much like the way the Model-T set the standard for the petrol-car to essentially create the automotive market for the following century, it is up to us again to set the standard for the industry for the coming generation of cars. We are convinced that time has come to reinvent and drastically improve the private vehicle, so it can actively address, rather than contribute to the large challenges our society and cities will face in the future. We need cars that are cleaner, safer, smarter than those we have now. We need cars that will give us back our free time. We need cars that can go hand in hand with other forms of transport. And we think, that here, at this symposium, we will present you that kind of car. And not just that - we will present you our vision of the city that could become possible with this new kind of vehicle. Let us surprise you, and take you to the 'city of tomorrow'. A city which, we hope, we will start to give shape here - in Amsterdam, first.



So, here I will present you the joint-venture that has been formed between us, the municipality of Amsterdam and the Dutch national government. The result of a good two years of intensive collaboration' Meanwhile, the plan was presented on the large screen behind Bill, showing how it was to consist out of three independent projects that were to be realised in three according phases. The first being the piloting phase of dedicated lanes on the A10, where test rides with different levels of autonomous cars were to happen. The second being the construction of 'transfer hubs', points predominantly positioned around the ring - next to existing P&R's and Transferia - where the switch from private vehicle to shared shuttle or public transport could be made. And the third being the transformation of street-profiles to accommodate the new shuttle service.

'Of course', Bill continued, 'we are aware that these spatial interventions will have to be accompanied by a couple of regulatory changes. For the first phase, new regulations should support the experimental phase of automobile companies - we would like to see restrictive regulations alleviated, and more permission to test with level 5 vehicles, as well as with level 3 and 4 vehicles that will be mixed with other, manually driven forms of transport. For the second phase, the construction of the transfer hubs, we desire regulations that will allow us to allocate large parking facilities for fleets of vehicles, as well as to built drop-off/hop-on zones for our shared vehicle services. Then, for the third phase, in which inner-city main streets will be redesigned, we desire that space will be allocated for our shared vehicle service, or that these services will be allowed to operate on existing public transport lanes.' Now, these are all our desires, we have yet to sit around the table with public authorities to decide on them.

'There is even more, however. Besides spatial interventions and policy changes, we believe there are some changes necessary regarding management and planning, of mobility and of the city, if we are to make this transition towards self-driving mobility successful. We, over at Ford, are convinced that we can play an important role as advisor to traffic planners, as well as the planners concerned with urban developments; through our insights derived from the traffic data we gain from the self-driving fleet. We want to help the government in understanding where and how to invest in private mobility infrastructures - from highways to charging stations. The autonomous vehicle could bring mobility and planning closer together, and we believe that



drawing by author, based on the works of François Schuiten and Benoît Peeters

THE FORD VISION, AS MADE IN COLLABORATION WITH THE CITY OF AMSTERDAM AND THE DUTCH GOVERNMENT RESULTS IN THE PLAN AS SEEN HERE

THERE WILL BE A STRICT DIVISION OF THE CITY INTO A SHARED AV ZONE WITHIN THE RING, AND A PRIVATE AV ZONE OUTSIDE OF IT

THIS TACKLES CONGESTION ISSUES AND PARKING LIMITATIONS IN THE INNER CITY - BUT PRESERVES THE FREEDOM OF CHOICE FOR THOSE OUTSIDE OF IT

TO ENTER THE CITY, OR TO MAKE THE TRANSITION BETWEEN ZONES, FORD TRANSFER HUBS ARE ALLOCATED ALONG THE HIGHWAY. THESE WILL TAKE OVER EXISTING P&R'S AND TRANSFERIA, AND ADD THE FACILITIES NEEDED FOR THE FORD SHARED SHUTTLE SERVICE AND PAV PARKING

THEN, LASTLY, THE INNER CITY WILL GET REDESIGNED STREET PROFILES, TO ALLOW THE SAV SHUTTLES TO OPERATE EFFICIENTLY AND SAFELY IN THEIR OWN PRIORITY LANES

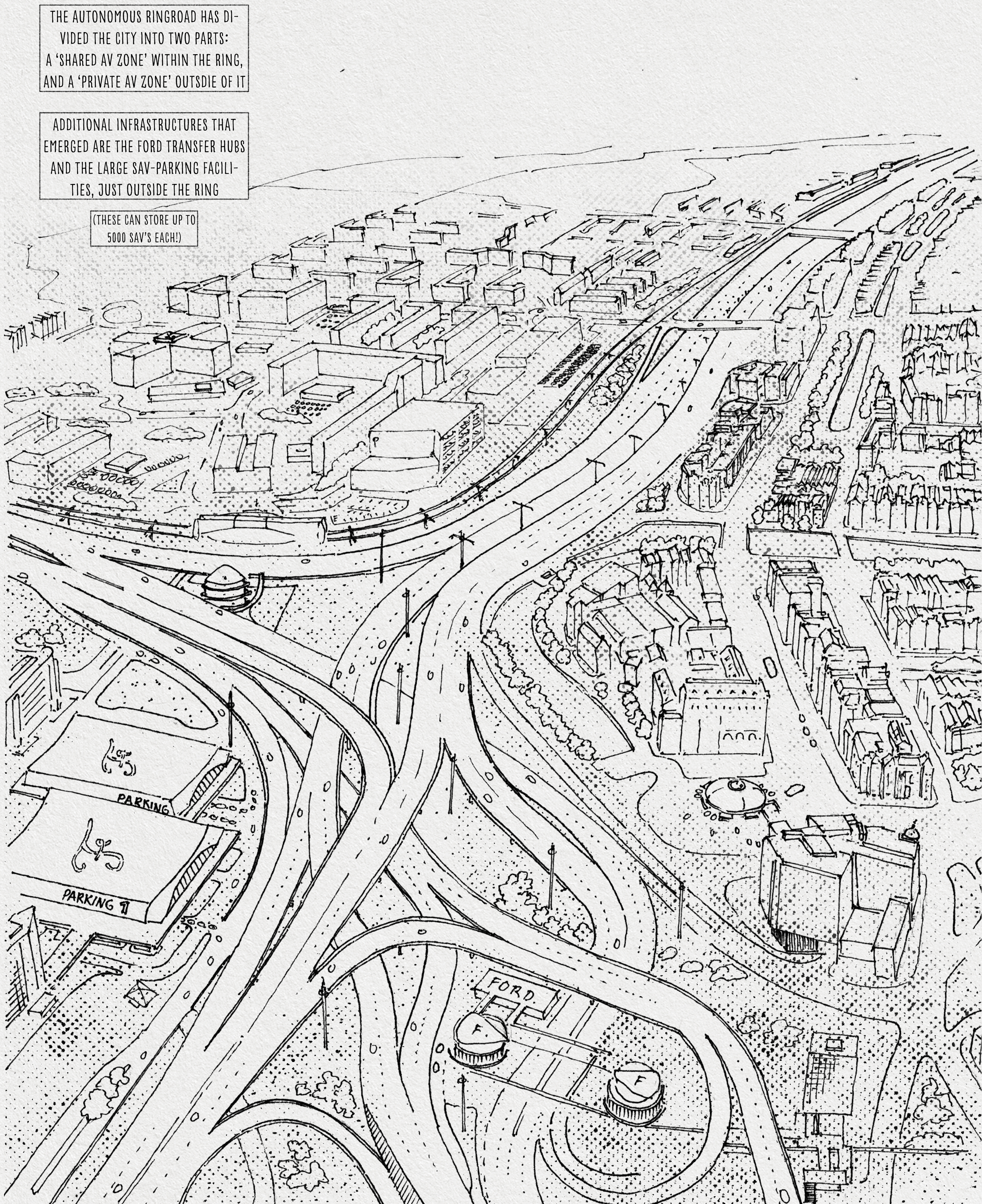
A new era of PAV-oriented city-building | Lock-in 2030 - 2050

In the years after the memorable 'City of Tomorrow' symposium, the Dutch national government, in close collaboration with Ford, but also under pressure of other car companies, Om Alec Khaoli would start to realise the proposed three phases of development. The responsibilities were divided as such: the government stayed in control over its highways, and took responsibilities over the dedicated lanes project, as well as the decision-making about by who and how there was to be experimented. The transfer-hubs became more of a collaborative project, where advisors of Ford were consulted to determine on the locations and lay-outs of these hubs. The last of the three projects, the re-design of the inner-city roads, was a collaboration of the municipality of Amsterdam and Ford. Here, it was especially the latter with the largest influence, as the powerful pro-AV lobby it was part of, pressurized national and local (wethouders) to decide in favor of car-oriented designs.

The idea was that this new system of private vehicles being switched into shared shuttles before entering the inner-city would lead to a more competitive environment in which local public transport providers and Ford would both operate. The neo-liberal thought was that this kind of competition would create a market with more diversity of options (e.g. different price categories), more efficient services and better accessibility. Local transit providers would be forced to reinvent, adapt and specialize their services, and problematic parts of the journey, such as the last-mile, could be supplemented by the Ford shuttles. Additionally, there was the believe that shuttles would serve as an effective way to persuade the stubborn car-owner to leave his private vehicle, and chose public transport. In other words, adding more car-like transit, the transition towards less private vehicles in the inner-city could be catalysed.

A rapidly innovating and expanding AV-industry

It was not far into the 30's that the idea of a mutualistic relationship between traditional public transport and the new shared shuttle service started to become unbalanced and problematic. It turned that Ford was capable of innovating and improving its service a lot faster than the GVB. New production techniques for the vehicles were discovered (by taking a close look at Chinese competitor Baidu and its 'software-

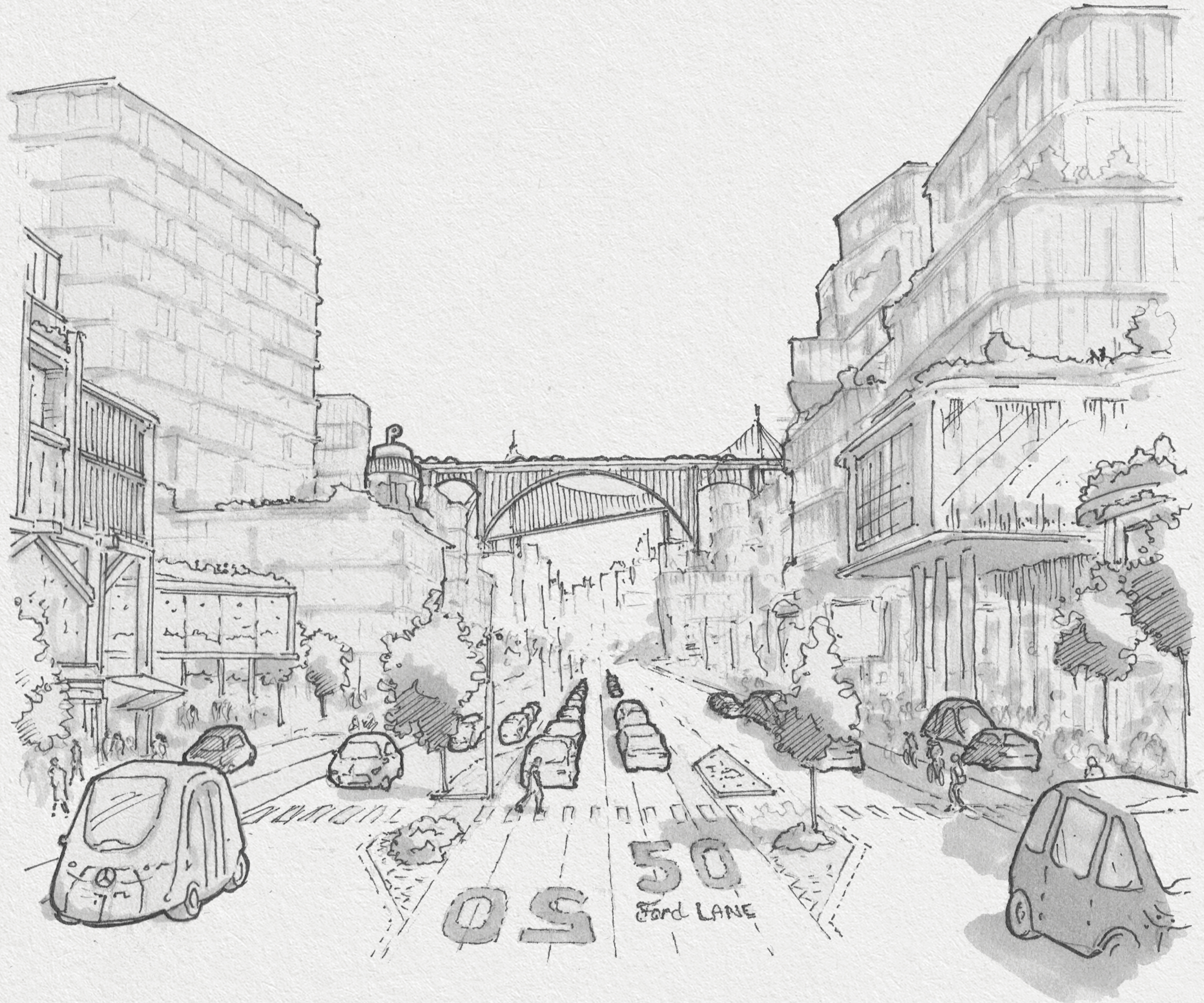


drawing by author, based on the works of Robbert and Rudolf Das for 'Op zoek naar leefruimte' (1966) and prototyping approach) and subsequently the prices of production of both the private cars and shared shuttles started to drop. Whilst scaling up the production, the industry around self-driving technologies started to specialize, and turned the whole production process from a niche one into a larger and more efficient one; entire branches became fully focused on delivering the best chips, sensors and other electronic components possible, at increasingly lower prices.

The result was that Ford was able to put self-driving vehicles on the market at a retail price which was unheard of for cars. This then opened up the opportunity for many citizens, most of which living in the outer-ring parts of the city (the place which had deliberately been saved from any car-restraining policies due to pressure from the increasingly powerful car-lobby) or in more rural areas, to own one, if not more, of these cheap vehicles. For those within the ring, the now explosively growing AV-market meant that cheaper shuttle services became available. These shuttles, which were already known for having a higher level of comfort than the traditional modes of transit, were now thus also more affordable than a tram or bus. When put in the context of a government that had been shifting its focus towards road-transport anyways, one can imagine that the future of public transport looked grim: Ford was leading the charge of an new autonomous-automobile revolution. The demise of tram- and bus-lines was inevitable.

The downfall of public transport was not just caused by the growing difference in costs of the services, or the lack of effort put in by the public authorities to turn things around. It has to be stated that at the time a larger cultural shift was taking place. One that would have likely led to the decrease of public transport use anyways. People were simply starting to expect more comfort, faster transport, more flexibility and individual freedom of motion. And the cheap autonomous cars, whether privately owned or used as a shared service, were both responsible for, and suited best, that new standard of mobility. It could best be described as a form of co-evolution between technological development and cultural change. The autonomous car and an emerging hypermobile lifestyle reinforced each other.

The cultural change was felt throughout the city, but its impact was seen strongest in the neighbourhoods outside of the ring of Amsterdam, the already more car-oriented parts of the city. As stated, the



drawing by author, based on the drawings for Sidewalk Toronto by Andrew Edwards price of the private autonomous vehicle (the PAV) had dropped significantly, and for many citizens this had been the reason to abandon public transport services and solely use the private vehicle to get around. A traveler survey from '35 further highlighted this trend; within the city, there was a drastic decrease in public transport usage and an astonishing increase of private vehicle usage (up to a 35% increase). Inter-city movement showed a similar trend, with train usage dropping significantly whilst the highways were busier than ever. The numbers were an indication not only of a major modal shift occurring, but also of the increase in movement in between cities and within them as a result of increased commuting. Lifestyles were truly becoming shaped by the private vehicle, which would start to have its effect on the built environment too.

The lifestyle that was being adopted by many could best be described as a kind of suburban, car-dependent lifestyle similar to the one adopted by the majority of American or Australian citizens decades ago. It meant that many citizens started to consider living further away from their work, as their self-driving car would allow them to use the time on the road efficiently or for leisure. Especially for a large group of citizens who could no longer affort the sky-high housing prices of the inner-city of Amsterdam, moving away to a more suburban area, with a larger house and private parking spot for less, was then also a logical choice. Satellite cities such as Purmerend and Hoofddorp became suddenly very attractive places to live for a large group of people. But also smaller towns in between, areas that were usually lacking adequate public transport services, as the self-driving car owner was not dependent on any form of transport apart from his or her trusty vehicle.

The pressure therefore grew on the edge-municipalities of the region to facilitate in this new desire for suburban housing. It no longer were the inner-city transformations within the ring of Amsterdam where people wanted to live, but low density developments in the Flevopolder or Haarlemmermeerpolder. It meant a whole shift for planners too; after years of focusing on redeveloping and transforming as close to the center of Amsterdam as possible to provide mixed-use, dense, transit oriented developments, they now suddenly saw a shift towards building in the open space, where low density, monofunctionality and poor access to public transport did not seem to be important criteria.

Satellite cities were pressured to deal with this new wave of residents. Their municipalities saw themselves forced to think about potential expansions of their cities into their surroundings. A city such as Almere, for example, now started to make plans for large scale developments in Almere Pampus and Almere Hout. Plans in which the selfdriving car would play a central role of course, resulting in criteria such as; low density, private parking spots, lots of green, and accessibility and proximity of entries to the highway network. These leading concepts were incorporated in nearly every new development that was to take place, and reflected clearly how the pro-PAV culture had also started to influence urban planners.

However, this pro-PAV attitude did find quite some resistance initially at many planning institutions. An often heard argument against this new way of city building was that this way op planning would fall for the same pitfalls of modernist planning that came with developing with the future of the private car in mind. The fragmentation of the city into monofunctional districts far apart, for example. Putting living, working and leisure at distances that would necessitate the private self-driving vehicle as the only way of dealing with such a daily mobility pattern.

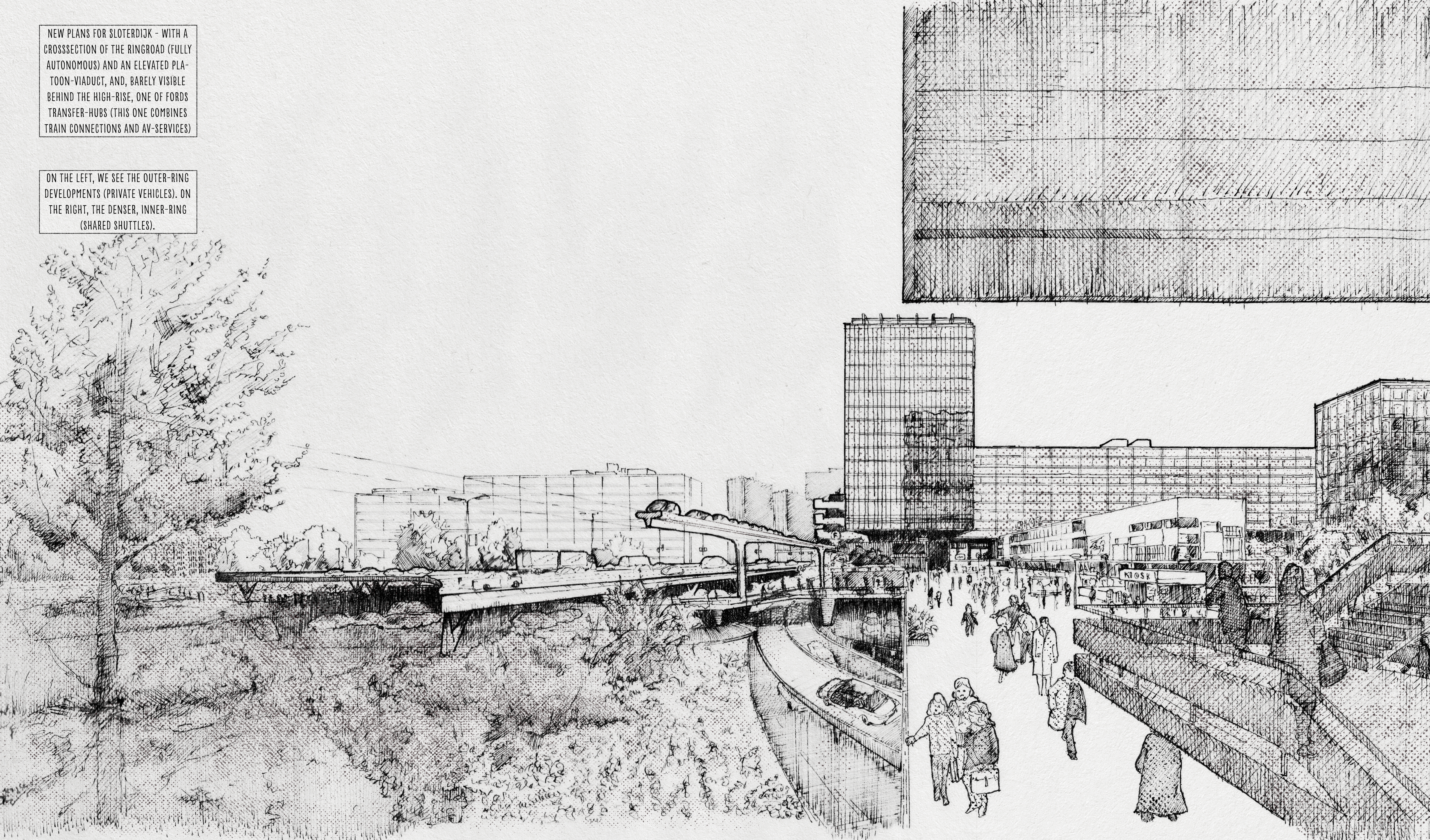
Despite such warnings, there was barely anyone who truly listened. The pressure from society for car-oriented housing developments, the pressure exerted by the powerful AV-lobby which had a firm grip on political decision-making, and the deminishing belief in the role of public transport in new urban developments (especially now large public investments were not be expected), gave momentum to a movement that was not going to be stopped by the warnings of a couple of planners.

The lock-in of a new AV-dominated system

In the years that followed, whole systems started to become centered around the self-driving car. From economical systems, consisting of former car manufacturers, technology companies - involved in the production process or software development of the vehicles - and energy companies responsible for the energy-grid, to spatial systems, consisting of new highway networks, mobility hubs, parking facilities, charging stations and much more. The self-driving vehicle and all it influenced, had given many a goal to work towards: the optimization

NEW PLANS FOR SLOTERDIJK - WITH A CROSSSECTION OF THE RINGROAD (FULLY AUTONOMOUS) AND AN ELEVATED PLATOON-VIADUCT, AND, BARELY VISIBLE BEHIND THE HIGH-RISE, ONE OF FORDS TRANSFER-HUBS (THIS ONE COMBINES TRAIN CONNECTIONS AND AV-SERVICES)

ON THE LEFT, WE SEE THE OUTER-RING DEVELOPMENTS (PRIVATE VEHICLES). ON THE RIGHT, THE DENSER, INNER-RING (SHARED SHUTTLES).



drawing by author, based on the drawings by Johannes Ingwersen and his 'plan voor Amsterdam' (1960) of the vehicle, and the lifes it made possible. The Netherlands became home to some of the largest AV-manufacturing factories, often clustered in large districts full of warehouses and test-circuits, largely unmanned such as port-areas, where robots and the occasional technician took care of the highy streamlined production and testing of the vehicles. The new mainports where responsible for the creation of many new jobs - though not so much within the factories themselves, but primarly in the offices and labs where the required technologies had to be developed. It were high-skilled jobs for the tech-savvy, and highly educated - and the Netherlands was one of the ideal locations. It meant that manufacturers like Ford became indispensable, and extremely important for the Dutch economy. In '38, the Dutch national government therefore decided to turn Ford, and several other smaller manufacturers, into a state-owned enterprise. This newly formed public company would primarly serve to fill in the gap within the inner-cities, where traditional public transport had deminished.

In the mid '40s, whilst the inner-cities were now buzzing with Ford-shuttles, the outer-city had started to expand into the open space of the metropolitan area. Formerly protected areas around Amsterdam, such as parts of Waterland and the 'green fingers' were dissapearing at an alarming rate, as previously seperated satellite-cities started to conglomerate to a single whole. Besides a few city centers here and there, the AMA started to look like a modern interpretation of the 'Broadacre City'.

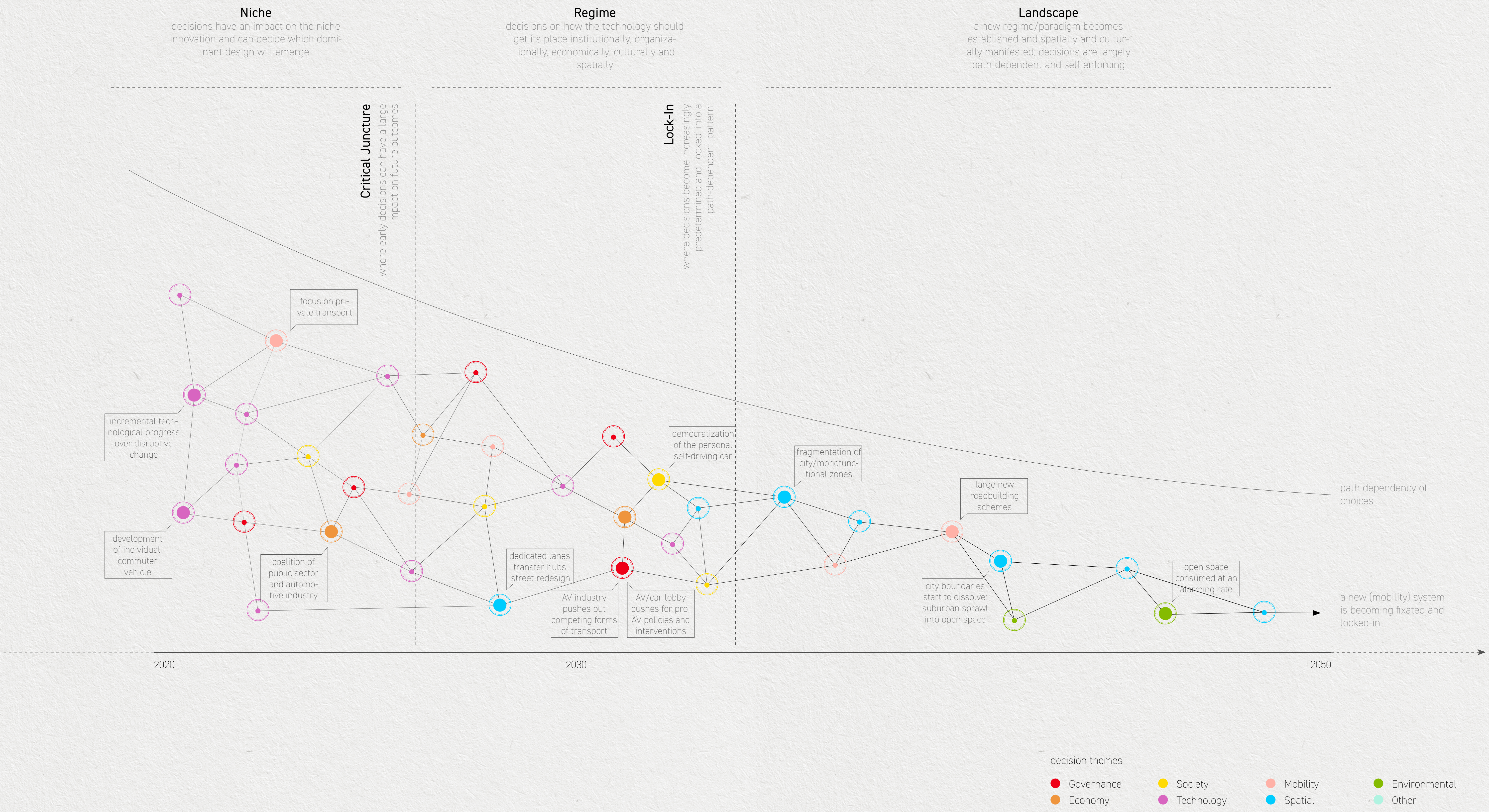
LET US ZOOM OUT, FOR A FINAL TIME, TO THE SCALE OF THE AMA REGION. OR, AS IT IS NOW KNOWN, THE AMSTERDAM METROPOLIS

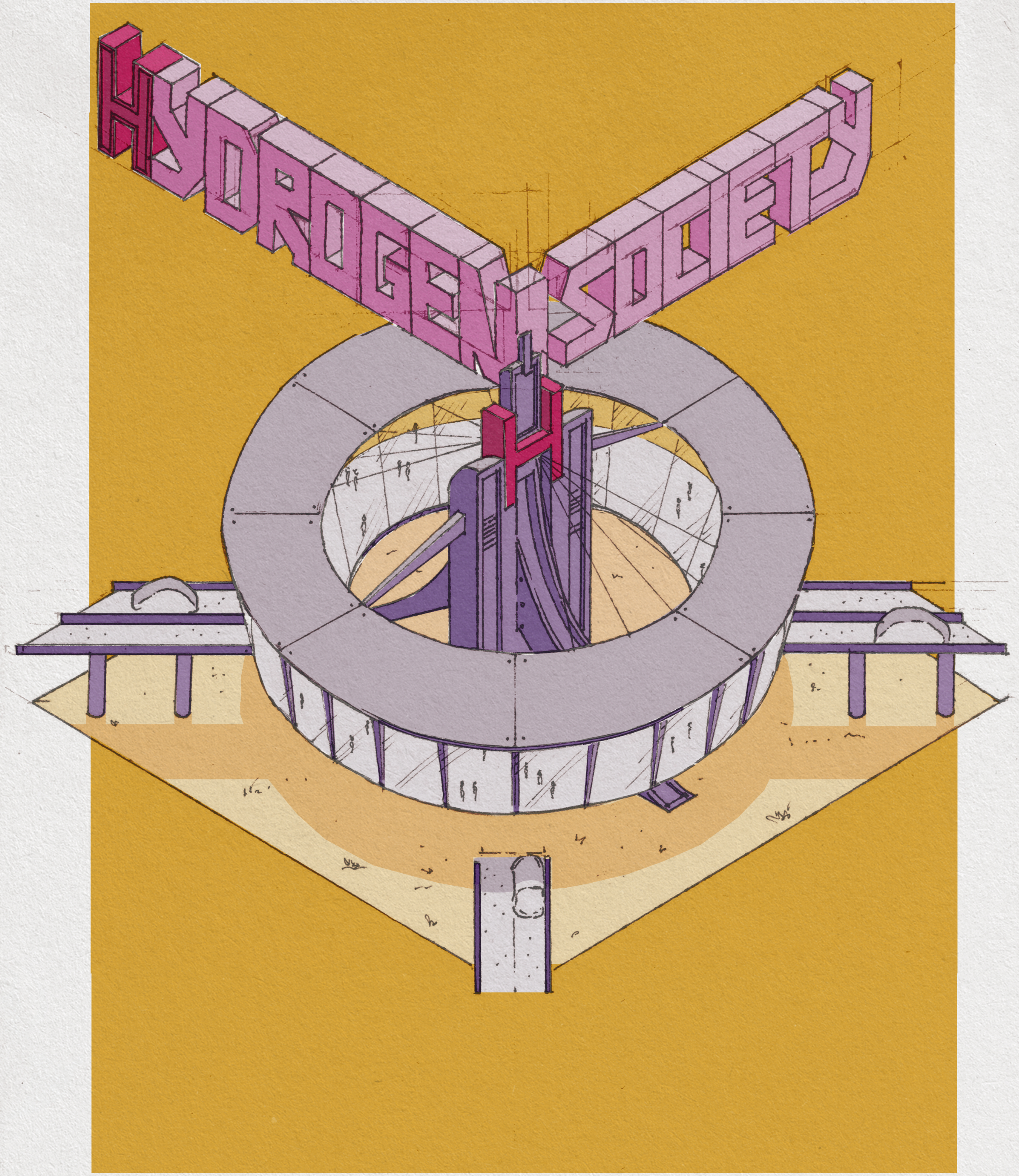
WE SEE THAT APART FROM THE CITY CENTERS, THE SHARED-AV ZONES, CITY BOUNDARIES HAVE DISSOLVED INTO INTO THE OPEN LANDSCAPE WITH END-LESSLY SPRAWLING LOW DENSITY SUB-URBS - THE HOUSING OF PREFERENCE FOR THIS CAR-DEPENDENT SOCIET

FURTHERMORE WE SEE NEW HIGHWAYS AND PLATOON-CORRIDORS TRAVERSING THE LANDSCAPE, ALLOWING PASSEN-GERS TO MOVE QUICKLY THROUGH THE VAST URBAN LANDSCAPE

LASTLY, WE SEE HOW REMAINDERS OF FORMER OPEN AREAS, SUCH AS THE GREEN HEART AND THE GREEN 'FIN-GERS' OF AMSTERDAM HAVE NOW TURNED INTO URBAN PARKS SUR-ROUNDED BY NEIGHBOURHOODS

CONCEPTUAL TIMELINE CONSERVATIVE CITY





THE TRANSIT CITY

This narrative explores what could happen if the future of mobility and urban planning would be led by strong 'top-down' governance; where guidelines are set by the EU and executed by het Rijk.

The plot:

Throughout the coming decade the Dutch national government will be closely involved in the development and implementation of new mobility concepts and the preparation for autonomous vehicles, to ensure all these new innovations will work well together with the national public transit system.

When the autonomous vehicles finally arrive, the development of an extensive and well-integrated public transit system of traditional- and new, autonomous forms of transit starts. On a regional scale the train remain the main mode of transport, and within cities a system of autonomous trams, metro's and shuttle's is implemented. With this new system, and with the help of strict policies and measures, the public sector hopes to provide an irresistible alternative to the private car.

But the ambition of the state doesn't stop there. Additionally to developing, implementing and monitoring the transit system, het Rijk is also deeply involved in the transit oriented development of cities. Resulting in a strict T.O.D/anti-suburbia agenda, which is enforced by top-down planning. Critique on this hierarchal planning system is that the planners are going far in forcing society into sustainable ways of living, and that this way of city building might fall for the same things as modernism once did.

Hierarchy
Future decision-making is in the hands of large institutions (EU, government)

Bureaucracy
Important decisions are made through complicated procedures/many rules/technical processes.

Technocratic Planning
De-facto rule by technical experts. Large amounts of public data are used to keep the system efficient

Proactive State
Government claims control (reclaims control) of many (formerly) public services and centralises power.

Socialism
Larger goals, such as sustainability, circularity and equity are leading principles

Strict Regulation
All market or civic society initiatives are steered by national policies

Public-Private Companies
Partly state-owned companies (like NS) are given priority and power.

Evolution
Evolution over status quo: citizens should be stimulated to switch to sustainable lifestyles

Collectivism
Values of the collective are more important than individual priorities.

Paternalistic
Society follows the course as set out by EU/government. There is little room for discussion

The Larger Goal
Society at large wants to make major transitions towards more equity and sustainability

Top Down Tech
Technological innovation is primarily in the hands of top-down actors

Steering Tech
Technology is used to improve services and steer in societies behaviour

Regulated Tech
Technologies are strictly regulated and should always be in line with the larger public vision

Restricted Movement
Society has to hand in freedom of movement - choices are (partly) made for them by the system

Public Transport at #1
The public transport system is the most important way to get around. Private transport is discouraged

Clean & Efficient
The public transport system should work as a clean and efficient machine

AVs as part of PT
AVs will not become privately available in cities - the technology will be used within the existing PT system as TAVs

Rail Network
Large investments are made in the expansion and improvement of the national rail network

Last-Mile Revolution
A large step is made in the last-mile part of PT. Micromobility and AV shuttles feed into stations/hubs

PT Platform
All public services are neatly integrated in a single platform (OV platform)

Micromobility HUB
Micromobility is essential for the last-mile, but remains strictly centralised at local mobility HUBs

Transit Oriented Development
Cities are designed after the expanded PT system. Around stations, developments are planned

TOD 2.0
New districts are developed around stations, according to TOD principles, car-free and AV serviced

Med-High Density
Areas are developed/transformed to higher densities, to make public transit viable and efficient

Centralised Functions
Facilities are clustered around main stations, important hubs, or local mobility hubs

Public Space
Large amounts of space become available and allow for densification/more public space.

Preservation of Green
Open (green/blue) space in the region is preserved by strict TOD rules.

Sustainable Traffic
Emission-free PT and restricted private mobility limits resource use and emission..

Big Brother
All data (from market and civic society) ends up in the hands of the government - though fully transparant and accessible

Active Travel
Steering in micromobility choices ensures active travel on the last mile

A Harsh Divide
Those living outside the TOD range are falling outside of the top-down system

Governance
Economy
Society
Technology
Mobility
Spatial
Environmental
Other

Amsterdam as a Transit Utopia | Situation 2050

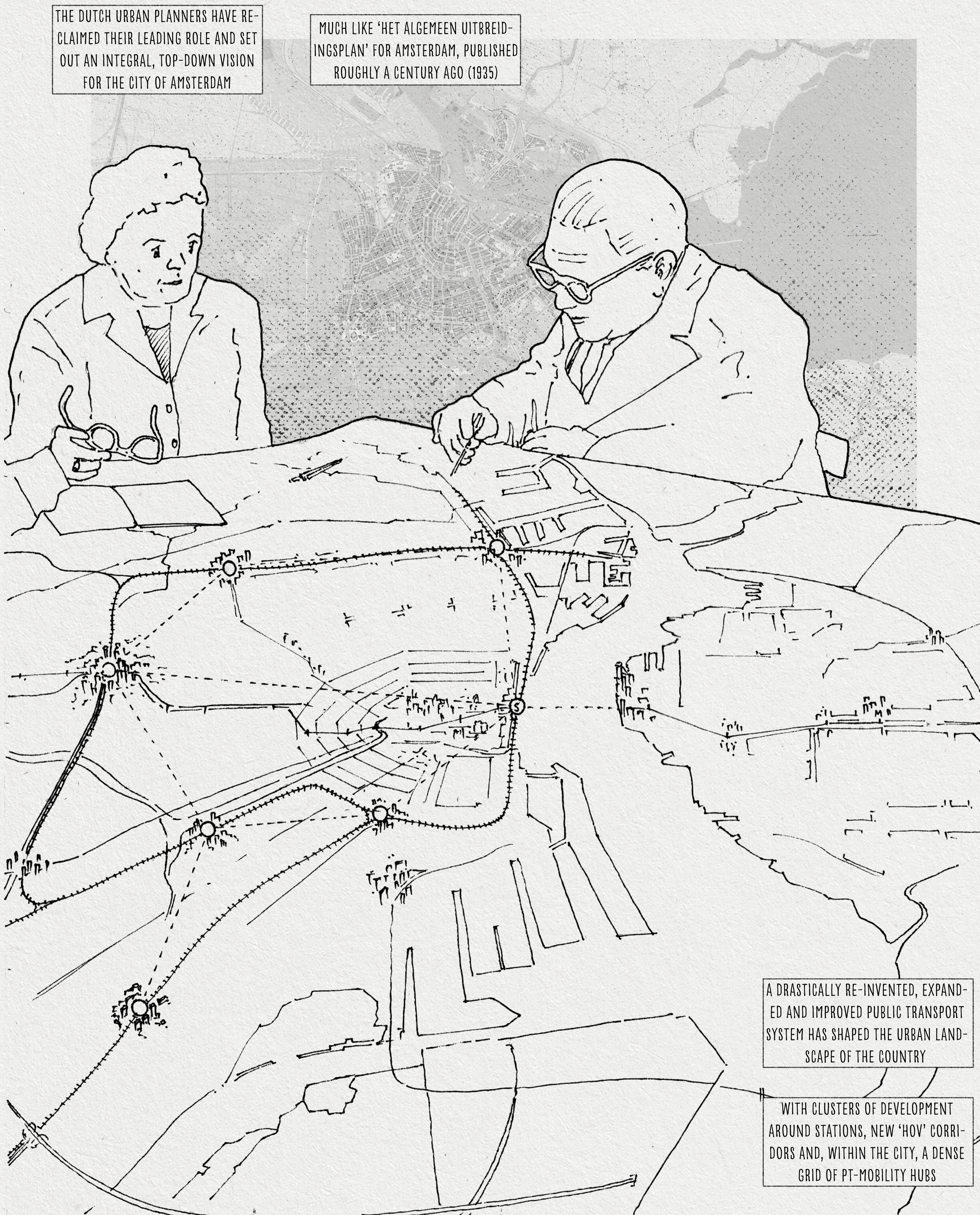
A Polynucleated AMA: The Manifestation of a Transit Utopia | Situation 2050

Back in 2020, it seemed as if the Paris Agreement would be turn out to be an unachieveable goal. Ever since the agreement was made, back in 2016, countries had to constantly lower their expectations and aims and it seemed as if none of them would meet the goals as initially set out. But how different is the situation now - with the Netherlands as a leading example of how a large transition for the good can be made, and how much can change within the timespan of thirty years.

The country has gone through a remarkable transformation and completely reinvented itself. Especially the way in it managed to make an end to the seemingly unending reign of the private automobile has put many in awe. Through strong top-down governance, and smart use of upcoming technologies for pubilc goals, the Dutch have expanded and improved their public transit system to such an unprecendented, well-integrated, sustainble system that even the most conservative car-owner eventually decided to give up his personal vehicle. How did the state manage to do that? And what where the - perhaps also less positive - implications of this unforgiving top-down approach?

Captivating the Potential of AV's for Public Goals I Critical Juncture 2020 - 2030

At the beginning of the '20s, Amsterdam Metropolitan Area was about to face a couple of large challenges. The region expected to grow steadily in the coming decades and especially within cities such as Amsterdam and Almere. These two alone would have to house hundreds of thousands of additional inhabitants within the coming thirty years. The increase in population was going to ask a lot from the region's mobility system, which was often already operating beyond its capacity. Both the highway system and the train-network saw daily moments of heavy congestion and overcrowded trains. It made the public authorities wonder, how on earth they were supposed to deal with the inevitable increase in commuters. Would they be able to sufficiently increase the capacity in line with the increased demand by expanding and improving the existing infrastructures? Or would they have to look for additional solutions and interventions?



vice with a greatly improved radius. A third one proposed a network of self-driving buses and jitney's - operating both between and within cities - meaning, it would help out the train to digest large commuter flows, and station areas to bring travelers to their door.

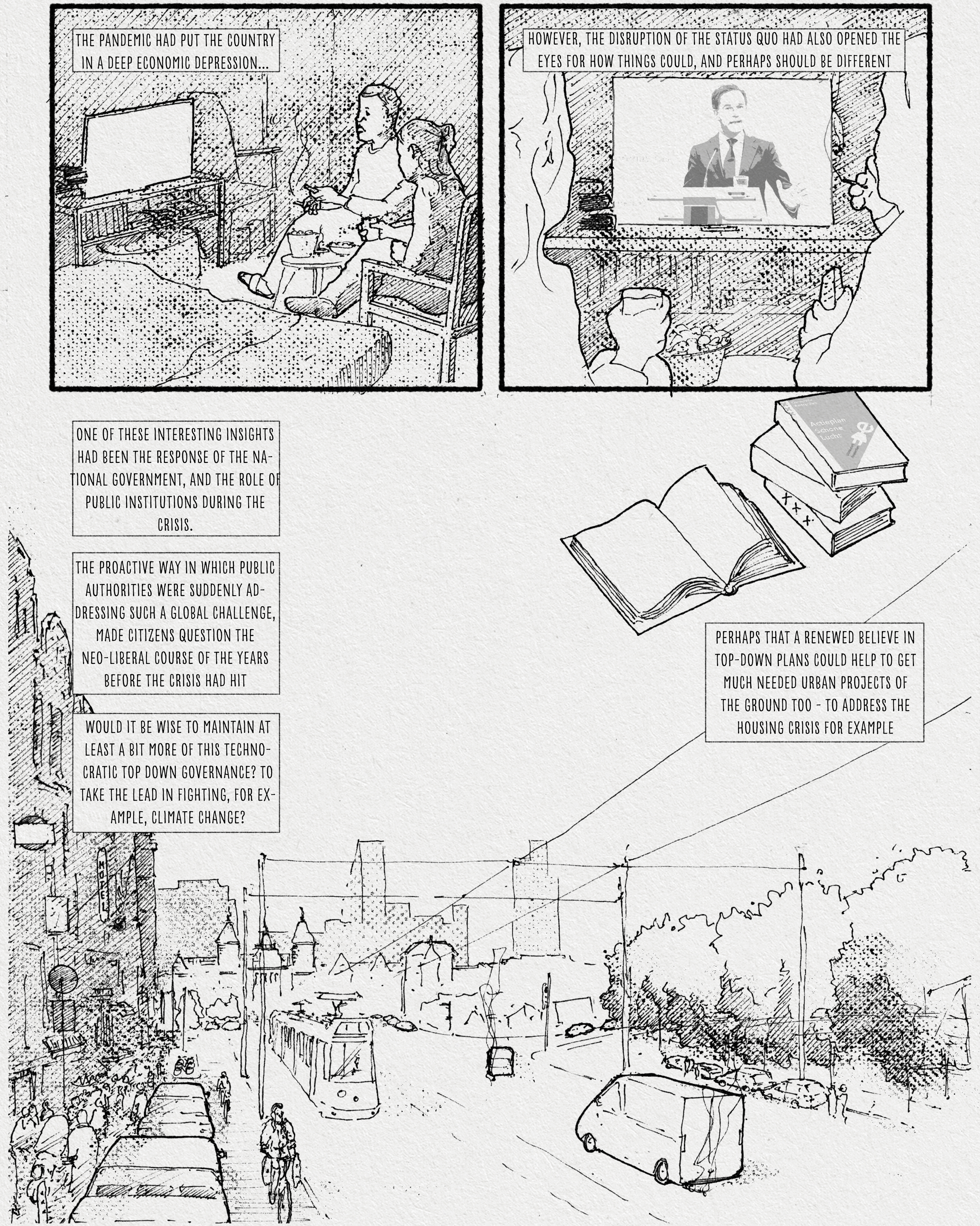
The Dutch government was particularly fond of the 'autonomous bus rapid transit' plan, as it was called. And it did not hesitate long before enthousiastically approaching the EU to see whether funding for an initial pilot would be feasible. It turned out there were quite a few already there, such as the CEF fund and the AVENUE - Horizon 2020 project, which stimulated similar experiments in Lyon[2], Copenhagen, Luxembourg and Geneva. The Dutch government thus saw an opportunity to make this radical and ambitious plan a reality - at least on a small scale to begin with. So it started to draft up both the plans for a pilot in the Amsterdam Metropolitan Area, as well as a vision for how to expand it into a nation-wide new transit network in the following decade.

The vision turned into a detailled plan for a long-term public transit transformation, which would take up to 25 years to complete. The first decade the government would mainly focus on getting important policies in place - including some strict car-discouraging policies. In the decade that would follow, so after 2030 roughly, the first tests with fully autonomous buses and last-mile services was thought to be feasible. And from there on, the system would expand quickly, with the phasing out of the traditional bus, and the arrival of self-driving bussen and jitneys, that would come to operate alongside trains as the main modes of intercity transport. In all of this, the national government, backed by the EU, would play a central role as planner and developer.

The Development of an Unprecedented AV-Transit System // Lock-in 2030 - 2050

It was not far into 3031, practically the second month of the pilot of self-driving jitney's between Amsterdam and Haarlem, and it already became clear the new system had the potential to become a hit. Where a decade earlier, people were convinced it were going to the adepts of Silicon Valley's technologies that would be the ones profiting the most from the arrival of autonomous vehicles, it now turned out this

2 Lyon has invited developer of autonomous transit NAVYA over to collaborate with SYTRAL and its public transport operator Keolis to deploy autonomous buses.



technology was used mostly by students and those living in the lower-income parts of the region. The appeal of the new jitneys and buses was so strong among these groups, as they had never been inculcated in the car culture to begin with. Instead, this autonomous transit system offered them just what they needed; inexpensive, on-demand, well-connected and flexible transportation; better than they had ever had with the traditional bus. And by integrating it seamlessly with other forms of public transit the public sector managed to provide a system that could compete with the car in regards to seamlessness, reliability, and ease of use.

The planning of a trip was already a whole new experience. Planning your journey would become kind of similar to how one would book a flight. One was able to book in advance, meaning that the earlier a ride was booked, the lower the fare would be. On-demand rides were a little more expansive however. The idea was that this pricing model would help to prevent excessive use of on-demand jitneys for smaller journeys which could be made by alternative modes of mobility instead, such as cycling and walking. Additionally, this planning scheme would allow the public sector to play with its fare rates; during certain events the price could be lowered to encourage people to take public transit over the private car for example. Also, the fares would be affected by a combination of the travel distance and the environmental impact of the journey; taking a more 'damaging' trip - let's say taking a small jitney from Amsterdam to Haarlem whilst the trains were relatively quiet - would lead to additional surcharges. Citizens were thus still able to choose freely from the options provided by the integrated mobility app, but were incentivized to take the least 'harmful' routes. This ensured the new buses and jitney's would not compete against, but with public transit, against the car.

Most of the journeys would start with a short jitney ride. After booking or hailing one of these small vehicles, the riders could meet their jitney at a nearby jitney-hub; a self-contained, moveable mini-station; providing shelter and traffic information. The flexibility of these stations to be relocated, was, especially in the early phase of the system, where the most efficient routes still needed to be calibrated, very helpful. In a later stage, as some common commuting patterns would have started to become visible and predictable, some of these jitney-hubs were to be placed in permanent positions. The longer trips would then usually involve a transfer at either a trainstation. Here the train or the intercity-bus could be taken, both of which were given a radical makeover - the train and bus of the future had little to do with the 'inflexible', and 'inpersonal' interiors of the past. The NS had made sure to make its latest modalities able to compete, at least to some extend, with the comfort of the private car[3]

In the years that followed, het Rijk would continue to expand the network of BRT lanes, according to the design of the Zuidtangent, a highly successful BRT infrastructure of separated bus-lanes from Haarlem to Schiphol, which was developed already in 2002. On the other lanes, there were of course still private cars – some of which were starting to become assisted or even fully autonomous. However, the interoperability of these vehicles was problematic, and the market of autonomous vehicles was unable to count on any support from the public sector to help them out here. In contrary, het Rijk phased in some new metered road tolling – in line with its ambition to meet the Paris Agreement – that would increase the toll on any private vehicle. The Dutch government made the autonomous vehicle for private use a true luxury item; if you really wanted to pay, you could get one. But for the regular Joe, the transit system would be the only available option.

Things kept on moving fast as the unforgiving top-down governance allowed for seriously big interventions, and let little room for resistance. The government had set out its course with its vision back in 2020, and made sure to stick close to it. This rigid approach was especially felt in the transformations of the station areas, which were now more important than ever. Just like with the mobility system, the national government made sure to stay closely involved in the planning and the lay-out of the areas - it even decided upon locations of important facilities such as hospitals, or schools, to ensure they would be properly connected to the public transit system. But it were also the data-specialists, who got to work with enourmous amounts of data generated by the extensive public transit system, who started to play an important role in advising and steering design of developments in the city, as they knew exactly which movement and behavioural patterns to play with and stimulate.

The Dutch way of planning became known as the 'revival of the planner'. After a long period in which much of the planning was steered

3 See e.g. 'Journey to the future: a Passengers Experience' by NS and Mecanoo. A Passenger Experience

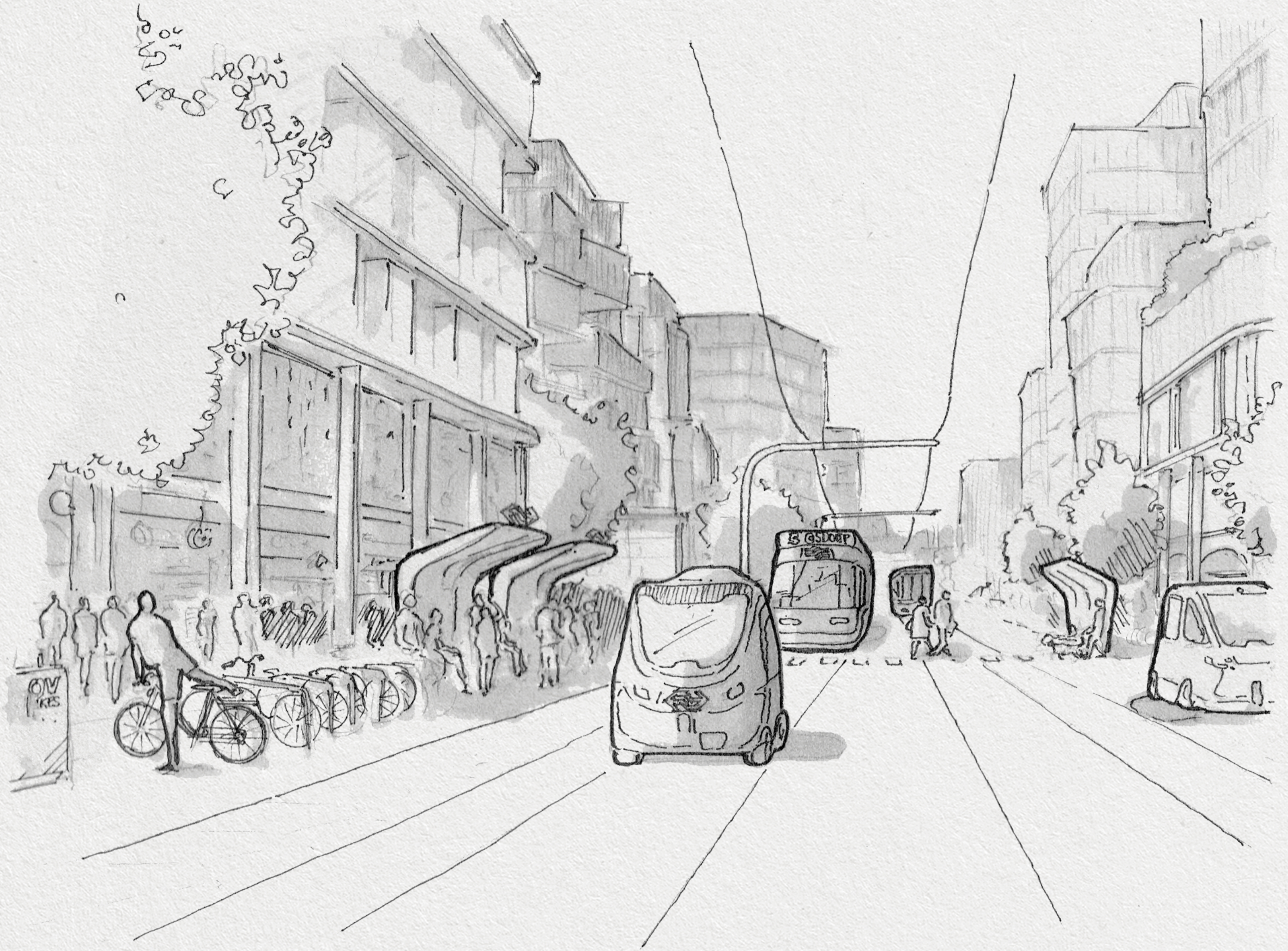
by private developers, planners and large housing corporations were once again setting out the main guidelines for urban development. The long-term vision for the public transit system was even accompanied by an equally long-term Transit Oriented Development plan that reminded some of the Nota's Ruimtelijke Ordening, the instrument planners used to work with from the '60s til the '90s.

In the years that followed, the Netherlands seemed to have entered a new golden age. With their revolutionary plan, it had solved the challenge that still remained for many other countries – how to use autonomous technologies to make an end to auto-centric development, instead of strengthening it. The plan had appeared to be financially feasible, accessible and affordable, environmentally sustainable, resilient, and smartly incorporated the already existing well-functioning public transport network the country had invested in so much. But in order to make this all happen, the public sector had to put itself into absolute control. Control over the design and implementation of the vehicles, control over the infrastructures, and control over the personal (travel)data and technological innovations used to successfully maintain and operate the system. The development of the entire system had essentially been a top-down, hierarchically controlled, technocratic, yet transparent project – which did not leave much room for involvement or feedback from the market or citizens.

At the heart of this governmental technocracy was the predictive modelling enabled by the personal data, as harvested by KPN and later the mobility system itself, that helped the planners to operate the system efficiently and to nudge people into making certain choices regarding routes or modes. But the data was used for much more than just to successfully operate the mobility system. Also urban design would come to more data-driven. Activity and movement patterns would be used, for example, to optimize the design around station areas and the transit hubs – suggesting how the accessibility could best be improved, or how liveability could be preserved in these increasingly dense developments. Data also was a way for the public sector to get a deep understanding of the travel behaviour of individuals. It would turn out to be valuable input for het Rijk to anticipate whether a new development plan was going to keep people with public transit – or whether they would be inclined to switch to the private car – at which het Rijk was likely to alter the plans, pre-

venting new residents from getting 'locked-in' to their car.

All in all, the technocratic planning regime led by the public sector was a success story. But to achieve it, the civic society was harshly restricted in its freedom. Both freedom of choice and freedom of unrestricted movement, were still present – but came at a high cost. Only the very rich were able to permit themselves to move outside of the public transit system, able to afford the expensive toll roads and their autonomous vehicles. The rest of the citizens had put their fate in the hands of their politicians. For some, this loss of control remained frightening however; what would happen if a new party would come to lead the country, that would use its mobility system to achieve less democratic goals? Other believed that, now the government had done the hard work in leading the way to a sustainable and prosperous future, it was time for it to let go off its grip a little; and to slowly let market and citizens initiatives onto the scene.



drawing by author, based on the drawings for Sidewalk Toronto by Andrew Edwards

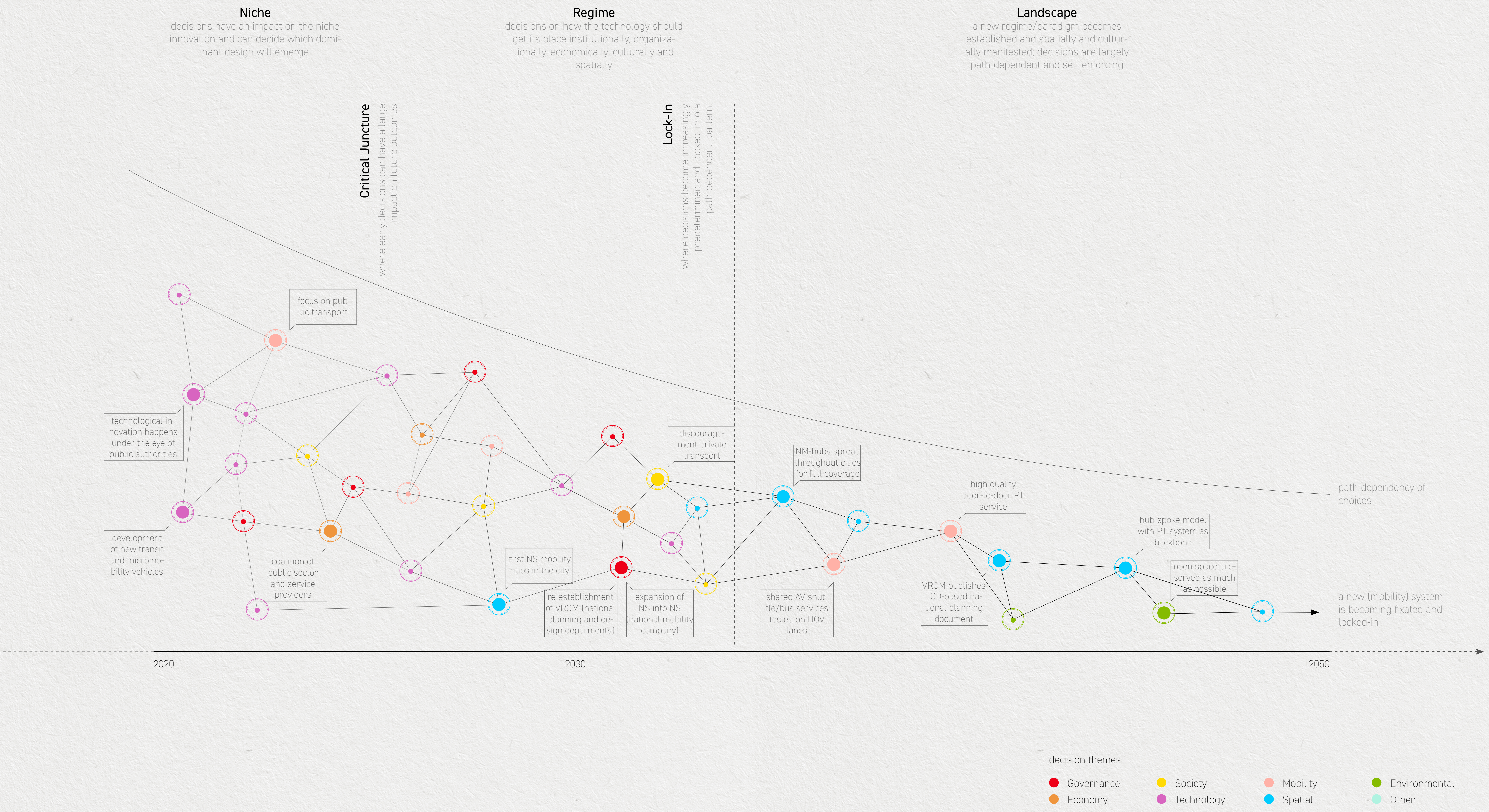
THE TRANSFORMATION OF HET LEIDSEPLEIN. THE BRIGHT YELLOW AND BLUE OF THE NATIONALE MOBILITEITSMAATSCHAPPIJ HAS MADE ITS ENTRANCE INTO THE MOST PROMINENT PLACES OF THE CITY. HERE WE SEE ONE OF THE LAREST INNER-CITY HUBS

HERE WE SEE ONE OF THE MAPS THAT WAS A PART OF THE VISION DOCUMENT PUBLISHED BY THE RE-ESTABLISHED VROM (2035)

CLEARLY VISIBLE TS THE PUBLIC TRANS-PORT SYSTEM AS THE REGIONS MAIN 'STRUCTURAL ELEMENT': AROUND THE STATIONS, CATCHMENT AREAS SHOW THE ZONES IN WHICH DEVELOPMENTS ARE PLANNED

THE HUB-SPOKE MODEL IS CLEARLY DIS-TINGUISHABLE TOO. A CLEAR DISTINCTON IS MADE BETWEEN AREAS THAT ARE CON-NECTED TO THIS MODEL, AND AREAS THAT FALL IN BETWEEN THESE SPOKES - IN A SORT OF NO-MANS LAND

CONCEPTUAL TIMELINE TRANSIT CITY



THE WIKI CITY

This narrative explores what could happen if citizens, led by their local authorities, were to take control over many private and public tasks. What if citizens get to play a major role in deciding about their future, instead of following the market-led smart city-future or the EU-led top-down plans. A possible alternative is called becoming 'local sovereignty', and revolves around localities - the scale of the town and the city - making their own decisions on urban planning and much more.

The plot:

In the early '20s, more and more cities decide to form alliances to stand stronger in their fight against predatory global tech-giants that seem to want to take control over cities' data and their public assets. By forming partnerships, 'technological sovereign' cities can share knowledge and work together in their process of reclaiming control over their own decision-making.

One of the main things local authorities want to get control over in the next decade is the development of their own local mobility system. With the decentralisation of most funding and planning responsibilities from the national government to the regional and municipal level, they are given that opportunity. It turns out some go for 'Jan Gehl-like' pedestrian-oriented urbanism, whereas others choose to design for and around autonomous cars - as a result a diverse patchwork of cities and municipalities emerges in the region, each with its unique character, but also with issues of interconnectivity.

On the one hand, does the ability to foster local, tailor-made experimentation and innovation lead to fantastic bottom-up initiatives, but on the other hand, results the lack of top-down control in poor cooperation, connection and unfair competition. It becomes clear not every decision should be left to the local level to be made.

"Wikicracy"
A Wikipedia-like bureaucracy, driven by bottom-up input. Amsterdam offers an open platform.

Participatory
Broader participation, such as consensus decision-making. Voting and referenda.

Open Decentralised Planning
Planning is decentralised to the level of municipalities and sometimes even further

Sovereign Locality
(Groups of) municipalities are largely in charge of their own decision-making, ie Amsterdam sets an individual course

Local Entrepreneurealism
Local actors are developing solutions for location-specific goals and values

Local Regulation
Localities are free to set their own rules regarding market innovation

A Unique City
Close collaboration municipality and entrepreneurs leads to unique innovation

Collectivism
Values of the collective (the city, the community) are more important than individual priorities.

Re-Localized
Lifestyles (and mobility patterns) are localized; daily lives are closer to home/less fragmented

Open Tech
Technological innovation is in the hands of start-ups and citizens. Large companies are strictly regulated/banned

Autonomous not for everyone/where
Fully autonomous never becomes fully commercially viable and is undesirable in the inner-city.

Electric and Flexible
New modes are primarily micromobility; e-bikes, scooters and jitneys.

A Cycling Utopia
Amsterdam ensures even more space will be made for biking and walking - a bicycle highway is constructed

A Bit Anarchistic
Traffic within the city should remain an 'organic, organised chaos'. Liveability is a leading goal

AVs as a Local Solution
Semi-AVs will be only active in some parts of the city - or for certain groups of society

Local Streets
Most investments go to the improvement of local mixed-traffic streets. Larger projects are given less attention

Downscaling Ringroad
The ring of Amsterdam is downscaled and largely dissolved in order to reconnect the urban fabric

Amsterdam Mobility Platform
All local services are neatly integrated in a single platform (OV platform), though only within Amsterdam

Community HUB
Community HUBs are more than gather points for mobility; local amenities and events are hosted here too.

People Oriented Development
The city grows around its PT network and the new community hubs.

Ringzone
Former large car-infrastructures are redeveloped or demolished to make room for new urban developments

Woonerfen
The car-free typology becomes the standard with the expulsion of the car

Mixed Use
Housing, facilities and workspaces are mixed. Diversity in programming creates liveable vibrant areas.

Public Space
Public space is the domain of the community. Traffic space is limited.

Preservation of Green
Open (green/blue) space is preserved and added where possible.

Sustainable Traffic
Emission-free PT and restricted private mobility limits resource use and emission..

Active Travel
The absence of motorized mobility and walkability of neighbourhoods encourages active travel

Governance
Economy
Society
Technology
Mobility
Spatial
Environmental
Other

A Patchwork of Rebel Cities | Situation 2050

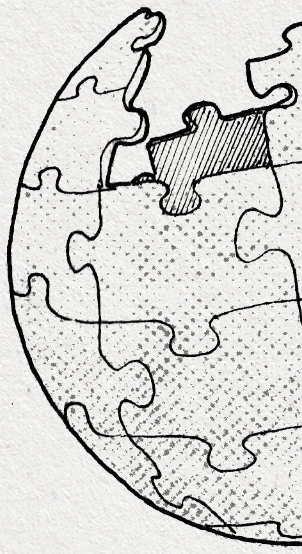
It's Friday the 16th of July, 2050, and we find ourselves in the Amsterdam RAI listening to a passionate speech from Ger Baron, former Chief Technology Officer of Amsterdam. As today we celebrate the start of the twenty-fifth conference on WikiCities, a yearly event that attracts visitors from all over the world, from progressive municipalities that come to learn from other cities, to grassroots movements that showcase their latest innovations and ideas. What connects this wide variety of visitors - public authorities, citizens, entrepreneurs - is the concept of the city built upon a 'wikicracy', a city which can best be described as an alternative, bottom-up and democratic variation on the 'smart city', a city – according to Morozov and Bria - in which it are citizens and municipalities that make proactive decisions, instead of the market or top-down forms of governance. In other words; cities that are autonomously deciding on their fate regarding topics such as mobility, development of infrastructures and urban planning through democratic processes, in which equality is one of the most important values.

The movement of the WikiCity can be seen as a movement of 'rebel cities' in a sense, of cities that stood up against ongoing globalisation and neo-liberalism politics[1] – of which large corporations and their 'smart city' are an obvious example. But also of cities and their citizens that were unhappy with the top-down, hierarchal governance of the EU and the control it had over national governments. It is thus a movement that has grown out of the desire of citizens to regain control, and to have a say in the decisions regarding the future of their communities, towns and cities. A desire to be independent from both global tech-giants, and large institutions[2].

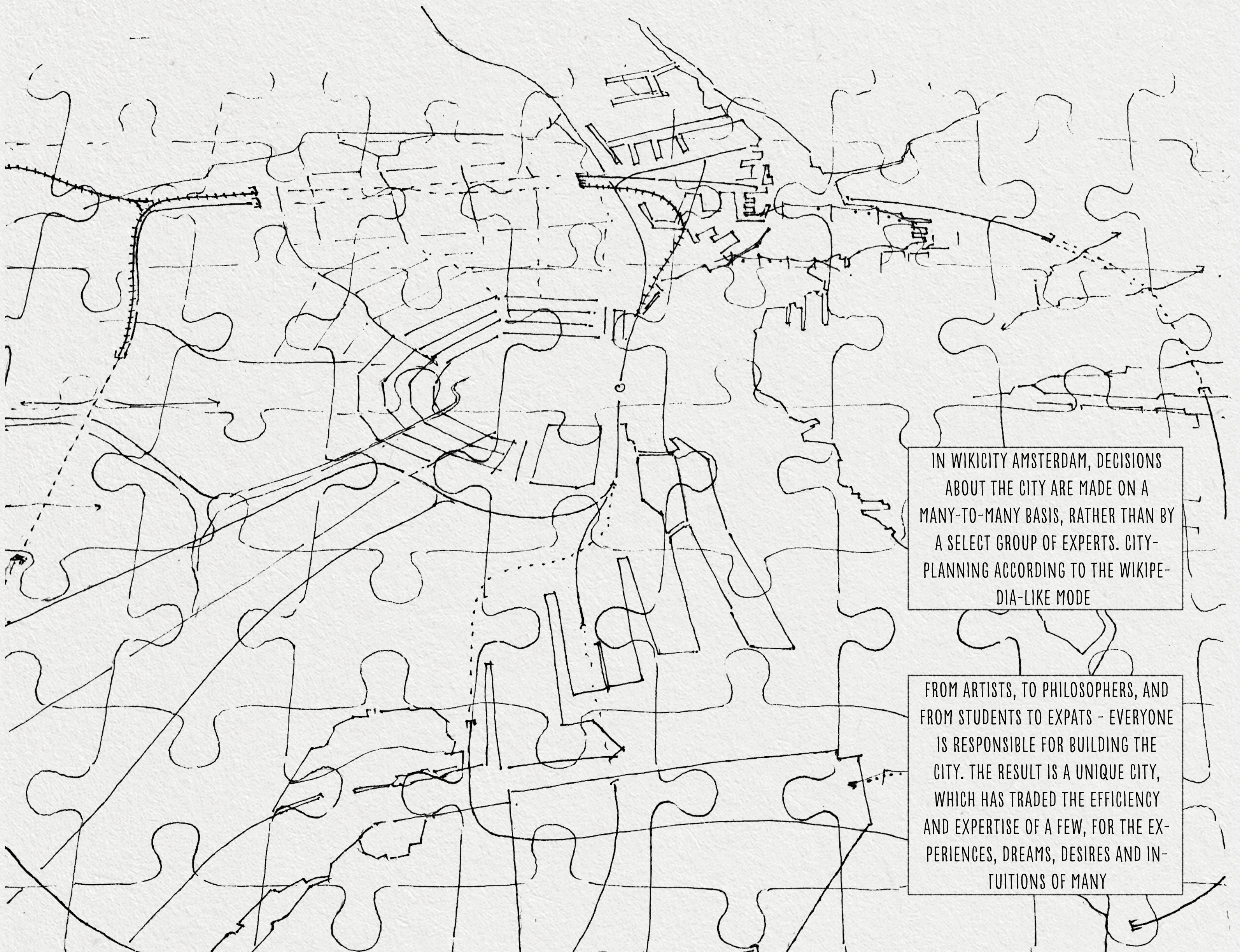
The result has been astounding. In the roughly thirty years since this

1 Two of the well-known critics of this 'laissez-faire' digital capitalism are Evgeny Morozov and Shoshana Zuboff (See her recent book on Surveillance Capitalism; 'The Fight for a Human Future at the New Frontier of Power')

2 Many scholars talk about what this kind of 'bottom-up alternative' could be. Interesting examples can be found in the paper by Carlo Ratti and Anthony Townsend from 2011 called 'The Social Nexus: The best way to harness a city's potential for creativity and innovation is to jack people into the network and get out of the way' and in the book 'Smart Cities: A Spatialised Intelligence' by Antoine Picon. They all discuss the importance of leaving behind the technocratic, efficiency-driven top-down smart city, in order to form an alternative of a collaborating (local) authorities and citizens. Access to open data, civic laboratories, room for local entrepreneurealism are all important elements.



WikiCity Amsterdam



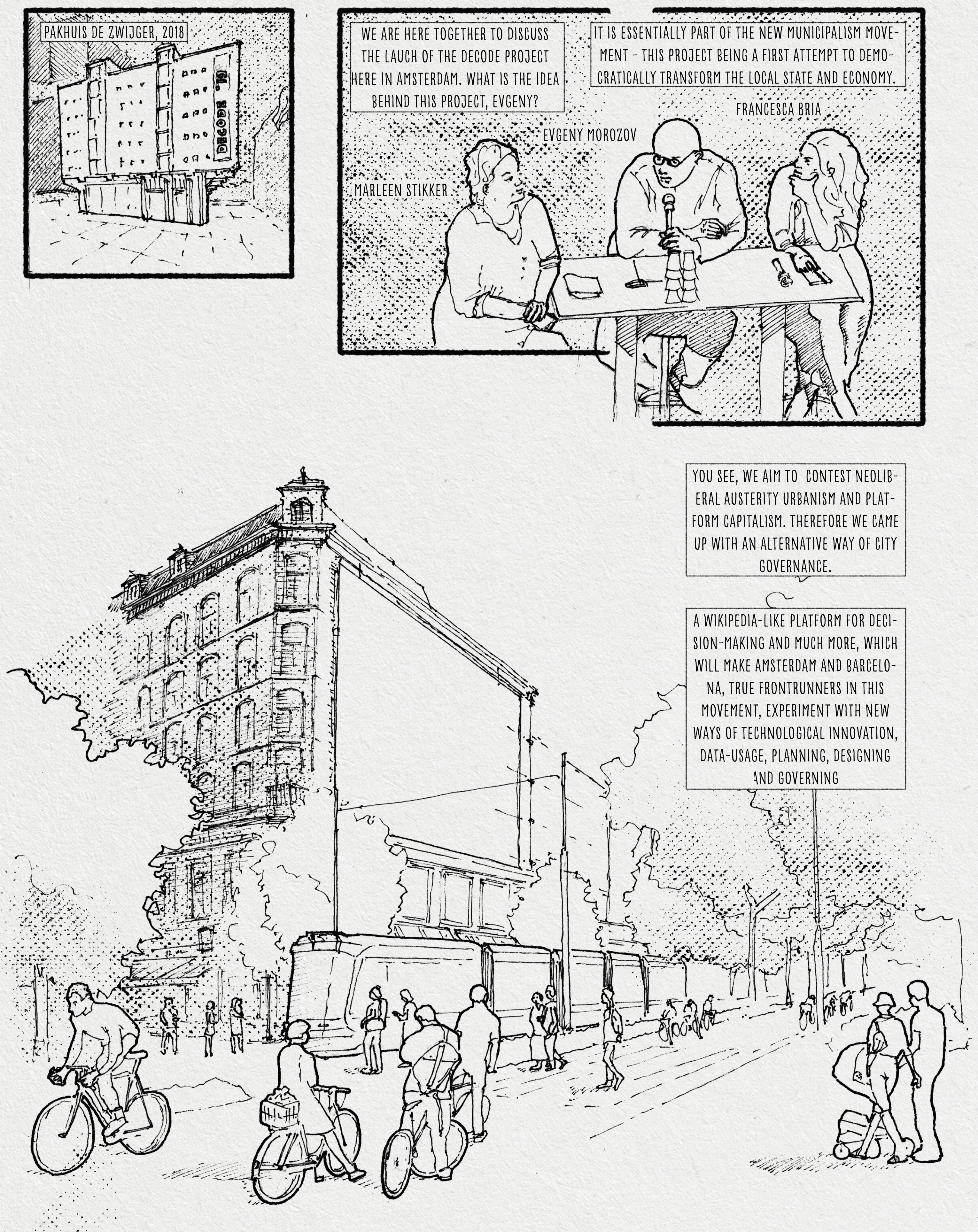
movement got ground, hundreds of cities worldwide have connected themselves to the network of rebel cities. All of them shared the ambition of returning to more local forms of governance and self-control. And already by just looking at an area the size of the Amsterdam Metropolitan Area will give a good indication of what this new paradigm of 'local planning and control' has led to; a widely varied patchwork of municipalities with each their own character. It is the direct result of the many different choices that have been made by each individual municipality in the fields of mobility, urban planning and the development of infrastructures. In 2050, going from a high-density, car-free and walkable city like Amsterdam to a now widely expanded, very car-dependent city such as Amstelveen might be a matter of minutes - the differences in things such as lifestyles, quality of infrastructures, character of public spaces or types of popular building typologies can be enourmous. Local control has had its up, and downsides, so to say.

Tapping Into Local Inventiveness | Critical Juncture 2020 - 2030

The story about the Local Society really takes off in 2022, but before we get there, let me try to set the stage and take you back to the situation in the Netherlands of the early '20's. Around that time, the Netherlands, as so many other countries, was in the midst of a tumultuous period in which major decisions about its future course had to be made. A divisive time in which clashing opinions about if, and how, the country should make transitions regarding climate and energy seemed to almost rip society apart at times. Whilst the political debate became increasingly polarized, drifting right and left-wing further away from each other, citizens too felt the need to become outspoken. Some of them out of fear of change, others out of fear things were not changing fast enough.

Whilst upset working and middle class citizens tucked in yellow vests roamed the streets of Paris– a rally initially sparked by rising fuel prices, but soon serving as a way to express a more general discontent - , a younger generation of students marched through Amsterdam to demand actions towards a climate transition from the Dutch government. A period of mass demonstrations seemed to have returned, making some reminisce of the anti-nuclear protest of the '70s and '80s, which drew hundreds of thousands at the time.

In 2022, yet another massive rally would be organised by the citizens of Amsterdam, though this time not targeting the government but a rela-

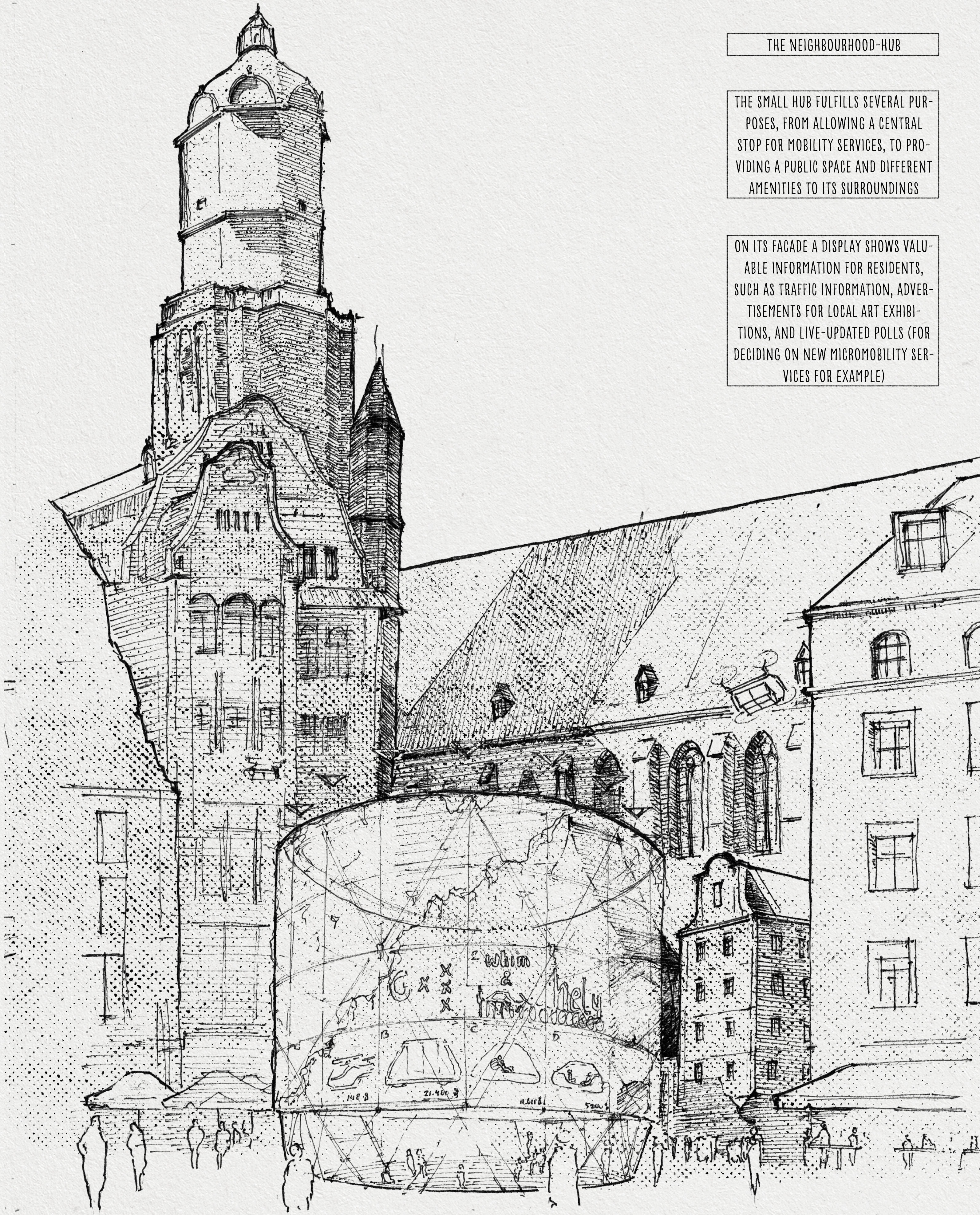


drawing by author, bottom image based on the drawings for Sidewalk Toronto by Andrew Edwards tive newcomer to the city: Uber. Since its arrival in 2012, the American company had managed to build quite an impressive and notorious lists of countless controversies in the just eight years' time the company had been operating in Amsterdam. When made public Uber was involved in yet another privacy scandal, concerning the leak of personal data and credit card information, a line had been crossed for many. What followed was the 'Amsterdam Uber-free' rally, attracting over 100.000 upset and worried citizens.

Not long after the rally, the municipality of Amsterdam, pressured by a collective of furious taxi-drivers, local public transport operators and agitated citizens, then saw no other option than to write a final chapter to the already impressive story of lawsuits, containing 'unfair competition', 'data leaks', 'tax evasion' and 'miserable working rights and wages of Uber drivers'; local regulations were changed and the platform service was banned from the Dutch capital for good. Amsterdam was applauded, as it now fitted in to a selective list of cities that had the guts to step up to a extremely popular and powerful company from Silicon Valley[3].
It meant the first major victory on one of the until then seemingly unstoppable tech-giants from Silicon Valley, led by a locally organised initiative of transport operators and citizens. However seen by some as a lucky win of David over Goliath, the event did raise awareness amongst the citizens of Amsterdam about their potential authority and power once well-organised, and it would not be long before this first event, marking the start of the Local Society, would be followed up by an even more astonishing one.

The victory on Uber was not just seen as a successful exclusion of a mobility provider with a bad reputation. The victory meant much more than that. It became an example, a source of inspiration even, for the citizens in their battle against globalisation and privatization. It gave momentum to a growing counter-movement of citizens desiring to re-localize and to emphasize on social rather than economic prosperity; now best known as the 're-localization-movement' of the early '20s.

3 Moscow has been another prime example. The Russian capital took a strong position, and stood up for its own local taxi providers, by stating it would ban Uber for as long as the company refused to fully share the data it extracted from the city, which it rarely does. Thankfully, this is part of a trend of cities that are 'putting forward more aggressive public policies to regulate on-demand economy players whose anti-competitive practices tend to bypass local regulations.' which is an essential first step in creating a fair climate in which local entrepreneurs and businesses can thrive (Morozov and Bria, 2017).



These desires materialized in the many community-based cooperation's that emerged during these years. Feeling the need for more tailor-made interventions, citizens started to take initiative in their own hands, as they began to collectively organise the maintenance of shared public space, green and facilities. Especially helpful were the early low-tech open-source platforms[4] that offered both a marketplace on which local entrepreneurs could come in contact with citizens, as well as an interactive model of the neighbourhood which could be used by locals to rate existing objects and to propose desired interventions[5,6].

The potential of self-organising services through local cooperations became even more visible in small, rural towns like Zuiderwoude, that started to operate their own local public transport. Local inhabitants were fed up with the usually poor bus-services – the dreaded bus 315 coming past Zuiderwoude was practically empty most of the time, departed only every hour and would take more than 45 minutes to cover the mere 10 kilometers to Amsterdam's Central Station – and decided it would be a better deal for both them and the region if it were to form a new cooperation with a local commercial transport provider to pilot a more demand-responsive and flexible shuttle service. The results were positive; the smaller shuttles were able to drive more frequently, were bookable via a community app and even allowed a door-to-door service for some elderly residents.

This led to the launch of the 'Local Challenging' concept in the following year[7]; it gave both municipalities and citizen collectives the ability come up with alternatives to national or regional plans if they had the idea they could do it better. The success was astonishing. Cities and their citizens felt the new challenging system gave them finally the opportunity to make sure money would go to the interventions they really needed; usually small plans that would address very specific and local issues, such as the transformation of a parking garage, or the repair of a local road.

The Local Challenging right was a first taste of what was to come; because two years later many national responsibilities - also financial responsibilities - would be in fact decentralised to the level of local authorities; regions, provinces and municipalities. These were then allowed to even further decentralise responsibilities to the level of the neighbourhoods. It would mean the end of much of national planning; from now on, municipalities were practically free to decide as they wished. The era of the 'rebel cities', locally sovereign in their urban planning, mobility, and whatnot, was born.

With the decentralisation of funds and governance, dreams of many could become a reality. In some parts of Amsterdam for example, a desire for a more local, creative and almost 'town-like' lifestyle had been growing for years, and could now, with the help of the local challenging platform, fully grow. Young and buzzing neighbourhoods like de Pijp was amongst the first to see the opportunities and take advantage. Here, many initiatives came to blossom quickly after the decentralisation of funding had given the municipality of Amsterdam the opportunity to invest in local startups and entrepreneurs. There was, for example, a group of students that managed to persuade their municipality to give some funding to help scale up a local service of sharing electric cargo bikes - giving them the help they needed - and previously would not have gotten. The resulting was positive, in many areas in the city, but also in other municipalities, the direct access to a bit of money and help sparked the local inventiveness of many small entrepreneurs, and the involvement in the planning process of citizen collectives, helped to resolve the right issues.

Not much later, even the more monotonous and monofunctional Vinex and groeikernen were starting to make use of the opportunities the localization had created. The upcoming 3D printing industry was an ideal opportunity for a locally oriented and decentralized new economy to emerge here, which was able to thrive just as well in a small mixed residential-workshop in Almere Buiten as in Amsterdam it appeared. Believe it or not, but the sleepy satellite cities started to come to live, and slowly turned into more independent cities, with a character of their own. The future seemed bright and buzzing.

4 Such as the Gebiedonline and DDDC pilots, API platforms released in Amsterdam that connected in total 230 partners; citizens, municipality, province and local entrepreneurs.

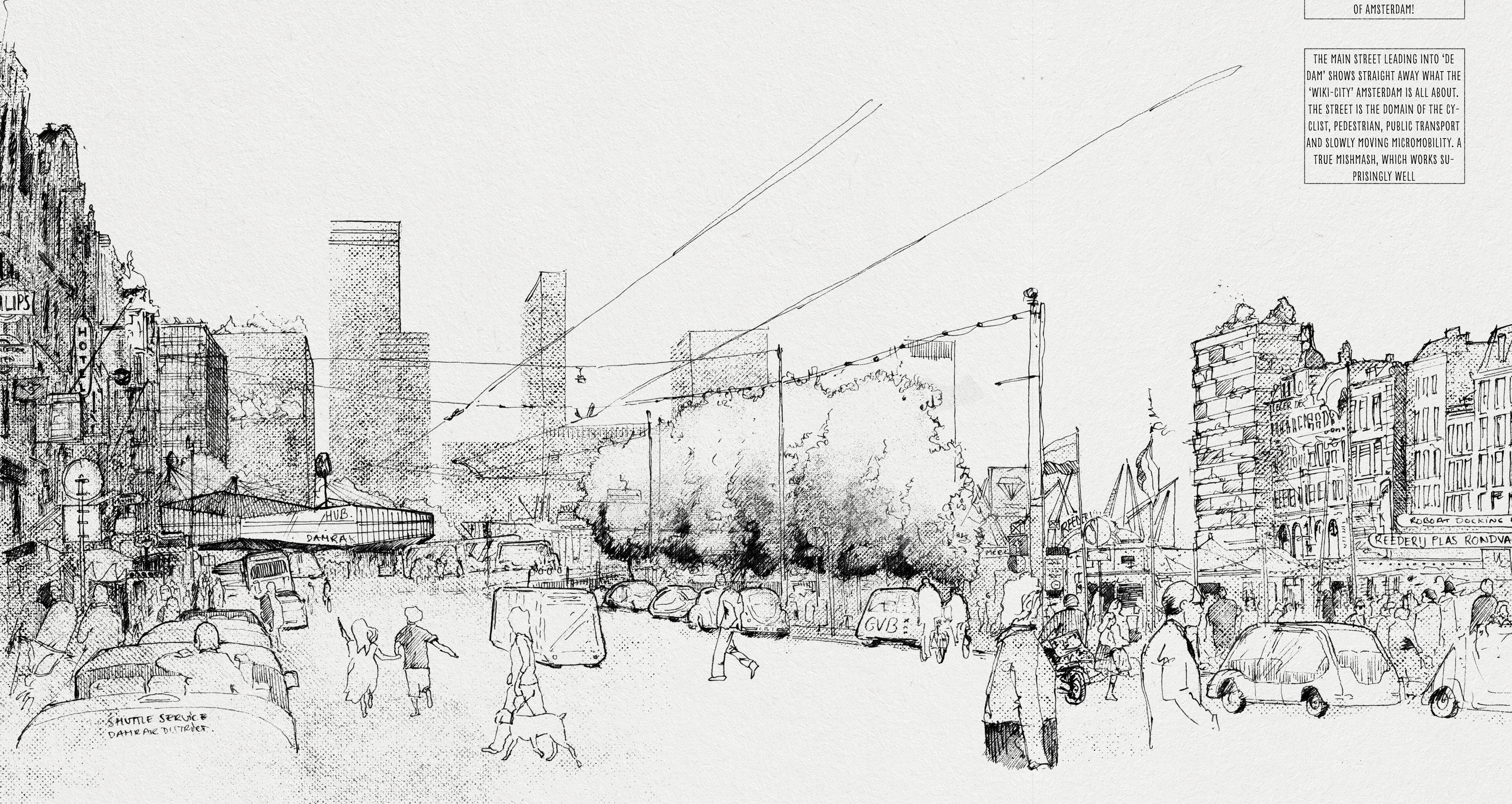
5 Another interesting development is the rise of online marketplaces, on which citizens can not only buy and sell, but also share products, goods and services. Sharing Cities Seoul initiative is a good example, meant to help 'the city adopt the concept of the sharing city', with the goal to empower citizens and spark social innovation. Amongst the shareable things are: parking spots, bookshelves, houses, and citizen participation projects. (http://english.sharehub.kr/what-is-a-sharing-city-seoul).

6 Interactive models for local planning are already available in many cities. Amsterdam is one of the frontrunners here with a lot of its environmental data available online. Another great example is Helsinki, with its Helsinki Smart City App Hack. As a source of inspiration and assistance for developers, 'the city is showcasing potential ideas, datasets, and contact points related to the five smart city topic areas'. Additional information and links to other open data resources are available on the Helsinki Smart City App Hack page (http://smartcityapphack.com).

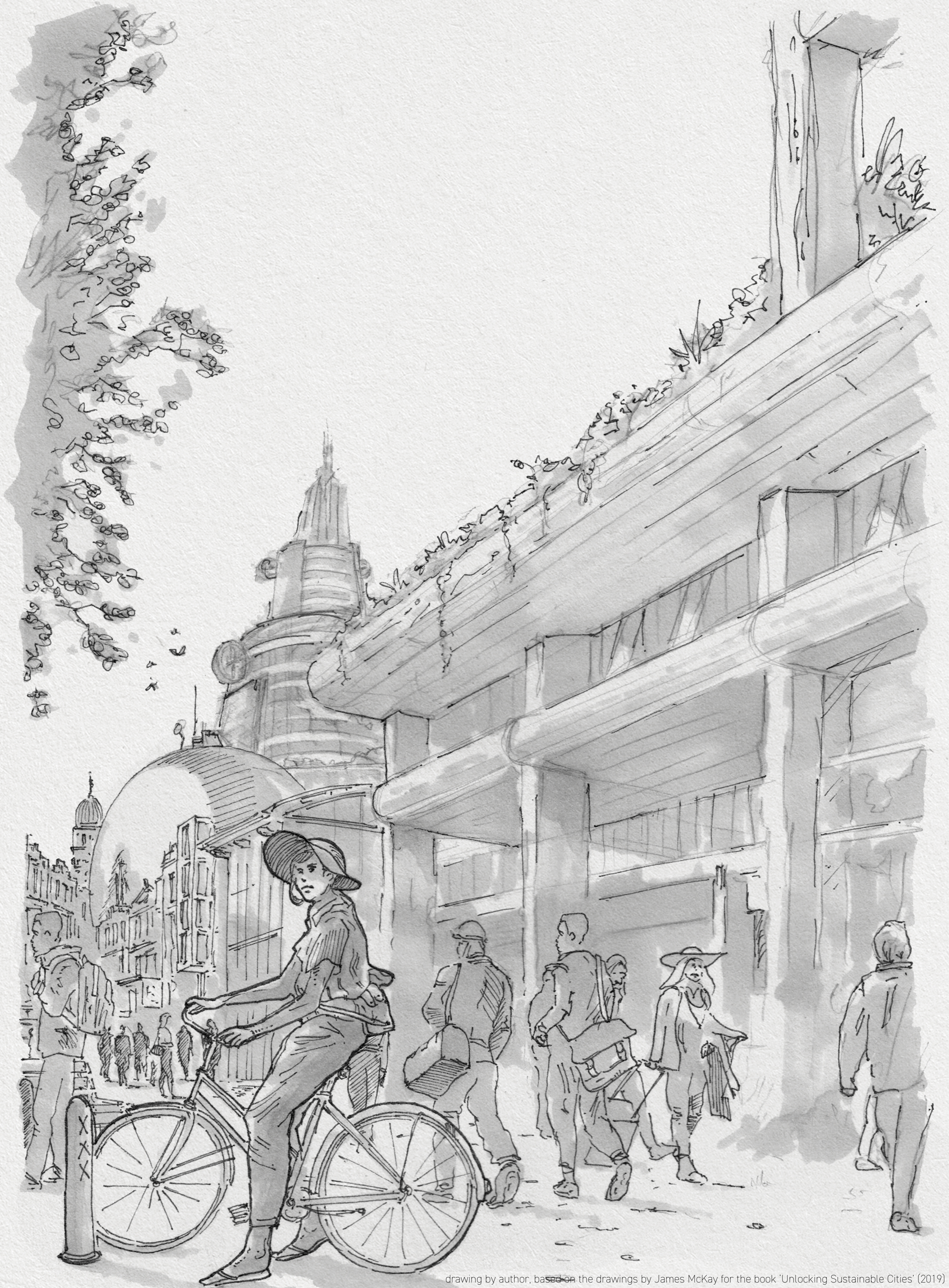
7 For this, I was partly inspired by the Neighbourhood Plan, common in the UK, which 'helps local communities to shape development in their area'. Essentially, the plan can be created by citizens gathered in a community, and, if it meets al the requirements, it can partly overrule the existing plans as made by a private developer or higher authority (GOV.UK).

THE FAMOUS DAMRAK, THE ENTRANCE OF AMSTERDAM!

THE MAIN STREET LEADING INTO 'DE DAM' SHOWS STRAIGHT AWAY WHAT THE 'WIKI-CITY' AMSTERDAM IS ALL ABOUT. THE STREET IS THE DOMAIN OF THE CYCLIST, PEDESTRIAN, PUBLIC TRANSPORT AND SLOWLY MOVING MICROMOBILITY. A TRUE MISHMASH, WHICH WORKS SUPRISINGLY WELL



drawing by author, based on the drawings by Johannes Ingwersen and his 'plan voor Amsterdam' (1960)



drawing by author, based on the drawings by James McKay for the book 'Unlocking Sustainable Cities' (2019)

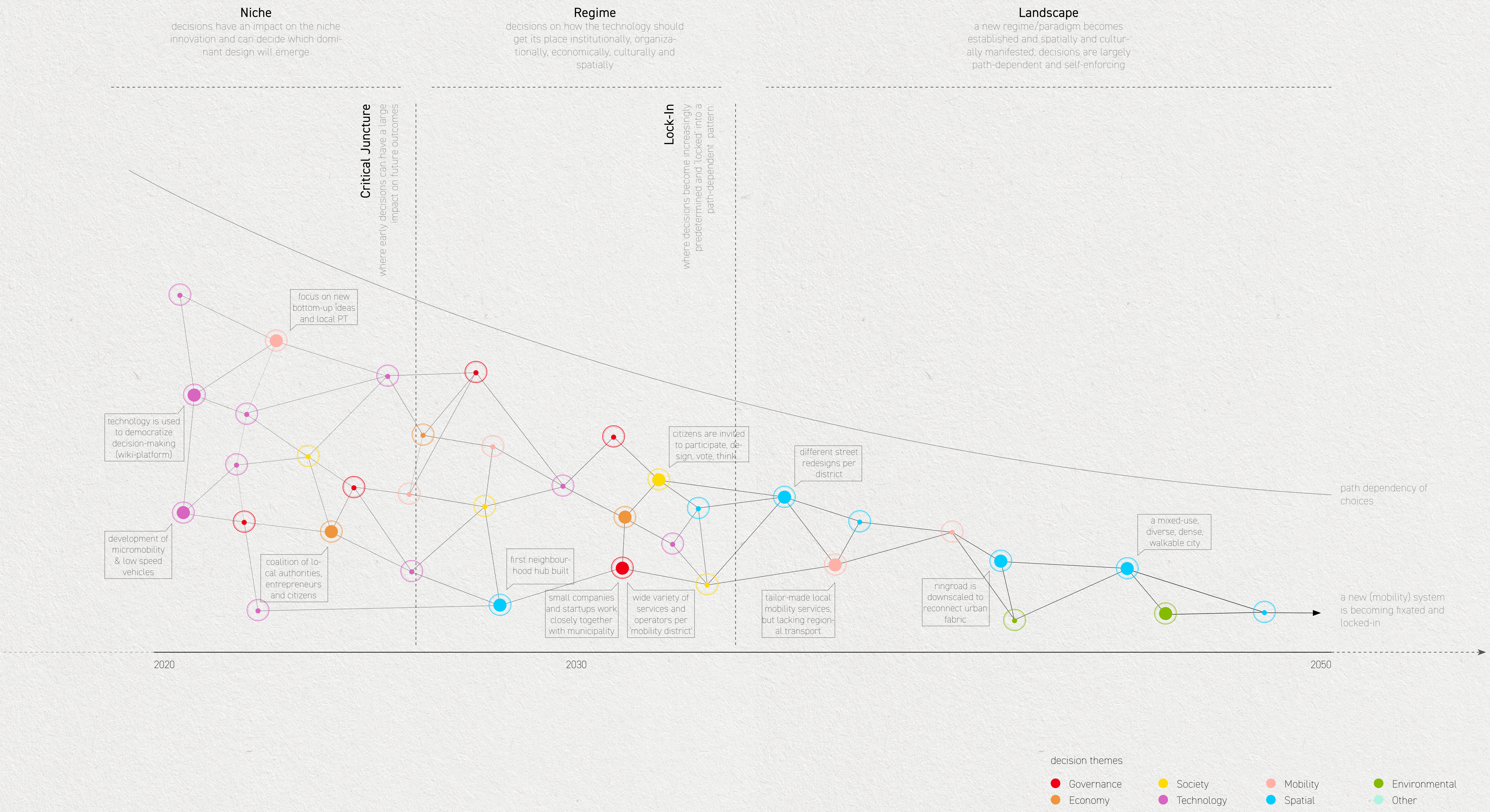
THIS TETRIS-LIKE MAP IS A CONCEPTUALIZED VISUALIZATION OF THE AMA REGION OF WIKI-CITIES

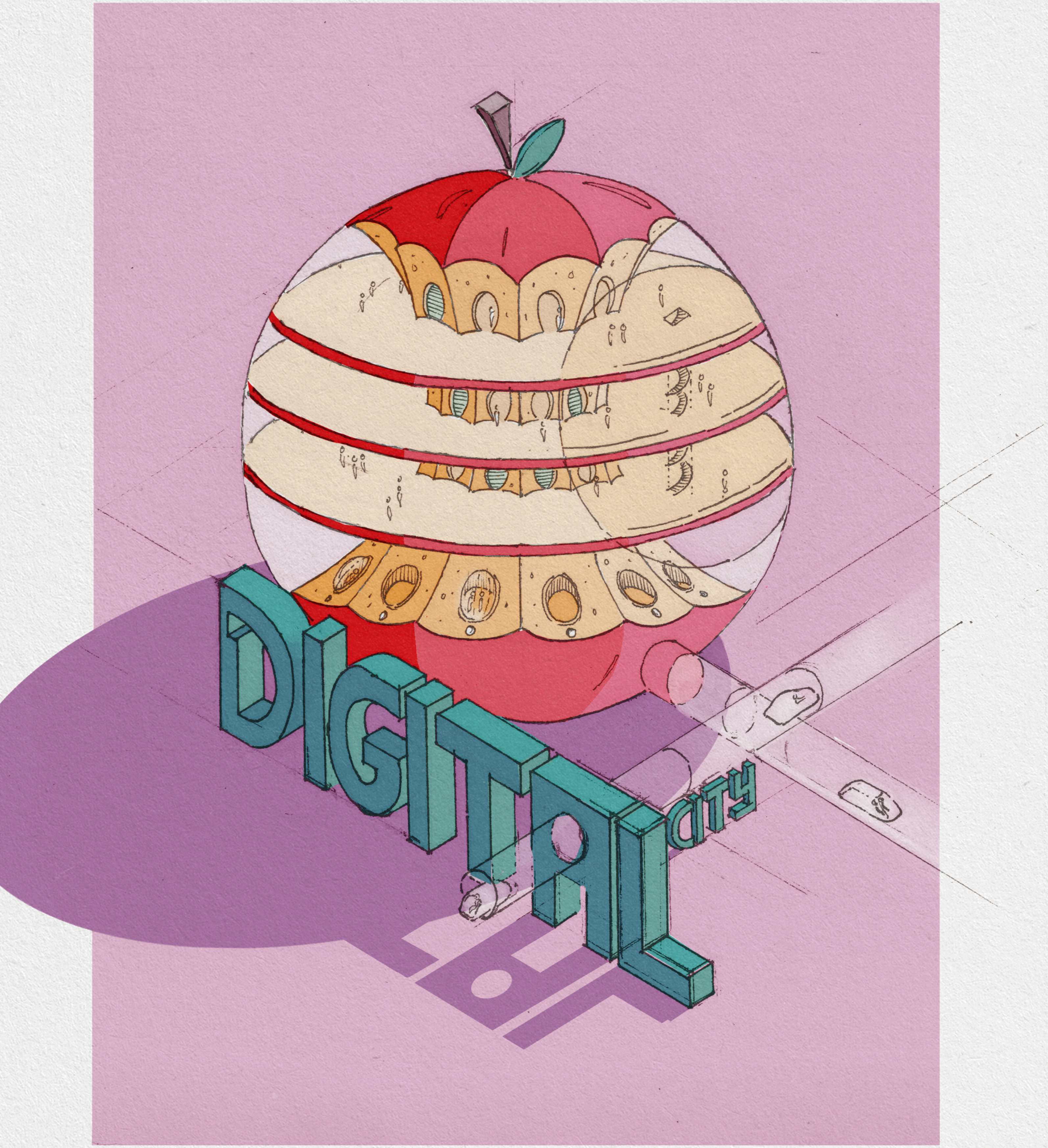
THE RESULT IS A PATCHWORK OF UNIQUE LITTLE DISTRICTS, MAKING UP DIVERSE CITIES FULL OF BOTTOM-UP INITIATIVES, LOCAL MOBILITY SERVICES AND SMALL SCALE DEVELOPMENTS

OTHER IMPLICATIONS ARE THE DOWNSCALING OF ROAD INFRASTRUCTURES - ESPECIALLY THE RINGROAD - IN ORDER TO RECONNECT AND BUILT FINE-MAZED, PEOPLE-ORIENTED URBAN FABRIC

THE 'CELEBRATION' OF THE LOCAL LEADS TO A NEGLIGENCE OF THE REGIONAL, HOWEVER. THE POOR CO-OPERABILITY AND LACK OF TOP-DOWN GUIDANCE LEADS TO A DEMISE OF HIGHWAY AND RAIL NETWORKS.

CONCEPTUAL TIMELINE WIKI CITY





THE DIGITAL CITY

This narrative explores what could happen if we were to follow the wishes of those favouring individualistic, high-tech and fast-paced lifestyles. Wat could be the impact on our cities if we were to open up the doors for the tech-giants from Silicon Valley, and allow them to set out the future course for us?

The plot:

In the coming decade, tech-corporations will make the entrance to the city. They no longer limit themselves to producing technologies and selling products for the smart city; they want to start building a city of their own, complete with its own mobility system. It could mean the beginning of the end of many public responsibilities and tasks and sparks the dilemma to which extend we want to privatize and let the market do things 'quicker, cheaper, more efficient', knowing that it comes at a loss of one's own authority and control.

The AMA decides nonetheless to step in the footsteps of Toronto, and invites Alphabet over to take responsibility over the development of the regions mobility system. The tech-giant does not hesitate - and within a matter of years it has taken over the roads with its swarm-like autonomous pods, and starts getting involved in the development of new districts. All of which, obviously, is fully serviced and supported by the companies technologies and algorithms.

The new developments turn out to be a kind of 'digitally gated communities' however. The high-tech places are unaffordable for many, and practically unaccessible for those who refuse - or are unable - to use the many products and services of the Alphabet-ecosystem. As investments are drawn from the existing city to these new areas, Amsterdam becomes increasingly spatially and socially segregated, showing harsh differences between blossoming 'high-tech' districts and a neglected 'old city'.

"Corporatocracy"
Future decision-making is in the hands of (one or more) large corporations

Private Planning
Alphabet becomes a powerful advisor regarding urban planning and traffic management

Public-Private Partnership
Government privatizes many of its services and invites Alphabet over for help

Profit-Driven
Economic growth remains the main goal. Liveability, sustainability and equity come second

Smart City
Amsterdam becomes a corporate smart city; planning and management is based on private (tech) services

Tech Industry
Technology has claimed a central position (and pushed out other professions/fields)

Service-based
Ownership has largely been replaced by the service-economy

Individualism
Individual interests go before those of the collective. Choices should be left to the individual

Cyborgs
Citizens become increasingly one with technology; the digital realm replaces some real life activities

Google Ecosystem
Most of the services and products are owned by a single company; which forces people to stay within this ecosystem

Smart City Model
New urban developments are 'out of the box' designs, with little regard to context or historic value

Technology for Profit
Technology is used for efficiency (saves investment, raises profit)

Tech Dependency
the technocratic course justifies/ makes tech the only solution.

AV x PRT
AVs have replaced public transport, and led to a new form of Personal Rapid Transit

Inner City AV
The Waymo pods are a drastic reinterpretation of inner-city mobility; traditional cars and PT have had to make way

G-Roads
a fully private infrastructure, operated solely by Google vehicles

G-HUB
G-HUBs gather all Google services in one place

Smart City Developments
Private investments are focused on smart 'gated communities'

High Tech/Low Tech
There are large differences to where investments happen and where not

Sustainable Traffic
Emission-free PT and restricted private mobility limits resource use and emission..

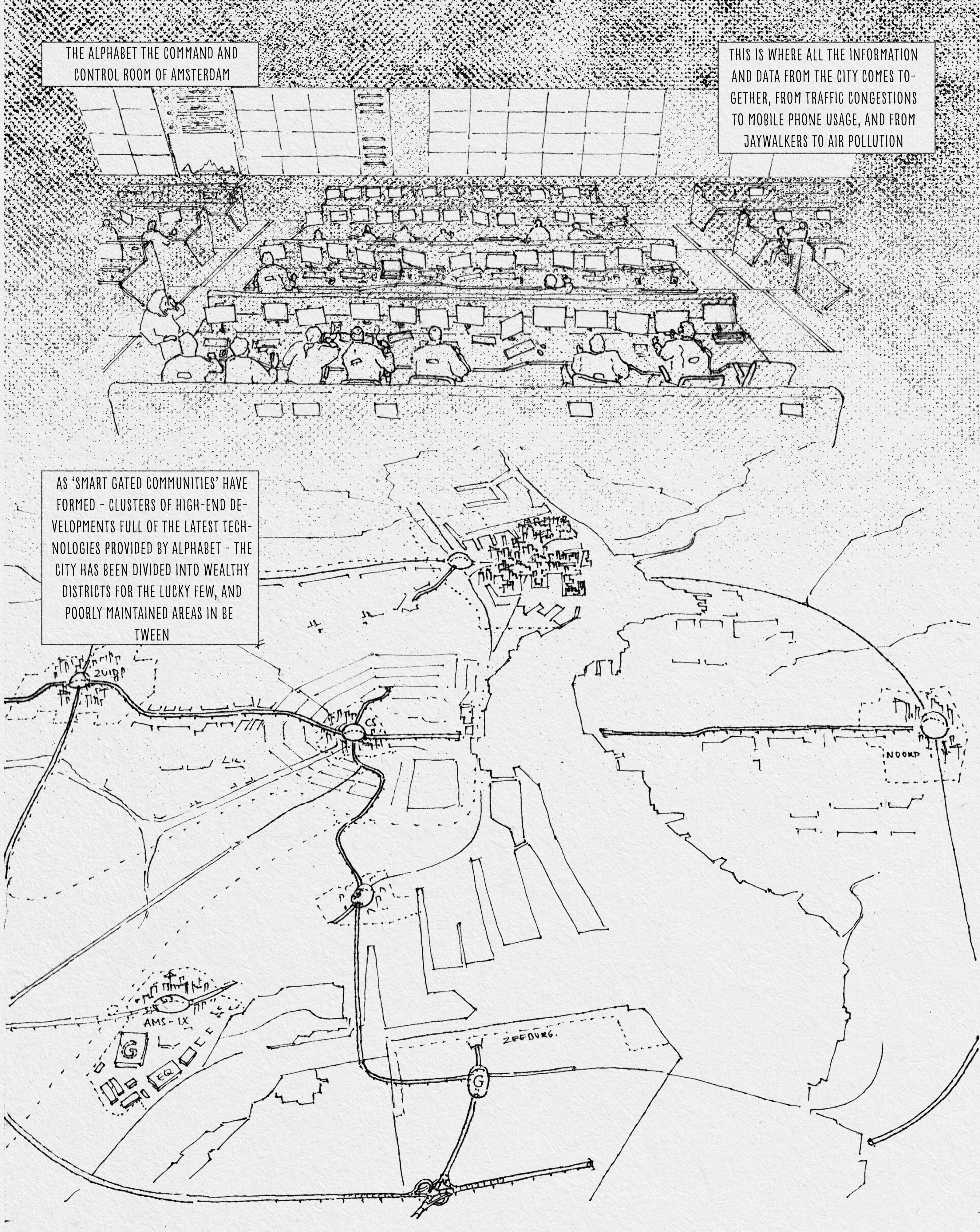
Big Brother
All data (from market and civic society) ends up in the hands of the government - though fully transparant and accessible

- Governance
- Economy
- Society
- Technology
- Mobility
- Spatial
- Environmental
- Other

Amsterdam in 2050; a drive from Havenstad to West | Situation 2050

We start off our journey in Havenstad, Amsterdam. As we buzz along the docks of the Coenhaven, our almost fully transparent Waymo pod grants us a view of the many shiny high-rise towers in construction, built around and in between the remains of the old harbour warehouses - many of which are now home to some of Amsterdam's coolest clubs and bars. On first glance this whole scenery might seem indistinguishable from what you would see at the Houthavens or IJburg - harbour transformations that appear to follow the same, well-known developers formula of transforming a former harbour district into an upscale neighbourhood for young professionals and expats. Only when we come to a halt - as our pod detects a group of young kids chasing a ball onto street in front of us - we can start to pay a little more attention to what actually makes this Google-led development so special; the many sensors that are practically everywhere around us. Even though most are invisible, concealed behind screens or within street furniture, you better bet they are there; from that lamp post on the side of the street, to the information screen near the 'AV-dropoff-zone', and from the facade of that cute little coffee shop to the smartphones hold by the pedestrians passing by. This dense network of sensors - all part of Google's expansive ecosystem of products, and thus all developed and monitored by the same company - is what makes possible a kind of data-driven city that was previously unimaginable. Havenstad is a perfect example of a corporate-led 'smart city' with unprecedented interconnectivity between people, the built environment and smart vehicles that are constantly learning from and adjusting to each other. And to ensure all processes happen efficient, safe and sustainable they are watched closely by the 'all-seeing eye' of the tech-giant from Silicon Valley.

As we continue our little trip, accidentally ignoring the proposed route by Google Maps, we enter Amsterdam-West and leave Havenstad behind us. The change of scenery is remarkable; it seems as if time has stood still in this part of the city. Old bus-stops look as if they have gotten their last paint-job 30 years ago, the traffic lights for the trams are shut off and the roads we drive over are poorly maintained - the little wheels of our pod make worrying sounds as they get caught in the cracks in the concrete. It may be clear; we have left the high-tech paradise that was Havenstad and moved into an old part of the



city. To further remind us, a pop-up message on our dashboard appears; 'your Waymo pod will slow down to 20km/h' as the roads we drive on are 'unlicensed' by Google. The lack of necessary sensors in our vicinity makes it too dangerous to drive at our normal speed the screen reads. Slowly moving forward, we decide to redirect our route on Maps as there should be a Google-licensed road just ahead where we should be able to pick up speed again - when all of a sudden our pod comes to a halt again, this time a lot more aggressively A new message pops up; 'you have left the radius of sensors, your vehicle is unable to connect to the Waymo-server', followed by; 'press here to open your Waymo's doors and log out of the system'. Before we know it the monitors inside our vehicle are starting to shut off and the doors pop open, as if to say; 'good luck figuring out how to continue from here'.

Our journey that started off so comfortable and smooth seemed to have come to an abrupt end; apparently Google does not want us to be driving around here in West.

It is a strange reality that whilst in one part of the city everything seems to come straight from a sci-fi movie, other parts are simply excluded from this futuristic world and made practically inaccessible. The contrast is so stark, and impractical, it makes one wonder why Google still refuses to provide a full coverage throughout the city, Was it too expensive, or is this part of town simply not profitable enough - and thus 'not worth it' for the company to invest in? And if that is the case, where is its sense of responsibility to provide equal access to mobility - especially as the public sector has privatized these responsibilities years ago?

A little astonished and disillusioned we ponder over these questions as we stroll along the Jan Evertsenstraat for a while, in search for the one bus-stop from which a bus will pick us up to bring us back to Havenstad. As we sit down on the worn-down bench, with a good half an hour to wait till the bus arrives, we decide; 'next time, we will obey our navigation system.'

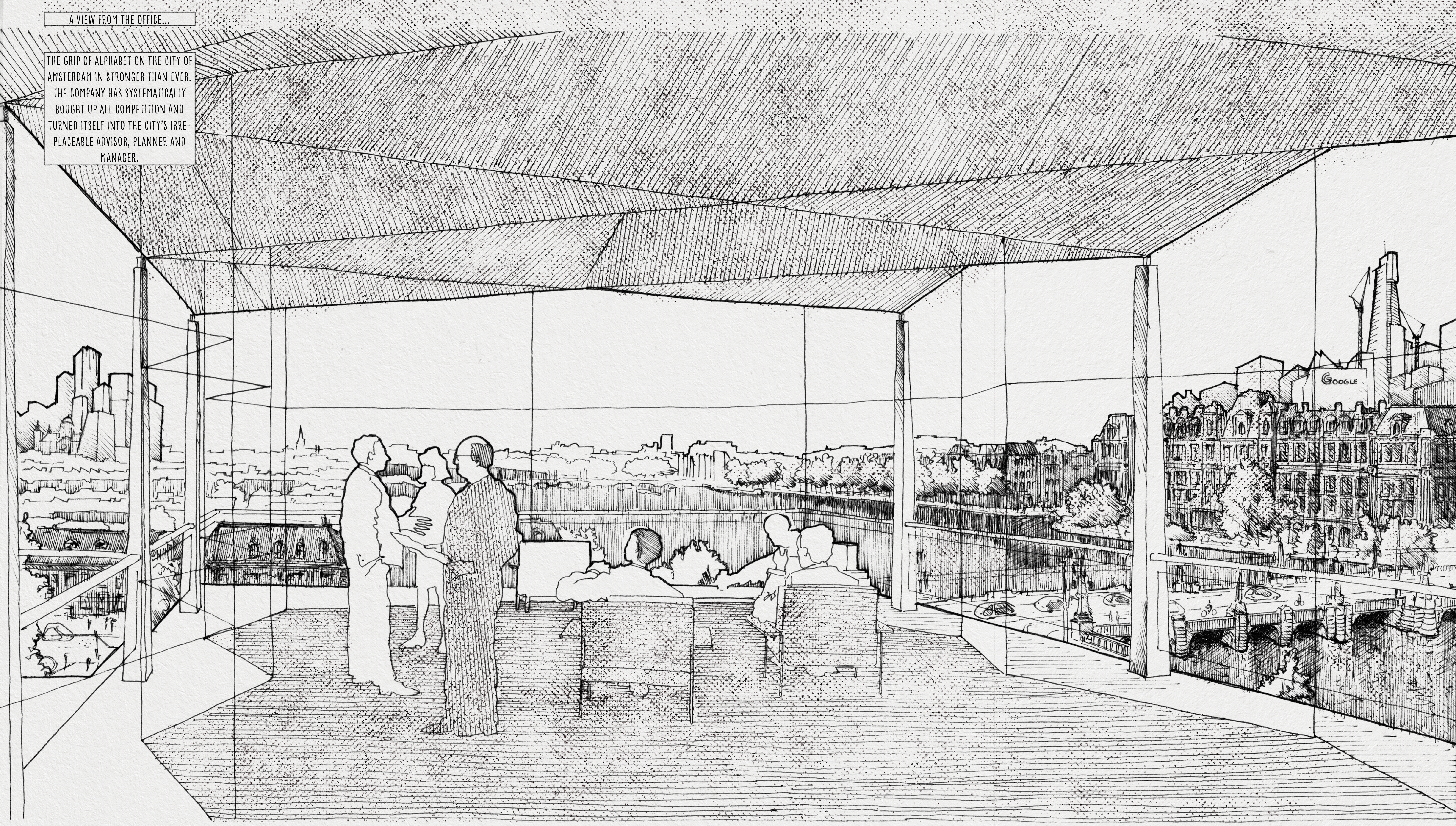
The Arrival of Alphabet | Critical Juncture 2020 - 2030

After it had conducted several successful experiments in the US, Waymo, Alphabets daughter company specialized in self-driving technologies, made its entrance in Europe. The IT giant from Silicon Valley had been looking to get involved in the European AV-market for a while, and eventually decided the Netherlands would be a great place to start. A location just north of Schiphol seemed to be ideal for the next Waymo production facility, partly because of the availability of high-skilled labour, and, of course, the exceptional AV-readiness of the Dutch road infrastructure and policy landscape[1] - important conditions for a tech-company eager to experiment and test its latest technologies.

Not far into 2021, the plant saw its first electric, fully-autonomous little pods roll off its assembly line. Interesting was the way Waymo went about producing these pods, which was unlike any traditional car manufacturer. Instead of bringing a finished model on the market for sale, the company developed their vehicles like they developed their software; the pods were released after rapid prototyping, after which they would be tested in controlled 'AV test locations' and were brought back to the factory regularly for small updates, fixes and design changes. Interesting was the statement that the vehicles were not for sale, nor would they be in the future. The only way to ride one of these Waymo pods was by booking one through the Waymo app - which was neatly integrated in Google's already famous Maps service. Besides offering the vehicles through an app people were already familiar with, Alphabet also made sure to offer many cheap rides at college campuses, airports, and other self-contained areas - which greatly helped to make the Waymo pod an extremely popular and highly anticipated product amongst many youngsters, students and high-skilled workers. People couldn't wait to see it being allowed within the city and on the highways.

Many were thus delighted to see that the Dutch government, its ministry of Infrastructure and Watermanagement, the Amsterdam Metropolitan Area and the municipalities of Amsterdam and Haarlem decided to approach Alphabet a year later, in order to discuss the possibility for a public-private experiment regarding the Waymo pods. The two cities in particular were quite eager to participate in the test, to see whether the autonomous pods could deliver on their promise of driving in so-called 'platoons' if they were given their dedicated infrastructure. After discussing who should be taking what responsibilities, the

1 Such as the relieve of some regulations in the agreement of Vienna made in 2016, which gives room for experimentation with autonomous vehicles on public roads (under some conditions of course).



drawing by author, based on the drawings by Johannes Ingwersen and his 'plan voor kantoorgebouw de Utrecht' (1960) board - consisting of public authorities, traffic planners and delegates of Waymo - decided upon a month-long test in which Waymo pods would get to use the HOV lanes belonging to the Zuidtangent, next to the continuing bus services.

Meanwhile, Alphabet was also in the Hague busy convincing departments of the benefits of a public-private partnership. It stated the importance of a rapid implementation of V2I and V2V technologies nation-wide[2], if the country wanted to make the transition to autonomous vehicles soon. The company even followed this up with a bold proposal; it was willing to fully finance the development and deployment of V2I sensors - without financial help from any public authority - if it was granted ownership of the data and information that was to be generated by the digital infrastructure in return.

It did not stop there however. The company got involved deeper and deeper into partnerships with the Dutch national government and local authorities of the AMA. The result was a whole scala of small, seemingly innocent deals, that were proposed by Alphabet and without much hesitation accepted by the public sector. Leaving things such as the development and installation of new 'smart traffic lights' to the market would be of no harm, was the consensus; after all, it would save quite a bit of money, time and effort on the one side, and there had to be no concern about the quality of Alphabet's products and service, which were cutting edge.

Other proposals were more ambitious however. Especially remarkable was the idea the company had to expand the HOV infrastructure network it was making use of - in close collaboration with the regions planners of course - even after the initial experiment had ended, if that would grant them permanent access to it.

It became apparent that the company wanted more than 'just delivering services and vehicles' - it was actively trying to gain control over the development, maintenance and exploitation of the infrastructures which those vehicles would use - both physical and digital. And it was up to the national government to decide how it wanted to respond to this offer from one of the largest players on the market - was it willing to privatize some of these public assets?[3]

2 Technologies required to let vehicles and infrastructure communicate with each other - essential to make autonomous driving possible.

3 This dilemma exemplary of the ongoing process of 'delegation and subcon-

In the coming months, the national government decided to buy into the visionary promises of the tech company, and continued to accept new offers. It meant that the traffic planners, technical experts and executives of Alphabet became important partners, who came to sit at the table with Dutch government bodies on a regular basis to discuss future plans. They were increasingly involved in important decision-making - things that went beyond decisions on small Waymo experiments - and started to become influential experts with a lot of useful data at their disposal (data which the public sector didn't have - at least not the same amount, and not with the capacity to process it). Alphabet started making proposals for where infrastructures could be improved, and advised on where new developments had to happen - such as where future mobility hubs for its Waymo pods were best situated. The company had, by 2030, turned into a developer, operator, advisor and investor in one. One with a huge amount of capital, data, and technological knowledge, and one which had to be involved in practically everything that had to do with mobility at this point[4]. And, for now, Amsterdam was extremely happy to have them on board - proud and hopeful that this partnership could make them frontrunners in mobility and urban development. And glad that some huge future expenses would come at the cost of Alphabet.

tracting of responsibilities previously re-served to public institutions to private players' as put sharply by Evgeny Morozov and Fransesca Bria in their publication 'Rethinking the Smart City'. They warn for this trend of subcontracting, and loss of control over the 'management, maintenance, and construction of infrastructure'.

4 The company has become such a critical player in multiple fields, due to its knowledge, capacity and the technologies and services it provides, it has become an unpassable actor, a gatekeeper. Every decision has to pass through them; they have become, what Soderstrom and others calls a Obligatory Passage Point (OPP). See, for an analysis of IBMs strategy - a similar tech giant the paper by Söderström from 2014: 'Smart Cities as Corporate Storytelling'

Smart Districts and Smart Mobility; a Corporate Dream Becomes Reality | Lock-in 2030 - 2050

After years of successful experimentation by Alphabet on the Dutch HOV network - which it had expanded and improved enormously in collaboration with the planners from the province and the metropolitan region, a proposal which had been looming for a while finally materialized. The tech giant published, in a 350 pages thick vision document, its plan for its own network of dedicated infrastructures - independent from the HOV-network - which would be made specifically for the Waymo pods (including the latest sensors, adjustable street layouts and mobility hubs - of course).

The plan envisaged an independent infrastructure that would partly be placed adjacent to existing roads - sometimes existing lanes were to be included - and partly completely separated - forming new connections that were previously lacking. For the planning and development of the infrastructure there would be sought close contact with planners from the national government, provinces and included cities, but the exploitation, investments and management was to be put in the hands of the company. It seemed reasonable, as the company took full responsibility over the vehicles that would make use of the roads, as well as the financing of the necessary digital infrastructure, and the traffic management. Alphabet would thus come to claim full ownership - and dubbed its new plan the 'GRoad Network'.

This would mean that the company would be allowed to regulate the pricing schemes - and the profits that those would generate - of its Waymo services. So not only would this allow them to harvest the data that came with the operation of the vehicles, they would generate a steady cash-flow out of the services themselves - which could make the project a profitable business in the future. For now, however, the initial costs and investments would be huge - and the income minimal. It was a project that could never be financed by a public sector, but thankfully, a giant like Alphabet had enough reserves and alternative cash-flows from its other services to sustain a loss for a while[5].

5 This makes the tech giants from Silicon Valley so disproportionately powerful. As Evgeny Morozov puts it: 'global presence - backed by capital injections from the likes of Goldman Sachs and Saudi Arabia - allows companies like Uber to operate on a massive scale, and to accept short-term losses by offering low rates in order to destroy all competition.' And 'in light of projected ever-falling transportation costs, one can see why cash-strapped cities are beginning to seriously consider subcontracting public transportation to the likes of Uber.'

With the approval of this plan, in 2033, Alphabet started rapidly with the transformation of several parts of formerly state-owned highways into GRoads. It also accelerated the production of Waymo pods - including a variety of last-mile spin-offs - and started the construction of the first transfer- and parking-hubs. By far the most ambitious plan however, was going to be the ring of Amsterdam and its surrounding urban fabric - scheduled for 2035 - as this was where the daily flow of Waymo platoons would come together before individual pods were to 'unplug' and drive to the nearest mobility hub just off the road. It meant that not only infrastructural, but also urban transformations would be made soon. And also here, the company would be closely involved in advising the urbanists and municipality on where the ideal locations for the hubs would be, and how the surrounding areas were best developed

It was exceptional to see how the development of the new mobility hubs, or Waymo Stations as they were called, catalysed large-scale redevelopments around the ring of Amsterdam. Many of these locations, from Over Amstel to Sloterdijk and Havenstad, had been included in the municipality's vision as important residential areas to be developed for a while already, but the economic interest that was generated by Alphabet's investment really kickstarted much of them.

Besides stimulating much needed urban redevelopment, the mobility hubs fitted in neatly with the plans of the city to make these new areas pedestrian friendly - and practically car free. A development such as Havenstad, for example, was planned to heavily discourage private car ownership and relied primarily on public transit and forms of active travel. For developments like these, the Waymo Stations were enthusiastically invited in; the centralised hubs from which Waymo pods, but also other forms of last-mile, on-demand services were to be easily booked by smartphone, would help immensely to decrease the amount of parked cars in the rest of the neighbourhoods. On top of that, the municipality saw the opportunity to cut down on expensive public transit investments, by connecting its latest developments to the GRoad network: it would mean in the case of Havenstad, some large investments in extending the metro line could be saved.

The locations became economically attractive, mixed-use areas, in which a central mobility hub was surrounded by new housing developments, commercial facilities and state-of-the-art office buildings. Despite the high density, the areas were developed according to a remarkable pedestrian and cyclist-friendly principles, and they were truly beautiful places to work, shop and live. The municipality did not interfere much in these districts, and left it to Alphabet to freely bring over and implement its latest technologies from successful smart-city projects elsewhere, such as the Sidewalk-developments it developed in many American and Canadian cities. The small districts around the ring-road became truly 'high-tech' paradises, with no lack of investments in the latest technologies or buildings and public spaces.

However, there were more critical sounds arising. The new areas were obviously well-connected to the GRoad network, but were usually poorly connected to the traditional pubic transit system. Add to this the lacking investments by the region and state in new public infrastructures to and within these developments, and one can understand that new inhabitants would be mostly dependent on their Waymo shuttle service. To a certain extend, it was thus a 'digital gated community' they lived in; well accessible and appealing for those who were part of Alphabets ecosystem of products, but largely inaccessible for those who were not.[6].

But it was not just Alphabet, and the real estate market that was to blame for the growing disparity between the newly developed areas and the rest of the city. It was the municipality itself too, which focused most of its attention (and budget) on these booming areas - and neglected large parts of the rest of the city. The result was that Alphabets districts came to blossom, with new investors, expats and high-skilled workers being attracted, whilst neighbouring areas started to fall into a state of despair.

The contrast between the high-tech gated communities and the 'low tech' old city became increasingly stark. Illustrative of the lack of connectivity were the Waymo pods, who could not operate in much of the existing city as Alphabet refused to invest in the needed sensors to make its network cover these areas. The areas would be not profitable

6 There has been much discussion on the topic of 'digital gated communities' lately. Richard Sennett talks about greenfield smart city developments in Asia such as Songdo and Masdar and how they function as gated communities in his latest book Building and Dwelling: Ethics for the City. But also in the US, similar trends are seen with the latest Google and Amazon urban developments proposed Activists like Bianca Wiley warn for the same thing to happen if these projects are allowed by local authorities without getting the right policies in place first.

enough, it stated, and there was no one to force to company to invest in things it did not wanted to invest in.

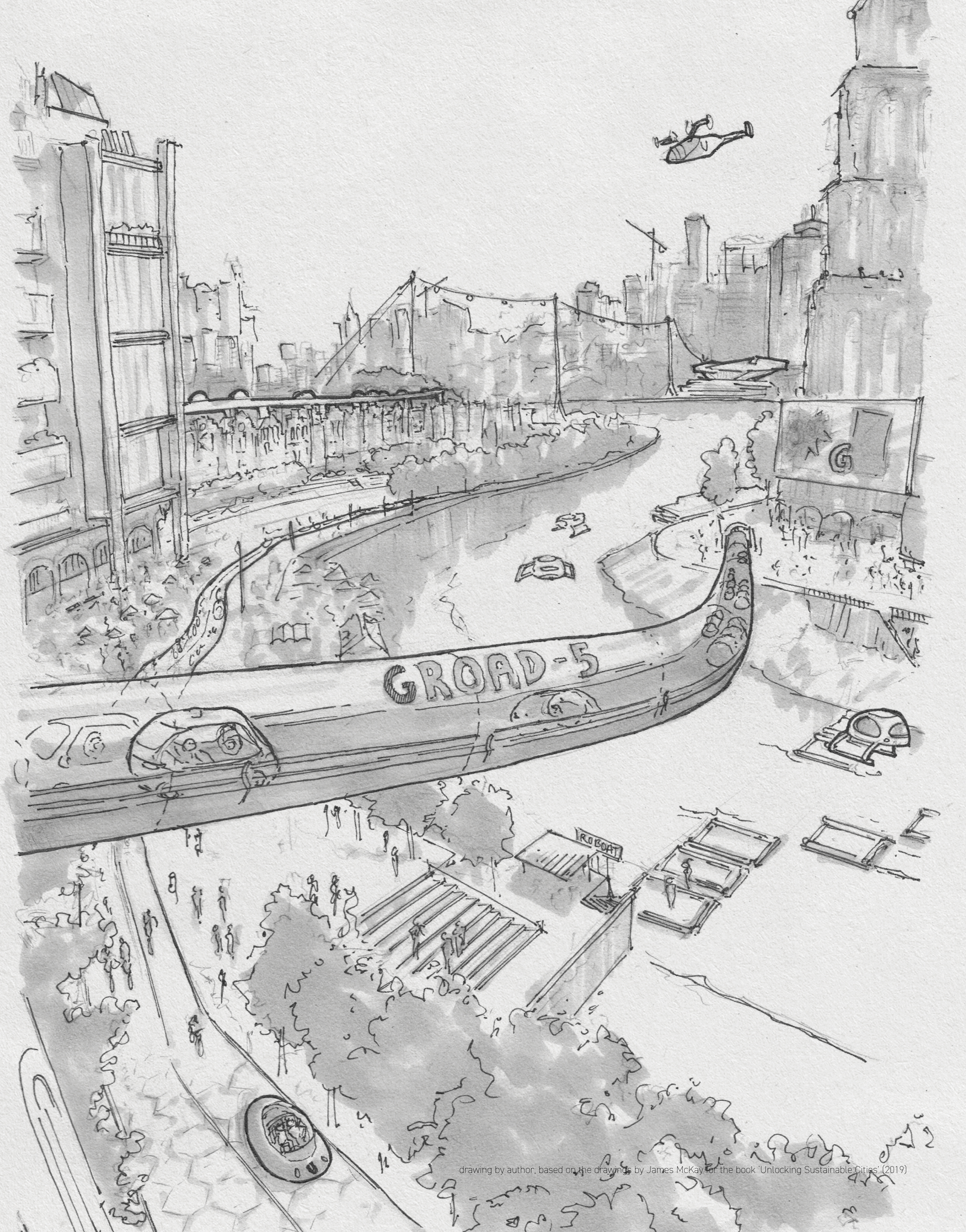
The situation became even more painful when Alphabet announced a next step in the expansion of its GRoad network: breakthroughs straight through the existing city. From many of its customers, the company had gotten the request to provide quick connections between the districts, as this was were most of their daily facilities were clustered. But as of now, they were often 'forced' to use the ring-road to get from district to district, as the seemingly more direct connection through the existing city would require them to make use of the poor public transit services. The company thus proposed a couple of diagonals to cut straight through the existing city, to provide fast access in between districts.

A new urban plan was sketched up by the planners of Alphabet. It was a plan that showed similarities to the revolutionary plan for Paris by Haussmann: wide boulevards, that had to provide room for platoons of self-driving shuttles, were seemingly drawn by a ruler, as they cut straight through old, historical parts of the city. It was a certain arrogance, combined with contextlessness and a shocking disrespect for the past, historical value, and existing social structures, that two decennia ago would have been harshly criticized and deemed downright ridiculous. But in 2040, the plan and its underlying ideology fitted in perfectly with the unforgiving zeitgeist of efficiency, speed and technological progress, in which a city had to function as a well-oiled machine[7], closely monitored by technological experts.

The municipality of Amsterdam, backed by a small army of Alphabet planners, started to break through the existing city as if they were a new Robert Moses[8]. Poorly maintained roads, damaged historical buildings and canals had to make way for new boulevards on which the Waymo pods could drive fast and unobstructed by other traffic. As half the city was in transformation by 2050, it became clear Amsterdam was to change for good under the control of Alphabet.

7 The vision of Hausmann was partly based on the idea that traffic could be seen as part of a body; specifically the circulation of blood - with roads and boulevards being the veins and arteries (Sennett, 2018).

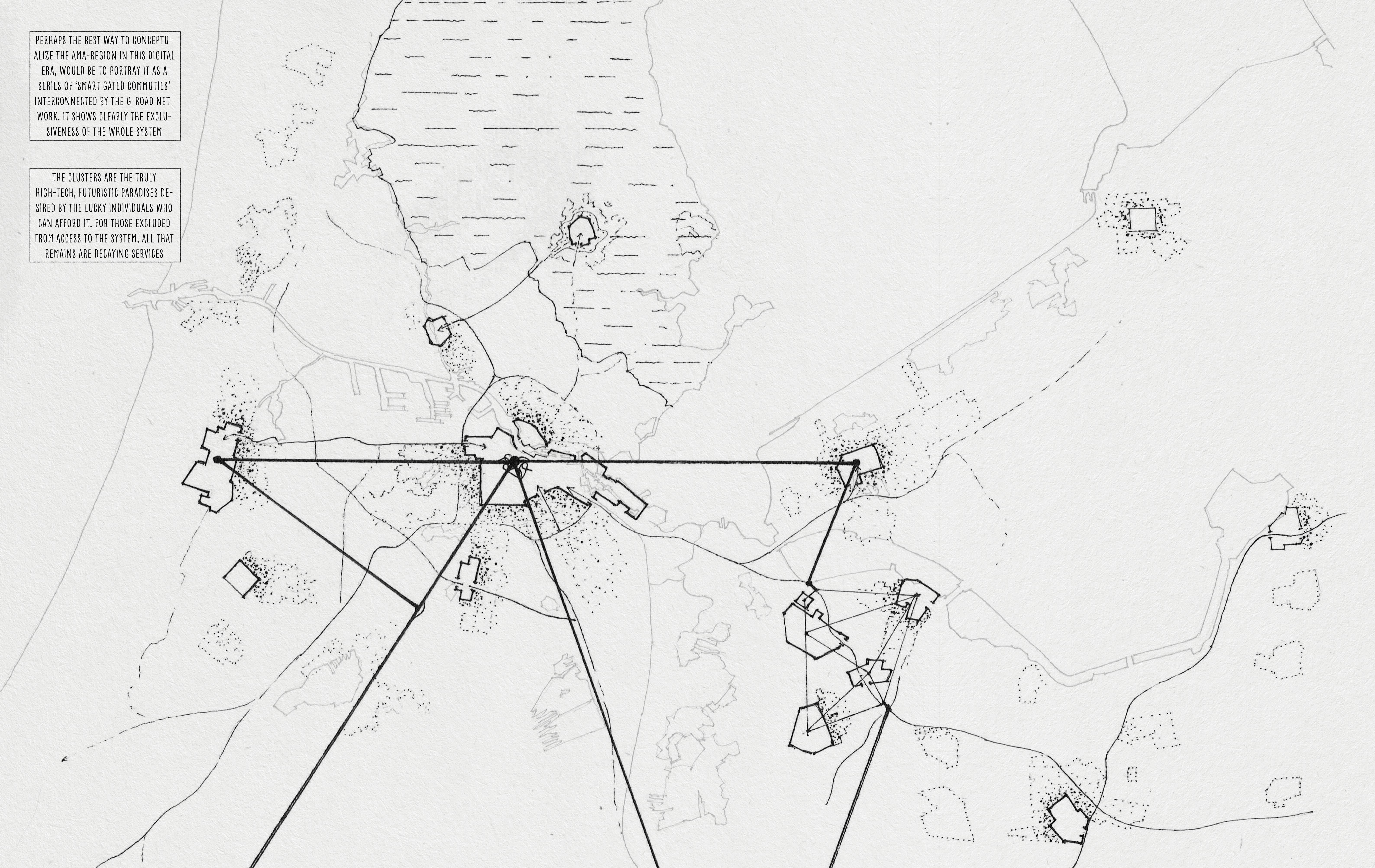
8 Robert Moses operated from the believe that the old city had become dysfunctional, and that - in a radical manner - space had to be made to accommodate for the new technology, the automobile (Jacobs, 1961, Sennett, 2018).

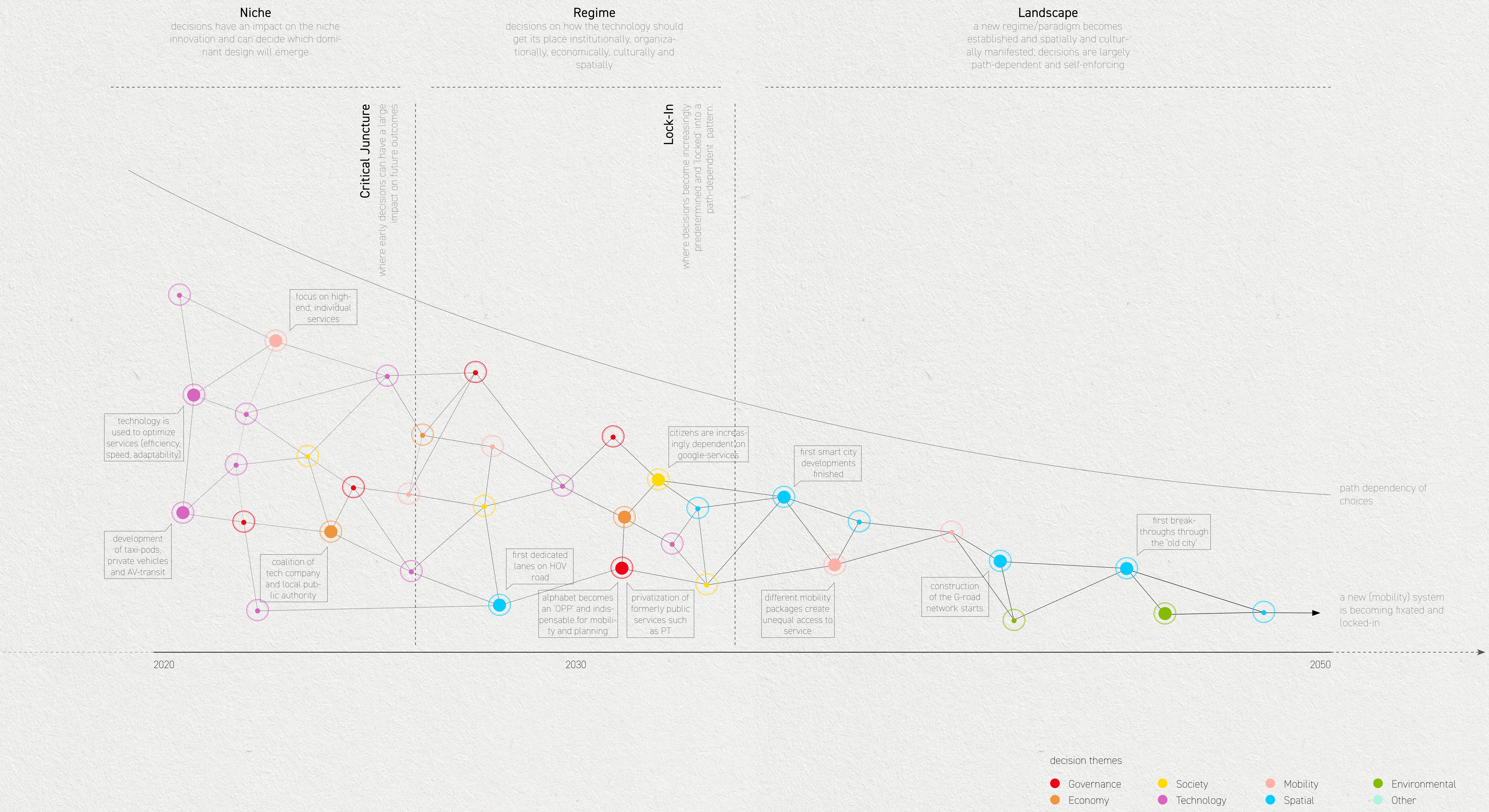


drawing by author, based on the drawings by James McKay for the book 'Unlocking Sustainable Cities' (2019)

PERHAPS THE BEST WAY TO CONCEPTUALIZE THE AMA-REGION IN THIS DIGITAL ERA, WOULD BE TO PORTRAY IT AS A SERIES OF 'SMART GATED COMMUTIES' INTERCONNECTED BY THE G-ROAD NETWORK. IT SHOWS CLEARLY THE EXCLUSIVENESS OF THE WHOLE SYSTEM

THE CLUSTERS ARE THE TRULY HIGH-TECH, FUTURISTIC PARADISES DESIRED BY THE LUCKY INDIVIDUALS WHO CAN AFFORD IT. FOR THOSE EXCLUDED FROM ACCESS TO THE SYSTEM, ALL THAT REMAINS ARE DECAYING SERVICES





Niche
decisions have an impact on the niche innovation and can decide which dominant design will emerge
Regime
decisions on how the technology should get its place institutionally, organizationally, economically, culturally and spatially
Landscape
a new regime/paradigm becomes established and spatially and culturally manifested; decisions are largely path-dependent and self-enforcing
Critical Juncture
where early decisions can have a large impact on future outcomes
Lock-In
where decisions become increasingly predetermined and 'locked' into a path-dependent pattern
focus on high-end, individual services
technology is used to optimize services (efficiency, speed, adaptability)
development of taxi-pods, private vehicles and AV-transit
coalition of tech company and local public authority
first dedicated lanes on HOV road
alphabet becomes an 'OPP' and indispensable for mobility and planning
privatization of formerly public services such as PT
citizens are increasingly dependent on google-services
first smart city developments finished
different mobility packages create unequal access to service
construction of the G-road network starts
first breakthroughs through the 'old city'
path dependency of choices
a new (mobility) system is becoming fixated and locked-in
2020
2030
2050
decision themes
Governance
Economy
Society
Technology
Mobility
Spatial
Environmental
Other

CHAPTER IV:

EVALUATION

CHAPTER 4 | EVALUATION

This evaluation chapter consists of 2 main parts: the story assessment (4.1) and the fine-tuning & recommendations, which gathers the 'no-regret' choices from the best scoring story (and some from the second best) (4.2)

This evaluation chapter can be seen as part II of the methodology. Where methodology part I (in chapter 3), provides a step by step method to building story-based scenarios, this part provides the method to evaluate these stories in order to come to helpful recommendations, which come in the form of policies, actions and spatial interventions.

4.1 Story Assessment

Goal of this first section is to select a winning/best scoring story out of the 4, based on the extend to which the core values of Amsterdam are met. In other words, which story - which future course/societal rationale - brings us to a future closest to the goals that have been set out by the municipality of Amsterdam? For that, we conduct three steps; the evaluation/scoring (of each individual story), the comparison (of the four stories together) and lastly, the selection (of the 'winning' story) (see figure on the right, part 4.1)

4.1.1 Individual Assessment

So, firstly, we start by scoring/assessing each story individually (4.1.1). For this we use three ways of evaluating/representing: a matrix, a 'scoring circle' and a written summary - all three will be made for each story (resulting in 4 matrices, 4 circles and 4 summaries).

First is the assessment matrix. For this we reuse the matrix that has been used in the problem statement: the matrix in which core values of Amsterdam were set out against AV Opportunities and Threats and against the 4 different actor groups. What is different this time, is that we do not score the visions of the different actor groups (and to which extend these could potentially lead to AV opportunities and threats), but we score the extend to which these actor groups have either supported or conflicted with core values (and thus, how the have led to either AV benefits or negative impacts) in the future story. In other words, where in the problem statement we have made a scoring of Opportunities and Threats related to the Core Values, we

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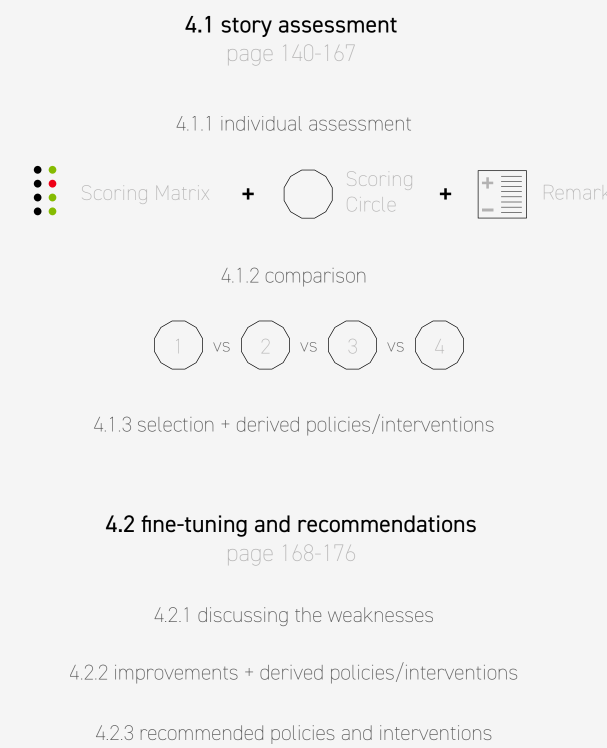
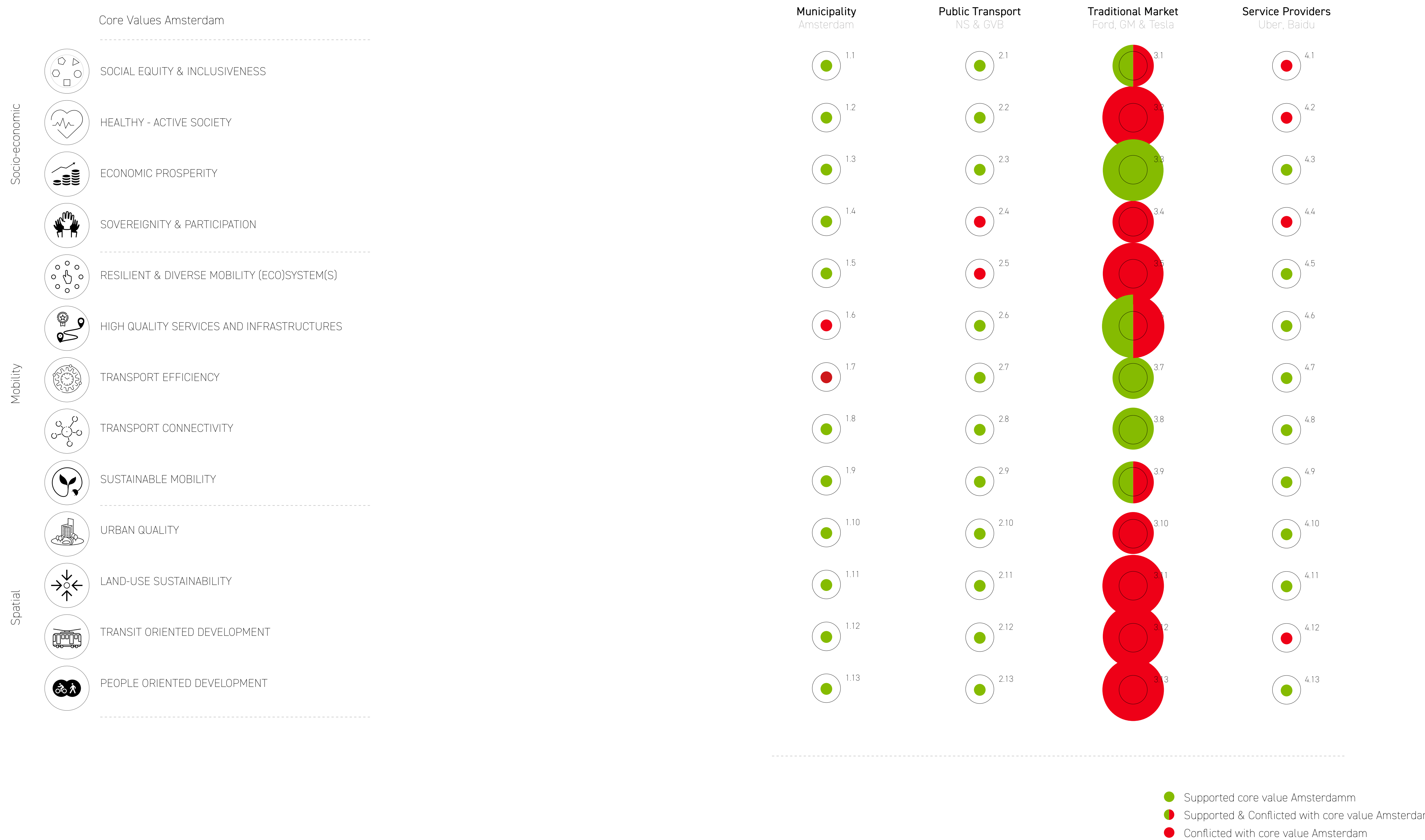


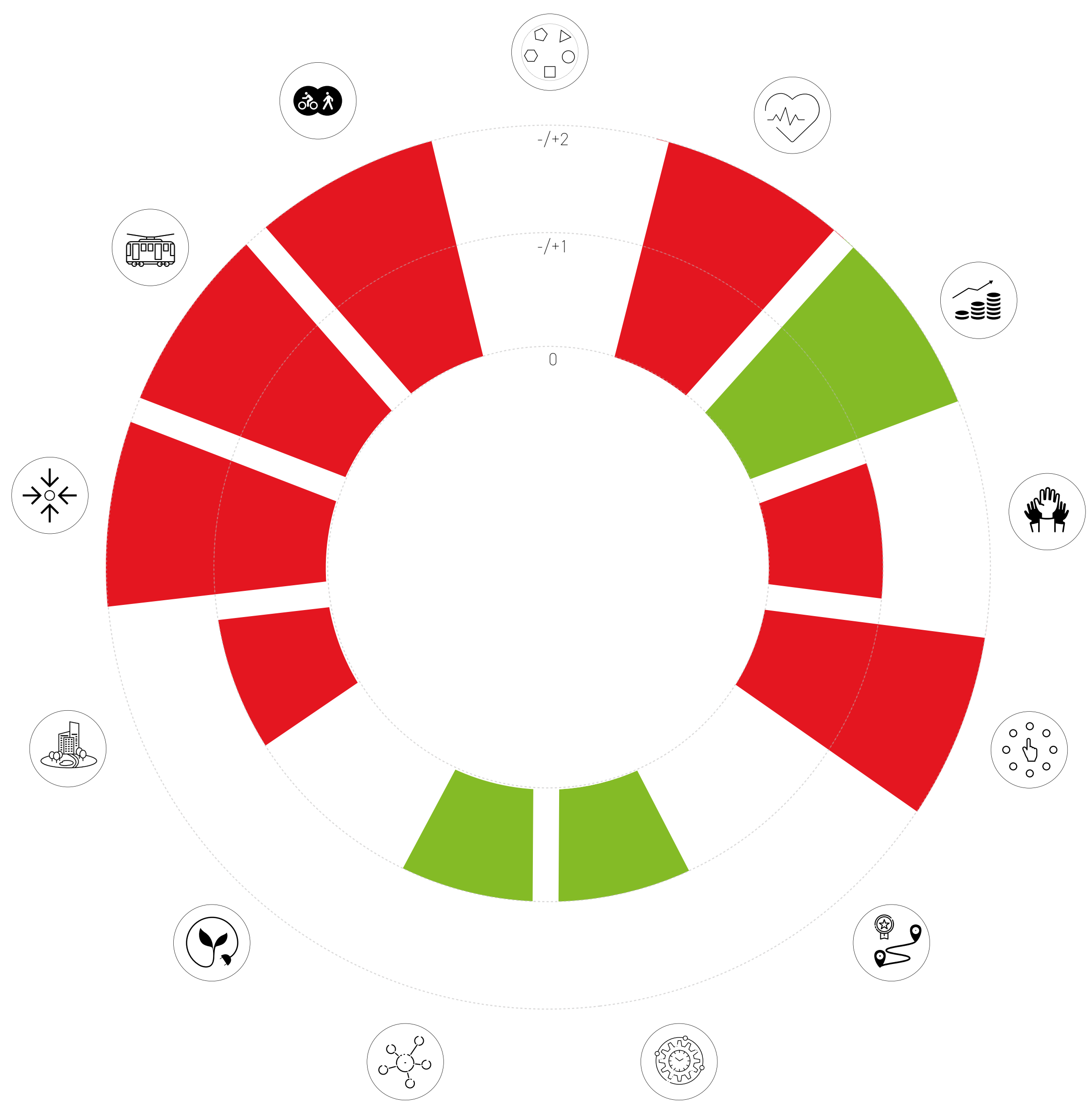
now look at how these O&T actually materialized into Strengths and Weaknesses in 2050 and how that impacts Core Values. The scoring system itself is either positive (supporting core values), negative (conflicting with core values) or ambiguous (both supporting and conflicting - a score which requires extra explanation, which is given in the appendix). The scoring is also varying in impact, or gratitude, resulting in two 'sizes'; normal (for a positive or negative impact on a core value) and large (for a more fundamental, extreme positive or negative impact on a core value).

After the core value x AV O&T x scoring matrix is completed, we visualize the same information in a 'scoring circle', which gives a more direct overview of where the stories score well, and where their weaknesses lie. The same color coding and 'sizing' applies here, too - as we work with scores of -2, -1, 0, 1, 2. (numbers corresponding with the different sizes of the circles in the matrix)

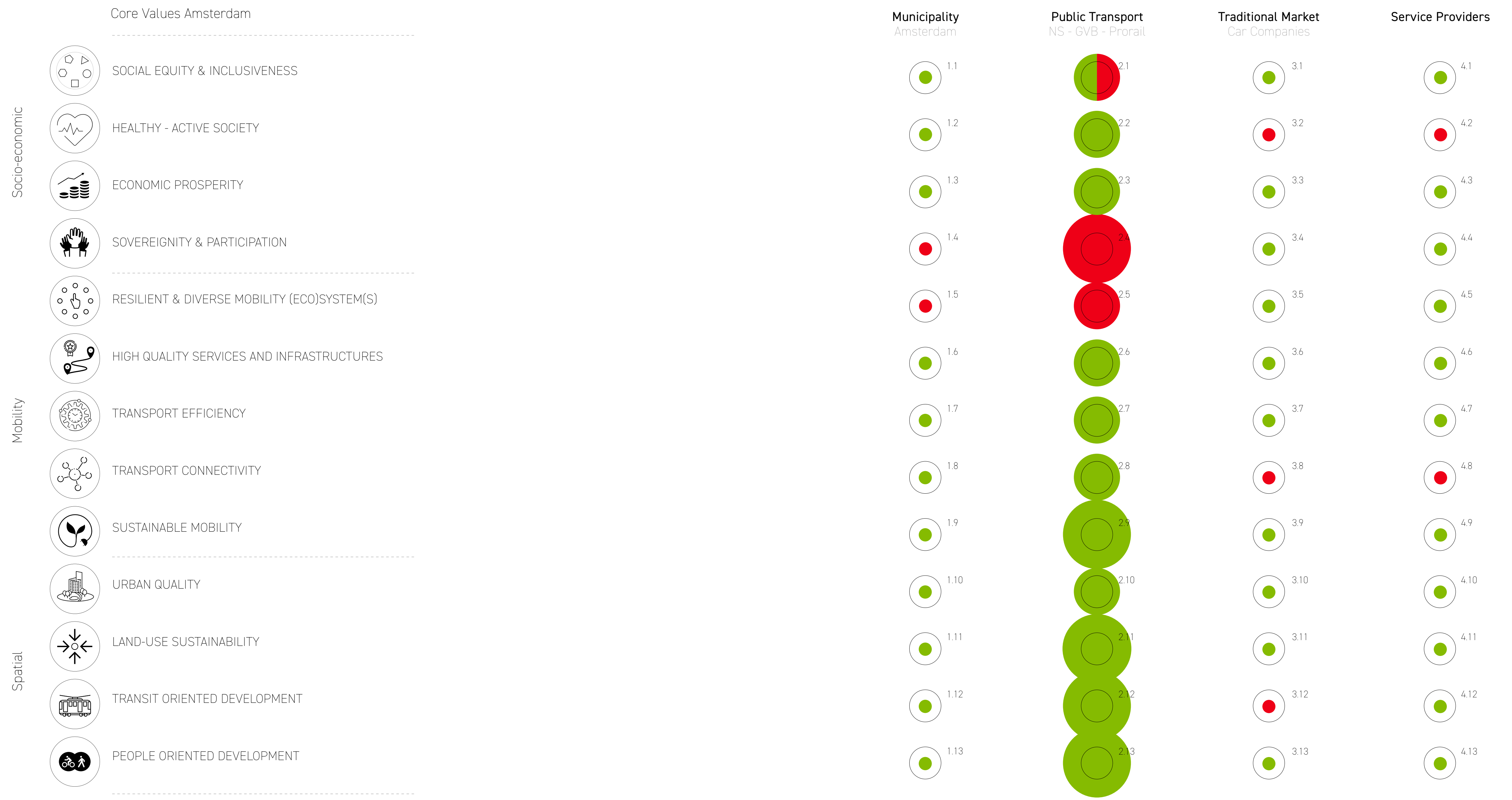
Then, lastly, we add a brief written summary/remarks on the scenario assessment, which tries to add some extra information/explanation/justification to the scoring that has been given - focusing specifically on the largest positive and negative impacts the story has (and the largest ambiguity, if that is the case).

The three ways of evaluating/representation together give a good idea of how each scenario individually holds up to the core values of Amsterdam, where they do well and where they do poorly - which will allow us to continue with the selection procedure in 4.1.2.


Core Values Amsterdam
Socio-economic
Mobility
Spatial
SOCIAL EQUITY & INCLUSIVENESS
HEALTHY - ACTIVE SOCIETY
ECONOMIC PROSPERITY
SOVEREIGNTY & PARTICIPATION
RESILIENT & DIVERSE MOBILITY (ECO)SYSTEM(S)
HIGH QUALITY SERVICES AND INFRASTRUCTURES
TRANSPORT EFFICIENCY
TRANSPORT CONNECTIVITY
SUSTAINABLE MOBILITY
URBAN QUALITY
LAND-USE SUSTAINABILITY
TRANSIT ORIENTED DEVELOPMENT
PEOPLE ORIENTED DEVELOPMENT
Municipality
Amsterdam
Public Transport
NS & GVB
Traditional Market
Ford, GM & Tesla
Service Providers
Uber, Baidu
1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 1.10 1.11 1.12 1.13
2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 2.10 2.11 2.12 2.13
3.1 3.4 3.7 3.8 3.9 3.10
4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 4.10 4.11 4.12 4.13
Supported core value Amsterdamm
Supported & Conflicted with core value Amsterdam
Conflicted with core value Amsterdam



Main positive/negative implications			Elaboration
Economic Prosperity		3.5	**Growth Before All Else** The car manufacturers have found in the Netherlands/AMA the perfect place to test and release their latest models. Additionaly, large investments are made to ensure accessibility of important economic hubs and to ensure efficient flows of platooning AVs.
High Quality Services and Infrastructures		3.6	**The Highway of the Future** On the one hand, the large investments by the public sector and by the car manufacturers lead to a truly state-of-the-art road-system of AV-ready highways and facilities. On the other, formerly important public transport infrastructures and services are deterioratеing due to decreasing number of passengers and lacking investments.
Resilient & Diverse Mobility Systems		3.5	**A Viscious Cycle of PAV Dependecy** A viscious cycle of personal AVs, which lead to more complex mobility patterns and longer journeys, AV-oriented planning and AV-dependent lifestyles makes all other modes of transport fall short - public transport and active forms of travelling are losing their relevance
Land-use Sustainability		3.11	**Suburban Sprawl** The freedom that is given by the personal AV makes it for more and more citizens possible to move further from work and facilities: the focus shifts from inner-city transformations towards suburban developments sprawling out into the open land.
Transit Oriented Development		3.12	**The Downfall of Public Tranport** Within the city, the partnership with Ford ties in with the city's TOD values. However, outside the ring, the personal AV is the main mode of transport, and renders public transport obsolete. In new development, low density and AV-oriented planning make PT inefficient and costly
People Oriented Development		3.13	**Make Way for the AV!** The comfort, speed and efficiency of the PAV are more important than the walkability or bikeability of the city. Streets are traffic corridors, first and foremost, other activities and functions need to make way.



Supported core value Amsterdamm

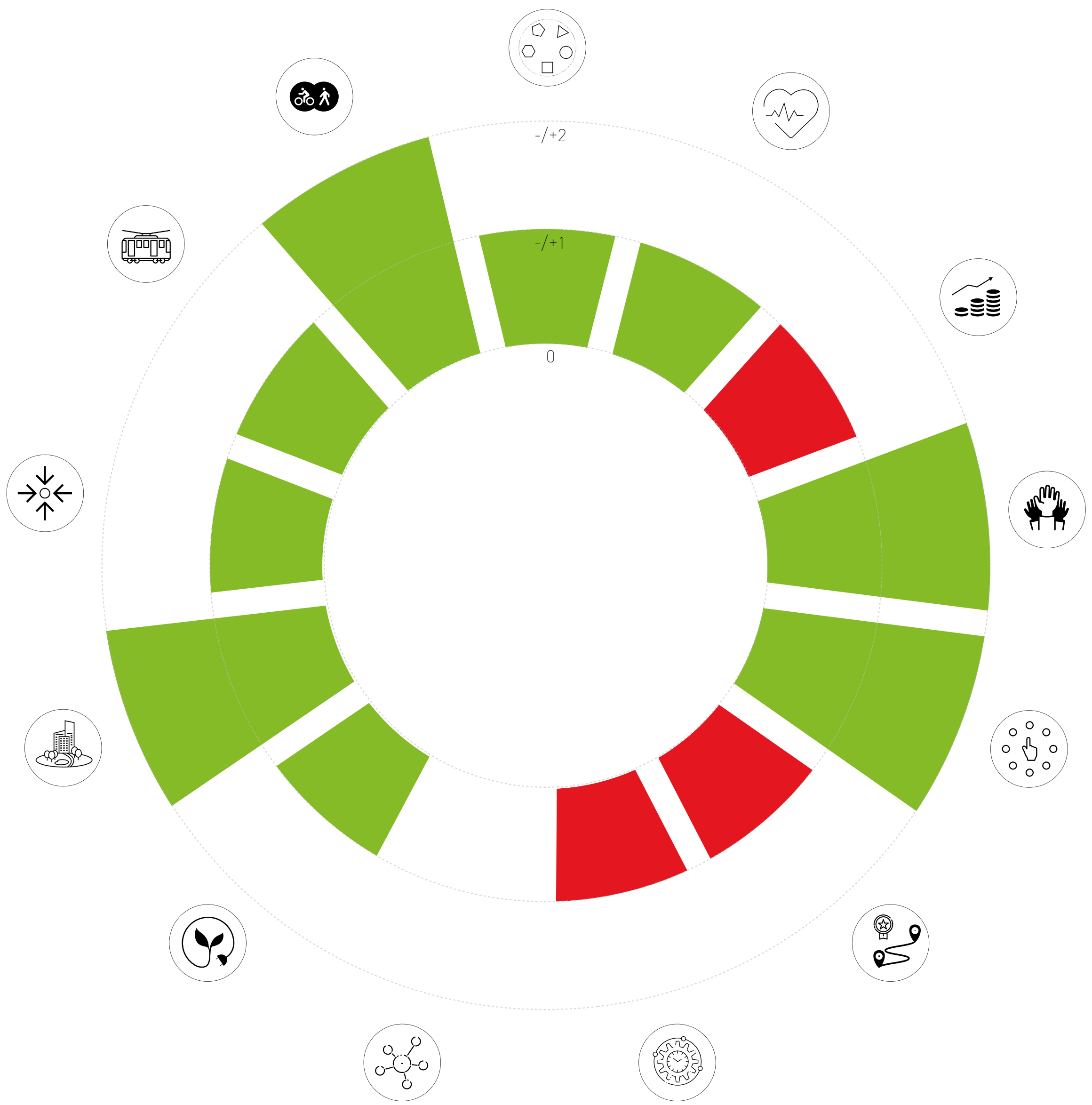
Supported & Conflicted with core value Amsterdam

Conflicted with core value Amsterdam

Main positive/negative implications		Elaboration
Sustainable Mobility	2.9	**Exceeding the Paris Agreement** Through large investments by the EU and the national government, as well as large scale programs (and policies), emission by traffic is pushed back significantly. Green innovation and circular initiatives, which require an integral, long-term approach, are stimulated in this scenario
Land-Use	2.11	**Preservation** Through enforcing strict transit oriented development guidelines for all new developments, and by focusing on transformation and densification within the existing city, open space and green is preserved as much as possible
Transit Oriented Development	2.12	**There is no other Way** From the very beginning, the focus is shifted completely towards public transport, which means that technological innovation, urban planning and design of the urban fabric are all aimed to improve (the use of) public transport.
Social Equity & Inclusiveness	2.1	**Perfect Service...for those within range** The strict TOD top-down planning for the region leads to winners and losers; for those falling 'out' of the system, as in falling between the catchment zones of the public transport system, there is less accessibility to mobility and overall less attention, investment and maintanance of existing services
Sovereignity & Participation	2.4	**Top Down Decides** The hierarchal way of governing, which puts a lot of power in the hands of a few (technocratic) experts, leaves little room for ideas from the public. Citizens have, apart from voting, little influence and little opportunity to share their dreams and desires or test their ideas.
Resilient & Diverse	2.5	**Control over Diversity** The newly established Nationale Mobiliteitsmaatschappij has integrated all mobility services under one umbrella. The large company structure, and the fact that most ideas are to be implemented at large scale or not at all, discourage experimentation and small start-up-like ideas.

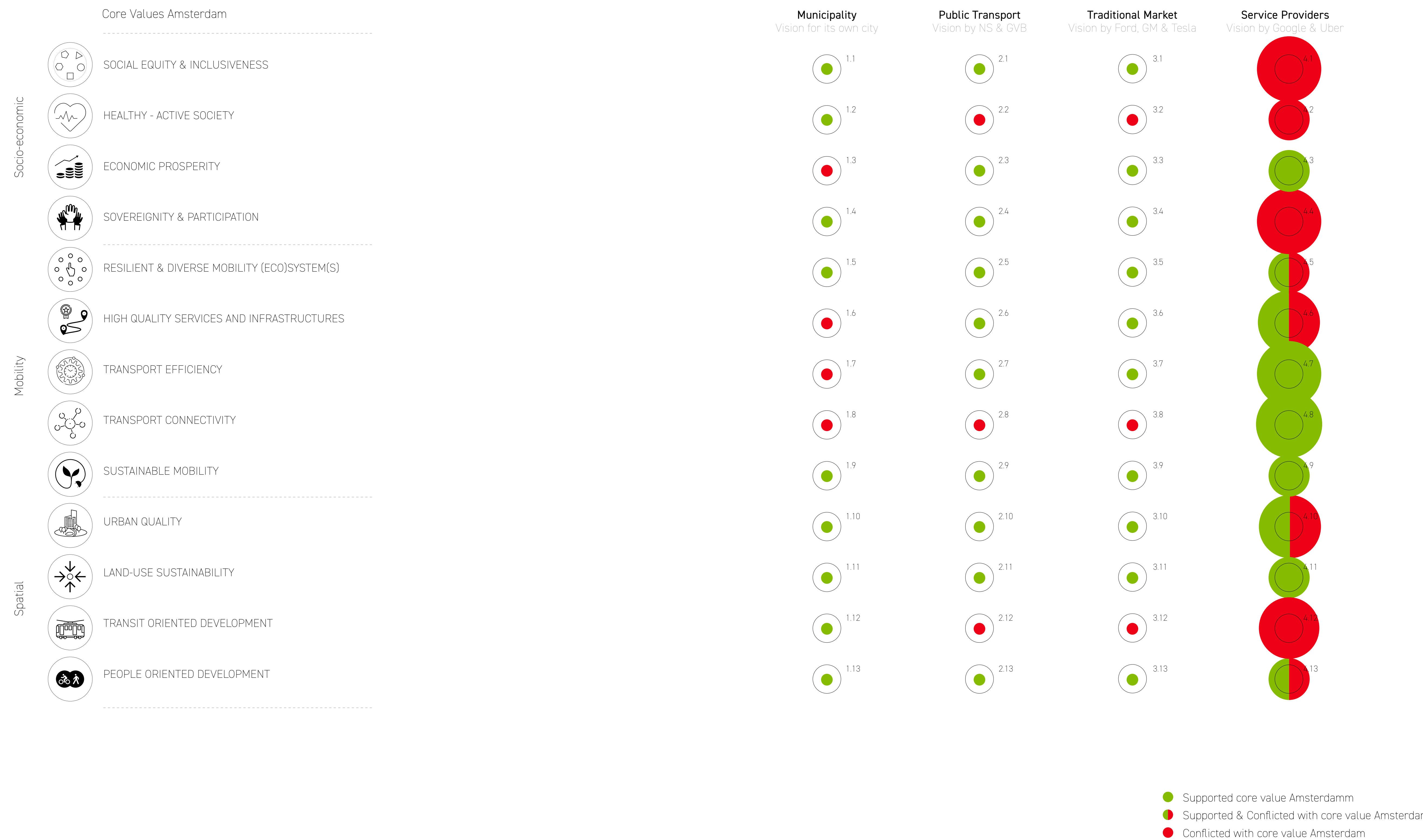
	Core Values Amsterdam	Municipality Vision for its own city	Public Transport Vision by NS & GVB	Traditional Market Vision by Ford, GM & Tesla	Service Providers Vision by Google & Uber
Socio-economic	SOCIAL EQUITY & INCLUSIVENESS	1.1 Supported core value Amsterdamm	2.1 Supported core value Amsterdamm	3.1 Supported core value Amsterdamm	4.1 Supported core value Amsterdamm
	HEALTHY - ACTIVE SOCIETY	1.2 Supported core value Amsterdamm	2.2 Conflicted with core value Amsterdam	3.2 Conflicted with core value Amsterdam	4.2 Conflicted with core value Amsterdam
	ECONOMIC PROSPERITY	1.3 Conflicted with core value Amsterdam	2.3 Supported core value Amsterdamm	3.3 Supported core value Amsterdamm	4.3 Supported core value Amsterdamm
	SOVEREIGNITY & PARTICIPATION	1.4 Supported core value Amsterdamm	2.4 Supported core value Amsterdamm	3.4 Supported core value Amsterdamm	4.4 Supported core value Amsterdamm
Mobility	RESILIENT & DIVERSE MOBILITY (ECO)SYSTEM(S)	1.5 Supported core value Amsterdamm	2.5 Supported core value Amsterdamm	3.5 Supported core value Amsterdamm	4.5 Supported core value Amsterdamm
	HIGH QUALITY SERVICES AND INFRASTRUCTURES	1.6 Conflicted with core value Amsterdam	2.6 Supported core value Amsterdamm	3.6 Supported core value Amsterdamm	4.6 Supported core value Amsterdamm
	TRANSPORT EFFICIENCY	1.7 Conflicted with core value Amsterdam	2.7 Supported core value Amsterdamm	3.7 Supported core value Amsterdamm	4.7 Supported core value Amsterdamm
	TRANSPORT CONNECTIVITY	1.8 Supported & Conflicted with core value Amsterdam	2.8 Conflicted with core value Amsterdam	3.8 Conflicted with core value Amsterdam	4.8 Conflicted with core value Amsterdam
	SUSTAINABLE MOBILITY	1.9 Supported core value Amsterdamm	2.9 Supported core value Amsterdamm	3.9 Supported core value Amsterdamm	4.9 Supported core value Amsterdamm
Spatial	URBAN QUALITY	1.10 Supported core value Amsterdamm	2.10 Supported core value Amsterdamm	3.10 Supported core value Amsterdamm	4.10 Supported core value Amsterdamm
	LAND-USE SUSTAINABILITY	1.11 Supported core value Amsterdamm	2.11 Supported core value Amsterdamm	3.11 Supported core value Amsterdamm	4.11 Supported core value Amsterdamm
	TRANSIT ORIENTED DEVELOPMENT	1.12 Supported core value Amsterdamm	2.12 Conflicted with core value Amsterdam	3.12 Conflicted with core value Amsterdam	4.12 Conflicted with core value Amsterdam
	PEOPLE ORIENTED DEVELOPMENT	1.13 Supported core value Amsterdamm	2.13 Supported core value Amsterdamm	3.13 Supported core value Amsterdamm	4.13 Supported core value Amsterdamm

Supported core value Amsterdamm
Supported & Conflicted with core value Amsterdam
Conflicted with core value Amsterdam

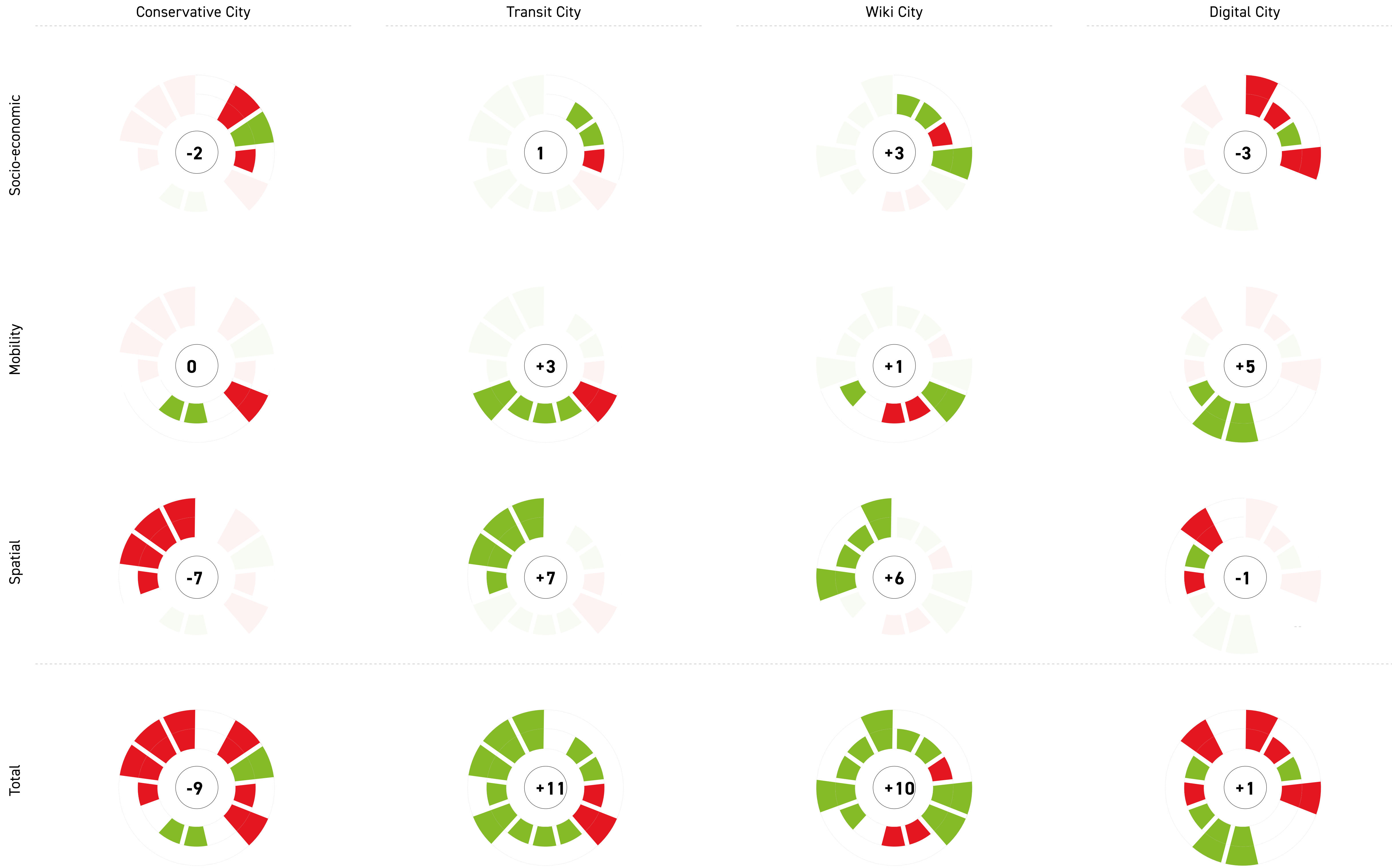


Main positive/negative implications		Elaboration
Sovereignity & Participation	1.4	**Amsterdam as a Bottom-up Paradise** The movement of 'new municipalism', of which a Wikipedia-like platform is one of the instruments, allows for all kinds of citizens, from entrepreneurs to artists, and from students to expats to participate in decision-making and making processes in the city. Decisions are based on a many-to-many model and allow a wide variety of ideas, dream, ambitions and visions to be incorporated and listened to.
Resilient & Diverse	1.5	**Rich Mobility (eco)Systems** The inclusion of many different views and ideas about the city, and allowing those small scale initiatives, start-ups or other bottom-up experiments to materialize and claim a space in the city, leads to a diverse city which does not rely on a select group of actors or services
People Oriented Development	1.13	**The City of the Flaneur** With the focus on slower modes of transport, from walking and biking to slow forms of micromobility, the city becomes a place for people, rather than for fast and efficient machines. Fine-mazed, mixed and dense urban areas create appealing Jane Jacobs-esque neighbourhoods which are aimed at local, people oriented lifestyles
Transport Connectivity	1.8	**All good up until the city's edges** The desire for local autonomy has resulted in the so-called mobility districts, which are small areas with each their own rules, modal split, and spatial design. The interconnectivity between these areas, or between municipalities, and the interoperability of the variety of different services becomes problematic due to a lack of overarching rules or standards enforced by a higher level of governance.
High Quality Services and Infrastructures	1.6	**Who pays for the large and long-term projects?** The local districts and municipalities rather invest in their own local projects, than to gather the needs to invest in larger, district transcending projects such as the maintanance of the national highway network or the accessibility of mainports. There is also a lack of long-term vision, which creates problems in addressing crises such as the housingcrisis
Transport Efficiency	1.7	**Traffic Management requires Technological Knowledge** With the decentralisation of responsibilities, some smaller municipalities find themselves forced to do tasks that they lack the (technological) knowlegde for, such as traffic control and management.

ASSESSMENT MATRIX | DIGITAL CITY



	Main positive/negative implications	Elaboration
Transport Efficiency	4.7	**An Undefeated Waymo Ecosystem** By holding all the services in one hand, Alphabet can ensure smooth cooperability of services and overall efficient traffic. Traffic efficiency is also prioritized, dedicated lanes for fast-moving platoons are for example cutting through and disconnecting parts of the city.
Transport Connectivity	4.8	**One Provider, One platform** By taking control over building and managing their own services, and by investing largely in data-driven management a state-of-the-art system has been built that functions highly efficient.
High Quality Services	2.12	**High-Tech versus Low-Tech** The Alphabet service, which offers different ways for getting around, from small personal pods to shared shuttles, is all high quality. However, that reflects in the price. For those not able to afford the high-end mobility packages that the company sells, only low quality (low frequency, poor accessibility) services remain. There is no in between, no affordable option for the large public with a 'decent' level of quality.
Social Equity & Inclusiveness	4.1	**Individualism at its Finest** The individualistic society allows for larger disparities to emerge between those who can afford certain mobility services, or an appartment in a well-off location and those who can't. There is minimal redistribution of goods/wealth to limit the unequal situation.
Sovereignity & Participation	4.4	**Keys in the Hands of Alphabet** There is little to no sovereignity left, not for state, municipality or citizen. Alphabet is involved in nearly all decision-making, which has shifted from being political to being largely data-driven/a technocratic process (and thus "apolitical"). In other words, Alphabet decides was it is the right way, as they have the knowledge about all urban processes.
Transit Oriented Development	4.12	**G-Roads have taken over** Instead of the private car or the public transport system, a third mobility system has emerged which has quickly taken over not just the mobility landscape, but also the way of urban planning. New developments are going hand in hand with the G-road system, rather than being transit-oriented or car-oriented.


Conservative City
Transit City
Wiki City
Digital City
Socio-economic
-2
1
+3
-3
Mobility
0
+3
+1
+5
Spatial
-7
+7
+6
-1
Total
-9
+11
+10
+1

4.1.2 Story Comparison

The individual story assessment is followed by the story comparison (see figure on previous spread). Here we have taken the same 'scoring circles' of each individual story, and gathered them in a comparison table. This table helps to, at a glance, show the differences in scoring between the different stories (in different aspects, as well as in total). What can we conclude from comparing the stories? Let us start by taking a look at the individual themes first (socio-economic, mobility, spatial) and the total scores at last.

Looking at **socio-economic values** (the values of social equity, health, economic prosperity, sovereignty & participation)

- we see that the best scoring story is the **Wiki City**, with a score of +3. The Wiki City scores well on social equity and healthy, and even better on sovereignty & participation. This comes to little surprise, as the rationale puts a lot of emphasis on egalitarianism, group solidarity and participatory processes - more so than any other rationale.
- we find the Transit City at the second spot, at quite a distance. The story scores a +1, which is primarily because it falls short in providing Amsterdam and its citizens with the ability to make their own decisions, and because it hardly allows for any challenging visions to exist next to its top-down vision, resulting in a low score for participation and sovereignty.
- .we see that the worst scoring story is the Digital City, with a score of -3. The story scores rather poor in all departments except economic prosperity. The profit-driven motives of Alphabet, and the individualistic choices made by citizens and politicians may bring profit to the lucky few, but are detrimental to social equity and participation of society at large. Additionaly, the comfort and ease of door-to-door AV services greatly harms the amount of active travel (and thus health) amongst citizens.

Looking at the **values of mobility** (resilient & diverse mobility (eco) systems, high quality services and infrastructures, transport efficiency, transport connectivity, and, sustainable mobility)

- we see that the best scoring story is the **Digital City** with a score of +5. Mainly because of the excellent efficiency, connectivity, integration and overall quality of the mobility services - thanks to the all encompassing system provided by Alphabet, which includes infrastructures, the fleet, and the Alphabet-led traffic planning department. Add to this the enourmous investments the company has at its disposal, a budget far out(reaching?) governmental budgets, and one can understand why the tech giant can realise such a well-oiled mobility system from the ground up.
- we then find the Transit City trailing with a score of +3. The top-down public transport system also scores high in efficiency and integration and even better in sustainability - a result of its clean, efficient and high-capacity public transport system, and the many policies that are introduced alongside it.
- we see that the worst scoring story is the Conservative City, Even though the mobility system is functioning fine (efficiency and integration are scoring quite well), it comes at the cost of many other forms of transport - leading to a poor diversity and resilience of mobility system(s). The domination of the car industry has led to a drastic decrease in public transport, and citizens are enforced to use their personal AV for practically everything.

Looking at **spatial values** (the values of urban quality, land-use sustainability, transit oriented development, and people oriented development)

- we see that the best scoring story is the Transit City, with a score of +7. The story scores well in pretty much every field, from urban quality to people oriented design, as the top-down planning visions ensure these values remain protected/are integrated in urban planning nationwide.
- we see that the same can be said about the runner-up, the WIki City, which scores a +6. This score is slightly lower, as the story does not reach the same level of TOD/integration with public transport and land-use sustainability - the main reason being the 'disconnection', - both on a physical and governmental level - that has appeared between the local (municipal) level and the national level, causing problems related to disconnectivity and poor interoperability.
- we find the Conservative City to have the worst impact, with a -7. The domination of the PAV in the suburbs and the overall trend away from TOD towards AV-oriented design, goes straight against all spatial values that have been set out by and for the city.

Looking at the **total scores** (all three themes together)...

- we see that the story with the best overall score is the Transit City, with a score of +11. The story scores well in mobility and spatial values. In the socio-economic category, there is room for improvement however. The story leaves little room for other initiatives, by both citizens and market - a problem which also translates to the mobility theme; where diversity and resilience of the offered services is lacking.
- we find the WIki City as a good number second, with a score of +10. The story scores really well in socio-economic and spatial themes, but falls short in mobility - even though the story shows great potential for a experimental, rich mobility system to emerge, the lack of efficiency and integration - due to a lack of coordination of the mishmash of small scale services - and the problematic cooperation with higher levels of governance turn out to be problematic.
- we see that the worst scoring story is the Conservative Story, which stands out, negatively, with a -9. The story is conflicting harshly with all of the core values in the spatial theme, making it clear that a conservative course, which in our story leaves room for car-companies to take the lead, would be far from desirable.

4.1.3 Story Selection

Based on the evaluation, and seen from a purely objective perspective, it has to be concluded that overall the best scoring story is the **Transit City**. In this next section, the strengths of the Transit City are elaborated on in a bit more detail.

The 'victory' of the story can mainly be attributed to its high scores in the fields of **mobility** and **spatial** values.

Spatially the story is the best scoring (+7, compared to +6, -1, -7), primarily because

- (1) the top-down plans ensure a certain level of quality/certain standards of 'urban quality' to be implemented/reached everywhere. Yes, investments in the built environment are made primarily in/around the stations (TOD)- so there is a difference in quality of services/investment in real estate/public space/ infrastructures between a central hub and a rural station, but ultimately all areas are holding up to a certain standard. Mainly because distribution of finances/investments happens through a large bureaucratic, hierarchal system, which is ultimately based on democratic processes/political discussion - meaning that unlike the market-led stories where powerful private actors get to decide where investments are going, that in the Transit story the civic society stays -indirectly - in control over this process/they can ring the bell when spatial inequality becomes too large.
- (2) the Transit city puts a lot of emphasis on 'preserving open land/land-use sustainability' by primarily developing med-high densities around important nodes/stations and by redeveloping within the existing urban fabric/city borders. The results of this are limited urban sprawl and preservation of open space, such as the Green Heart/Waterland/Scheggen.
- (3) the developments themselves are strictly following the important TOD principles and those of 'people-oriented urban planning'; developments around the stations are made walkable, bike-able (solve the last-mile issue), have a higher permeability (small block sizes), are designed after a human scale, attractive, mixed-use (overall vibrant places), have a density high enough to make PT efficient, leave little room for private transport/car-based traffic.

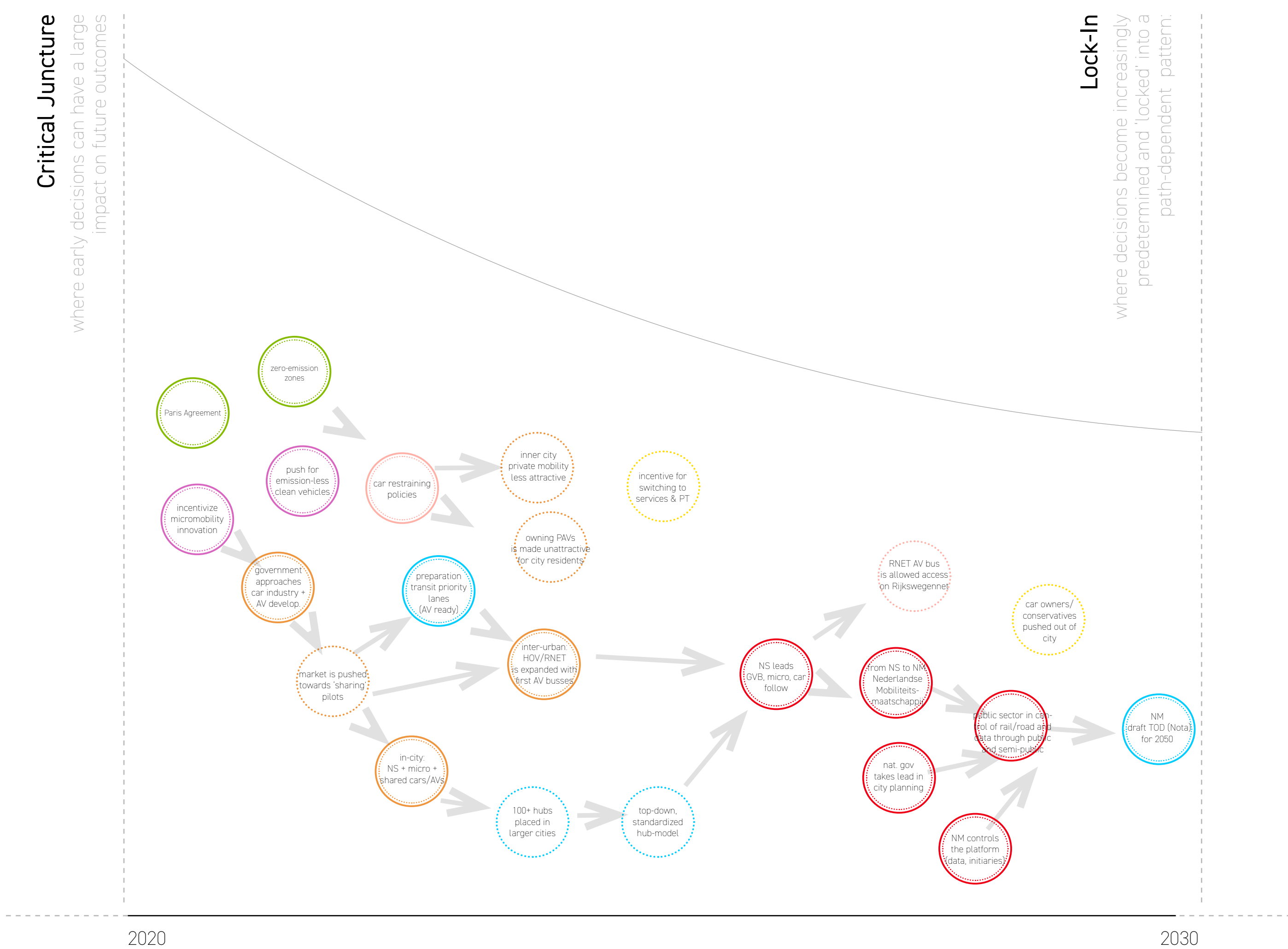
The story also scores high in mobility (+3, compared to 0, +1 and +5), because

- (1) The story continues to invest in/work with the already efficient/well established public transport system in the region/ country. Through improvements in the last-mile part (through SAVs), in the city part (AV tram/bus/metro) and inter-city part (through ART/autonomous rapid transit - both trains/bus) of the system (so practically improvement in all its aspects), a high quality public service and infrastructure is provided
- (2) transport efficiency and connectivity is scoring high trough the integration of most services under a single platform (making booking, payment, planning a journey easy), through improving gaps/poor connections (AV shuttles/micromobility can fill in gaps in the last-mile/distances within the city) and through better traffic management (AV modes allow for less errors (human-mistakes), trains/trams/metro driving closer together,

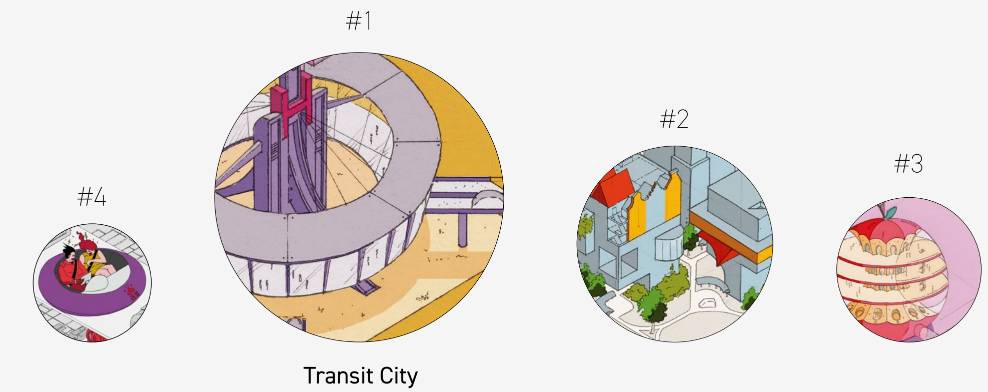
By taking a look at the critical juncture once more, this time with a focus on how the aforementioned strengths (especially transit oriented development, land-use sustainability and sustainable mobility) have been established/reached, it is possible to extract the crucial early interventions and policies that have made this possible.

These policies, actions and spatial interventions are in our case the 'no-regret' decisions; they will help to at least 'lock-in' a part of the Transit City future - or, to put it differently, they will put in motion a certain 'path-dependency' towards transit-oriented development, land-use sustainability and sustainable mobility.

The critical juncture can be seen below, the derived decisions are found on the figure on the right.



METHOD STEP 4: STORY SELECTION



METHOD STEP 5: KEY DECISIONS TO ENSURE/lock-in STRENGHTS

strenghts what to ensure?	**no-regret decisions** which actions to take (2020-2025)
transit-oriented development	Zoning measures; prioritizing public transport Discourage PAVs in cities; stimulate SAV experimentation Expand PT options: individual transit, micromobility Expand role of NS: partnerships with local & private actors operating in cities Transit priority lanes (in anticipation of AV bus/AV shuttles) Transfer points (hubs/stations): variety of transport options (services)
land-use sustainability	Provide a long-term national planning vision (public transport network) Reclaim a more steering role as national government (chosing locations) TOD and car free developments around public transport network Prioritize inner-city transformations/expand only in high density-mixed use
sustainable mobility	Zero-emission and no-car/no-PAV zones. High parking rates (lower for SAVs, shared cars, green micromobility) Prioritization of SAV/pedestrian&cyclist over individual transport Form partnerships with green/sustainable frontrunners from the market 'Superblock' division of 'transit avenues' and cycling/pedestrian roads Develop electricity/recharging grid of stations/docks

Policies
Actions
Spatial Interventions

4.2 Fine-Tuning and Recommendations

Goal of this second section is to discuss where the Transit story needs improvement, what these improvements could be, and how they could be incorporated. For that, we conduct three steps; in the first, we identify the weaknesses of the Transit story (i.e. '*what could be improved/what needs to be improved?*'), in step two we turn to the other three stories in search for their qualities in the relevant areas (i.e. '*where can we find improvements/what elements of other stories could we use to improve the Transit story?*') and in the third, we provide a complete list of recommended policies, actions and interventions, based on the Transit story and the desired improvements.

4.2.1 Discussing the Weaknesses

From the scoring matrix we derive two weaknesses for the Transit story (in red), and one ambiguity (green/red), which are worth discussing. These are '**sovereignty & participation**' '**resilience & diversity**', and, as the ambiguity, '**social equity and inclusiveness**'. Why is the story scoring poorly regarding these values, what are the consequences/implications of this?

'**Sovereignty and Participation**' is the first value that gets a poor score. A first reason is the lack of citizen involvement and empowerment in the decision-making processes of the top-down, technocratic organised system. Specialists lead the way, and little to no room is left for citizens to participate or come up with ideas or initiatives of their own. A second reason is that the concentration (centralisation?) of power has shifted back to the level of the national government in the Transit story. Municipalities have lost a lot of their responsibilities and their right to make their own decisions - e.g. plans regarding the mobility system and surrounding developments are, also on a local level, now firmly in the hands of national planners rather than local ones. Cities such as Amsterdam have lost a large part of their 'sovereignty', and with it the ability to address local issues more specifically.

The loss of sovereignty and participation is felt amongst citizens, municipalities and the market. Promising initiatives such as the Amsterdam Smart City platform, where the three actors come together to innovate, share and test out new ideas, are now struggling to implement their start-ups in the city as the sheer amount of rules that come with the extensive bureaucracy slows down the process of trial-and-error and quick learning for these small to medium enterprises. On top of that, many of the national planners now in charge of the mobility system (that now stretches/encompasses the full door-to-door chain, including last-mile) see little in the potential added value that local entrepreneurs could bring with their experiments within this system - the planners consensus is that they might potentially harm its efficiency, cause connectivity problems and complicate the system - it would be better to keep control and innovation in the hands of the centralised organs.

'**Resilience and Diversity**' is the second value that scores poorly in the Transit story. A first reason is based on the aforementioned sidelining of citizen initiatives, local entrepreneurs and the market in general. By excluding other actors from participating/offering their services as part of the public transport mobility system (which is in the hands of the national government and its (semi)-public companies such as the NM (formerly: NS)) a lot of experimentation, and thus diversity in modalities and services, is lost. Additionally, other forms of transport, mainly private transport, have been made largely unusable/less attractive through a series of interventions and measures. Think: heavy taxes/fees (which made the car/PAV an expansive and for many, unaffordable option), conversion of highway lanes into HOV lanes (which greatly reduced the amount of space available for personal transport/non-public transport) and the restricted access for cars/PAVs in cities. For many, making use of the public transport system is now the only option available. Whereas in cities this system offers diversity in trains/tram/metro/bus/shared shuttles/micromobility, many rural areas are becoming reliant on sometimes just a bus or shared shuttle.

The point of these rural areas brings us to the third weakness of the Transit story; the '**social equity and inclusiveness**'. This theme has been given both a positive and a negative score - positive because the Transit story succeeds to provide a public transport system that is affordable for all - but also negative, because, primarily in rural areas (areas that fall out of the direct 'catchment' of the public transport system), the mobility system can be hard to access or has poor services. The rural, low density areas are simply unsuitable for high frequency transport, or to have more than one or two types of services. The strict top-down development of both the public transport system as well as the TOD developments, responds to this by neglecting these areas/forcing people to move to higher density areas/locations with access to public transport.

4.2.2 Potential Improvements

Looking at how the other three stories could form potential improvements for the three weaknesses of the Transit City - sovereignty & participation, resilience & diversity, and social equity & inclusiveness - it has to be concluded that all of those are to be found in the **Wiki City**. It is in fact the only story out of the four that manages to get high scores in these departments (see comparison table).

Firstly, lets discuss the high score on '**sovereignty and participation**'. What are the actions, interventions and policies that we encountered in the Wiki story that were responsible for this high score?

A major first step was made in the early stages of the story, when the Dutch national government, in close collaboration with local municipalities, decided to stand up strong to the rapidly expanding (often in a predatory manner) tech-corporations such as Uber and AirBnB. It pushed for policies that would require these companies to share their data (such as traffic data) with other entrepreneurs, knowledge institutes and the cities in which they operated - if a company were to refuse, like Uber did, it would simply be expelled from the respective city. It was a strong and brave move to reclaim the right to data relatively early on - and to prevent it from becoming a powerful bargaining chip for these corporations to make deals with the public sector in the future.

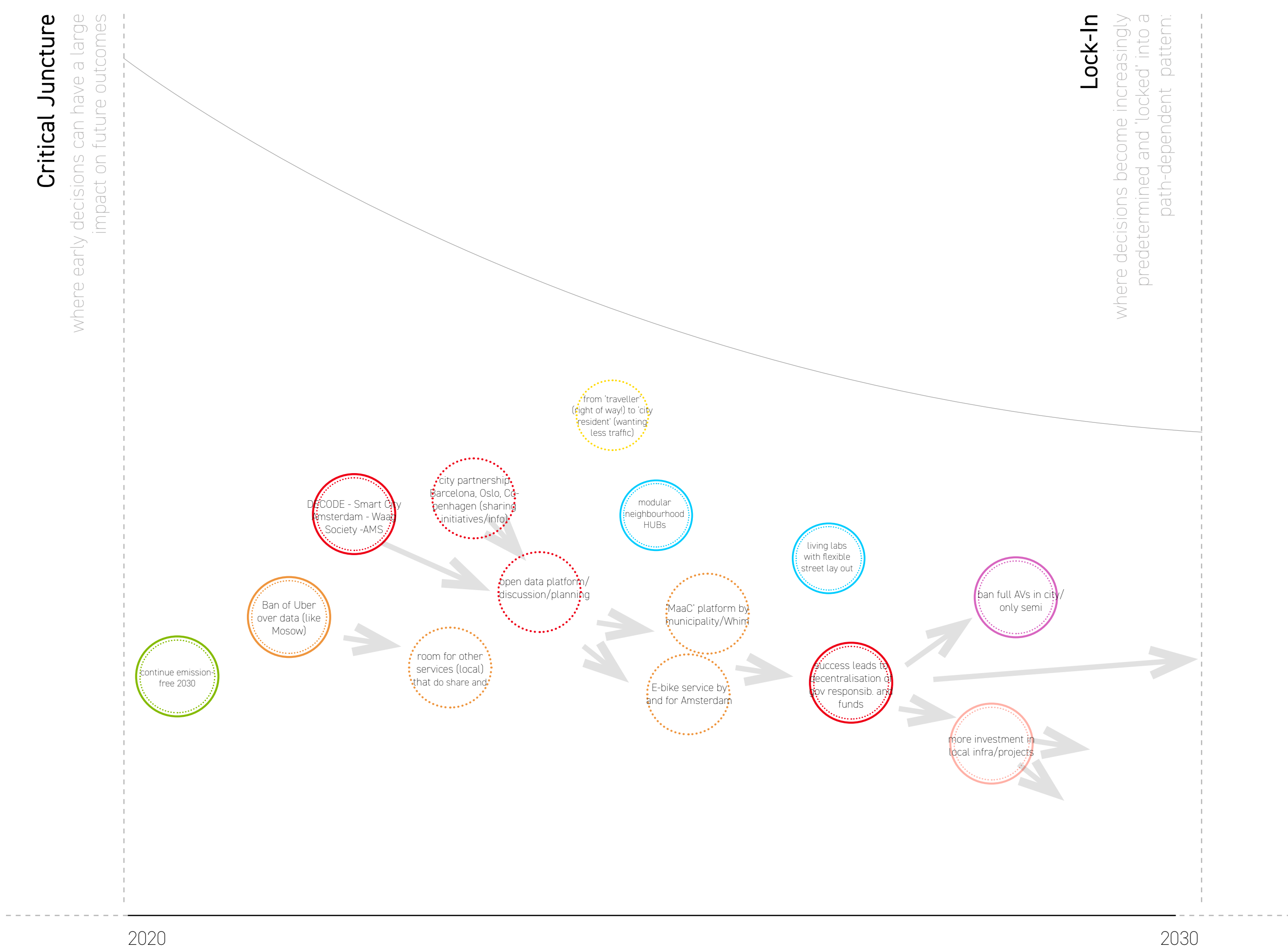
In addition, the government pushed through new policies which helped cities to keep the experimentation of these large companies under control; stricter rules were introduced for companies who wanted to experiment and operate - rules about location/spatial impact and what their fleet size could be, were useful policies with which cities were able to ensure a market which was both controllable, and diverse. By giving out small licenses to wide varieties of enterprises, from local mobility providers to the occasional Silicon Valley company, the city prevented a monopoly from forming, and kept citizens and local entrepreneurs involved in the experiments.

This was further supported by partnerships that were created between Amsterdam, GVB, NS and local (some even operating on a neighbourhood level) mobility providers. The result being a varied patchwork of different, and location specific services, operating from the 'community HUBs'. Citizens were given the power to decide over which modalities would operate in their district, which gave them a great sense of responsibility and empowerment.

As the problem of cooperation/interoperability between 'mobility districts' appeared, a large effort was put in by Amsterdam to ensure standardization of data/information/services. New policies were introduced that stated all local mobility providers had to operate through the Amsterdam Smart City platform - which was in its turn linked to the Decode platform, part of the city alliance with many other cities. It ensured sharing of knowledge between operators, and it gave the city the ability to monitor/play the role of coordinator/connector of all these services. The result being one booking platform/one payment system/centrally made timetables - the bare minimum however.

We return to the critical juncture once more, this time with a focus on how the aforementioned improvements (especially sovereignty & participation, resilience & diversity, and social equity & inclusiveness). Again, just as with the Transit story, the goal is to extract the crucial early interventions and policies that have 'locked-in' these values.

The derived policies, actions and spatial interventions are found on the figure on the right.

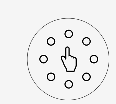
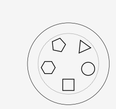


METHOD STEP 6: STORY IMPROVEMENT

#2

Wiki City

METHOD STEP 7: KEY DECISIONS TO ENSURE/ lock-in IMPROVEMENTS

improvements what to ensure?	**no-regret decisions** which actions to take (2020-2025)
 sovereignity & participation	Keep local mobility market open for small companies/local innovations Enforce 'open innovation' (e.g. data sharing) Set out 'standardization rules' (for services and for knowledge sharing) Allow and preserve small scale trial-and-error/living lab pilots Decentralize some responsibilities to district levels (eg. types of vehicles at hub) Allow (temporary) neighbourhood/campus/businesspark hubs
 resilience & diversity	Incentivize (radical) innovation over incremental/techical updates of the existing Establish clear hierarchy (structural framework and what is left for bottom-up) Wikipedia-like platform for feedback between citizens and city Modular hubs/mixed traffic experiments/lanes for micromobility
 social equity & inclusiveness	Enforce equal access/evenly spread mobility services Mobility as a Commons instead of Mobility as a Service Invest in walking/cycling/micromobility networks

Policies
Actions
Spatial Interventions

strenghts & improvements what to ensure?	no-regret decisions which actions to take (2020-2025)
transit-oriented development	Zoning measures; prioritizing public transport Discourage PAVs in cities; stimulate SAV experimentation Expand PT options: individual transit, micromobility Expand role of NS: partnerships with local & private actors operating in cities Transit priority lanes (in anticipation of AV bus/AV shuttles) Transfer points (hubs/stations): variety of transport options (services)
land-use sustainability	Provide a long-term national planning vision (public transport network) Reclaim a more steering role as national government (chosing locations) TOD and car free developments around public transport network Prioritize inner-city transformations/expand only in high density-mixed use
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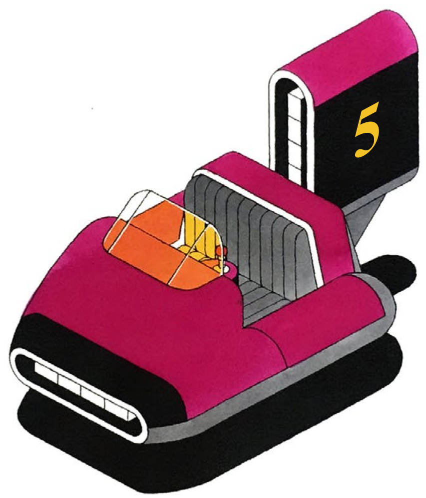
sovereignity & participation	Keep local mobility market open for small companies/local innovations Enforce 'open innovation' (e.g. data sharing) Set out 'standardization rules' (for services and for knowledge sharing) Allow and preserve small scale trial-and-error/living lab pilots Decentralize some responsibilities to district levels (eg. types of vehicles at hub) Allow (temporary) neighbourhood/campus/businesspark hubs
resilience & diversity	Incentivize (radical) innovation over incremental/techical updates of the existing Establish clear hierarchy (structural framework and what is left for bottom-up) Wikipedia-like platform for feedback between citizens and city Modular hubs/mixed traffic experiments/lanes for micromobility
social equity & inclusiveness	Enforce equal access/evenly spread mobility services Mobility as a Commons instead of Mobility as a Service Invest in walking/cycling/micromobility networks

Policies
Actions
Spatial Interventions



CHAPTER V:

CONCLUSION & DISCUSSION

CHAPTER 5 | CONCLUSION

This final chapter will start by summarizing and discussing how the different chapters of the project have tried to answer the research sub-questions, and how, in the end, the main research questions has been answered. Then, the research is concluded by discussing limitations of the project, future research suggestions and a reflection.

5.1 Conclusions

Chapter 1

In chapter one, a start was made by setting the context of the project, followed by the problem statement, the project aim, the research questions and the proposed methodological framework.

The context, or background, required three steps. The first introduced and discussed autonomous vehicles and the importance of decision-making during the experimental period these vehicles are currently in. The second discussed what the arrival of the autonomous vehicle could mean for the Amsterdam and its region, and showed what the current visions are of the city, the region and different private actors form the market regarding autonomous vehicles. The third step then highlighted the current trend of public authorities (worldwide) which are putting proactive decision-making regarding autonomous vehicles in the hands of private actors, due to a lack of insight in what important early decisions are.

After the background was established, the chapter showed how the lack of suitable foresight- and scenario methods could be seen as part of the cause behind the lack of decision-making. It continued by stating that there is an urgency for more a socio-technical, story-driven scenario method, as this could fill in a gap that is left un-addressed by the plethora of technocratic, reductionist and quantitative scenarios on autonomous vehicles. This led to the conclusion, simultaneously the project aim, that there is a need for a new method which can provide insights in important early decisions regarding autonomous vehicles.

Chapter 2 (RSQ1 and RSQ2)

This brought us to the second chapter, in which a start was made to find suitable elements for this method, and to built it. The leading research sub-questions in this chapter were:

- RSQ1: *"What makes storytelling such a popular way of future-making/and is it suitable for envisaging uncertain futures?"*
- RSQ2: *"How can storytelling be turned into a method for making alternative stories on autonomous vehicles?"*

Research sub-question 1 lead the research into the 'why' of storytelling. Through looking at how storytelling is used to inform/steer future decision making, by both public sector and private actors, we figured that the idea of 'future storytelling' might be suited for writing stories on autonomous vehicles with a focus on decision-making and implications. Even more so than conventional scenario methods.

This lead to the second part of the chapter, in which research sub-question 2 was addressed. Through theory on 'society rationales', and socio-technical systems and transitions, three steps were made that make up the method of storytelling: society rationales being the foundation (step 1), a critical juncture/lock-in scheme as the structure (part 2) and story elements to complete the start (part 3). These three steps together made up the fist part of the storytelling method.

Chapter 3 (RSQ3)

The third chapter was fully reserved for the four stories on Amsterdam and autonomous vehicles, resulting in the Conservative City, the Transit City, the Wiki City and the Digital City - which formed the answer to the third research sub-question;

- RSQ3 "What are potential future stories regarding autonomous vehicles in Amsterdam and the AMA?"

Chapter 4 (RSQ4 and RSQ5)

In chapter four, it was time to evaluate and compare the stories, in order to figure out what the main recommendations/no-regret decisions are for Amsterdam. It addressed the following questions:

- RSQ4 "How do the stories relate to the core values of Amsterdam?"

- RSQ5 "What are the key recommendations/no-regret decisions that we can derive from these stories?"

The forth research sub-question led the first part of the evaluation chapter, which consisted of the story assessment, the story comparison and the story selection. By putting the stories against the core values of Amsterdam, it was concluded that the Transit City was in fact the highest scoring, and therefore the most qualified to be the foundation of the recommendations.

The fifth research sub-question was then answered by another two steps. First, the weaknesses of the Transit City were discussed and replaced by strengths of the Wiki City, to fill up the weak spots. Secondly, the final recommendation was provided in the form of a scheme which showed the important no-regret decisions that were derived from the Transit City, as well as some additional decisions derived from the Wiki City. Together, these make up the recommendation for the city of Amsterdam - which is the final output of the project.

Main Research Question

- MRQ "How can a storytelling-scenario method provide Amsterdam with important no-regret decisions regarding autonomous vehicles."

The storytelling-scenario method has led to a list of recommendations for the city of Amsterdam in the form of policies, spatial interventions and other actions. It has done so by building different future stories about the city and autonomous vehicles in a way that gives transparency of decision-making and subsequent implications (based on socio-technical theories), whilst giving the stories a speculative and imaginative character through (visual) storytelling elements.

Other than most traditional foresight- and scenario methods, this way of producing and thinking about futures is thus a relatively free/expressive/creative way of speculating about the future, whilst still allowing important insights to be derived from it. This is something helpful in uncertain situations like these where, in reality, no one really knows what is going to happen/and where the exploration of certain directions of futures might be sufficient (for now). Quantitative, reductionist scenarios can only do so much for the anticipation of autonomous vehicles - and are therefore well complimented by an antithetic method in the form of qualitative, systemic scenarios.

5.2 Future Research, Limitations and Reflection

Limitations and reflection

One of the shortcomings of this project, is that it failed to make use of municipal input, or workshops with relevant stakeholders. Other, similar scenario-based projects, such as the PBL study and the Re-Programming study (PBL, 2019, Townsend, 2014) have made extensive use of expert panels, interviews, workshops and other ways to gain a input for the scenarios. This project did do extensive literature research, media analysis, and the author did held a selection of unstructured interviews with planners involved in mobility, but this could have been done in a more serious and organised manner.

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Another major limit to the research is the fixation on the city of Amsterdam. The whole production of stories, and especially the selection of the Transit story, makes sense in the context of a large city with relatively many progressive citizens. But the outcomes would hardly translate to more conservative areas, such as rural towns or an Almere. The outcomes are thus to be taken highly context dependent.

A next step would be to see how these spatial differences could be represented. As, in reality, no country, or city, can be characterized by a single worldview, a more realistic representation would result from layering all four stories on top of each other, with different locations leaning towards a certain worldview more than others. A patchwork would be the result, with some areas scoring high on the Transit and low on the Conservative worldview, and others high on the Digital and low on the Egalitarian, for example.

How this patchwork could then be translated into recommendations is a question yet unanswered. I feel that, to some extend, location specific recommendations are a possibility; different municipalities should be able to decide differently in some regards. But how more fundamental, large scale, governmental choices would have to be made (also in a fragmented manner? or should a national government take a stance here, and chose a worldview of its own which is leading for the entire country) is something that has to be explored further.

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