Smart Cycling Futures

Capita Selecta

keuze uit meerjarig
fietsinnovatieonderzoek

Friso de Vor en Marcus Popkema (red.)

Colofon

Smart Cycling Futures Capita Selecta

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Samengesteld door:
Friso de Vor & Marcus Popkema (Hogeschool Windesheim)

Met bijdragen van:
Marco te Brömmelstroet, Matthew Bruno, Inge Helbers-Bonte, Hugo Kampen, Sukanya Krishnamurthy, George Liu, Thomas Long, Samuel Nello-Deakin, Anna Nikolaeva, Rob Raven, Arnoud van Waes & Pieter van Wesemael

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Smart Cycling *Futures*

Deze uitgave is tot stand gekomen in het kader van het onderzoeksproject **Smart Cycling Futures** (SCF), www.smartcyclingfutures.nl. Hierin bestuderen kennisinstellingen samen met partners in verschillende gemeenten en provincies de kansen die fietsinnovaties kunnen bieden aan verbetering van het fietssysteem – en daarmee kunnen bijdragen aan de leefbaarheid van steden en regio's. Universiteit Utrecht, Universiteit van Amsterdam, Technische Universiteit Eindhoven en Hogeschool Windesheim werken daartoe samen in een consortium met de gemeenten Utrecht, Amsterdam, Eindhoven en Zwolle, evenals de provincies Overijssel, Utrecht en Noord-Brabant en vervoerregio Amsterdam. SCF maakt deel uit van het onderzoeksprogramma 'Smart Urban Regions of the Future' (SURF) van het kennisinitiatief Verbinden van Duurzame Steden (VerDuS, www.verdus.nl). Hierin werken de ministeries IenW, BZK en EZK samen met NWO, Platform31 en het Nationaal Regieorgaan Praktijkgericht Onderzoek SIA.

Voorwoord

Het fietsonderzoek Smart Cycling Futures is een rijke bron van nieuwe fietskennis en -inzichten gebleken. De voor u liggende Capita Selecta is daarvan een mooi bewijs. Als mede-initiatiefnemer was ik vanaf het eerste begin betrokken bij de ontwikkeling van dit project. Zwolle heeft veel ambitie op het gebied van fietsen en werkt innovatief samen met lokale bedrijven en bewoners. Doordat we Fietsstad 2014 werden, konden we nieuwe initiatieven nemen en het landelijke onderzoeksprogramma VerDuS SURF bood daartoe een mooie kans. We werkten al samen met Hogeschool Windesheim en de Fietsersbond, en met provincie Overijssel en nog een aantal andere steden, regio's en universiteiten kwam het onderzoeksproject Smart Cycling Futures tot stand. In Amsterdam, Eindhoven, Utrecht en Zwolle zijn onderzoekers en praktijkpartijen gezamenlijk in zogeheten living labs aan de slag gegaan om vernieuwingen door te voeren. In de verschillende steden en regio's is aan mooie innovatieve projecten gewerkt, waarbij het samen leren en ontwikkelen voorop stond. Dan telt niet alleen het concrete resultaat, maar ook de inzichten die je opdoet.

Voor Zwolle en Overijssel betekende dit dat we bij de snelfietsroute Dalfsen-Zwolle, die deels tijdens Smart Cycling Futures werd gerealiseerd, onder andere met de gebruikers van de fietsroute en regionale werkgevers hebben samengewerkt. Dit ging vooral over hoe we door middel van fietsstimuleringsmaatregelen slim het gedrag van (potentiële) fietsers kunnen beïnvloeden, zodat zij (meer) gaan fietsen en van de route gebruik gaan maken. Een ander living lab was 'Fietsen geeft vrijheid'. Dit project van welzijnsorganisatie Travers in de Zwolse wijk Holtenbroek draaide om fietslessen voor allochtone vrouwen. Het bestond al, maar is tijdens Smart Cycling Futures verbreed. Weesfietsen werden opgeknapt en beschikbaar gesteld. Ook is de methodiek achter het project verder doorontwikkeld samen met de SCF-onderzoekers. Een derde project rond de inzet van wisselfietsen bij NS-station Zwolle heeft na de onderzoeksfase nog geen uitgebreid vervolg gekregen. Dit is afgezien van één van de betrokken ondernemers die op basis van het onderzoek de wisselfiets verder heeft uitgewerkt tot een kleinschalige proef.

Hoe dan ook, in alle gevallen was de inbreng van de SCF-onderzoekers van evident belang. Zij dachten mee, adviseerden ons, deden onderzoek en ondersteunden de meewerkende studenten; de onderzoekers begeleidden het gezamenlijke leerproces in de living labs. Alle opgedane ervaringen en verkregen inzichten zijn waardevol voor ons. We zullen ze dan ook zeker benutten bij ons verdere werk aan de innovatieve wereldfietsstad!

Syb Tjepkema | Senior beleidsadviseur bereikbaarheid | Gemeente Zwolle

Inhoud

Smart Cycling Futures, *kennis voor een slimmer fietssysteem*

Ruim vier jaar onderzoek naar de mogelijkheden voor en effecten van een 'slimmer' fietssysteem is afgerond. In het onderzoeksproject Smart Cycling Futures (SCF) werkten wetenschap en praktijk nauw samen bij het uitproberen van uiteenlopende fietsinnovaties. Tegen de achtergrond van de uitdaging van steden en regio's om leefbaar te blijven en zich duurzaam te ontwikkelen, zijn we vanuit verschillende disciplines ingegaan op de vraag hoe de transitie naar een slimmer fietssysteem hierbij een rol kan spelen. Met een kernteam van vijftien onderzoekers (hoogleraren, senior- en junior-onderzoekers/AIO's) hebben we onze tanden gezet in allerlei vraagstukken die spelen op het snijvlak van fietsen, innovatie en stedelijke en regionale (vervoers)vraagstukken. Dit heeft een veelkleurig en omvangrijk palet aan nieuwe kennis opgeleverd.

Een groot deel van de nieuw verworven kennis heeft zijn beslag gekregen in academische publicaties, zoals internationale tijdschriftartikelen, conference papers, proefschriften en boeken. Tegelijk hebben we een minstens zo groot deel van onze bevindingen, ervaringen en geleerde lessen op andere manieren met de wereld gedeeld, via onder andere speciale fietsbrochures, handreikingen voor de praktijk, MOOC's (Massive Open Online Course), vlogs en blogs, diverse symposia en optredens in de media. Belangrijke platforms van kennis- en ervaringsuitwisseling waren daarnaast de zogeheten living labs, waar we als onderzoekers samen met de praktijk geëxperimenteerd hebben met fietsinnovaties. Naast bevordering van het begrip over de uitgeteste innovatie, heeft het vooral ook praktijkkennis opgeleverd over de werking van living labs als vorm van samenwerking tussen onderzoek en praktijk en als methode om in gezamenlijkheid vernieuwing te genereren (co-creatie).

Met deze Capita Selecta proberen we een glimp te tonen van de rijkheid en veelzijdigheid van de opbrengsten van ruim vier jaar SCF-onderzoek. Het heeft geleid tot een gebundelde mix van artikelen, Engelstalig en Nederlandstalig, dat het brede spectrum bestrijkt van wetenschappelijke beschouwing en reflectie tot lessen en oplossingsrichtingen voor de (beleids)praktijk. In *Vier lessen uit SURF-project Smart Cycling Futures* reflecteren Popkema en De Vor op de hoofdmoot van onderzoeksuitkomsten en trekken de belangrijkste lessen voor de (verkeerskundige) praktijk. In *Exploring velotopian urban imaginaries: where Le Corbusier meets Constant?* verkennen Nikolaeva en Nello-Deakin fietsutopieën langs de ideeën van de twee vooraanstaande twintigste-eeuwse stedebouwkundige visionairs. Praktischer van insteek is het artikel *Towards a maintenance-based approach to mode shift: Comparing two cases of Dutch cycling policy using social practice theory*. Bruno en Nikolaeva vergelijken Nederlandse beleidsprogramma's en concluderen dat Nederlands fietsbeleid te weinig oog heeft voor de bestaande fietser en hun mogelijkheden om het fietsen te versterken en aantrekkelijker te maken. Op hun beurt gaan Liu en anderen in *Practitioners' perspective on user experience and*

design of cycle highways dieper in op hoe beleidsmakers en ontwerpers de beleving van de fietser meenemen in het ontwerp van nieuwe fietsinfrastructuur. Zij zien dat het ontwerp veelal het resultaat is van het opvolgen van standaarden en richtlijnen, zonder dat de eigen logica, beleving en veelsoortigheid van fietsers voldoende onderkend wordt. Het artikel van Long en Van Waes belicht een heel ander onderdeel uit het bestudeerde spectrum: business model innovatie bij deelfietsplatformen. Meer specifiek: in *When bike sharing business models go bad: Incorporating responsibility into business model innovation* gaat het over de rol van sociaal-ethische factoren bij het succes of falen van een dergelijke innovatie. Succesfactoren zijn ook geïdentificeerd in *Geeft fietsen vrijheid?* Kampen en anderen evalueren in hun bijdrage het living lab in de Zwolse wijk Holtenbroek, dat draaide om georganiseerde fietslessen en andere fietsactiviteiten en hoe deze het fietsgebruik bevorderen van nieuwe Zwollenaren – oftewel, migrantenvrouwen met beperkte fietsvaardigheden. In het laatste geselecteerde artikel, *Challenges and dilemmas in strategic urban experimentation*, staat het living lab als manier van experimenteren en onderzoek doen centraal. Van Waes en anderen analyseren vier living labs die gedurende het SCF-project zijn opgezet en komen tot welgeteld zestien uitdagingen en dilemma's voor living lab experimenten en stedelijke transities.

In zijn geheel heeft Smart Cycling Futures bijgedragen aan de kennisbasis van het fietssysteem, in Nederland en daarbuiten. Een compleet overzicht van de producten van het project is te zien in het hoofdstuk Publicaties. De opbrengst van het onderzoek draagt hopelijk bij aan de verdere ontwikkeling van de fietspraktijk, en daarmee aan de inrichting van leefbare stedelijke regio's. Want in die gebieden kunnen voorlopig nog voldoende stappen worden gezet om de kwaliteit van leven te bevorderen.

HOOFDSTUK 01

Vier lessen uit SURF-project
Smart Cycling Futures

Marcus Popkema[a] en Friso de Vor[a]

m.m.v. Marco te Brömmelstroet[b], Matthew Bruno[c,d], Jacco Farla[d], George Liu[b,c], Samuel Nello-Deakin[b], Anna Nikolaeva[b], Arnoud van Waes[d], Pieter van Wesemael[c]

[a] Hogeschool Windesheim Zwolle | [b] Universiteit van Amsterdam | [c] TU Eindhoven | [d] Universiteit Utrecht

Eerder verschenen als congrespaper voor het Nationaal Verkeerskundecongres 2020 (29 oktober 2020).

Samenvatting

Het vier jaar durende onderzoeksproject Smart Cycling Futures (SCF) is nagenoeg afgerond. Deze bijdrage vertelt wat we van dit onderzoek naar fietsinnovaties hebben geleerd. We concentreren ons op de lessen die relevant zijn voor verkeerskundige adviseurs die voor of bij overheden werken. In verschillende Nederlandse steden hebben we samen met praktijkpartijen in zogeheten living labs geëxperimenteerd met en onderzoek gedaan naar fietsinnovaties. Dit heeft inzichten opgeleverd die de basis vormen voor een viertal lessen.

1. Experimenteren in een living lab kun je leren
2. Kies de bestaande fietser als vertrekpunt voor fietsbeleid en -innovatie
3. Voor de fietser geldt een eigen logica
4. Fietsinnovaties zijn niet waardevrij

Met deze lessen geven we handvatten voor verdere ontwikkeling van de rol van de fiets in het mobiliteitssysteem. Een belangrijke voorwaarde voor succesvolle toepassing van living labs is dat partijen in gezamenlijkheid willen zoeken naar vernieuwing. Het helpt als partijen bereid en in staat zijn om de minder voor de hand liggende politieke aspecten van innovaties tegen het licht te houden. Hiernaast bieden de geformuleerde lessen ook perspectieven voor het versterken van fietspraktijken. We roepen overheden, innovatoren, onderzoekers en burgers op om hiermee samen aan de slag te gaan: perspectieven uitwerken, maatregelen ontwikkelen en die vervolgens uitproberen.

Inleiding

In het kader van het onderzoeksproject Smart Cycling Futures (SCF) hebben we vier jaar lang diverse fietsinnovaties onderzocht. Het is tijd om terug te blikken. Wat voor inzichten heeft het experimenteren met en onderzoeken van fietsinnovaties opgeleverd? Verpakt in een viertal lessen delen we de voornaamste inzichten die relevant zijn voor de verkeerskundige beroepspraktijk. De lessen zijn met name bedoeld zijn voor verkeerskundig adviseurs die voor of bij overheden werken.

SCF vormt een onderdeel van onderzoeksprogramma Smart Urban Regions of the Future (SURF). Het SCF-consortium bestaat uit vier kennisinstellingen en diverse praktijkpartijen. In het project werken Universiteit Utrecht, Universiteit van Amsterdam, Technische Universiteit Eindhoven en Hogeschool Windesheim Zwolle nauw samen met de gemeenten Utrecht, Amsterdam, Eindhoven en Zwolle, evenals de provincies Overijssel, Utrecht en Noord-Brabant en de vervoersregio Amsterdam. Direct vanaf het begin lag de nadruk van het project op experimenten met fietsinnovaties voor uiteenlopende stedelijke (vervoers)vraagstukken. In Amsterdam, Eindhoven, Utrecht en Zwolle zijn we als onderzoekers samen met praktijkpartijen in zogeheten living labs aan de slag gegaan om vernieuwingen door te voeren. Het monitoren en evalueren van de innovaties en het innovatieproces in de living labs heeft een viertal lessen opgeleverd die we hier nader bespreken.

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1. Experimenteren in een living lab kun je leren

In een living lab experimenteren betrokken partijen, zoals overheden, marktpartijen, belangengroepen, gebruikers en kennisinstellingen, met het vinden van oplossingen voor de gekozen opgaven. Hierbij ligt de nadruk op samen leren, liefst samen met gebruikers of andere burgers. Zo hebben alle participerende partijen invloed op het proces en het resultaat ervan. Gesprekken in een living lab gaan daarom zowel over de inhoud als over de route die wordt bewandeld om tot een bepaald resultaat te komen. Kenmerkend voor dit type ‘co-creatie’ is dialoog, samen leren, daadkracht en aandacht voor resultaat.

We hebben gekozen voor het living lab als methode, wat een vorm is van transdisciplinair onderzoek. Verschillende partijen die zijn betrokken bij het onderzoek, doen en volgen hierbij experimenten in een ‘levende laboratorium’ omgeving – met de bedoeling om innovaties te bevorderen en ze (beter) te begrijpen. Deze manier van experimenteren en onderzoek doen sluit naadloos aan op de uitgangspunten van het overkoepelende SURF-onderzoeksprogramma. SURF beoogt dat (wetenschappelijk) onderzoek naar vernieuwingen zoveel mogelijk concrete en meetbare bijdragen levert aan de Nederlandse samenleving. In die zin is een living lab bij uitstek geschikt om met onderzoek maatschappelijke impact te genereren.

In een living lab is de rol van de overheid, maar ook die van de andere deelnemers aan het experiment, anders dan betrokkenen meestal gewend zijn. In een living lab is de overheid één van de partijen die bijdraagt aan de ontwikkeling van de vernieuwing, en heeft daarbij inhoudelijk gezien dezelfde positie als iedere andere deelnemer. Bij de gesprekken over inhoudelijke aspecten van een innovatie weegt de stem van de overheid even zwaar als die van een andere betrokken partij.

Bij het opzetten van de experimenten en de pogingen om daarvan te leren heeft de overheid evenwel een aanjaagfunctie. Zij neemt het initiatief en betrekt partijen die een belang hebben bij het realiseren van vernieuwingen. Ze zorgt dat rollen goed verdeeld worden en zet een proces uit waarin op het juiste vlak experimenten plaatsvinden. Tevens zorgt ze dat de betrokken partijen van de proeven leren.

We hebben geconstateerd dat het afstemmen van kennisniveaus en verwachtingen over experimenteerprocessen tussen de betrokken organisaties een belangrijke succesfactor is (Van Waes, Nikolaeva en Raven, 2021). In SCF hebben we geleerd om de experimenteerprocessen vorm te geven door te doen (learning by doing). We hebben ervaren dat de uitdagingen het best overwonnen kunnen worden door ze expliciet te maken. Al werkende heeft dit geleid tot aanpassing van de leerdoelen, verwachtingen, activiteiten en rollen. Daarnaast stimuleerde het de interactie tussen de deelnemers, wat hielp om samen te werken aan de gestelde doelen. Door het leren explicieter te maken, werd het leerproces geïntensiveerd, wat uiteindelijk tot uiting kwam in een grotere betrokkenheid van alle deelnemers en een meer geïntegreerd en effectiever innovatieproces.

Wat hierbij helpt is het (beter) leren omgaan met verschillende achtergronden, rollen en disciplines van living lab partners. We zagen dat praktijkprofessionals andere vragen hebben dan andere partijen in het living lab. Erkenning van de verschillen en expliciet maken van de waarde van deze verschillen voor het realiseren van de vernieuwing is van belang. Speciale vermelding verdient de rol van de burger/gebruiker. Deze moet van meet af aan worden betrokken bij het proces en een volwaardige positie te krijgen. Vaak wordt óver burgers gesproken en niet mèt hen. De kwaliteit van de vernieuwing neemt toe als de burger een volwaardige gesprekspartner is.

2. Kies de bestaande fietser als vertrekpunt voor fietsbeleid en -innovatie

Veel overheden richten zich in het huidige fietsbeleid op het vergroten van de aantrekkelijkheid van het fietsen voor niet-fietsers. Het is beter om uit te gaan van bestaande fietsers en hun mogelijkheden om het fietsen te versterken en aantrekkelijker te maken. Uit onderzoek van Oldenziel et al. (2016) blijkt dat een fietscultuur wordt gevormd en gedefinieerd door bestaande fietsers, ongeacht hun aantal. Een overgang naar een duurzaam transportsysteem begint met begrip, ondersteuning en investeren in de praktijken van die mensen. Ons onderzoek laat bovendien zien dat het bestaan van een kritische massa van bestaande fietsers een vorm van 'menselijke infrastructuur' vormt die een cruciale rol speelt bij het ondersteunen en stimuleren van fietsen voor iedereen (Nello-Deakin en Nikolaeva, 2020). Hoewel ruimtelijke ordeningsmaatregelen, innovaties en omgevingsfactoren zeker een rol spelen bij het creëren

van gunstige voorwaarden voor fietsen, is het belangrijk om te beseffen dat de sociale omgeving een even belangrijke rol speelt (Nello-Deakin en Harms, 2019).

De verklaring voor het belang van de 'menselijke infrastructuur' voor de ontwikkeling van fietspraktijken kunnen we vinden in de sociale theorie. Beleid dat de ervaring van bestaande fietsers verbetert, wordt versterkt door processen van sociale feedback die optreden als mensen zien dat anderen genieten van het fietsen (Macmillan en Woodcock, 2013; Skov-Petersen et al., 2017). Een bijkomend voordeel van het voorop stellen van de menselijke infrastructuur zou kunnen zijn dat de overgang naar een duurzame mobiliteitssysteem wordt versneld. Daarvoor kan worden aangehaakt bij degenen die al de keuze hebben gemaakt om duurzaam reizen serieus te nemen.

Voor verkeerskundig adviseurs bij overheden betekent deze aanbeveling in sommige gevallen dat de doelgroep van het beleid verandert. Niet langer staat voorop dat wordt geprobeerd om automobilisten te verleiden vaker de fiets te laten pakken. De nadruk komt te liggen op het versterken van de handelingsmogelijkheden van bestaande fietsers.

3. Voor de fietser geldt een eigen logica

Verkeerskundigen gaan op dubbelzinnige wijze om met fietsers. Aan de ene kant wordt de fiets vaak geschaard onder het langzame verkeer. In het Engelse taalgebied behoren fietsers samen met de voetgangers tot de zogenaamde 'slow modes'. In sommige landen wordt dit heel letterlijk genomen en moeten fietsers hun weg zien te vinden op de stoep. Aan de andere kant wordt de fietser behandeld als een langzame automobilist. Vanuit een overeenkomst in de mogelijkheden om individuele mobiliteit vorm te geven, passen de ontwikkelaars van fietsinfrastructuur vaak auto-logica toe bij het creëren van fietsruimtes. Efficiëntie en doorstroming staan voorop, met de ontwikkeling van een onpersoonlijke verkeersruimte tot gevolg.

Fietsers hebben evenwel hun eigen manier van omgaan met de omgeving. Ten eerste zou de fysieke component van de fietservaring meer kunnen worden onderkend (Liu et al., 2018). Mensen zetten hun eigen lichaam in als instrument met mogelijkheden om sensitief op de omgeving te reageren. Tegelijkertijd beleeft een deel van de fietsers plezier aan het gebruik van het eigen lichaam als middel om voortstuwing te realiseren. Ten tweede is fietsen in veel hogere mate dan bij een verplaatsing per auto een sociale aangelegenheid. Niet alleen voor mensen die samen opfietsen, maar bovenal in de contactmogelijkheden die er zijn met medeweggebruikers. Op de fiets is 'onderhandelen' met andere verkeersdeelnemers veel gemakkelijker dan vanuit een auto.

Met SCF tonen we dat de logica van de verkeerskundige heeft geleid tot een specifiek ontwerp van de fietsruimte in onze straten. De fietsruimte bevat verborgen verwachtingen of 'scripts' over hoe fietsers zich dienen te gedragen (Karndacharuk et al., 2014). Het ontwerp staat de fietser niet toe om zijn kwaliteiten volledig te benutten. Er liggen derhalve kansen om meer dan bij bestaande infrastructuur het geval is op de fysieke en sociale mogelijkheden van de fietser in te spelen, zodat deze meer zijn eigen logica kan volgen (Liu et al., 2019).

Voor verkeerskundig adviseurs bij overheden betekent dit dat er mogelijkheden zijn om de fietsinfrastructuur nog beter toe te snijden op de 'kwaliteiten' van fietsers. De manier waarop dit kan plaatsvinden moet nog verder worden uitgewerkt. Overheden kunnen ervoor kiezen om hiermee te gaan experimenteren. Voor het aanbrengen van samenhang in de nog te verwerven kennis ligt een rol van het Fietsberaad voor de hand.

4. Fietsinnovaties zijn niet waardevrij

We hebben ons project destijds Smart Cycling Futures genoemd. Dat klinkt natuurlijk aantrekkelijk, een slimme fietstoekomst. Maar wat betekent het eigenlijk? Wat betekent het om 'slimmer' te fietsen? In SCF hebben we 'smart' fietsinnovaties geanalyseerd om te begrijpen wat voor soort toekomst is besloten in de beloften om het fietsen sneller, gemakkelijker en leuker te maken (Nikolaeva et al., 2019; Nikolaeva & Nello-Deakin, 2019). We concluderen dat 'smart' van alles kan betekenen. Bovendien zijn sommige toepassingen controversieel omdat ze de stedelijke mobiliteit wel eens radicaal zouden kunnen veranderen. Sommige innovatoren zien slimme technologie als een manier om mobiliteit nog efficiënter te maken. Anderen roepen op om het dominante verhaal van efficiëntie en snelheid tegen het licht te houden en de zintuiglijke en sociale dimensies van fietsmobiliteit meer te waarderen (Nikolaeva & Nello-Deakin, 2019; Popan, 2019).

In dit perspectief zijn keuzes voor bepaalde innovaties niet waardevrij. Sommige technieken openen andere mogelijkheden dan andere. We pleiten ervoor om te doordenken wat keuzes in het heden betekenen voor de mogelijkheden van morgen. Keuzes leiden onvermijdelijk tot verandering van fietspraktijken. We benadrukken het belang om te bespreken welke fietstoekomst we wenselijk vinden.

Voor een overheid betekent dit dat ze, wellicht meer dan nu het geval is, gesprekken moet gaan voeren over de betekenis van de innovaties die ze doorvoeren. Daarbij zou de vraag aan de orde moeten zijn of de betreffende technieken bijdragen aan de gewenste toekomstige mobiliteit. En welke rol zien overheden weggelegd voor fietsers in het mobiliteitssysteem van morgen? Deze vraag zou sowieso onderdeel moeten uitmaken van de gesprekken die in eventueel nieuwe te vormen living labs plaatsvinden. Maar deze zouden niet alleen daar moeten plaatsvinden. Om dit type gesprekken vaker te laten plaatsvinden zouden verkeerskundig adviseurs de betrokken politici breder kunnen informeren over de verborgen politieke consequenties van het mobiliteitsvak. Het ontwikkelen van een zekere gevoeligheid voor mobiliteitsethische kwesties, bij zowel beleidsmakers als bestuurders, lijkt hierbij een pré.

Lessen uit SCF

Hierboven zijn vier lessen uit onderzoeksproject Smart Cycling Futures geformuleerd. De lessen zijn gebaseerd op de inzichten en leerervaringen die wij als onderzoekers hebben opgedaan in het project. De lessen geven handvatten bij het verder ontwikkelen van de rol van de fiets in het mobiliteitssysteem. De ervaringen uit de living labs helpen om vernieuwingen op een zinvolle manier uit te proberen waarbij het experiment verder gaat dan de uitvoering van een pilot. De belofte van het ontwikkelen van een gezamenlijk leerproces parallel aan het inhoudelijke experiment in een living lab is dat het de kwaliteit van de innovatie uiteindelijk bevordert.

Een belangrijke voorwaarde bij het toepassen van living labs is dat partijen in gezamenlijkheid willen zoeken naar vernieuwing. Bij het zetten van stappen richting verandering helpt het als partijen bereid en in staat zijn om de minder voor de hand liggende politieke aspecten van de betreffende innovaties tegen het licht te houden.

Twee van de vier lessen reiken alternatieve inhoudelijke perspectieven aan: het belang van de 'eigen' fietslogica en de suggestie om meer uit te gaan van bestaande fietsers. Vooralsnog gaat het om perspectieven en niet om concrete handreikingen voor toepassingen op straat. We geloven niettemin dat deze perspectieven zullen bijdragen aan het versterken van fietspraktijken. Om tot een concretisering te komen is het noodzakelijk om de perspectieven uit te werken, maatregelen te ontwikkelen en die uit te proberen. We geloven dat het waarde heeft als overheden, innovatoren, onderzoekers en burgers hiermee samen aan de slag te gaan.

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Exploring Velotopian Urban Imaginaries: Where **Le Corbusier** *meets* **Constant***?*

Anna Nikolaeva[a,b] (corresponding autor), Samuel Nello-Deakin[b]

[a] Department of Geography, Planning and International Development, University of Amsterdam, Amsterdam, The Netherlands | [b] Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, The Netherlands

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Abstract

Cycling is increasingly seen as a solution to a large variety of urban problems, and as such continues to inspire innovations that aim to upscale cycling to unprecedented levels. Taken to the extreme, these ideas promise a future 'Velotopia' in which cycling constitutes a dominant or single mobility mode. Focusing its attention on Dutch cycling innovations and two recently envisaged cycling utopias by Fleming (2017) and Popan (2019), the present paper offers a critical exploration of current velotopian urban imaginaries. It does so by tracing their ideological ancestry back to two visionary urban designs of the 20th century: the dense city of speed and efficiency of Le Corbusier, and the endless Babylon of Constant where mobility is a means of discovery, play and human interaction. Our analysis shows that both Corbusian and Constantian understandings of mobility are reflected in current velotopian imaginaries, not only in opposition but also in combination with each other. This combination of Corbusian and Constantian velotopian imaginaries, we suggest, has largely become part of mainstream urban discourses instead of providing a radical alternative to them.

Velotopian imaginaries: the bicycle as world-saver?

The bicycle, famously celebrated by the Dutch countercultural Provo movement for its simplicity as 'something, but almost nothing[1], (Jordan 2013), is increasingly seen as a transformative agent of urban change. As such, it is often presented as an almost uniquely benevolent transport mode bringing only positive changes for everyone (Cupples and Ridley 2008; Pucher and Buehler, 2008). As a recent account puts it, 'the bicycle is the single most important tool in our urban toolbox for improving our cities' (Colville-Andersen 2018, 1). Academics, urbanists and activists emphasize that cycling can contribute not only to public health, urban sustainability and liveability agendas, but also to social connectedness, people's feeling of freedom in their city and a vibrant public life on urban streets (Bruntlett and Bruntlett 2018; Montgomery 2014; te Brömmelstroet et al. 2017; Walker 2017).

The promises of the bicycle have recently been amplified by the perceived possibilities of smart technology. While the bicycle has remained a mature simple technology for a long time, it is increasingly seen as a vehicle that can be "smartified" and made part of the wider smart mobility system of the future (Nikolaeva et al. 2019b; European Cyclists Federation n.d.). E-bikes, smart technology and new business models of bike-sharing and bike-leasing services can supposedly provide easier access to cycling for various demographics and needs, while electric cargo bikes are increasingly proposed as a solution to urban logistics (Behrendt 2018; Lenz and Riehle 2013; Schliwa et al. 2015). According to a commentator on *Wired* discussing the recent boom in dockless bikesharing, 'bikes plus smartphones' may lead the world 'in a new golden age for cities' (Salmon 2018).

As a result of cycling's growing protagonism in the smart mobility agenda, current discourses on the bicycle as a centrepiece of the future urban mobility system are no longer produced only by cycling activists, or even by advocates of low carbon mobility in general. At present, bikesharing systems are backed by multimillion-dollar investments (Griffith 2017): in 2018 the CEO of Uber announced that the company will increasingly focus on e-bike sharing (Topham 2018). Numerous other smaller companies seeking to connect cycling to the field of smart mobility have also emerged, claiming that they can help rescue cities from congestion and pollution (Nikolaeva et al. 2019b).

What we see at present, thus, is the emergence of a 'cycling will save the world'[2] narrative by a variety of actors. While this narrative by no means dominates the discussion about the future of urban mobility, it appears to be becoming increasingly prominent. The seeming consensus over the benefits of cycling and the corresponding velotopian urban imaginaries[3] which ensue from them, we argue, deserve to be critically examined. Drawing on Sengers' (2017) articulation of an urban imaginary as 'a shared understanding of what constitutes a desirable future city' (2764) and Pinder's (2005) definition of the 'utopian' not as the impossible or dismissible, but as that which challenges the status quo, we consider as 'velotopian urban imaginaries': (1) visions of a city revolving around cycling as a dominant mode of urban transport, and (2) technologies and solutions that use the bicycle for urban questions traditionally serviced by other modes, thereby expanding the role of the bicycle in the city.

Our rationale for critically examining contemporary velotopian urban imaginaries is threefold. Firstly, the current diversification of actors involved in the production of velotopian imaginaries entails the diversification of rationales and expectations associated with velotopian futures.[4] Scholars have argued that the bicycle has historically been a 'rolling signifier' taking on multiple meanings that contradict each other, occasionally becoming a tool of opposing goals and ideologies (Hoffman 2016; Popan 2019). The "cycling will save the world" narrative, however, obfuscates this diversity. In this paper, we explore the diversity behind this apparent consensus: different velotopian imaginaries may entail different 'politics of mobility' (Cresswell 2010), produce different experiences and ways of moving around the city, normalise particular uses of space, or prioritise the mobility of certain groups over others, eventually leading to radically different urban environments.

Secondly, it is becoming increasingly apparent that the growing protagonism of cycling in the urban landscape does not have universally benign effects, but can also be implicated in the creation or maintenance of inequalities. Thus, new cycling infrastructure has been criticised as a vehicle of gentrification, displacement and reproduction of privilege (Houde, Apparicio and Séguin 2018; Flanagan, Lachapelle and El-Geneidy; Lubitow and Miller 2013; Stehlin 2014, 2015; Tucker and Manaugh, 2018; Vith and Mossner 2017; Wild et al. 2017). In addition, bikeshares (BSS) proliferating across the world have been criticised for achieving neither environmental nor civic goals (Médard de Chardon 2019; Spinney and Lin 2018[5]). As a number of scholars have argued, it is not just that businesses that attempt to live off cycling do not live up to their promises, but that they capitalise upon the benevolent image of cycling in order to further capital accumulation and data harvesting (e.g. Spinney and Lin 2018, 2019; Duarte 2016). Duarte's (2016) analysis of bikeshare systems is particularly instructive:

'a BSS might be part of a broader technological assemblage that involves extensive gathering of personal data, which can be mapped in real time and matched with other socioeconomic and urban features and marketing strategies that take advantage of the powerful environmentally friendly image associated with bicycles, combined with increasing restrictions or high prices for outdoor media in big cities' (112).

Similarly, urban cycling logistics companies have come under fire for producing precarious working conditions under the guise of flexibility and autonomy (Prassl 2018; Shapiro 2018). This again underscores the potential complexity of outcomes behind the benign promises of cycling, which may play out differently when embedded in real-world politics.

Third, promises of a better future have historically also been made in relation to other transport modes – most prominently air travel and automobility, and with dire consequences. The freedom, autonomy and flexibility that the automobile was supposed to deliver remains a largely unfulfilled promise as drivers keep waiting in traffic jams, while others continue to suffer the isolation, pollution and exclusion produced by car-centric urban development (Sheller and Urry 2000). While one may argue that the cycling lobby does not even have a fraction of the power that 'motordom' (Norton 2008) continues to enjoy, we maintain that emerging articulations of desired urban futures matter because they are performative. The language

that is used by designers, consultants, marketers and policy-makers acts not only as a mirror of reality, but also shape the choices that make certain future realities more possible than others (Fischer and Forrester 1993). Shared visions are performative not only because they may lead to the mobilisation of resources and actions towards desirable futures (Sengers 2017) but also because they 'filter' the repertoire of possibilities by *not* describing other futures.
As a means of critically exploring current velotopian urban imaginaries, we trace back their intellectual ancestry to the ideas of two visionary urban designers of the 20th century: Le Corbusier and Constant. This exercise is valuable because it highlights how current velotopian ideas do not all share the same aspirations, but rather push us in very different directions. By exploring these directions, the present paper helps us reflect on current velotopian discourses. What kind of visions are being proposed? What is their rationale for putting cycling at the centre of urban mobility? What kind of city is imagined as a 'natural habitat' for cycling utopia, and what are its consequences for urban mobility? What alternatives may exist?

Our analysis of current velotopian urban imaginaries builds on two different accounts: firstly, on an analysis of contemporary cycling-related innovations in the Netherlands; and secondly, on two recent books by Fleming (2017) and Popan (2019), which seek to outline the basis for a future "cycling utopia" and arguably represent the two most comprehensive velotopian visions proposed in recent years. We chose to focus on the Dutch innovation scene for three reasons. Firstly, the Netherlands (sometimes alongside with Denmark) is frequently considered to be cycling utopia (or its closest real-world equivalent) by many cycling advocates around the world, an example to learn from and to follow (Bruntlett and Bruntlett 2018; Pucher and Buechler 2008; Pojani and Stead 2014). Amsterdam and other Dutch cities attract hundreds of study tours each year, while Dutch consultants and policy-makers constitute a large share of presenters at Velocity, an annual event dedicated to dissemination of applied knowledge on cycling. In various ongoing EU projects, Dutch cities participate in the exchange of cycling knowledge[6], often in the role of "champions" mentoring other aspiring European cities. Secondly, innovative solutions, and in particular ICT and IoT applications, figure prominently on the Dutch national and local policy agenda on cycling. To take one example, the national "Agenda Bicycle 2017-2020"[7] puts the leadership of the Netherlands in cycling innovation as the first of its eight goals and mentions ICT innovation as one of the means to achieve four of its other goals (Tour de Force n.d.)[8]. The combination of these two factors constitutes the third reason for focusing on the Netherlands: whichever trends and visions of the future become important on the Dutch cycling scene are likely to have an impact on cycling globally given the Netherlands' prominence in cycling expertise worldwide.

We begin by outlining and counterpoising the two urban visions of Le Corbusier and Constant, focusing on the different meanings of mobility they entail. Next, we explore how cycling-related innovations we have identified as "velotopian" resonate with the visions of Le Corbusier and Constant. Over two years, we have collected 52 examples of cycling innovations – either developed in the Netherlands or applied in the Netherlands – by keeping track of professional publications on cycling policy and infrastructure, social media and attending public events such as debates, cycling community gatherings, cycling innovation competition, etc. Our analysis suggests that some innovations reflect a Corbusian understanding of

mobility, while others resonate with the vision of Constant. Critically, however, we suggest that the predominant urban vision reflected in many innovations appears to combine *both* Corbusian and Constantian ideals. We then move on to consider Steven Fleming's *Velotopia* (2017) and Cosmin Popan's *Bicycle Utopias* (2019[9]). While Fleming's book offers a blueprint for a cycling utopia which is largely organised along Corbusian principles, Popan proposes a slow cycling utopia based on the principles of conviviality and sociality, echoing many of Constant's ideas. In the final discussion, we seek to assemble these various threads together by bringing different velotopian urban imaginaries into conversation. We discuss the alliances and the tensions between them, and call for more attention to the politics of velotopian urban imaginaries.

Urban utopias and mobility

Visionary urban designs have often revolved around the possibilities that mobility can bring to society, exploring the possibilities of new vehicles, new ways of arranging transportation, or the consequences of mass use of vehicles that are as of yet used by a few (Fishman 1982). Visionary thinkers have made movement serve their goals, 'staging' mobility (Jensen 2013) in ways that reflected their ideas about public good and societal order. This 'politics of mobility' (Cresswell 2010) is evident in Thomas Moore's idea of restricting unauthorized mobility around Utopia, Leonardo da Vinci's proposal to separate the mobility of low and high classes in his ideal city, or in Frank Lloyd Wright's association of individual freedom and autonomy with personal vehicles (Tod and Wheeler 1978). Ideas that are considered to be utopian also challenge contemporary ways of thinking about architecture, urban planning and society; by transgressing the limits of what is seen as feasible or imaginable, they open up possibilities for critique and change (Burden 2000; Pinder 2001, 2005).

While the importance of mobility in shaping urban utopian visions has been recognised by various scholars (e.g. Fishman, 1982; Shelton, 2011), such accounts tend to focus primarily on urban planning rather than on mobility in itself. As noted by Timms, Tight, and Watling (2014), "there is no identifiable body of literature on urban transport/mobility utopias to draw on" (85). In their own article, Timm, Tight, and Watling (2014) provide a first step in this direction, distinguishing between three 'archetypal images of transport utopia' (85). Thus, they distinguish between a Corbusian dense city relying on the automobile and public transportation, a Wrightian low-density type of settlement where the car is the dominant mode, and a Howardian vision where a balance of private and public, motorised and non-motorised transport prevails (ibid, 85-86).

In the present paper, we have chosen to explore current velotopian imaginaries, focusing not on the *urban form* they produce, but on meaning of mobility they espouse. We do so by relating them to the ideas of two thinkers: Swiss-French architect Le Corbusier, and the Dutch artist Constant, a prominent figure in the avant-garde movement CoBrA and in the Situationist International movement. The main reason for this choice is that for both visionaries mobility was of key importance in urban life. Their views on what mobility meant for city and society, however, were fundamentally different: Le Corbusier saw mobility as a derived demand, while Constant valued it as a meaningful social activity and enjoyable way of exploring the world.

A city of speed versus a city of play

Le Corbusier (1887-1965) was a 20th century visionary who retained a fascination with movement and speed throughout his career. 'A city made for speed is made for success', he proclaimed in 1924 (Le Corbusier 1987, 179). Ever since then, Le Corbusier tried to inscribe mobility in the urban order and to rationalize flows of people, goods and communication. In *A Contemporary City of Three Million Inhabitants* (1924), the Central Station functions like a kind of dynamo machine for the whole transportation network, 'the hub of the wheel' at the very centre of the city ([1929] 1987,170-171). The multi-layered Station flanked by skyscrapers provides an interchange between all kinds of traffic: railway, metro, motor transport and air transport. Le Corbusier sees the Station and the rest of the infrastructure related to transportation as *infrastructure only*, spaces with a purely functional justification: 'negative' spaces rather than spaces of work, dwelling or leisure. In his later volume *La Ville Radieuse* (1934) Le Corbusier (1964) asserts: 'Big train stations are an illusion. A station is simply the scene of temporary passage' (303). On the one hand, thus, Le Corbusier attributes one the most important functions of the city to 'circulation': it enables the good coordination of the rest of a city's three functions (living, working and leisure). One the other hand, spaces of circulation are utterly devoid of meaning for him.

Corbusier's disregard for spaces of mobility as anything more than spaces for circulation applied not only to transport infrastructures but to streets as well, which he viewed as 'machines for traffic' (Le Corbusier [1929] 1987, 123). This attitude was not merely an extension of the emphasis on efficient circulation, but was part of his strong distaste for 'the mingle-mangle of the street, the muddle of bodies and the threat of touching strangers' (Pinder 2005, 73). He found the interaction of different modes on streets of European cities to be dangerous, incompatible with a 'healthy' modern city where circulation proceeded along separated channels for traffic. If ordered, mobility could work as oil in a perfectly efficient machine, but unregulated, it entailed danger and chaos (Pinder 2005, 103). Such aversion to wandering is underpinned by a moral argument which was anything but new in modern European societies (Cresswell 2006), but it is in Le Corbusier's negative stance on unregulated mobility that we see a translation of this moral judgement into urban design. The look of many cities across the world, planned from a perspective of a car driver, testifies to the wide adoption of Le Corbusier's ideal of a city made for speed and circulation. Equally, the practice of transport planning often continues to rely on the view of mobility as a disutility (Aldred 2015; Banister 2008; te Brömmelstroet et al. 2017; Vigar 2013), with massive monetary investments into a few minutes of time saved in commute being justifiable – though not uncontested – in public policy across the Global North.

The Dutch artist Constant (1920-2005), by contrast, imagined a city where mobility was the essence of the city, but not because it connected A to B: for him, it was a valuable social and sensory experience in its own right. Closely linked to ideas and practices of the Situationist International (SI), Constant's vision of New Babylon was at the antipodes of the Corbusian city. Originally called *Deriville*, his project builds on situationists' belief in the value of the practice of 'derive' ('drift' in French): unplanned wandering through urban space, a revolutionary strategy meant to disorient the individual, to allow people to break away from

the monotony of social life in the era of advanced capitalism (Wigley 1998). New Babylon, imagined by the artist through drawings, models, collages and other media, is an endless city where mobile residents rearrange the environment according to their needs. Inspired by Johan Huizinga's ([1949] 2016) idea of 'homo ludens', Constant imagines a city of play and exploration, in which mobility, wandering and spontaneous encounters are the very fabric of social life rather than an undesirable side effect (Pinder 2005). Furthermore, mobility in New Babylon is an emphatically embodied, sensorial experience: urban living for Constant equals mobile engagement with people and places in a permanently shifting urbanscape. Interestingly, Constant is by no means a luddite: his nomadic society of play is made possible by technological progress and automation (Pinder 2005). Yet instead of putting technological efficiency at the centre of urban life as Le Corbusier, he sees its value in affording for free time, play and flexible, unrestrained living.

While the Corbusian view of a city as a machine for circulation is still echoed by techno-cratic practices which see mobility as a matter of efficiency, time savings and cost benefit analyses, such a view has also been openly criticised for decades by scholars, activists and urban designers. Meanwhile, the ideas of Constant and the SI have seemingly enjoyed a revival and re-appropriation. On the one hand, situationist ideas continue to inspire activists and artists performing temporary creative appropriations of urban space (Pinder 2005; Swyngedouw 2002). Already in the 1960s, Constant was an important figure for Dutch counter-cultural movements – including Provo, which directly engaged with the subject of urban mobility by putting out white public bicycles on the streets of Amsterdam in what became known as the world's first bikeshare. On the other hand, according to Swyngedouw (2002), the legacy of SI has been appropriated selectively in ways that 'reinforces exactly what the Situationists actively criticized and tried to undermine' (153). As Pinder (2005) comments, some aspects of situationist ideas and New Babylon are not unfamiliar to us:

'Situationist demands to revolutionise urban structures, their attacks on urban planning, and their opposition to temporal and spatial fixity through continual urban change certainly take on different connotations at a time when cities have been overturned and remade through processes of commodification; when planning has been undermined by neo-liberal advocacy of free markets; when capital itself requires high geographic mobility for «flexible» and temporary workers; and when commercial logic dictates that office buildings favour neutral structures and a "skin architecture" to allow easy reconfiguration of internal spaces accommodate the needs of "flexible" firms.' (255)

In the last decade, with the advent of the smart city concept and the increased involvement of tech companies in producing urban imaginaries, the promises of situationists and Constant's New Babylon even seem to resonate with what Morozov (2017) has labelled 'Google Urbanism' – developing cities in such a way that there are no fixed uses of buildings, only flexible spaces and assets governed by algorithms.

The appropriation of Contantian and SI ideals and their seamless incorporation into an ideological context that they would have resented echoes or perhaps even forms part of

the outcomes of another "battle" of urban ideals – that between Robert Moses and Jane Jacobs in New York in the 1950s and 1960s. The Jacobsian ideal of a mixed-use convivial city of spontaneous encounters has arguably "won" over the Moses's grand vision of the city created for (car) flow, directly inspired by Le Corbusier. Nevertheless, the Jacobsian vision has been subject to much 'misappropriation and 'sentimentalization', e.g. by the New Urbanism movement or Richard Florida in his 'creative cities' script (Lyes, 2014). The latter has contributed to fetishizing some of the elements of Jacobs' legacy, 'locating', according to Peck (2007), 'streetlife and authenticity… within the circuits of (accelerating) interurban competition.'[10]

Dutch cycling innovations: towards Corbusian, Constantian and hybrid urban imaginaries

In what follows, we explore how velotopian imaginaries in contemporary discourses on cycling innovation resonate with the meanings of mobility represented by the ideas of Le Corbusier and Constant. We then discuss how these two apparently antithetical understandings of mobility appear to become combined with each other in a specific vision of the urban future which is implicit in many innovations, and which is increasingly echoed in current mainstream discourses on smart urbanism and the future of mobility.

Corbusian velomobilities: Efficiency, speed and order

The idea of efficiency features prominently in the Dutch cycling innovation discourse, both as a rationale for cycling and as a justification for innovation. In the Dutch context, innovators develop this idea within an already existing cycling regime, yet one that can presumably be even more efficient. Various types of innovations that promise upgrades to transport infrastructure which improve cycling flow fall under this category: from smart traffic lights that prioritise cyclists to interactive infrastructures that help the cyclist to catch a green wave: e.g. Volg Groen (Follow Green), Flo, Evergreen, Bikenow, Groenvoorspeller (Green Predictor), FLIP, Warmtesensor (Warmth Sensor), Schwung (Dash).[11] For instance, the Evergreen innovation – LED lamps on the road surface providing signals to cyclists – is described as a way to eliminate inefficient waiting time for cyclists, bringing it on par with the rest of traffic circulation.

'The circulation of bicycle traffic does receive attention in this regard, but in practice the bicycle is usually of secondary importance at an intersection controlled by traffic lights. Because of this cyclists often have to wait (unnecessarily). By giving cyclists information about the desired speed to get the green light far in advance before the intersection, waiting is kept to a minimum and routes with good traffic flow can be created.' [12]

This emphasis on efficiency and speed as the evident desired qualities of velomobility is echoed in cycling infrastructure projects such as elevated or separated cycling highways (see e.g. "Snelle Fietsroutes", n.d.).[13] Such projects often also include a "smart" component, e.g. a mobile application supporting the cyclists following a cycling highway (BicycleBuddy, Go-Light Avenue).

Another prominent theme in innovation discourse is what might be labelled as "ordering

cycling". The supposed need to eliminate inefficiencies is articulated here primarily in relation to parking: overcrowded parking racks, 'orphan bikes' taking up space in the city, bicycles obstructing walking, and even the inefficiency of human labour (parking guards). Proposed solutions to these grievances include mobile applications and smart infrastructures that show cyclists how many free parking spaces are available (e.g. P-Route, FietsPlek, Cloud Fietsenstalling), and bikesharing solutions that supposedly tackle the issue of bike oversupply (e.g. Mobilock, BikeShare050). In the rhetoric around bicycle highways and new parking concepts, the bicycle is increasingly treated as an automobile, as the cyclist is provided with tools formerly only available to car drivers and is encouraged to help solving the side-effects of a cycling regime.[14]

More generally, efficiency is often presented as the very reason why cycling should be supported. Across different types of innovations, cycling is often praised by innovators for its ultimate efficiency – a cheap, environment-friendly way of moving around the city as efficiently as possible in the context of contemporary congested cities:

'You would therefore think that the bicycle is a more practical means of transport than a car. No traffic jams, it is healthy for your body and it is also cheap.' (GoLight Avenue, cycling superhighway concept)

'Most short commuting distances (5-15 km) are now made with fuel cars, while the electric bike is an excellent alternative. Up to 8x cheaper, 72 x more efficient and infinitely healthier.' (Burn Fat not Fuel, mobile application encouraging cycling)

This theme highlights that velotopian urban imaginaries can be Corbusian through and through, with smart technology finally 'elevating' cycling to what an automobile has failed to deliver: non-stop traffic flow, speed and order.

New Babylon on the bike: Interaction, discovery and play

Nonetheless, there are also innovations motivated by the qualities of velomobility itself – the possibilities of exploring the city, the joys of riding a bike, the value of mobile encounters. Thus, the Dutch application Ring-Ring® which encourages people to cycle more celebrates the 'freedom' and the intensity of interaction with the environment provided by cycling:

'Cycling makes you happy, gives you freedom and sometimes you simply experience the best moments en route to work, family or activity'.

The innovation The Social Light offers cyclists the possibility to interact with each other using messages projected by a laser:

'To improve communication during this busy period you can use The Social Light. This is a rear light on which you can display texts. For example, "Sorry!" if you accidentally bump into someone. Or can you say to everyone you overtake, "Good Morning!" To improve the atmosphere in the morning! Hopefully this will make cycling on the cycle path together a bit

more social.' (For similar ideas, see Smart Jacket and Light Up your Mood)
Outside of the world of 'smart' innovation, we have found ideas that are even closer to the spirit of New Babylon, such as the YellowBackie project which encourages visitors of Amsterdam hop on a bike of a 'friendly stranger' and explore the city together, or the Detour project, proposed by a group of Rotterdammers during a Cyclehack hackathon, which involves placing stickers across the city that would inspire people to take new routes and see the city from a new perspective. The enjoyment and freedom of velomobility are brought to the fore in a variety of texts on innovation – from bike shares and smart locks to smart infrastructures. However, as we will see in the next section, the idea of play and enjoyment of mobility is more often than not coupled with references to efficiency in the form of time saving, optimised route; in this way, Constantian and Corbusian views on mobility are packaged into an urban imaginary that accommodates both.

The city of instant access and satisfaction: Where le Corbusier meets Constant

The apparently antithetical meanings of mobility in the utopias of Le Corbusier and Constant are combined in a large group of cycling innovations which revolve around the idea of flexibility and instant access to products, people and experiences. Many of these innovations are based on the contemporary app-based gig economy, and build on the practices of bike messengers (Kidder 2009): they see the bicycle primarily as a fast and cost-effective means of delivering goods and services. In these innovations, chores and unpleasantries are outsourced to a new class of mobile service workers – from Foodora 'riders' to mobile teams of bike repair workers (Fietsenwacht, FietsNed) or even 'bike hunters' who can find and retrieve a stolen bike for you (Van Moof subscription).

As suggested by UberEats's slogan 'Appetite? Click. Enjoy!', these innovations conjure up an image of instant satisfaction and access to whatever you may need: bicycle 'riders' deliver your food, while mobile workers come to fix your bike or can even bring a lease bike to your door (Swapfiets). Some of these innovations create a stark dichotomy between the consumer and the 'rider's experience: the ease of ordering stands in opposition to the monotonous physical labour that has to be performed for that satisfaction to happen. Nevertheless, the associations that velomobility can evoke make it possible to reframe that labour as a source of fun, discovery and health. Foodora appeals in the following way to the potential 'riders': 'Deliver food on the bicycle, stay fit and discover your city while making money' (as does TringTring). Bike deliveries evoke an image of an urbanite for whom the city is a territory of discovery, a street-wise mobile subject belonging to the city space: 'In a city we feel at home' (Foodora, see also TringTring). Juxtaposed with the criticisms of bike delivery services raised by 'riders' themselves and scholars of gig economy (Tassinari and Maccarrone, 2017; Prassl, 2018), this celebration of freedom of new nomadic figures seems problematic. These figures become necessary in an on-demand city of services where some people do not have time to walk or bike as they are 'always busy' (TringTring) and thus expect services and products to be delivered to them: the speed and physical exertion of some are the pre-condition for others' idleness – that is the politics of mobility (Cresswell 2010) in the city if instant satisfaction.
Cycling helps making mobility not just 'efficient' (quick and cheap) in most basic sense of the term, but also in other ways that fit in a contemporary neoliberal city. Mobile applications

promoting cycling, such as SMART and Burn Fat not Fuel offer to make cycling 'even nicer' through 'challenges' and 'rewards', while at the same time underscoring the efficiency of this mode choice. Burn Fat not Fuel emphasizes the benefits for the employer:

'The employer gets a lot of benefits, such as healthier employees with lower absenteeism, better accessibility of the company location, lower CO2 emissions, a better company image and savings on parking costs.'

Commentary from Spinney (2016) is fitting here; he argues that the recent rise of cycling in London can be understood as a form of neoliberal governance which seeks to shape individuals into entrepreneurs of the self. In this way, cycling becomes a 'solution' to the problems of urban transport, public health, and ecological sustainability, shifting responsibility in these domains to the self. Smartified cycling thus turns into an ideal type of mobility in the urban imaginary where labour is marketed as fun, where speed and efficiency have to be green, where consumption becomes guilt-free. Green, healthy and above all cost-efficient vehicles are the hardware of our times – times in which round-the-clock flexibility, instant access to places, people and services are expected by the mobile urbanite. Thanks to cycling, the Corbusian dream of efficiency is spiced up by the promise of adventure, freedom, pleasure and flexibility.

Toward what kind of cycling utopia?

In present section, we move our focus from cycling innovations to two recently envisaged cycling utopias: Fleming's *Velotopia* (2017) and Popan's *Cycling Utopia* (2019). These two visions, we argue, are interesting because they represent contrasting cycling utopias which echo the opposing meanings of mobility espoused by Le Corbusier and Constant. By offering us a glimpse of two potential divergent velotopian endpoints, they help us reflect on the kind of city which different types of cycling innovations are driving us towards. Moreover, Fleming and Constant's accounts arguably constitute the most recent and comprehensive visions of a city organized along velotopian principles. Although the utopian imaginary of a cycling-based city can arguably be traced back to the cycling boom of the 1890s (Friss, 2015), the fact is that accounts of fully-fledged cycling utopias appear to be few and far between. In Fleming's case more attention is paid to urban design and architectural principles, while in the case of Popan's vision the meaning and practice of mobility receive more attention than physical design.

Fleming's Velotopia (2017)

Fleming's Velotopia is an imaginary circular city of 6 million people in which the vast majority of trips are carried out by bicycle. With the exception of walking for short distances and a small number of automated vehicles for deliveries, emergency services and transport for the disabled, cycling is the de facto transport mode for moving around the city. This makes it possible to eliminate traffic lights and even conventional streets: buildings are set on pillars which allow to cycle underneath them, and houses and offices and have built-in ramps which make it virtually possible to cycle from one's bed to one's desk. Similarly, 'cycle-through' supermarkets are standard practice.

On the one hand, Velotopia is a city where speed, efficiency and order predominate. Fleming's intellectual indebtedness to Le Corbusier and other modernist urban utopias is explicitly acknowledged. By creating a city completely attuned to cyclists' needs, Velotopia can become the 'fastest' and 'most connected' city in the world. Following Mies van der Rohe's 'less is more', Velotopia is an elegant, orderly and minimalist city, without any street clutter or traffic segregation. The problem of disorderly bicycle parking is also dealt with in Velotopia, albeit in an unconventional manner (i.e., by having designated parking space within each apartment).

On the other hand, and echoing Constant's situationist understanding of mobility as playful exploration, Velotopia also sees movement as a form as play and interaction. Cycling in is not meant to be only a utilitarian tool, but a fun and enjoyable activity: 'moving in this city is fun. People make more discretionary trips. Half of the time they're moving through the city for no reason other than to be out' (132). Playful architectural forms, undulating ground planes and infrastructure which engages the senses of cyclists are part of the city: 'In Velotopia there are smooth tracks that attract skaters, dirt tracks with berms and jumps designed for mountain bike riders and more paving treatments than you could fit in a catalogue' (132).

The overarching promise of flexibility and instant access present in various cycling innovations is replicated in Velotopia, which promises an individualistic mobile lifestyle based on freedom, speed and convenience. In this sense, Velotopia appears to share some of the same premises as contemporary innovations. However, in Velotopia the pursuit of velomobility is treated not only as a matter of individual self-interest, but also of public necessity. As a cost-effective sustainable transport mode, mass cycling is seen as imperative in the light of global environmental crisis and growing motorisation in developing countries. In many ways, this this view of cycling parallels Spinney's (2016) view of cycling as a mobility 'fix' for contemporary cities. Following Fleming, individual self-interest and the public good can be made compatible by making cycling attractive enough that it will appeal to our 'selfish-worst selves' (38) so we can be 'sustainably selfish'. People should not be forced into cycling, but rather be gently 'nudged' into it by making it as convenient as possible.

Popan's Bicycle Utopias (2019)

Cosmin Popan's *Bicycle Utopias* (2019) is more than a vision of future where bicycles are the main mode of transportation. It acknowledges that bicycle utopias are plural, as the bicycle has meant different and often opposing things to different groups of people across history. Popan diagnoses a tendency of present-day policy-makers, innovators and cyclist organisations to steer towards the utopia of fast cycling in which cycling is approached from the utilitarian perspective as a fast and efficient replacement for driving. Such a utopia, according to Popan (2019), perpetuates the same meanings of mobility that are responsible for the current lock-in in the automobile system, as it does not question the ideology of growth, individualism and productivism that has led car-centred societies to gridlock and the world to the brink of ecological catastrophe. As an alternative, he proposes a utopia of slow cycling that is 'embedded in constellations of social practices which oppose the current unsustainable levels of production and consumption' (89). His vision, underpinned by a sociological critique of current society, is a normative one, as he maintains that 'a bicycle system must not accelerate

mobilities and societies but, on the contrary, aim at slowing them down' (173), creating space for sociable and convivial mobilities that stimulate the senses and offer possibilities for exploration and for connection with other people and the environment. Quite explicitly affirming the connection between the societal order and the forms of mobility it affords and encourages, Popan advocates not only slower cycling but *slower lives* freed from imperatives of productivism, speed, growth and utilitarianism. This vision is explicitly an anti-Corbusian one; while it does not go as far as to proclaim nomadism and play as the cornerstones of the ideal society, it strongly resonates with the ideals of Constant's New Babylon, and is radical in its call for degrowth and accepting 'sufficiency'[15] as the norm in the contemporary (predominantly) neoliberal political landscape.

Discussion: Repoliticising velotopian imaginaries

The contrast we have identified between Corbusian and Constantian velotopian urban imaginaries shows that the apparent consensus on cycling's desirability among velotopian thinkers and cycling innovators often masks a fundamental tension as to what cycling should be and what kind of city it should be part of. Should cycling be efficient or should it be fun, fast or slow, solitary or social? Do we think cycling should be encouraged because it is convivial, or because it helps us solve traffic congestion? Will velotopian cities simply translate the imperatives of car-centric cities or overturn them? Is cycling but a tool to optimise the use of supposedly scarce space and scarce time, or can it provide a means, as Popan suggests, to rethink the meaning of mobility in society and move away from the efficiency imperative (cf. Nikolaeva et al. 2019a)?

Nevertheless, certain velotopian imaginaries – as evident in certain cycling innovations and in Fleming's *Velotopia* – appear to simultaneously appeal to both the Corbusian and Constantian logic: they want to have their cake *and* eat it too, so to speak. Given the antithetical understandings of mobility espoused by Le Corbusier and Constant, this begs the question of whether both logics can be truly combined. If taken seriously, Constant's emphasis on play seems irreconcilable with Le Corbusier's emphasis on efficiency. At the same time, we also think it would be simplistic to treat imaginaries of 'fast' and 'slow' cycling as an irreconcilable dichotomy. While to a certain degree fast and slow cycling may be mutually exclusive, in reality it may be possible to plan for either fast or slow cycling on a place-specific basis. In the Netherlands, for instance, cycling planning strategies are becoming increasingly differentiated between city centres and their surrounding periphery. In the former, there is increasing talk of the need to slow down cyclists to avoid them becoming 'the new car' (Goossens 2017) while in the latter new intra-urban fast 'cycling highways' are being built (CROW 2014; Liu et al. 2019), though not without contestation or resistance, as for some fast cycling does not belong in their neighbourhood (van Gool 2019). Rather than thinking of velotopian imaginaries as 'one size fits all', we should recognise that different imaginaries are likely to play out differently depending on geographic, institutional and sociocultural contexts (see Macmillan and Woodcock 2017; Pojani et al. 2017).

Moving beyond urban design questions into the realm of underlying ideologies of velotopian imaginaries, it would seem that many of the considered imaginaries do not strongly contest,

but are compatible or even an intrinsic part of current mainstream urban discourses. On the one hand, the prominence of a Corbusian imaginary of cycling as the ultimate tool of urban efficiency – evident in many cycling innovations and, to a certain extent, in Fleming's Velotopia – fits in rather well with current neoliberal and smart city discourses on urban competitiveness (Hollands 2008; March 2018). This echoes a line of thought recently advanced by Spinney (2016), who has suggested that in the modern neoliberal city, cycling is arguably no longer a form of dissidence, but rather a cost-effective mobility 'fix' which fits in broader mechanisms of neoliberal governance and capital accumulation. On the other hand, the way in which Constant's vision of mobility as a form of interaction and play is reflected in many of the velotopian imaginaries espoused by cycling innovations arguably constitutes a bastardised form of the original, echoing Swyngedouw's (2002) and Pinder's (2005) critiques of the appropriation of SI legacy, as well as the appropriation of elements from 'early cybernetic utopias' by Google Urbanism (Morozov 2017). Rather than embracing a transgressive idea of cycling as a tool of playfulness and spontaneity, in these visions cycling is reduced to a vehicle for hedonistic consumption, exercise, or simply a marker of the 'creative city'.

While the idea of cycling as playfulness may have been partially co-opted by neoliberal discourses, it is important to remember that it can also constitute an important form of protest against the existing order. Indeed, this vision of cycling as a joyful form of disruption can be traced back to the Provo movement in the Netherlands, and continues to exist under a variety of forms. As noted by Williams (2018), critical mass rides constitute "ecstatic ritual" in which "rebellious play" and "carnivality" play a central role; Terry and Todd (2013) discuss the monthly San José "Bike Party" in similar terms. Such an image of cycling appears to be most closely aligned with Popan's 'slow utopia', which connects with a degrowth agenda and stands out as a radical alternative to dominant velotopian imaginaries. Precisely the fact that it stands out so clearly from the rest, we suggest, is in itself strong evidence of the extent to which most velotopian thinking has been depoliticised (cf. Furness 2007) and integrated into dominant urban discourses. Popan (2019) points out that a utilitarian view of cycling, supported by smart innovations, may be celebrating cycling not just for its intrinsic qualities or for its possibility of offering a slower, more convivial life, but because it allows to approach the unfulfilled automobility dream (also see also Nikolaeva at al., 2019b, on "automobilization" of cycling). To some extent, Fleming's (2017) account also provides a form of velotopian thinking which marks a significant departure from current mainstream urban visions – most notably in its almost entire rejection of intra-urban motorised transport. Nevertheless, Fleming's vision does not pay much attention to politics, and ultimately seems fairly compatible with current discourses on urban liveability, sustainability and competitiveness.

Finally, we would like to briefly reflect on the implications of our focus on the Netherlands and on the role of this country in shaping velotopian thinking. Dutch cycling practices provide inspiration for both Fleming and Popan's accounts, and yet this does not mean that the Netherlands *is* a cycling utopia: Fleming, for instance, is quite critical of many aspects of the situation of cycling in the Netherlands, pointing out that the country risks losing its achievements if it does not take a more radical approach and puts the bicycle central in urban design. The image of cycling in the Netherlands is arguably in flux in various respects;

lately, the Dutch government, has shown considerable interest in driverless vehicles and new mobility concepts such as Mobility as a Service (e.g. Ministerie van Infrastructuur en Milieu, 2016). Two Dutch government officials recently shared their concerns about the future of the bicycle in a conference paper with a telling title: "Biking the Smart city, a Dream Image or the End of the Bicycle: Will a driverless vehicle stop before the bicycle or will the bicycle stop before the car? " (Arntzen and Lindeman, 2016). As the answers to this question are still taking shape – in the Netherlands and elsewhere – it is likely that the direction that such developments take in the Netherlands will influence events in other countries. We therefore suggest that this is an important direction for future research.

Conclusions

This paper offers a critical examination of contemporary velotopian urban imaginaries: visions of cities that give cycling a central space and celebrate it as a tool of desirable transformations. Our contribution is in pointing out that despite the seeming consensus within the contemporary velotopian discourse on the benefits of cycling, different velotopias attempt to "save" very different worlds.

We have examined the contemporary landscape of cycling innovation in the Netherlands and the two recent comprehensive velotopian visions by Fleming (2017) and Popan (2019) in order to explore the underlying assumptions and ideologies behind the tendency to see cycling as a solution to a range of urban problems. In this analysis we have drawn on the legacy of two visionary thinkers – Le Corbusier and Constant – who imagined the role of mobility in a city completely differently, offering two different poles onto which we map contemporary velotopian discourse. This exercise allows us to illustrate that these two archetypes of thinking about city and mobility are still clearly distinguishable in relation to cycling. On the one hand, a number of cycling innovators – and, to a large extent, Fleming's *Velotopia* (2017), put forward a velotopia of efficiency – the dream of unrestrained movement that automobility failed to deliver, but put on two wheels. On the other, Popan's (2019) velotopia and a number of cycling innovations resurrect the Constantian ideal of mobility as play, a convivial activity in a city freed from productivism and haste.

Furthermore, we have identified a discourse that blends the Corbusian and Constantian ideals, seemingly offering the best of two worlds: time savings and excitement, productivity and fun. In alignment with a number of scholars (e.g. Spinney, 2016; Duarte, 2016), we suggest that cycling may have become enrolled into discourses that correspond to a neoliberal urban agenda with a tinge of greenwashing and a mobility politics in which the physical labour of delivering products and services is obscured by the imagery of fitness and adventure.

As new mobility concepts, visions and technologies capture the imagination of policy-makers and general public, the place and content of velotopian imaginaries within broader urban mobility discourses is likely to continue to evolve. Will the bicycle eventually come to be seen as a complementary add-on in the driverless car system, or as its challenger? If the latter, will this challenge be on the grounds of efficiency, speed and convenience, or on the grounds of a possibility of a life without hurry? Depending on the trajectory that is ultimately taken,

cycling may even lose its place on the streets entirely as it once did in many cities around the world. The groundwork for these possible futures is laid now, as various stakeholders mobilise resources around different urban imaginaries. Further research on whether and in what ways current visions around hyperloops, autonomous vehicles, smart mobility and mobility-as-a-service in various geographical contexts include cycling, we suggest, might help us gain additional insight into some of the questions we have explored in the present paper: in what ways might we expect cycling to shape (if not save) future cities?

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Notes

[1] In Dutch: *De fiets is iets, maar bijna niets* (attributed to Robert Jasper Grootveld).

[2] The Guardian's correspondent Peter Walker has literally titled his book *Bike Nation: How Cycling Can Save the World* (see Walker, 2017). In talking about the "cycling will save the world" narrative, we allude not only to his specific book but to a multitude of publications, academic and otherwise, that advance a comparable argument.

[3] Derived from the title of the book by Steven Fleming (2017) Velotopia.

[4] The diversity of "scripts" (Akrich 1992) in the texts on ICT and Internet of Things cycling innovations and the changes that they envision in the bicycle system, in its governance, in cycling experiences and identities is a subject of detailed analysis in Nikolaeva et al., 2019b.

[5] Although see Nixon and Schwanen (2019) discussing possibilities for more inclusive schemes.

[6] See e.g. such projects as BITS https://northsearegion.eu/bits/about/; HANDSHAKE http://www.isinnova.org/handshake-creating-cycling-friendly-cities/; CYCLEWALK https://www.interregeurope.eu/cyclewalk/

[7] "Agenda Fiets 2017-2020" in Dutch.

[8] In the Netherlands, cycling policy is the responsibility of local authorities, supported by the national government. "Tour de Force" is an alliance of national and local authorities, knowledge organisations and societal partners seeking to drive the national cycling agenda.

[9] The book's full title is *Bicycle Utopias: Imagining Fast and Slow Cycling Futures*.

[10] Jacobs' legacy remains a contested subject. While some argue her ideas are being misused, others are more critical, suggesting that she laid "groundwork" for Richard Florida's work (Tochterman 2012).

[11] The websites of the mentioned Dutch innovations can be found in the Appendix to Nikolaeva et al., 2019b as part of a larger dataset.

[12] Hereinafter translations of the excerpts from Dutch are made by the authors.

[13] For a detailed discussion of competing visions of cycling highways see Liu et al. (2019).

[14] This point is further developed in Nikolaeva et al., 2019b.

[15] Drawing on Gorz (2010).

HOOFDSTUK 03

Towards a Maintenance-Based Approach to Mode Shift: Comparing two cases of **Dutch cycling policy** *using social practice theory*

Matthew Bruno[a], Anna Nikolaeva[b]

[a] Department of Industrial Engineering & Innovation Sciences, Eindhoven University of Technology, Eindhoven, The Netherlands | [b] Department of Geography, Planning and International Development, University of Amsterdam, Amsterdam, The Netherlands

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Introduction

The transition to sustainable transportation systems has become an important element of long term transportation planning (Bertolini, Clerq, & Straatemeier, 2008; Miller, de Barros, Kattan, & Wirasinghe, 2016; Schiller & Kenworthy, 2017). The policies behind this goal often focus on investing in programs intended to change people's attitudes towards sustainable transportation with the belief that this will lead people to drive less and use sustainable modes of transportation more (Domarchi, Tudela, & González, 2008; Kormos, Gifford, & Brown, 2015; Stradling, Meadows & Beatty, 2000; Vredin Johansson, Heldt, & Johansson, 2006; Young & Caisey, 2010).

This approach has been criticized by scholars using social practice theory (SPT) (Shove, 2010; Strengers & Maller, 2015). SPT posits that practices are complex and that more than a change in attitude is necessary to alter them (Evans, 2012). Scholars that acknowledge this complexity have argued that change can be achieved through more comprehensive policies that support all the different elements of a practice: materials, meanings and competencies (Evans, 2012; Spotswood, Chatterton, Tapp, & Williams, 2015; Watson, 2012). This, however, is still difficult, as practices are interlinked, which makes them very hard to change. For example, many people who drive have multiple appointments scheduled close together. They may develop a positive attitude about alternative forms of transportation as well as relevant skills ('meaning' and 'competencies' in the language of SPT), but actually using them would require making difficult adjustments to other activities such as shopping, childcare, social activities, etc. (Berg & Ihlström, 2019; Jeekel, 2011).

Previous studies that applied SPT to sustainability transitions have focused exclusively on cases where the goal is to *replace* a less sustainable practice with a more sustainable one (Cass & Faulconbridge, 2016; Hargreaves, 2011; Sahakian & Wilhite, 2014; Verbeek & Mommaas, 2008; Watson, 2012); in the field of transportation, that has often translated into focusing on how driving can be substituted by cycling (Bjørnarå et al., 2019; Dill & Carr, 2003; Rowangould & Tayarani, 2016). Our proposition is to use SPT to focus on the possibilities for *maintaining* sustainable practices and thus reducing the number of people that change from a sustainable practice to a less sustainable one. This means articulating a new approach for achieving a mode shift for sustainability purposes, an approach that could compliment the current change based efforts. This shift would occur by reducing the number of people that changed from cycling to driving, for instance as the result of a life event such as a new job, marriage, the birth of a child, or retirement or due to a deterioration of cycling conditions.

The application of this approach might not only bring about an increase in the percentage of people cycling, it would also allow for investments to support existing, desired sustainable practices, ensuring that they are not lost. The alternative approach of only investing in people not currently engaged in a particular behavior means, by definition, not investing in the people who already practice the desired behavior. This approach seems to assume that the existing practices are not vulnerable to change. Yet they are, as, for example, research on the decline of cycling in Europe (Oldenziel et al., 2016) or substitution of walking and using public transit with ride-hailing in the US demonstrates (Clewlow & Mishra, 2017). Our proposed approach

to mode shift focusing on *maintenance* of sustainable mobility practices puts this vulnerability and possibility of change at the center of planning sustainable transitions. As the concepts of recruitment and defection are well established elements of SPT (Herington et al., 2017; Shove et al., 2012; Strengers and Maller, 2014; Watson, 2012) using the theory to argue for a focus on the maintenance of existing practices does not require further expanding or developing SPT, but rather giving attention to already present but overlooked elements of the theory as they relate to sustainable transportation goals.

To support our argument, we use the case of cycling in the Netherlands. With over a quarter of all trips made by bicycle, the Netherlands has the highest rate of cycling in the world (Harms & Kansen, 2018). The cycling rates across different ages, however, are not evenly distributed. Children, teenagers, and young adults cycle at much higher rates than middle-aged and older adults, with teenagers between the age of 12 and 19 biking an average of 2,000 km a year, double the average of adults in the Netherlands (Centraal Bureau voor de Statistiek, 2015). Thus, in this case the majority of people engage in a sustainable practice from a young age but many move to the less sustainable practice of driving at a later age. If more people maintain their cycling practices instead of changing to driving practices, the ratio of driving to cycling will shift in favor of cycling.

Drawing on two national Dutch cycling policy programs that illustrate two different possible approaches to a mode shift in favor of cycling, we argue that investments in a maintenance-based approach also have the potential to contribute to achieving the modal split goals seen in change-based approaches. Specifically, we compare the Bicycle Master Plan, a comprehensive national investment in cycling promotion that took in place in the Netherlands from 1991 to 1997, and With the Bicycle Less Congestion, a Dutch national program to develop bicycle highways near congested roads that lasted from 2006 to 2009.

While the first program, the Bicycle Master Plan, took a broad approach and considered any element that would improve the chance of increasing cycling rates over the long term, With the Bicycle Less Congestion invested all of its resources in a very specific approach: promoting a shift from driving to cycling by targeting people driving on congestion prone routes and investing in changes that might encourage them to change their behavior and choose to cycle instead.

The contribution of this paper is thus twofold. First, we contribute to the scholarship on sustainability and behavior change that uses SPT with the goal of advising policy-makers. Drawing on the strengths of SPT postulates, we propose that the implications of focusing on the maintenance of sustainable practices has thus far not received attention. This maintenance-based approach could apply to any situation in which a large number of people have a sustainable practice but might change to an unstainable practice (areas with high levels of cycle or transit ridership, for example).

Second, we contribute to the debate on transitions to sustainable transportation by articulating a new approach to achieving mode shift, providing a broader understanding of the policy

options available. We do not suggest that no investments should be made in encouraging people to move from driving to cycling; rather, we argue that the maintenance of sustainable transportation practices represents an approach missing from the policy toolkit that could complement and support current investments.

In the sections that follow, we will describe how social practice theory has been applied to sustainability transitions, with a specific focus on cycling. We will give a brief overview of the two Dutch national cycling policies that we will be using as case studies to illustrate our argument. We will then discuss the two policies in relation to social practice theory to show how the two policies reflect two different approaches to mode shift, one based on maintenance and the other on change. Finally, we will conclude with a discussion section that relates some of the limitations of our approach as well as the potential implications and applications of our findings.

1. Research design and methodology

Our article compares With the Bicycle Less Congestion with the Bicycle Master Plan. Rather than evaluating these two cycling policies based solely on outcomes, we analyze both policies through the lens of SPT and compare them to illustrate an approach to mode shift that is supported by existing SPT concepts but has not received attention in the literature that applies SPT to the transition to sustainable transportation systems.

The analysis is based on government documents, consultant reports, and contemporaneous statements from project supporters and detractors. The majority of these documents are in the Dutch language. For the Bicycle Master Plan, this includes three comprehensive reports produced by the Ministry of Transport, Public Works and Water Management: one states the policy of the Bicycle Master, the second evaluates the program, and the third documents what had been accomplished after its conclusion. The analysis of With the Bicycle Less Congestion is based on a government commissioned study conducted by a transportation consulting company that sought to predict the effects of the program, as well as supporting material from project partners that detailed goals, budgets, and implementation plans. We have also gathered and used critiques and commentary on the projects that have been published in Dutch language journals. The references lists the original Dutch names of all the documents consulted along with English translations.

2. Social practice theory and transitions to sustainable transportation

2.1. Social practice theory on behavior change

A transition to sustainable forms of transportation requires changes in people's travel behavior. Over the past two decades, several systematic reviews have been conducted on the effectiveness of various interventions intended to encourage people to switch from driving to more sustainable forms of transportation such as walking or driving (Ogilvie et al., 2004; Pucher et al., 2010; Scheepers et al., 2014; Yang et al., 2010). New approaches have also been articulated, including life oriented travel behavior research that looks at the long term interdependency of life choices and transportation choices (Zhang and Van Acker, 2017)

and mobility management campaigns that can include a broad array of approaches form congestion charges to providing personal assistance in the development of individual travel plans (Hiselius and Rosqvist, 2016).

The major contribution of social practice theory (SPT) to this debate on behavior change and transitions to sustainability has been in proposing an alternative to the so-called "ABC framework" of social change as Shove (2010) has labeled it, with ABC standing for attitude, behavior and choice. As summarized by Shove (2010), the ABC framework, based on theories of planned behavior, assumes that social change depends on promoting *attitudes* that will lead to a set of desired *behaviors* that an individual will choose so long as key barriers are removed. SPT offers a critique of this behavior change model, arguing that instead of focusing on individual behavior and individual action, transitions to sustainability require focusing on socially shared practices defined as

a routinized type of behavior which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge. (Reckwitz, 2002, p.249, as cited in Strengers and Maller, 2015)

While the debate over how to conceive of these particular elements of social practice continues, many scholars use the framework developed by Shove, Pantzar, and Watson (2012) that describes three primary elements that constitute a practice: meanings (ideas, aspirations, values and symbolic interpretations); competences (shared abilities and practical knowledge); and materials (physical things, including technologies, objects and infrastructure) (Strengers & Maller, 2015). These concepts become the foundation for understanding the dynamics of social practices, including their development and change over time (Reckwitz, 2002; Shove & Pantzar, 2007; Shove et al., 2012). In particular, the complexity of practices as comprised of meanings, materials and competencies, means that more than a change in attitude is necessary to alter them (Evans, 2012; Genus & Jensen, 2019, Shove, 2010). Accordingly, SPT scholars suggest that the most effective focus for a policy oriented towards behavior change is an examination of "the social and collective organization of practices – broad cultural entities that shape individual's perceptions, interpretations and actions within the world" (Hargreaves, 2011, p. 79).

Taking cycling as an example, this means that understanding the practices of cycling requires an understanding of the "actions, habits and routines of daily experience" (Watson, 2012, p. 490) of those who cycle. It also requires an understanding of the material elements involved with the practice, including bicycle paths, bicycle repair shops, and the bicycle itself, among others. These elements of meanings, materials, and competencies are certainly not identical for each individual cyclist, but have wide differences across time and location and can even vary between specific instances of cycling by a single individual. Taken collectively, however, a diverse set of performances of cycling can reveal patterns that provide insights into the practice of cycling and how that practice may be likely to change (Watson, 2012).

According to SPT, a social practice grows when more people are recruited into it than defect from it and declines when more defections occur than recruitments (Shove et al., 2012). This process of defection has received limited attention in studies of mode shift by SPT scholars, as we will discuss in the next section. For our argument, however, this process becomes central as we propose to shift the focus from change to maintenance in the debate on sustainable transitions and modal shift.

2.2. Social Practice Theory, Sustainability Transitions and Cycling

Cycling policy and practice and in the context of transitions to sustainable mobility has been a subject of analysis for a number of SPT scholars. In applying SPT to developing policies designed to increase cycling rates, previous research shares a common approach: examining the meanings, materials, and competencies of the people engaged in the practice of cycling to understand which interventions will be the most effective. Rather than starting with traffic counts or engineering principles, the literature that applies SPT to cycling begins with a statement of the need to understand the performance of cycling as an embodied practice of the people who engage in it. In this paper we draw on the major insights from this literature, yet propose a novel approach that addresses the gaps in the debate. This section provides a brief overview of research that has explicitly addressed the relevance of social practice theory to encouraging cycling as a form of sustainable transportation and describes the connections between their work and our central argument.

Watson (2012) has linked SPT with cycling in order to provide an overview of the types of interventions that support a transition to sustainable transportation systems. Watson frames the rise of the automobile and the decline of cycling as a process of recruitment and defection, with the two modes competing over the same limited resources of time, space and money. Watson (2012) is not arguing that declines in cycling are solely responsible for the rise of automobility, but rather argues that understanding transport as an interconnected system involving bundles of practice allows for points of intervention to be identified that can increase recruitment towards more sustainable forms of transport. We build on this argument, but, unlike Watson (2012), we focus specifically on the how the retention or maintenance of cycling practices can create a mode shift in favor of sustainable transportation.

Shove (2012) does focus on retention, yet she focuses on a context where cycling is marginal. She examines the way that cycling challenges the traditional narrative of innovation by being a transportation technology that many predicted would disappear and yet endures through the practices of cyclists in areas that terms “pockets of persistence” – countries and cities where cycling is no longer practiced by the majority of people but still survives as an active practice among a subset of the population (p. 372). We build on this concept by describing how a transition to a sustainable transportation system can be achieved in a country where cycling is still practiced by the majority of people.

Spotswood et al.(2015) directly employ SPT as a tool for exploring ways to increase cycling rates in the United Kingdom. Noting that the cycling rate has held steady at 2% in the United

Kingdom in spite of a large amount of money invested in programs targeting voluntary behavior change at an individual level, they suggest the use of SPT as an alternative approach for both understanding and potentially creating social change. The authors examine not only how the individual components of practices reveal barriers to cycling, but also how these components both have direct connections with each other and are interlinked with the practice of driving: thus, for instance, reducing auto speed limits changes the efficiency meanings attached to driving while increasing the sense of competency for people on bicycles afraid of fast moving traffic. The authors suggest "a range of coordinated legislation, infrastructure, policy and marketing interventions may be required for reconfiguration of utility cycling practice" (Spotswood et al. 2015, p.30) and that employing SPT approach to analyze current cycling practices could help "intervention managers to produce a complex but rigorous web of interrelating factors which can form the basis for a multi-layered behavior change strategy" (ibid). The conclusions are drawn from two studies conducted in the UK, a country with currently low average cycling rates. Our paper draws directly on these conclusions, but applies them to a country with high cycling rates where the practice of cycling may need to be supported but not necessarily reconfigured.

Finally, Larsen (2017) has used SPT to examine a city with high cycling rates in detail, describing the materials, meanings, and competencies that allow cycling practices in Copenhagen to thrive. The article focuses on the complex relationship between existing user practices and the steps taken by planners in the city to recruit people into the regular performance of cycling practices. We examine a country with high levels of cycling and describe the interaction between planners and cyclists across two different policies, but we place our focus on avoiding the defection of existing practitioners rather than on the recruitment of new practitioners.

3. Two Dutch National Bicycle Policies: An Overview

In this section we discuss two specific Dutch national programs in the domain of cycling to demonstrate, how a focus on *maintaining* existing cycling practices can help achieve transportation sustainability goals. The first, the Bicycle Master Plan ('Masterplan Fiets' in Dutch) was a 32.6 million guilder (approximately 14.8 million Euros) project implemented over seven years in the 1990's to reduce the projected growth in car traffic (Directoraat-generaal Personenvervoer, 1998). The second, With the Bicycle Less Congestion ('Met de Fiets Minder File' in Dutch) had a budget of 31 million Euros over three project stages and was started in 2006 as part of a larger set of congestion reduction strategies (Van Boggelen, 2010). Both of these plans were funded and administered at the national level (Directorate-General for Passenger Transport, 1999; Van Boggelen, 2010). Because bicycle planning in the Netherlands moved largely to the provincial and local level after the Bicycle Master Plan (Ministry of Transport Pubilc Works and Water and Management, 1992), these two projects both reflect what were viewed as a national priorities in cycling policy at the time of their development. Comparing them reveals changes in how the national government approaches cycling policy. While these programs had very similar goals, they developed through different processes and measured their success in different ways. The following section provides an overview of the purpose, development, and implementation of each program (for a summary of the key elements of each program, see Table 1).

Table 1. Summary comparison of the Bicycle Master Plan and With the Bicycle Less Congestion.

	Bicycle Master Plan	***With the Bicycle Less Congestion***
Time Period	1991–1997	2006–2009[1]
Project Leader	Dutch Ministry of Traffic and Water Management	Dutch Ministry of Traffic and Water Management
Budget	14.8 million Euros	31 million Euros
Goal	A 30% increase in the number of kilometers travelled by bicycle	Reduce highway congestion by 5% in congested areas
Implementation Strategy	112 projects across 4 broad categories: research, pilots, policy and information exchange	mprove bicycle routes between 5 city pairs with high levels of congestion

[1] The initial project evolved into a still active platform that supports the implementation of cycle highways.

Fig. 1. The Bicycle Master Plan looked at a wide variety of cycling related issues, including how to improve bicycle parking at bus stops. Photo by the author.

3.1. The Bicycle Master Plan

3.1.1. Project Background

In 1996, a planned decentralization process began throughout the Dutch government, and one result of this was that provinces and regional entities became responsible for how money would be allocated to bicycle projects (Directoraat-generaal Personenvervoer, 1997). In September of 1990, in anticipation of this decentralization process, the national government of the Netherlands, under the authority of the Ministry of Traffic and Water Management, formed a project group called Bicycle Master Plan (Directoraat-generaal Personenvervoer, 1997). The purpose of this group was to encourage provincial and local governments, businesses and institutions, public transportation companies, and national ministries to integrate cycling policies into their plans and programs. (Directoraat-generaal Personenvervoer, 1997). More specifically, the project group wanted to make sure that cycling policy, even after it was decentralized, would still receive sufficient attention at other levels of government to make a significant contribution to the goal that the government set in 1986 to reduce the projected growth in car traffic by 50% (Ministry of Transport Pubilc Works and Water and Management, 1992). The Bicycle Master Plan lasted from 1991 to 1997 and during those six years implemented 112 separate bicycle projects (Directoraat-generaal Personenvervoer, 1997).

3.1.2. Project Structure

The structure of the Bicycle Master Plan was relatively simple. The project was directed by a project leader who oversaw the work of a project group. The project group consisted of people with an experience in policy formation from a variety of different departments within the Ministry of Traffic and Water Management. While the ministry was ultimately responsible for determining which projects to implement, they also relied on feedback from a much larger committee made up of members of a wide variety of bicycle interest groups. This committee consisted of representatives from 13 different organizations.

These different organizations were particularly active in the early years of the project, providing advice on how the policies and projects formulated by the ministry could obtain the broadest level of support possible (Directoraat-generaal Personenvervoer, 1997).

3.1.3. Project Goals

The initial policy document for the Bicycle Master Plan stated the following as the central goal of the project: “Promote the use of the bicycle while simultaneously increasing the safety and attractiveness of that bicycle use” (Directoraat-generaal Personenvervoer, 1998, p. 15). This single sentence demonstrates a commitment to both new and current users of the cycling system and is stated broadly enough to allow for a wide variety of projects under the policy. This potential for project diversity was realized in the 112 projects that were ultimately implemented under the Bicycle Master Plan. These projects were broadly categorized as 31 research projects, 41 pilot and model projects, 18 projects related to policy development and 22 information exchange projects (Directorate-General for Passenger Transport, 1999). These projects formed the means by which the policy planned to achieve its stated goal of a 30% increase in kilometers travelled by bicycle between 1986 and 2010 (Directoraat-generaal Personenvervoer, 1997).

3.1.4. Evaluation

The Bicycle Master Plan project group was formed in 1990 with a goal of completing all of the proposed projects by the end of 1994. The project was ultimately extended until 1996 with the focus in the final year of evaluating the results and communicating them with all of the stakeholders involved (Directorate-General for Passenger Transport, 1997). Both the long term nature of the plan and the diversity of the projects that came under it make providing a simple evaluation of its outcomes difficult. The final report detailing the results listed both the gains that had been made through the project, including the development of new best practice concepts through the research and the successful implementation of approximately half of the pilot projects, and the challenges that still remained, including the integration of bicycle policy with long term city planning goals, the incorporation of bicycle parking with new and existing buildings, and the optimization of public transport and cycling, including improved bicycle parking at bus stops [figure 1 near here] (Directorate-General for Passenger Transport, 1999). Throughout the period of the Bicycle Master Plan, cycling rates in the Netherlands remained relatively stable, with the average Dutch adult cycling approximately 2 km per day in both 1990 and 1996 (Godefrooij and Goeverden, 2010).

Although cycling rates in this period did not rise substantially, the evaluation produced at the end of Bicycle Master Plan concluded that the project had had a measurable effect on the support Dutch cities provided to cyclists. A consulting group selected 19 Dutch cities of varying size across the Netherlands and reviewed their approach to promoting bicycle use before and after the Bicycle Master Plan. The review found that 16 of the 19 cities were now putting more of a focus cycling policy, including ensuring integrated cycle path networks and developing plans to actively encourage cycling. None of the cities had reduced the amount of attention they gave to cycling (Directoraat-generaal Personenvervoer, 1998).

3.2. With the Bicycle Less Congestion

3.2.1. Project Background

In 2006, the Dutch national government took on a new role in the funding and development of bicycle infrastructure when the Ministry of Traffic and Water Management began the program Congestion Proof (Fileproof in Dutch). The program was created to develop a series of measures that could potentially reduce congestion within a relatively short period of time. The ideas came from government workers, organizational and societal partners of the government, and 16,000 suggestions sent in from readers to the Dutch newspaper De Telegraaf. Ultimately, between its inception in 2006 and its conclusion at the beginning of 2009, Congestion Proof implemented 40 different programs intended to reduce congestion (Eurlings, 2009).

One of these programs was With the Bicycle Less Congestion. Developed in cooperation with the Dutch Cyclists' Union, the program focused on developing and improving bicycle routes parallel to highways in order to increase the number of people choosing to bicycle for trips between 5 and 20 kilometers. (Van Boggelen, 2010).

Table 2. Overview of the groups participating in the Bicycle Master Plan consulting committee.

Bicycle Master Plan Consulting Committee Groups[a]

Dutch Name	***English Translation***	***Group Description***
Advocacy Groups		
ENFB (Echte Nederlandse Fietsers Bond)	The Dutch Cyclists' Union	The national advocacy organization for cyclists' interests in the Netherlands, currently known as the Fietsersbond.[b]
ANWB (Koinklijke Nederlandse Toeristenbond)	Royal Dutch Touring Club	A Dutch advocacy organization focused broadly on mobility with a particular focus on supporting people travelling on vacation or recreationally.[c]
SLF (Stichting Landeljik Fietsplatform)	The Foundation for a National Bicycle Platform	A not for profit organization that works with other bicycle advocacy groups to advance the interests of recreational cyclists.[d]
Stichting Fiets!	The Bicycle Foundation!	A non-profit organization that works with consumers and bicycle dealers, certifying bicycle dealers according to standards intended to protect the consumer.[e]
VVN (Veiligverkeer Nederland)	The Dutch Traffic Safety Group	A social organization supported by the government, private companies and volunteers that focuses on improving traffic safety.[f]
Industry Groups		
RAI (Rijwiel en Automobiel Industrie)	The Bicycle Section of the Dutch Union for the Bicycle and Auto Industry	The bicycle section of a lobbying group for manufacturers and importers of vehicles.[g]
BOVAG (Bond van Automobiel Industrie)	The Union of Auto Dealers and Repair Technicians	A general mobility organization that certifies repair shops and other businesses as well as lobbying for the concerns of the businesses it represents, including bicycle sellers.[h]

NCBRM (Nederlandse Christelijke Bond van Rijwiel- en Motor-handelaren)	The Dutch Christian Union of Bicycle and Motorcycle Dealers	An advocacy organization for sellers of bicycles and motorcycles that merged with the bicycle section of BOVAG (Union of Auto Deals and Repair Technicians) in 2003.[i]
NS (Nederlandse Spoorwegen)	The Dutch Railway Company	The company that operates the Dutch train services, including bicycle parking at stations.[j]
VSN (Verenigd Streekvervoer Nederland)	The Union for Regional Transportation	A holding company whose 10 different bus companies, at the time of the Bicycle Master Plan, had a 92% market share of public bus service in the Netherlands.[k]
Fipavo (Fiets-parkeervoor-zieningen)	The Union of Bicycle Parking Manufacturers	An industry advocacy group focused on the interests of companies that provide bicycle parking in public spaces.[l]
Governmental Groups		
VNG (De Vereniging van Nederalndse Gemeenten)	The Union of Dutch Municipalities	A group that includes every municipality in the Netherlands and that focuses on sharing knowledge between muncipalities, lobbying for municipal interests, and providing services to muncipial administrators.[m]
IPO (Interprovinciaal Overleg)	The Inter-province consulting group	A group that advocates for the concerns of the Dutch provinces and their partners and stakeholders, both nationally and with the European Union.[n]

[a] Directoraat-generaal Personenvervoer, 1997; [b] Fietsersbond Pers, 2020, https://www.fietsersbond.nl/ons-werk/wat-hebben-we-bereikt/; [c] ANWB, 2020, https://www.fietsersbond.nl/ons-werk/wat-hebben-we-bereikt/; [d] Fietsplatform, 2020, https://www.fietsplatform.nl/over-het-fietsplatform; [e] FietsNL, 2020, http://www.fietsnl.nl/pagina/Visie_&_Missie; [f] VVN, 2020, https://vvn.nl/over-veilig-verkeer-nederland; [g] RAI, 2020, https://www.raivereniging.nl/over-ons; [h] BOVAG, 2020, https://www.bovag.nl/over-bovag; [i] BOBAG, 2020, https://www.bovag.nl/archief/persberichten/2003/wim-van-vliet-nieuwe-voorzitter-bovag-afdeling-twe; [j] NS, 2020, https://werkenbijns.nl/over-ns/ns-organisatie/; [k] "Jorritsma wil monopolie vervoersmoloch Verenigd Streetkvervoer Nederland breken [Jorritsma wants to break the monopoloy of transport juggernaut VSN]," Trouw, November 2, 1996 https://www.trouw.nl/nieuws/jorritsma-wil-monopolie-vervoersmoloch-verenigd-streekvervoer-nederland-breken~b22295cc/?referer=https%3A%2F%2Fwww.google.com%2F; [l] Vereniging Straat Meubilair, 2020, https://straatmeubilair.org/over-ons/; [m] VNG, 2020, https://vng.nl/rubrieken/vereniging; [n] IPO, 2020, https://ipo.nl/over-het-ipo

3.2.2. Project Structure

The project began in 2006 with the ministry and the Dutch Cyclists' Union selecting five city pairs where the routes between the cities had a high level of congestion. The government then invested in improving these routes for cyclists, building new bike lanes and improving existing ones as well as improving wayfinding signage and reducing spillover traffic from the highway along the bike routes (see Table 2, page 44) ("Over Fiets filevrij," 2017).

3.2.3. Project Goal

With the Bicycle Less Congestion had a specific policy objective. The goal was to bring about a 5% reduction in highway congestion by improving the bicycle infrastructure near congested areas. The project leaders initially identified five routes with a high potential of commuter trips under 15 km. The congestion reduction could be achieved by convincing people who drove on these routes to bike instead, potentially reducing congestion in the process (Muconsult, B.V., 2007)

3.3.3. Evaluation of With the Bicycle Less Congestion

In 2008, the project changed its name to Bicycle Free from Congestion ('Fiets filevrij' in Dutch) (Van Boggelen, 2010). Under this name, the group evolved from developing its own projects to providing project support when funding became available for new cycling highways ("Over Fiets filevrij," 2017). For example, in 2016 the Bicycle Free from Congestion platform worked with the Ministry of Infrastructure and Water Management to organize discussion sessions with local and regional groups working on cycle highways. The discovered that a majority of the participants found financing to be a major obstacle in implementing their bicycle highway plans (Bot et al., 2016). In 2018, the Ministry of Infrastructure and Water Management dedicated an additional 100 million Euros to support bicycle highway and station bicycle parking projects (Rijksoverheid, 2018a).

Two years after the inception of With the Bicycle Less Congestion, an initial evaluation determined that the new infrastructure resulted in 1% of the drivers along the congested route switching to cycling, much lower than the target goal of 5% (the calculation of this 1% mode switch has been challenged based on its low sample size). Even accepting the 1% change in practices, the effect on congestion reduction was so low as to be within the margin of error (Van Boggelen, 2010). Cycling levels on a whole did rise during the period of With the Bicycle Less Congestion, but they continued along a trend of gradually increasing cycling rates in the Netherlands, with the average percentage of short distance trips (up to 7.5 km) taken by bicycle having risen from 31% to 34% between 2000 and 2016 (Rijksoverheid, 2018b).

4. Comparative analysis of The Bicycle Master Plan and With the Bicycle Less Congestion

While the Bicycle Master Plan took a broad approach and considered any element that would increase the chance of increasing cycling rates over the long term, With the Bicycle Less Congestion invested all of its resources in a very specific approach. It has promoted a shift from driving to cycling by targeting people driving on congestion prone routes and investing in changes that might encourage them to change their behavior and choose to cycle instead. The difference between the Bicycle Master Plan and With the Bicycle Less Congestion does

Fig. 2. This high-speed cycling route between Utrecht and Breukelen was one of the five routes constructed under With the Bicycle Less Congestion. Photo by Henk-Jan Dekker, used with permission.

not simply represent a difference in focus, however. Interpreting the policies through the lens of social practice reveals key differences between an approach focused exclusively on change and one that includes the maintenance of existing practices and demonstrates the potential value of the latter. This section discusses differences in how each program considered the practice of cycling in terms of materials, meanings, and infrastructure; how those differences led to differing formulations of project goals; and how those goals reflect a fundamentally different approach to mode shift.

4.1. Differences in Developing an Understanding of the Elements of Cycling Practice

Given that an understanding of the complexity of practices and the diverse elements that comprise them is at the core of SPT, any policy focused on behavior change would have to have a means of acquiring knowledge about this diversity in order to be effective. This attempt to understand the practice of cycling in all its diversity is well reflected in the Bicycle Master Plan. The governance structure of the Bicycle Master Plan that provided advice and consultation on the proposed projects involved 13 different organizations, each representing aspects of the meanings, materials or competencies associated with cycling (see Table 1). For example, the material elements of cycling were represented not only by the government agencies that would fund the infrastructure, but also by interests groups representing the business that sold bicycles, repaired bicycles, and provided bicycle parking. Each of these groups would be likely to have insights into the competencies of their clients and how particular investments could support the practices that sustained their businesses. Similarly, people who cycle were not represented by only one advocacy group, but rather four different cycling advocacy groups, allowing for a diversity of perspectives from cyclists through a diverse set of representation

on which meanings, materials and competencies associated with cycling deserved attention. While the Bicycle Master Plan attempted to increase cycling rates by spreading its investments throughout a wide range of projects that intersected with a broad array of elements from the cycling system, the infrastructure developed by the With the Bicycle Less Congestion did not reflect this same degree of complexity in developing an understanding of the practice of cycling. With the Bicycle Less Congestion isolated a single element, the state of bicycle infrastructure near congested highways, and relied on this as its only mechanism for achieving its modal change goal. The focus on a limited group, people who drive on congested roads, seems to have carried over into the resulting infrastructure design: straight, wide bike paths built adjacent to highways. This design reflects the principles that make automobile infrastructure effective, not cycling, as cycling rates correlate with fine grained networks of cycling infrastructure (Marshall & Garrick, 2010). Even if people who drive find the bicycle highway attractive, the policy does not address the cycling experience leading to and from the bicycle highway. It also does not take into account the particular needs of existing cyclists, as will be discussed in detail in section 4.3. The infrastructure is built around the requirements for cycling perceived to be held by people who drive but the policy does not address the bundles and complexes of linked trips made by those who drive that result in car dependency (cf Shove et al., 2015). While the Netherlands is a country of relatively high density, it has been a part of this global trend of increased individual commitments distributed over a wide area but scheduled close together. Schedules that are compressed in time and spread out over space limit people's ability to shift the mode of a single trip type, such as the commute from home to work (Jeekel, 2011).

4.2. Differences in Goal Formulation

The choice to involve groups that understand the practice of cycling and the systems that support it reflects the overall approach of the Bicycle Master Plan. While the goal of the project was to reduce auto use, the measurement of whether or not that goal was achieved was formulated from the perspective of cycling rather than driving.

Specifically, the original policy document for the Bicycle Master Plan stated that the primary goal of the project was to achieve an increase of 3.5 billion (or 30%) kilometers travelled by bicycle between 1986 and 2010. This goal was calculated to be the equivalent of an 8.75% reduction in the total number of auto kilometers travelled (Directoraat-generaal Personenvervoer, 1997).

This approach meant that the achievement of the goal was not entirely reliant on people who drove shifting to cycling. The 24 year time span also allowed for the goal to be achieved by improving bicycle infrastructure so that fewer people chose to defect from their cycling practice and purchase an automobile. The shift from driving to cycling could therefore also be accomplished through a generational shift in which younger people chose to continue cycling instead of purchasing a car while older individuals drove less as a result of retirement and age related issues.

With the Bicycle Less Congestion defined its goal differently than the Bicycle Master Plan. Rather than attempting to increase the number of kilometers cycled, that stated ambition of

the project was to reduce the number of mid-range car trips on the highways near the bicycle infrastructure by 5% (Van Boggelen, 2010). This project goal was reflected in the cost-benefit analysis created by the ministry responsible for With the Bicycle Less Congestion. The tool specifically assigned value to number of people who switched from driving to cycling as a result of the infrastructure, but assigned no value to the retention of existing cyclists (Van Ommeren et al., 2012).

The projects funded and implemented under the policy of the Bicycle Master Plan reflect the broad approach allowed by the governance structure and reveal an orientation towards the practices of current cyclists. Even though a modal shift from driving to cycling was one of the principal objectives of the policy, the actual projects that were implemented under this focal point demonstrate how the project considered supporting the practices of existing cyclists to be a key component of this modal shift goal. While some projects, such as research into how driving trips could be replaced by cycling trips and informational material for employers on encouraging cycling, were focused exclusively on people who currently drove, other projects listed under the modal shift goal were oriented towards simply improving the experience of those who cycled. Projects of this type included research on the economic value of bicycle traffic, research on history of bicycle use and bicycle policy; pilot projects on wind protection for cyclists, wayfinding signs, and streets where bicycles have priority; guidelines for the development of bicycle friendly infrastructure, for the maintenance of bicycle paths, and for the inclusion of local bicycle connectivity planning around transportation infrastructure projects for other modes; and information exchanges on bicycle policy both between Dutch cities and between the Netherlands and other countries interested in Dutch bicycle policies (Directoraat-generaal Personenvervoer, 1997).

4.3. Differences in Acquiring Knowledge about the Target Group

The different way each project had of formulating its end goal carried over into different approaches for how each project acquired the project development knowledge considered necessary to achieve that goal. Because the focus of With the Bicycle Less Congestion was on changing the behavior of drivers, the project used people who drove as the knowledge base for policy considerations. In order to determine the effectiveness of the first five bicycle highways built under the project, an online survey was conducted prior to the construction of the infrastructure that targeted people who drove along the five routes but who could have chosen to bicycle instead. The responses of this group were compared with responses from people bicycling on the route after the improvements were made.

The online survey asked respondents to evaluate 15 different hypothetical trips in which respondent could choose to travel either by bicycle or by car. The purpose of the survey was to evaluate how elements such as crossings, traffic lights, cycle path surface quality, and lighting would affect people's decision to use the bicycle route. Five thousand people responded to the e-mail but only 497 responses were ultimately used in the evaluation of the bicycle infrastructure. The preferences of many respondents were not included in the evaluation because the survey was intended only for people who mostly drove to work and could potentially either start using a bicycle or bicycle more frequently. Therefore, a person's

preferences for bicycle infrastructure would only be included if that person met the following conditions:

- They had a driver's license.
- They had a paid job.
- They lived in the area of one of the bike routes under consideration.
- They sometimes drove on the highway along one of the routes under consideration.
- They sometimes drove to work during rush hour.
- They had a commute that was occasionally shorter than 20 km in one direction.

If a person did not meet all of these conditions, they were not included in the survey. The largest number of participants from the survey on bicycle highways were rejected because their commute was not likely to be made by bicycle (1,891 people), they did not have a driver's license (1,178 people) (Muconsult, 2007).

The design and evaluation of the With the Bicycle Less Congestion program reflects its narrow definition of a transition from driving to cycling. Interpreted through the lens SPT, the survey attempts to gain knowledge about what makes the practice of cycling attractive by questioning people who do not engage in the practice and excluding the people that do. One of the challenges of encouraging people to switch to other modes is that people who do not cycle regularly often have a more negative attitude towards cycling (Namgung and Jun, 2019; Oosterhuis, 2015). Their ideas about what would be needed to bring them to cycling might not be reflective of the actual practice of cycling. Perhaps more importantly, one study showed that 95% of the people on new bicycle highways were existing cyclists (Skov-Petersen, Jacobsen, Vedel, Thomas Alexander, & Rask, 2017). By specifically excluding the vast majority of potential users from the survey, the project risks fundamentally misunderstanding what would make the infrastructure attractive to cyclists, the stated goal of the survey.

This stands in stark contrast with the Bicycle Master Plan. While the advisory committee comprised of various stakeholders may have been active primarily in the early years of the project (Directoraat-generaal Personenvervoer, 1997), their inclusion as part of the project structure from the beginning underscores the difference between the two projects in their approach to acquiring knowledge for policy development. The early focus on existing cycling practices in the Bicycle Master Plan, the project that focused on increasing the number of kilometers cycled, and the absence of interest in existing cycling practices in With the Bicycle Less Congestion, the project that focused on reducing congestion rates, suggests a relationship between how a project formulates its modal split goals and how it develops its policies. How a project conceptualizes model split, therefore, has implications for both theory and practice. In the discussion section that follows, we will explore these implications as well as the limitations of including a focus on practice maintenance in relation to a sustainable transportation transition, with particular attention to possible areas for further research.

5. Discussion

The starting point of this paper is the argument that the current literature does not give

enough attention to the maintenance of existing sustainable transportation practices when considering how SPT theory can be applied to achieving sustainable transportation goals. Through comparing two Dutch cycling policies, we have discussed the value of the maintenance of sustainable transportation practices. In this section we consider how specifically a focus on the maintenance of practices could be developed, addressing the limitations of current conceptualizations of mode shift and defining an alternative conceptualization that includes a focus on maintenance. We then briefly discuss how this concept of mode shift could be translated into policy. Finally, we reflect on the implications of our findings outside of a specifically Dutch context and suggest possible areas of further research in relation to other countries and other modes of transportation.

5.1. Incorporating a Maintenance Based Mode Shift Approach into Cycling Investments

When trying to achieve mode shift goals, programs such as With the Bicycle Less Congestion focus on convincing people who drive to cycle instead – a challenging transition given the obstacles associated with car dependency (Jeekel, 2011; Oosterhuis, 2015; Shove et al., 2015). As argued by Spotswood et al. (2015) from the perspective of SPT, shifting from driving to cycling requires identifying the missing breaks in meaning, materials and competencies that create obstacles to the practice of cycling and finding ways to use policy to remove these obstacles. Changes to the cycling experience, however, will not affect people who do not cycle, and therefore may have little influence over their established practices.

By viewing the modal choice of commuters as an individual choice and by viewing a modal shift as consisting solely as a choice to stop driving and start cycling, With the Bicycle Less Congestion restricted itself to relying for its success on a group that may consist largely of car dependent people resistant to change. By viewing modal choice as part of a complex and interconnected series of practices by diverse groups of actors and by viewing modal shift as both a change from driving to cycling and a continuation of existing cycling practices over time, the Bicycle Master Plan created an umbrella program that was able to support an enormous diversity of projects under its policy framework and use the knowledge of those who actively cycle and those directly connected to the cycling system to work towards its goals.

Stated another way, With the Bicycle Less Congestion considered mode substitution only in the form of car trips that could potentially be taken by bicycle, while the Bicycle Master Plan's approach reflected a broader conceptualization of substitution formulated by Piatkowski et al. (2015) in which a person who cycles for all of their trips and does not own a car is substituting all driving trips for bicycle trips.

Because the cost-benefit analysis developed for bicycle infrastructure in the Netherlands does not factor in this latter type of substitution (Van Ommeren et al., 2017), cycling investments are evaluated based only on people who potentially may cycle rather than people who are already engaged in the practice. The cost-benefit analysis, therefore, does not allow for a calculation of the benefits of a maintenance based approach that includes a focus on improving the experience existing cyclists in order to achieve a long term increase in sustainable transportation practices. Future research could explore how this approach could be incorporated into the evaluation of cycling investments.

5.2. Possibilities for Practical Application of a Maintenance Based Approach to Dutch Cycling Policy

In the Netherlands, the elements of cycling practice are established by a large portion of the population at a young age. As people get older, cycling rates generally drop (Centraal Bureau voor de Statistiek, 2018). This statistical drop in cycling was confirmed by a longitudinal study on cycling habits in Netherlands that showed that people under 30 were the most likely to change from a cycling commute to a car commute (Oakil, Ettema, Arentze, & Timmermans, 2016). A possible reason for this decline is suggested by the findings of a government report that found people's decision to purchase a car in the Netherlands is frequently paired with a major life event, such as starting a new job, having a baby, or retiring (Kennisinstituut voor Mobiliteitsbeleid, 2014).

The high cycling rate in the Netherlands, therefore, is not a result of a large number of people having chosen to give up their cars and start cycling instead, but rather the result of people who grew up cycling and who continue to do so. Since cycling rates are highest among younger people, cycling rates can also be increased (and driving rates decreased) by lowering the number of people who shift from cycling to driving after a major life event.

Whatever the meanings, materials, and competencies that form the practice of cycling are, people who are regularly engaged in the practice of cycling, by definition, possess them. The challenge becomes determining how these elements change during transitional events that lead people to stop cycling. As the approach of the Bicycle Master Plan demonstrated, one way to meet this challenge is by bringing together as many representatives of all the diverse practices involved with the system of cycling and investing in strengthening those practices throughout the system.

The principle of social feedback (Skov-Petersen et al., 2017) suggests that people look to the experience of others when evaluating their own future experience. Improving the cycling experience for commuters that cycle between cities, people with children, or retired people, for example, increases the chances that people who already cycle will have a positive model for adapting their meanings, materials, and competencies when faced with a new commute, the arrival of a child, or their approaching retirement. Focusing on improving conditions for existing cyclists, therefore, also results in better conditions for people evaluating what their cycling experience will be like in relation to their new job, their new child, or their retirement lifestyle and this may also result in a reduction of people changing from cycling to driving. While these events take place at various points in the life cycle, this approach would not necessarily require waiting a generation to see results. If the number of people who would have started driving in a given year but continued to cycle because of an intervention is higher than the number of people who stopped driving and started cycling in that same year, the maintenance based approach would, by definition, be the one providing better short term results. Further research would be required to determine which interventions would have the most potential at these transition points.

5.3. Adapting a Maintenance Based Approach in Other Countries and for Other Modes of Transportation

The Netherlands has a significantly higher cycling rate than other countries (European Union

Economic and Social Committee, 2011). For example, in the United Kingdom, cycling trips comprise approximately 2% of all trips (Spotswood et al., 2015) and in Australia the rate is closer to 1% (Harms & Kansen, 2018) while in the Netherlands 27% of all trips are made by bicycle (Harms & Kansen, 2018). This could be one explanatory reason for the absence of scholarly attention to maintenance of sustainable transportation practices, particularly in relation to cycling.

However, while the cycling rate may be higher in the Netherlands, life events have been shown to be associated with changing cycling practices in other countries as well. A study in the United Kingdom used interviews with residents in towns with improved cycling infrastructure to show that changes in cycling were often triggered by life events (Chatterjee, Sherwin & Jain, 2013). An Australian study found that decreases in cycling rates among women were linked to many of the same events listed in the Dutch study of auto acquisition (moving to a new house, starting a new job, and having children)(Bonham & Wilson, 2012).

While the potential benefits of the maintenance of cycling practices is obvious in a country with a high cycling mode share like the Netherlands, investing in the maintenance of practices could also be of benefit in countries with a lower cycling mode share. For example, in Great Britain 1% of all vehicle miles travelled are travelled by bicycle. This 1%, however, is not distributed evenly across the population. Males made 2.5 times as many cycle trips as females and cycled 3.6 times as many miles. Across areas of Great Britain, younger age groups had higher cycling rates than older age groups (Cycling UK, 2019). This suggests a cycle of recruitment and defection, with a new set of younger male cyclists continuously replacing their older counterparts. While the literature on risk perception and its relationship to cycling remains limited (Wardlaw, 2014), young males have been shown to have higher risk tolerances in other transportation contexts (Hulse et al., 2018; Turner and McClure, 2003) and the decision not to cycle has been linked to perceiving cycling as a dangerous activity (Heinen et al., 2011; Manton et al., 2016). This could potentially be one explanatory factor for the growth in U.S. cycling rates coming almost entirely from men, with cycling rates for women stagnating and those for children dropping substantially (Pucher et al., 2011). To increase cycling rates, policy makers could not only focus on expanding the bicycle network along commuting routes, but also invest in making the existing network safer, decreasing the risk tolerance necessary to cycle. As bicycle safety improvements have already been shown to attract new cyclists (Noland, 1995), safety improvements would also seem likely to reduce the number of people who stopped cycling as their risk tolerance increased with age.

For example, a hypothetical city could have a stable cycling mode share of 2%, but every year have 20% of people cycling for the first time and 20% of people choosing to no longer cycle. If the number of people who chose not to stop cycling was cut in half, the city would double its cycling mode share to 4% within 7 years as 10% more people started the practice than stopped among an ever increasing active group of cyclists.

Further, a maintenance based approach to a sustainable transportation mode shift need not be limited to the practice of cycling. The argument that investing in the maintenance

of sustainable transportation practices has value still holds for other modes of transport in other countries. A large body of literature exists examining the effects of programs aimed at convincing people to stop driving and take public transportation instead (Adler & Van Ommeren, 2016; Anderson, 2013; Beaudoin & Farzin, 2015; Duranton & Turner, 2011; Pang, 2018; Salon, Boarnet, Handy, Spears, & Tal, 2012). While evaluating a modal shift from driving to public transportation in the context of SPT is beyond the scope of this paper, the argument made here that existing cyclists can be part of a mode shift in a country where most of the population begins cycling at a young age could potentially be used to argue for a focus on maintaining current ridership levels in a city, region or country where practices of transit use start at an early age. One key similarity between the Netherlands and the United States, England, Australia and many other countries in Europe is a trend towards acquiring a driving license at a later age (Delbosc and Currie, 2014; KiM, 2014; Le Vine and Polak, 2014; Ortar et al., 2018; Schoettle and Sivak, 2014; Thigpen and Handy, 2018) Future research could expand on an Australian study that examined the multiple reasons millennials were choosing to delay getting driving licenses (Delbosc and Nakanishi, 2017) and explore how maintenance based approaches to not only cycling but also walking, ride sharing and public transit could support the sustainable transportation practices of young adults and further raise the average age at which many young adults shift to driving.

6. Conclusion

While the existing body of literature uses SPT to discuss which policies might support a change to sustainable practices, possibilities to use SPT to understand how existing sustainable practices can be supported to further sustainability goals have not been explored. Addressing this gap, our paper articulates an approach to achieving mode shift in the direction of sustainable transportation through a focus on the maintenance of existing sustainable transportation practices.

Drawing on two national Dutch cycling policy programs that illustrate two different possible approaches to a mode shift in favor of cycling, we have argued that investing in a maintenance-based approach could contribute to achieving the modal split goals set by change-based approaches. Specifically, we compared the Bicycle Master Plan (1991-1997) to With The Bicycle Less Congestion (2006-2009). While the first program, took a broad approach and considered any element that would improve the chance of increasing cycling rates over the long term, the latter invested all of its resources in a very specific approach: promoting a shift from driving to cycling by targeting people driving on congestion prone routes and investing in changes that might encourage them to change their behavior and choose to cycle instead.

This paper, therefore, both contributes to the scholarship on sustainability and behavior change that uses SPT with the goal of advising policy-makers and to the debate on transitions to sustainable transportation by articulating a new approach to achieving mode shift that can provide a broader understanding of the policy options available.
This maintenance-based approach could apply to any situation in which a large number of people have a sustainable practice but might change to an unstainable practice (areas with high levels of cycle or transit ridership, for example).

We do not suggest that no investments should be made in encouraging people to move from unsustainable to sustainable transportation practices; rather, we argue that the maintenance of sustainable transportation practices represents an approach missing from the policy toolkit that could complement and support current investments.

Specifically, focusing exclusively on a narrow definition of mode shift that only includes people who go from unsustainable to sustainable practices fails to take into account the potential benefits of a broader definition of mode shift, one that includes a focus on the maintenance of existing sustainable transportation practices over the whole life cycle.

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HOOFDSTUK 04

Practitioners' Perspective on User Experience and Design of **Cycle Highways**

***George Liu[a,b], Marco te Brömmelstroet[a], Sukanya Krishnamurthy[b], Pieter van Wesemael[b]**

[a] Urban Cycling Institute, Centre for Urban Studies, AISSR, University of Amsterdam, Amsterdam, the Netherlands | [b] Eindhoven University of Technology, Eindhoven, the Netherlands

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Abstract

Cycle highways, also known as "fast cycle routes", are an emerging concept in urban planning that describes long distance, high quality bicycle routes built for commuter use. In Northern European countries, large sums of money are invested into cycle highways promising to induce a mode shift with little critical assessment as to how cyclists experience these infrastructures. Through eleven interviews of practitioners from five European countries – the Netherlands, Belgium, Germany, United Kingdom and Denmark – this paper explores how practitioners define cycle highways and how their conceptualizations of cycling experience shape the physical design of cycle highways. Results show that while practitioners are guided by infrastructural standards for cycle highways such as width, design speed, and intersection treatments, it is less clear how these infrastructure elements fit within the surrounding environment to create desirable cycling experiences. In addition to commuters, cycle highways are also used by recreational and sport cyclists, so policy makers and designers should consider a wide variety of user groups and their aesthetic and social experiences in the planning and design of cycle highways. Future research should investigate cycle highway experiences from the perspective of various user types.

1. Introduction

Cities around the world are building cycle highways to encourage sustainable inter-urban transport using bicycles, e-bikes, and other forms of small wheeled vehicles [1]. To further reduce automobile use and to promote physical activity, environmental sustainability, economic growth, and accessibility, cities in Europe have invested in a variety of infrastructure and policies to improve the attractiveness of cycling [2]. Cycle highways are often framed within a package of interventions, along with improvements to public transport, with the intent of changing commuting behavior by substituting investments in road infrastructure to cope with expected commuter traffic growth [3]. From general cycling research, we know that cycling becomes relatively less attractive compared to other modes as trip distances increase [4], [5]. Cycle highways seek to encourage cycling for longer distance commuting trips, and survey data from governments seem to suggest that users of cycle highways do indeed tend to take longer trips [6]–[8] . On a policy level, Rayaprolu, Llorca, and Moeckel [9] attribute cycle highways to a Dutch concept in response to "rising environmental and health consciousness, and the growing popularity of electric bicycles". At the time of writing this paper, there are major cycle highway routes and networks being planned and constructed in northern and western Europe [9]. The Netherlands was the first to experiment with the cycle highway concept with demonstration routes in Tilburg and The Hague in the 1970s, yet modern designs have only been implemented since 2004 [10], [11]. More recently, the concept of "Cycle Superhighways" has been popularized in the English media with London opening its first routes in 2010 and having eight completed as of 2018 [12]. Copenhagen opened their first cycle highway in 2012, with fifteen planned for 2021 [13]. More recently, Germany began executing their first plans for cycle highways with three pilot projects in 2012, following examples of cycle highways from the Netherlands, Copenhagen, Belgium, and London [14]. Similarly, the Netherlands is planning a nation-wide network of bicycle highways that connect urban cores.

As more attention, funding and projects utilize the language of cycle highways to improve cycling numbers, there does not appear to be a clear understanding among design and planning professionals and policymakers of what cycle highways *are* and what they *should be*, with evolving conceptualization of its design and purpose. For example, the first generation of cycle superhighways in London, built in 2010, was little more than blue paint on high traffic roads. London's new cycle superhighways have since evolved towards more "continental" design, incorporating elements such as traffic separation and protected intersections [15]. The European Cyclists' Federation CHIPS project defines cycle highways as, "… a mobility product that provides a high quality functional cycling connection. As backbone of a cycle network, it connects cities and or suburbs, residential areas and major (work)places and it satisfies its (potential) users" [8]. However, there are multiple terms that could be used almost interchangeably to describe similar typologies, such as "cycle superhighways", "greenways", "high quality cycle paths", "through cycle routes", and "fast cycle routes" to name a few. Without a clear definition and especially given the variety of languages used to describe the cycle highway concept, it is difficult to assess the performance of cycle highways as an intervention and to transfer knowledge about successes and failures, especially across countries. It also blinds us to underlying, and contested, assumptions of what cycling is, or ought to be.

Currently, using the terminology of "cycle highway" might be strengthening an underlying vehicular approach to bicycle infrastructure design. In relation to this, Dutch practitioners Sargentini and Valenta [16] warn that bicycle paths should not be built with the same logic as automobile highways and instead should take cyclists' embodied experiences and a variety of individual motives into account. They urge practitioners to stay away from car-oriented thinking, moving beyond A-to-B logic, and proclaim "do not make cycle highways into car highways!" [16]. This plea for the unpacking of the black box of travel by developing a more nuanced understanding of the journey is echoed by mobilities researchers who have conceptualized travel in terms of meanings and experiences [17]–[20]. There is also tension within the concept "cycle highway" itself. On the one hand, cycling has an experiential element that scholars have attempted to conceptualize in relation to aesthetics, emotions, and spatial design [21]–[25]. Yet, the term highway seems to place this type of infrastructure more in common with the logic of automobile highways; focused only on the fast and efficient transport of people and goods [26]. Hamilton-Baillie [27] conceptualized traffic zones versus social zones as realms of competing logic, both physically and conceptually. Hamilton-Baillie defines the traffic zone as "single purpose, uniform, regulated, impersonal, and predictable", whereas the social zone is characterized as "multi-functional, diverse, culturally defined, personal, unpredictable". On a street, these zones are demarcated by the sidewalk for pedestrians and the roadway for motorized vehicles. Where do cycle highways belong on this scheme, and what design logic do cycle highways currently follow? To what extent do practitioners pay attention to each aspect of Hamilton-Baillie's logic, and do cycle highways seek to create a unique zone for the cyclist, taking into account Forsyth and Krizek's unique perspective of the cyclist [22]?

In academic literature, cycle highways have been analyzed from a few perspectives. From bicycle counter data and three questionnaire campaigns, Skov-Petersen et al. [3] analyses Copenhagen cycle highways in the framework of induced travel demand, cyclist satisfaction and competition for funding. From the a public health perspective, Buekers et al. [2] estimates health impact of modal shift due to two cycle highways in Flanders, Belgium. From the physical design perspective, Kristjansdóttir and Sjöö [11] provides a technical review of European cycle highway standards in the Netherlands, Denmark, United Kingdom, Germany, Norway, and Sweden, focusing on engineering criteria such as infrastructure type, intersections, markings, lighting, width, curve radii, etc. This paper seeks to develop an understanding of how practitioners define cycle highways and how they conceptualize users, experiences, and design in relation to cycle highways. Cycle highways incorporate many of the elements known to improve the attractiveness of cycling, such as priority crossings, rest areas, lighting and effective wayfinding [14]. While these measures have been shown to improve the attractiveness of cycling routes [4], there is a relatively little academic research on how these elements impact the experience of cycling and none to date that explore practitioners' conceptualization of cycling experience. Thus, our research question are:

1. **What are the main concepts used to describe and define cycle highways by practitioners?**
2. **How do practitioners articulate cyclist types and cyclists' motives within the conceptualization of cycle highways?**
3. **How is cycling experience conceptualized by cycle highway practitioners?**
4. **How is the perspective of the cyclist reflected in the design of cycle highways?**

2. Methodology

2.1. Selection of Practitioners

We interviewed practitioners from five European countries that are actively working on developing cycle highway networks – the Netherlands, Denmark, Germany, United Kingdom, and Denmark. To select interview participants, an initial search was conducted of internet and media reports of cycle highway projects that are either recently constructed, under construction, or being planned in the near future. Particular attention was paid to northern and western European countries in which cycling is relatively matured [28], [29]. London, although with lower cycling rates, has been actively building a cycle highway system.

From the list of projects based on geographic location, expert government practitioners were selected for interview based on their associated project, their position in the organization, and their work portfolio having contained cycle highways. Interviewees for this research hold, or have previously held, positions in regional or provincial governments working on cycle highway projects for at least two years; the time in their position is used as an indicator of their familiarity with the subject area. Given the relative novelty of cycle highways as a concept, none of the interviewees had a formal education in cycle highway planning and design, and perhaps due to the novelty of the cycle highway concept, none spent more than ten years working on cycle highways. All Interviews were conducted in English.

Fig. 1. Example cycle highway, mixed with automobiles. RijnWaalpad, Arnhem-Nijmegen area, Netherlands (Photo Credit: George Liu).

Table 1. Interview participants, affiliations, and their cycle highway projects.

Interviewee	***Project***	***Affiliation***	***Role***	***Department***
UK1	Cycle Superhighway	Transport for London	Design Manager	Engineering Directorate, Highways and Traffic
UK2	Cycle Quietways	Transport for London	Senior Engineer	Engineering
BE1	F1	Province of Antwerp	Policy Member	Dienst Mobiliteit
BE2	F1	Province of Antwerp	Policy Officer (team Fietsbeleid – teamverant-woordelijke	Dienst Mobiliteit
BE3	F3	Provincie Vlaams-Brabant	Policy Officer	Dienst Mobiliteit
GR1	Radschnellweg Mannheim-Heidelberg	City of Mannheim	Traffic Planner	Department of Urban Planning
NL1	RijnWaalpad	Province of Gelderland	Coordinator	Cycling Team
NL2	RijnWaalpad	Royal HaskoningDHV	Bicycle Mobility Advisor	Transport and Planning
GR2	RS1	Ruhr Regional Associations	Project Manager	Regional Development Department
DK1	Cycle Superhighway	City of Copenhagen	Project Leader	Office for Cycle Superhighways
DK2	Cycle Superhighway	Rødovre Municipality	Road Engineer	Road and Traffic Department

2.2. Interview Structure

We followed a semi-structured interview format, consisting of four sections. These sections ask practitioners about 1) the general concept of cycle highways, including their typology, differentiation, and best practices 2) the cycle highways they have currently worked on, including design priorities, good and bad aspects of design and target users 3) describing the ideal cycling experience, and relating this ideal experience to any considerations of cycling experience in the design of the case study cycle highway and 4) the professional role and knowledge sources of the interviewee, including the focus of their work, extent and type of their professional network, experience with cycle highways, and use of professional and academic sources on cycle highway design.

Each interview lasted between forty-five minutes to one hour, and participants were encouraged to share personal anecdotes where relevant to the question. Interviews were recorded in person or through recorded telephone or internet voice call. Interview data was transcribed then coded inductively focusing on the following themes: 1) definition of cycle highways, 2) design of cycle highways, 3) user types and trip purposes, and 4) experience of cycling. (See Appendix A for interview script). After transcription of the interview and coding for themes in the interview answers. These themes then formed the basis for the findings of this paper.

3. Findings

3.1. Competing Logics

The interviews begin by establishing how cycle highways are defined. Participants were asked, "what is a cycle highway?" and "what makes cycle highways distinct from other types of infrastructure?" Participants responded with reference to three general themes, representing competing logics that are implicit in the discourse surrounding cycle highways. These logics contextualize the extent to which cycling experience plays a role in current discourse among practitioners. Broadly, these categories are:

1. Political context, jurisdiction, and funding
2. Infrastructure and environmental quality
3. Directness, efficiency, and competition with other modes

Cycle highways are defined differently among the practitioners interviewed, varying among responses coming from the perspective of policy makers, designers, and engineers. Some respondents feel there is no clear definition at this point. NL2 states, "I've got no clue. I've been working for 10 years in it, I've got no clue, but it really depends on who you ask. I think that's a proper answer." Policy makers have also framed the concept of cycle highways differently depending on the state of political priorities. In reference to the Netherlands, "Probably the answer in the coming four years is that it will help us reduce our carbon dioxide emissions, and maybe in the four years after that it might contribute to a healthier city… By strategic positioning of projects as a cycling highway you see that it gets us more attention and gets us more political attention and thus you can get more funding, and then suddenly you can also become more ambitious as a matter of fact, and you can invest more" (NL2).

Cycle highways should also distinguish itself from other cycling infrastructure by having a distinct character achieved through signage, infrastructure design, and environmental quality. GR2 states, "at the first glimpse, you should see it's more than an ordinary bike path, meaning there should be a special design, a special color scheme, and unique signage of the cycle highway, so you see that it is not just an ordinary bike path, but that you have really a special way for cycling." When asked about taking cyclists' experiences into account, BE2 says there is a growing realization of the importance of the surrounding environment adjacent to the bike path, stating, "we are struggling with that question because, our main goal, what our politicians asked from us, is that we build a clean, smooth, and wide infrastructure, and there is not really a real vision about how a cycle highway feels and what it has to offer alongside this infrastructure." Definitions of cycle highways tend to require high quality cycling infrastructure, yet quality is defined in terms of minimum physical design standards and lacks a vision for how physical design relates to improving the cycling experience.

Some practitioners choose to define cycle highways primarily through a political lens in relation to jurisdiction and funding. UK1 emphasized the importance of allocating cyclists' own space on the street and distinctive branding, yet jurisdiction boundaries can limit the types of infrastructure that can be built. UK1 gives the example that Transport for London only has jurisdiction over major arterial roads, so London's Cycle Superhighway infrastructure is built on heavy traffic corridors. Given this limitation, London's Cycle Superhighways focus on creating an easy to follow route from the suburbs to central London. In the context of Copenhagen, cycle highways must go through many municipalities with different objectives and political agendas, so compromises are made in the quality of routing and design elements where political boundaries are crossed. In practical terms, "it means some municipalities are not very ambitious. They must do what they need to do in order to get it approved" (DK1). Thus, cycle highways are also distinguished from other cycling infrastructure through their strategic relevance on a regional and national level, in many cases requiring cooperation from many municipalities in order to realize a continuous cycle highway route.

In addition to physical design and political context, a third logic is revealed through the language used to describe geographic connections and relative efficiencies over a larger scale. These descriptions place cycle highways in relation to traffic network and urban planning goals. Interviewees conceptualize cycle highways as providing the fastest, most direct, and most efficient route between two places over relatively longer commuting distances, directly connecting suburbs to urban centers. "To bring them (cyclists) from A to B, without lots of interference with other traffic and giving them their own space is crucial. But that's the dream. In reality, we do not always achieve the high level that we want." (BE2). Another goal of cycle highway is to encourage people to switch from cars to cycling, especially for commuting trips, where convenience is a key factor in accomplishing this goal. The German RS1 case reveals that the literal translation of the term "radschnellweg", or "bicycle highway" is taken seriously in the marketing of the route. The RS1 logo is one of a bicycle imposed on a recognizable blue sign used to represent the German Autobahn network [30]. UK2 also relates cycle highways to the design of motorways, "I would say it is a dedicated cycle facility. And one that is a pretty fast and direct. If I was thinking what a highway is and then applying it to cycling, that's what I come up with."

These definitions of cycle highways by practitioners illustrate that the existing logic of cycle highways seeks to implement an engineering-based criteria of cycle highway design that is limited by funding, ambitions, and cooperation among bordering political entities. It is clear that conceptualizations of cycling experiences are missing from initial definitions given by practitioners, even though interviewees have an intuitive sense that the experiential elements play a role in improving the attractiveness of cycling trips.

3.2. User Differentiation by Motives, Demographics, and Vehicle Types

After defining cycle highways, practitioners were then asked about their conceptualization of relationships between the various users of cycle highways and to their cycling experiences. In general, practitioners prioritize commuter cyclists' needs and design cycle highways with home-to-work journeys in mind. "The question is, for what do we design it for? We do it for the commuters etc., and they want to spend the least time on mobility and transportation, so that means they want to get A to B in the shortest time" (GR2). There are other cyclist needs, but the primary target group of cycle highways are commuters who want to minimize their travel time. "If you are doing it via greenways etc., it may be the case that it takes much longer and that is okay if it is about leisure activities on the weekend, but I think most of the people just want to get to their destination quite quickly" (GR2).

Cycle highways should also be inclusive for users of all ages and abilities. BE2 says, "when we design or a cycle highways we try to design them for eight year olds so they can cycle independently from A to B." But problems may also arise from the mix of users on the cycle highways, and how they interact with each other. "We have a problem from certain cyclists… the more soft kindergarten children, elderly. And when we used the words FAST as a term to define a cycle highway…, then you refer to what people see when they think about the highway and, and they think SPEED. It's a real discussion. Some people are afraid because of the high speeds." BE1's response considers how the faster speeds of speedpedelecs (fast e-bikes) and sport cyclists creates potential conflict with the needs of more leisurely commuters, "There are also people who bike more at ease and they say, 'I don't want to hurry.' These people also want to use the cycle highways. Cycle highways are also for them." BE2 then mentions the problem of understanding and accommodating cycling experiences of different people, "We have some colleagues who are older. They like something else compared to the younger ones. Men, women, and children may also like different things, so you try to make something one fits all or, or, at least appreciated by different target groups."

Like in more famous cycling contexts Copenhagen and Amsterdam, urban tourists on bikes are a category that is being recognized in London as well. "…there's now at least three, probably four companies who do cycle tours around central London, and they all use the super highways more or less to get round the tourist sites and obviously with the London cycle hire, you see a lot more people cycling along the inner superhighways, whereas before they would have kept themselves to the parks instead of the road" (UK1). Hence, UK1 sees different users for each part of the cycle highway network, "[We want to] to get commuters in from the outside to central limit and then get them out of the cars. I would say the central part of the behind is we're much more than designed with recreational use in mind as well, so we don't just design something for the morning rush and the evening rush"

While it is clear that cycle highways are primarily designed for commuters, practitioners are well aware of different experiences as perceived through different people. In addition to commuters, users are differentiated by their trip purpose (sport cyclists, leisurely recreation cyclists, commuters, etc.), their vehicle (e-bike, normal bike, etc.), and age (children, elderly, etc.), and gender. Although the primary target audience of "commuters" is clear, cycle highways should also be designed with different users in mind.

3.3 Elements of Experience

Safety is the most frequently mentioned topic in relation to cycling experience, and traffic safety is the main concern for practitioners in Germany and the United Kingdom where cycling rates are lowest. There is a perceived tradeoff between traffic safety and expediency, especially when handling cyclists at intersections. UK2 states, "I think in the Quietways, [as opposed to Superhighways], there's perhaps a perception that cyclists emphasize safely. So the idea is that when you get to an intersection, you may not have an advantage over traffic, but… you will be able to cross safely." UK2 emphasizes social safety in addition to traffic safety, saying, "[In] isolated areas like parks or down under, under railways or through subways, we seek to enhance or improve security conditions. I suppose the word is social safety… under the healthy streets approach now that is even more important"

It is also a variety of experiences along a route that seems to be important. There may not be one ideal cycling environment, but a combination of environments with transitions to give variety to the cycling journey may be more ideal. GR2 states, "you are also passing through greenbelts and then you have the rural experience of just being in the countryside, so it is a mixture of both urban areas and rural parts. So that makes it quite attractive because you have both experiences being on the cycle highway" Design considerations change when designing for long distance versus short distance journeys, and DK1 emphasizes both the social and sensory aspects of cycling, and how these relate to a sense of time. "Longer distance, especially commuting and in that sense if time is important for you, but also the experience as a cyclist you just like dealing with pedestrians, you like to have something to look [at]. You like to have other people around you, so I think to that extent it's possible, you should definitely try to have the cycle highways away from car traffic with the noise. And have it in places where it's either really beautiful or there's other people around that you can look at it because it'll make time fly by. And also, that's what you can do on a bike. You interact with your surroundings." Practitioners from Flemish Belgium reflects on the similarity of their cycling culture compared to the Netherlands in that cycling is seen as a social experience, highlighting the importance of being able to cycle side by side, especially over long distances on cycle highways.

GR1 gives a vivid account of the journey experience, from a spatial perspective alluding to many of Kevin Lynch's [31] ideas about navigating and experiencing the city. GR1 describes, "For example, when you go on the cycle highway, you see the biggest inner-city tower or something that you want to reach. Like when I go… I live in Heidelberg, it's 20km from Mannheim, when go cycling to the office, I always see the Television Tower of Mannheim, so you see it getting closer and closer and you think, 'I'll get there.' It's not hard stuff, but the soft topics should not be ignored and there should be no feeling like 'How much longer will it still

take?'… You should say, 'Ah, how fast that my ride is over now!' so when you reach your office, it should be like 'Ah, I want to continue cycling… the weather was so nice, etc.'" UK2 mentions wayfinding as an important aspect of experience, "I think having that certainty of where you're going, where you're going or what's close to you is a big deal. There's nothing like going out on a bike and like kind of embarking on a journey through a network and then you get lost and your confidence will just drop and you need to use your phone." DK2 remarks cyclists should feel like they are part of the traffic picture. "People should have a good time while using cycle highways… and feel like they are contributing by taking the bicycle instead of the car."

Overall, visual aspects of experience were mentioned, including greenery, nature, and landscape. Landmarks are an interesting case that represents both an element of aesthetic pleasantry as well as wayfinding reference points. Participants also made the distinction between urban and rural environments, and mentioned the importance of these transitions and variations as important to creating an interesting cycling experience. Non-visual experience include noise, weather, and comfort in relation to the quality of the infrastructure. In terms of comfort, surfacing is an aspect that was deemed an important factor, with overall quality determined by materials, construction quality, and maintenance. There are also differing views on cycling together with other people. Some pictured a solitary cyclist on the highway in the countryside, while others talked about the pleasure of being able to interact with others. Others mentioned the ideal cycling experience as one that provides opportunities for "serendipity", or "being able to ride hands free", and perhaps good design is one that enables these experiences as well.

3.4. Design Considerations

Width, quality standards, and intersections are the main concepts mentioned in relation to design. Practitioners say they refer to design standards to guide theirw work but many cite difficulties when the ideal physical requirements of cycle highway design conflict with other uses of space in urban settings. For example, GR2 refers to the design standard for cycle highways in Germany, which is ideally a 4 meter, bi-direction cycle path with a 2 meter path for pedestrians [32]. However, participants recognize that segregated cycling infrastructure is not possible on streets where space is limited in the central city, so mixing or separation of bicycle traffic from motorized traffic seems to be a reccuring design consideration in urban environments. Even though high quality is frequently mentioned in describing the design of cycle highways, it is unclear what exactly high quality entails.

We don't say what this high-quality means in the definition. It's more a functional definition, but it means that you have higher quality than just normal cycle infrastructure… The problem with qualities, you could say we need, for instance, four meters wide and not too much pedestrians, or if there are a lot of pedestrians, you have space for the pedestrians like in the RS1 in Germany. In the practice, you could also have sometimes just a quiet road where you have a little bit mixed with cars. (BE3)

Where cycling infrastructure is relatively new, for example in the context of London, cycle highway designers have started recognizing cyclists as road users with their own needs, distinct from the needs of pedestrians or automobiles. UK1 states,

Instead of being either treated as pedestrians, you put them on the foot way or, and treat them as a traffic and put them in with general traffic… you design specifically for the cyclists, at the start of your scheme instead of trying to put a cycle facility almost as an afterthought to your designs. Yeah, I would say that's probably the biggest change is that cyclists are now thought of right to the start of a project instead of as a, Oh yeah, we just need to do something. Let's put a little bit of wide lane in or bit of paint for them. (UK1)

Some practitioners also emphasize the perspective of cyclists in the design process. BE2 explains that cycling infrastructure is best understood by those who have experience using them. "In cycle infrastructure it is the Flemish road agency that designed a lots of cycle paths, but they are engineers who don't cycle and then you see the difference" (BE2). DK2 uses the example of traffic lights to illustrate a counterintuitive example that highlights the behavior of people in response to unreasonable infrastructure. DK2 says, "the worse thing is always, of course, is when you have a good speed on the bicycle then you have to stop for a red light." DK2 continues, "we must be aware that if they feel annoyed by stopping, they will actually try to break the red lights and that could lead a situation where they actually have some accidents which you could perhaps have avoided because they get impatient." So, it seems that not losing momentum, especially on a human powered vehicle, is an important part of the cycling experience, and designing around this experience can also help cyclists negotiate traffic safely. Cycling experience also depends not only on design, but on the behavior of others. BE2 remarks, "we have to be respectful to each other. It's a soft mode of transport."

Practitioners agree that the design of cycle highways cannot be wholly copied from automobile infrastructure, "It's not my aim to make a copy of highways now to cycle highways because it's different. Cyclists are not motorists. They have other needs. You can't just copy paste. It's not possible. It's not a good idea." (BE2). Yet BE3 suggests the aesthetic considerations of scenic parkways in the United States can serve as inspiration for some aspects of cycle highway design, "even motorways are sometimes designed from the point of view of pleasure in a way. You could find some interesting examples where you add a slight bend where you look at the landscape and the scenery. I think in the United States, sometimes they have beautiful examples." This sentiment resonates with ideas from Appleyard, Lynch, and Myer's The View from the Road on how to design landscapes and environments to be enjoyed on the move [33]. However, BE3 cautions, "of course you have to be careful with comparing with motorways, but I think for cycling, and that's really important point… one of the motivations to cycle is also the pleasure of cycling, and doing something healthy, and working on your condition, and enjoying the environment, and nature, and the weather, et cetera. And if we want people to commute more, we want to, we have to think about their motivation to commute"

Traffic logic is also implied in wayfinding signage, directing cyclists to go the fastest route, not necessarily the most scenic, "Cycle highways are directed at commuters who go to work, and serves a wayfinding function to signal the most direct route to follow." (DK2). DK1 mentions the importance of providing alternatives to fit cyclists' desires for directness and experience, especially through built up areas. "We have these route that runs along an old railway line and it actually goes right through Copenhagen. But it will never be the fastest route, because

it curves a lot. But it's just so much more fun to take it. The infrastructure's good but you go through parks and squares and there's something happening along the entire route, so I think that would be a case of if you want to go really direct you would take one of the main roads along with people cars. Or, if you want to experience something, you would take the other route. It's also just a trade-off what can actually be done here because there's already a city." The conceptualization of design varied in scales of analysis, from detail design such as smoothness of pavement to cycle path width, to more network level characteristics such as route connectivity and directness. Experiential elements such as enjoyability, convenience, safety, and attractiveness are often mentioned in relation to physical design, along with concrete ideas such as design speed, traffic separation, curves, traffic volume, and other measurable variables. Although designing for good cycling experiences is not prescribed by design standards, practitioners try to incorporate their own intuition of good design with the goal of making journeys more pleasant for cyclists.

4. Discussion

4.1. Defining cycle highways

Practitioners gave two types of cycle highway definitions, with one relating to goals and another relating to execution. Policies set out visions and goals that cycle highways should fulfil, while design manuals attempt to translate these visions and goals into physical design. Bridging policy and design manuals are funding requirements that define what types of infrastructure qualify for regional and national funding schemes. A definition in terms of goals refers to matters of policy, such as sustainability, traffic congestion, and the desirability of a fast, efficient, and equitable transport system. A second type of definition focuses on the design of cycling infrastructure to meet these goals, such as speed, directness, width, quality standards, and signage. The two types of definitions can be linked by examining how good design can serve policy goals. Practitioners believe that good design of cycle highways can induce commuters to cycle instead of travelling by car for commuting, and the main mechanism for this modes shift is better comfort and travel time and cost savings. This logic of using cycle highways to induce mode shift is tested by the research of Skov-Peterson et al. [3], on a Copenhagen case study, yet they found that most of the increased cycling along the new cycle highways is the result of cyclists switching from alternative routes, with "only a modest share (4–6%) of the bicyclists on the renewed routes switched to cycling from other transport modes" [3]. At the same time, their surveys showed improved cycling experience along the new route in terms of surface quality, lighting conditions, traffic safety, and personal safety [3]. These research findings suggest that cycle highways may not be meeting their desired policy goals for shifting commuter traffic towards cycling, but higher quality cycling infrastructure still impart benefits for existing cycle commuters and recreational cyclists. Thus, defining cycle highways in relation to the policy goal of achieving mode shift may not fully capture the intrinsic benefits of higher quality design that makes cycling a more comfortable mode of travel for existing users.

4.2. Non-commuting uses of cycle highways

Cycle highways are a challenge for practitioners because it is unclear how related concepts

such as "high quality", "functional", and "attractive" should be interpreted and how these criteria can be translated into physical design. On a policy level, cycle highways are conceptualized as functional infrastructures to reduce automobile congestion by encouraging commuting by bicycle [34]. Yet, even with measures to improve directness and flow, the slower speed of cycling over longer distances cannot compete directly motorized modes in terms of minimizing travel time. Attention to the quality of the surrounding environment can make cycle highways more attractive not just on the basis of time savings, but also for creating a pleasant experience for cyclists [22]. Practitioners are aware that the same cycle highways built to attract commuters also draw other uses such as recreation, sport, and tourism. For urban designers, these uses are considered optional activities that highlight the intrinsic attractiveness of cycling in relation to the environment, and a high level of optional activities are indicative of good quality physical environments. In reference to pedestrians, Gehl [35] defines optional activities as, "… taking a walk to get a breath of fresh air, standing around enjoying life, or sitting and sunbathing. These activities take place only when exterior conditions are favorable, when weather and place invite them" Gehl [35]. For cycling, a high proportion of non-commuting activity is an indication of good spatial quality, which also benefit commuter cyclists through intrinsic benefits such as better familiarity with one's surroundings, connection with other people, freedom and cognitive stimulation [24]. It is likely that commuter cyclists enjoy the positive intrinsic benefits of those gained by non-commuting cyclists, plus the quantified health, cost and travel time benefits of cycling [2], [9].

4.3. User experience from a cyclists' perspective

Practitioners recognize the importance of designing for a good cycling experience. When asked about what makes for an ideal cycling experience, interviewees engaged in broader concepts such as greenery, noise, weather, landscape and moving scenery. Practitioners benefit from being able to view a design in relationship to the potential experiences of people that their infrastructure seek to serve, and we found that practitioners draw extensively on their own experiences to talk about cycle highway design. A recent Dutch study by Goudappel Coffeng found that large enough differences between respondents that there is no average cycling experience and that it is more informative to understand cycle routes from the perspective of different cyclists. They identified five different user types and found that that many people cycle for both commuting and leisure, so there is not always a clear relationship between individual trip purpose and the characteristic of the cyclist [36]. A diversity of speeds on the cycle path also leads to a social problem of interaction between various users of the space [20].

It seems that the challenge with cycle highways, in the model of Hamilton-Baillie, is the quest to provide a uniform, regulated, and predictable environment for faster cyclists while also providing enough variety to satisfy the desire for a diverse, personal, and serendipitous environments for more relaxed, leisure cycling. Public transport research shows that the subjective feeling of waiting for a bus feels twice as long as being underway, and waiting time can be subjectively reduced by giving passengers an indication of expected arrival time [37]. The same logic can be applied to traffic lights or to the design of wayfinding elements. Wayfinding is generally focused on quality signage and readability at higher speeds, but

some practitioners also conceptualize wayfinding in terms of reference points and notable changes in physical environments. Lynch [31] discusses a multisensorial, albeit primarily visual, approach to wayfinding and ethnographic research by van Duppen and Spierings [38] shows that journeys experienced on a bike is also composed of transitory experiences such as smells, traffic, sounds and the weather. As cyclists experience each journey differently, these observations highlight the opportunity for a multisensory and inclusive approach to cycle highway design.

4.4. Flexibility in design

Practitioners tend to conceptualize and high quality standards in terms of wide paths, direct connections, quality of paving, and wayfinding, yet it is unclear to what degree positive experiences arise from well-designed infrastructure and traffic regulation devices versus aesthetic elements and social activity along a cycle highway. Some cycle highway designs include pedestrian paths and others do not. Some cycle highways include sections of shared streets with automobiles while other routes are completely separated from motor traffic. Cycle highways in the Netherlands permit heavy vehicles such as mopeds travelling up to 45 km/h while cycle highways in Germany only permit lighter e-bikes with a maximum of 25 km/h. There are opportunities to take advantage the mix of typologies seen on existing cycle highways like the RijnWaalpad in the Netherlands, and in plans for future cycle highways as illustrated in a feasibility study for Mannheim to Heidelberg connection [39]. We know that design concepts carry different meanings when applied to automobile landscapes [33] versus pedestrian environments [35], and the term “cycle highway” is taken more literally in some contexts than others. For example, the German RS1 stands in clear relationship with automotive highways through both the design of its logo as well as an image of a bicycle in the middle of an empty motorway [30]. As an alternative to “highway”, the Dutch also uses the term “fast bicycle routes” to describe their system of long-distance bicycle infrastructure in order to move the discourse away associations with automobile highways, but as revealed in the interviews, even the word “fast” is a point of contention [33].

In terms of design logic, cycle highway practitioners struggle with how the uniform, predictable, and regulated engineering of highway environments can be balanced with the diverse, vibrant, and human-scale design of pedestrian environments [27]. However, all participants recognize to varying degrees that the idea of a “highway” means something different for bicycles than for automobiles. “There needs to be a middle ground, but I do feel that in the current debate we sometimes tend to move too much to the engineering part,” says NL2 recounting the construction of the RijnWaalpad between Arnhem and Nijmegen in the Netherlands, “It’s something we, at that point, discuss it from a traffic engineering point of view, but during the process, we quickly discovered that this wasn’t enough.” As meeting minimum cycle highway standards is necessary for many projects to receive subsidies from the national and regional government, these funding criteria standards determine the basic physical form of cycle highways in terms of width, intersection frequency, lighting, and grading in various street and spatial typologies. Whereas these design requirements form the building blocks for the cycle highway typology, practitioners are still left with flexibility in terms of route choice and designing cycle highways to fit their surrounding context.

4.5. Limitations and Future Research

There are four limitations to this study that provide opportunities for future research. First, as there is growing awareness of the cycle highway concept outside of Europe, the views of European practitioners may not translate directly to other contexts. It would be interesting to explore how the cycle highway concept can be adapted to contexts with different planning agendas and a wider diversity of land use patterns and to work towards a framework for evaluation. Second, cycle highways have not been researched in relation to the perspective of cyclists themselves. It is clear that practitioners draw extensively from their personal experiences of cycling, but the exact meaning of experiences should be properly explored and defined from the perspective of various user groups in the context of cycle highways. From Jensen's [40] Staging Mobilities perspective, this paper explored staging from above in how planning, design, regulations, and institutions shape bicycle highways from the perspective of practitioners. In addition, a nuanced understanding of experiences should be obtained from users themselves and how cycle highways are staged from below by the activity of its users. Third, written knowledge, in the form of design manuals and policy documents have not been extensively reviewed in this paper. Practitioners derive their knowledge and framework of discussion from policy documents and design guidelines, so research focusing on those documents extensively would add depth to understanding how the process of designing cycle highways and other cycling infrastructure takes place. Fourth, practitioners have repeatedly mentioned that cycle highways can facilitate the use of e-bikes, and studies do show that e-bike users perform more trips and cycle longer distances than conventional cyclists [41], [42]. The discussion of user experience and behavior becomes increasingly important as we see an increasing heterogeneity of speeds and vehicle types such as e-bikes, scooters, and other personal electric vehicles sharing cycling infrastructure with human-powered transport.

Fig. 2. Example rural cycle highway. RS1, Essen, Germany (Photo Credit: George Liu).

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HOOFDSTUK 05

When bike sharing business models go bad: **Incorporating responsibility** *into* **business model innovation**

Thomas B. Long[a,1], Arnoud van Waes[b,1]

[a] Centre for Sustainable Entrepreneurship, Campus Fryslân, University of Groningen, Netherlands |
[b] Innovation Studies, Copernicus Institute of Sustainable Development, Utrecht University, Netherlands

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Abstract
Innovations to business models are particularly promising for tackling societal challenges. However, innovation outcomes can be unpredictable. To minimise negative impacts and enhance the success of business model innovation processes, we argue that socio-ethical issues must be incorporated and managed. Research on responsible innovation, which seeks socially desirable and ethically acceptable innovations via the incorporation of socio-ethical issues, is well developed but has often used a technocentric lens. Consequently, it is unclear how socio-ethical issues interact with business model innovation. We explore how business model innovation interacts with socio-ethical issues and aim to understand the ways responsible innovation can help inform business model innovation processes and outcomes. We do this by exploring platform enabled bike sharing business models in the Netherlands. We construct a theoretical framework considering purpose, process and product dimensions of business model innovation. Our results illustrate how socio-ethical factors can play a key role in the success or failure of business model innovation. We argue that without including socio-ethical factors explicitly within analytical lenses, that key elements may be missed, resulting in an incomplete picture of key business model innovation dynamics.

1. Introduction

Business model innovation (BMI) is seen as particularly promising in terms of tackling sustainability challenges, such as achieving sustainability mobility, as well as delivering business benefits (Chesbrough, 2010; Freudenreich et al., 2020; Geissdoerfer et al., 2018). The sharing economy is one example of a set of innovative business models, enabled by digital platforms, that are disrupting existing industries (Meilă, 2018; Owyang et al., 2013) and helping to tackled sustainability challenges (Belk, 2014; Curtis and Lehner, 2019). For example, car sharing platforms offer temporary access to cars, reducing consumption by increasing the use of 'idle goods' (Bondorová and Archer, 2017; Geissinger et al., 2019). Platforms also reduce costs and enable rapid scaling of innovations (Kolk and Ciulli, 2020).

However, as with other BMIs, the promise and potential of platforms, has often not matched actual outcomes and impacts (Acquier et al., 2017; Geissinger et al., 2019; Meilă, 2018). For example, the ''boomerang effect'' has shown that low cost access to shared vehicles (e.g. ride sharing) may increase their use at the expense of more sustainable options such as public transport, cycling or walking (Murillo et al., 2017). While the explosive growth of these types of platforms has created wider social and ethical issues such as privacy concerns, adverse impacts on public space, nuisance or tax avoidance (Frenken et al., 2020; Meilă, 2018; van Waes et al., 2020).

Platforms, as new innovative business models, show that even where sustainable advances are possible, that unexpected, unintended and negative impacts can occur. This raises the question of how best to manage BMI[2] in a way that delivers sustainability advances, while minimising unintended and negative impacts, as current traditional approach to innovation or risk management appear to insufficiently take account of these effects. Answering this question involves the synthesis of business model and responsible innovation literatures. Responsible innovation (RI) responds to this challenge by seeking to ensure that innovations avoid doing harm on the one hand, and provide positive impacts on the other, by taking socio-ethical issues into account through anticipative, inclusive, reflexive and responsive approaches (Stilgoe et al., 2013; Voegtlin and Scherer, 2017; Von Schomberg, 2013). RI seeks to go beyond only motivating positive outcomes (intention), to also enable positive outcomes, by incorporating an explicitly moral perspective to traditional innovation practices (Bennink, 2020); it emerges alongside similar techniques, such as Design Thinking, but takes a more explicit moral stance (Nathan, 2017; Pavie and Carthy, 2015). By combining the definitions of RI and BMI, a responsible BMI approach can be defined as the 'conceptualisation and implementation of new business models in a transparent and interactive process by which societal actors and innovators become mutually responsive to each other, with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its outcomes. Socio-ethical issues include social issues: where the issue at hand is beyond the control of single individuals, and where the issue creates conflicting opinions (e.g. how best to manage privacy); and ethical issues: those that require an actor to choose between options that must be evaluated as right (ethical) or wrong (unethical) (e.g. the 'trolley problem' faced in the development of self-driving cars).

However, the issue of 'responsible' BMI is largely ignored within both the RI and BMI literature. For instance, one the one hand, while most definitions of sustainable business models explicitly or implicitly include ethical concerns (Stubbs and Cocklin, 2008), most do not include the responsibility to 'avoid harm', focusing only on the responsibility 'to do good'.[3] Some limited engagement with the concept of 'value destroyed' is the only exception (Bocken et al., 2013; Yang et al., 2017). On the other hand, the RI literature largely takes a technological focus, with those studies exploring non-technological aspects either omitting the business model or engaging with it superficially (Jarmai et al., 2020; Long et al., 2020a,b). These omissions are problematic, as business models influence the success and impact of technologies and how they are deployed and used (Chesbrough, 2010), meaning it is likely that the business model also influences the socio-ethical impacts of a technology. This raises the prospect of 'responsible technologies' being applied 'irresponsibly' due to the business model used.

In this research, we therefore aim to improve our understanding of the role of socio-ethical factors in BMI processes, and the influence they have on BMI outcomes. We posit, that for responsible outcomes, socio-ethical factors must also be integrated into BMI processes (Hope and Moehler, 2015), as well as technological innovation processes. We aim to explore the interplay between socio-ethical factors and BMI processes and design. We thus seek to answer the following research question: *How does BMI of platform enabled bike sharing interact with socio-ethical aspects?*

By tackling this question, we will improve our understanding of how to avoid unintended and negative outcomes, potentially improve our understanding around BMI failure, as well as critical role BMI for sustainability more broadly (Bocken et al., 2014; Chesbrough, 2010; Schaltegger et al., 2016). Established factors, such as triple bottom line issues or levels of resource allocation (Geissdoerfer et al., 2018), play key roles in the success or failure of BMI. However we argue that incorporating an RI lens and the consideration of socio-ethical factors into analysis of BMI creates a more complete picture of BMI processes and impacts and introduces socio-ethical factors as an additional category for BMI failure and design-implementation gaps. In doing so, we answer calls to further explore the barriers and challenges e in this case, socio-ethical issues e facing BMI (Geissdoerfer et al., 2018). This will be of value to those innovating business models and stakeholders, including communities, users and governments.

Free-floating bike sharing

To realize our research aim, we explore the emergence of a new generation of bike sharing enabled by platform business model innovation: free-floating bike sharing (FFBS). This represents an interesting case, as advocates claim FFBS as an innovative business model able to achieve sustainability mobility.[4] Although FFBS is a relatively new phenomenon, pioneering studies demonstrate how the emergence of this business model created wider socio-ethical issues. The business model and launching strategies are associated with causing "significant disruptions and stresses" (Ma et al., 2018; Me´dard de Chardon, 2019; Meilă, 2018; Spinney and Lin, 2018). Recent studies have documented a range of impacts, such as the privileging of access to these new forms of mobility for more affluent groups (Me´dard de Chardon,

2019), through to companies taking advantage of the friendly image of bikes for gathering of personal data for marketing purposes (Duarte, 2016). Spinney and Lin (2018) highlight how platform enabled bike sharing has given rise to new terrain of capital accumulation. While, van Waes et al. (2018a) and Petzer et al. (2020), discuss the impact of FFBS on public space leading to public nuisance. Curtis and Mont (2020) observe that the free-floating bike sharing market in China was saturated by hyper-competitive companies, which created an oversupply of (often low-quality) bikes, leading to under-utilized bikes. van Waes et al. (2020) show non-collaborative approaches of how business models are launching in cities without formal consent. Hence, such platforms (such as free-floating bike sharing) are not sustainable by default, meaning their business models require strategic and deliberate design and implementation.

To this end, this research set out to explore the incorporation of responsibility into BMI. The remainder of the paper is structured as follows. In section 2, we explore key literature, before articulating a theoretical framework. In section 3, we outline the empirical context and methods used to answer the research question. In section 4, we describe different companies and city responses. In section 5 the results of applying the framework are described. In section 6 we discuss our findings. We end with a conclusion.

2. Literature review

2.1. Responsible innovation

RI seeks to solve grand societal challenges while also avoiding potential unforeseen and negative consequences that can occur with innovation (Von Schomberg, 2013). Initially conceived within a science and technology domain under the term responsible research and innovation (Burget et al., 2017), RI is widely defined as: "a transparent, interactive process by which societal actor and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)" (Von Schomberg 2013:1). More recently, RI is increasingly seen as an umbrella concept (Grunwald, 2011), with wider definitions emerging from management science highlighting three dimensions as the responsibility to 'do no harm', the responsibility to 'do good', and the responsibility of 'innovation governance regimes' to facilitate these aims (Voegtlin and Scherer, 2017). We argue that these definitions are not mutually exclusive and draw on both the science and technology studies-based definition of Von Schomberg (2013) by incorporating the frameworks developed by Stilgoe et al. (2013) and Stahl et al. (2017) while recognising the value in the umbrella definition offered by Voegtlin and Scherer (2017), which is able to incorporate the science and technologies studies perspective, as well as management-based approaches, such as BMI.

The responsibility to avoid harm has largely been pursed through forward looking frameworks, which seek to overcome the deficiencies involved in retrospective regulatory approaches (Stilgoe et al., 2013). These approaches focus on process, such as the 3Ps framework; this examines socio-ethical issues via purpose (the motivations and justifications), process (the

activities involved in the innovation process), and product (or outcomes, and their societal and environmental impacts according to specific indicators) (Stahl et al., 2017). Alternatively, the AIRR framework, highlights four key dimensions, including anticipation, inclusive deliberation, reflexivity, and responsiveness (Stilgoe et al., 2013). Anticipation requires that 'what if … ' questions are asked by innovators, which helps to ensure an openness to many possible outcomes and to think systematically about possible impacts, seeking to address dilemmas of control (Genus and Stirling, 2018). Inclusive deliberation encourages a diverse set of societal stakeholders to be included in the innovation process. While reflexivity focuses on questioning and exploring the moral boundaries and roles of innovators. The fourth dimension, responsiveness, seeks that the necessary resources and capabilities are available to appropriately respond to any issues raised through the first three dimensions.

The responsibility to do good and generate positive outcomes draws on approaches such as eco-innovation, shared value creation or sustainable business models (Boons and Lüdeke-Freund, 2013; Markman et al., 2016; Porter and Kramer, 2011; Schaltegger et al., 2016), which we will explore in more detail in the following sections, and includes efforts to link more established inclusive innovation approaches, such as 'Design Thinking' (Nathan, 2017; Pavie and Carthy, 2015). While a key third responsibility highlights the importance of governance, raising questions of how best to ensure that innovation processes incorporate and adhere to the responsibility to do no harm and do good (Scherer and Voegtlin, 2020; Voegtlin and Scherer, 2017).

While research on RI in business or industry settings is growing, to date it has failed to explore innovation within business models. Instead, it largely focuses on technological innovation, for example within the health, agri-food or ICT sectors (Eastwood et al., 2019; Gremmen et al., 2019; Long et al., 2020a,b; Stahl et al., 2017), or taking conceptual or review approaches to establish the relevance of the concept for industry actors (Halme and Korpela, 2014; Nazarko, 2019). Critically, engagement with business models or related innovation process are largely missing or superficial (Hope and Moehler, 2015; Jarmai et al., 2020; Long et al., 2020a,b).

2.2. BMI, sustainability and responsibility

Business models are conceptual tools that show the underlying value creating logic of organisations (Osterwalder et al., 2005). They define how a business creates value, chooses customers and users, which markets to enter, and are generally seen to include a value proposition, revenue model, key activities and key resources (Boons and Lüdeke-Freund, 2013; Chesbrough, 2010; Osterwalder et al., 2005; Osterwalder and Pigneur, 2013).

BMI is a key lever for enhancing sustainability, termed Sustainable BMI (Geissdoerfer et al., 2018). Sustainable BMI focuses on creating sustainable value, through changes to how an organisation, and its wider network, create value (Bocken et al., 2014). While we focus on the broader category of BMI, sustainable BMI research is helpful and relevant due to its focus on wider sustainable value, and explicit incorporation of societal and ethical factors (Boons and Lüdeke-Freund, 2013; Geissdoerfer et al., 2018).

In terms of normative BMI guidance, Boons and Lüdeke-Freund (2013) proposed that: (1) the value proposition integrates environmental and/or social additional to economic ones; (2) the supply chain is managed responsibly; (3) the customer interface motivates users to take responsibility; and (4) the financial model takes account of social and environmental externalities, ensuring fair distribution. While, in their review of sustainable BMI, Geissdoerfer et al. (2018) find that SBM definitions generally incorporate pro-active multi-stakeholder management, the creation of both monetary and non-monetary value for a broad range of stakeholders and incorporate a long-term perspective. The importance of stakeholder values is also well established in the SBM literature (Breuer and Lüdeke-Freund, 2016; Randles and Laasch, 2016).

Hence, clear synergies are observable between range of aspects of RI and sustainable BMI. Both use grand societal challenges as points of departure, via the aims or 'purpose' of an innovation, or the value proposition of a business model. Additionally, pro-active stakeholder management and stakeholder theories (Evans et al., 2017; Freudenreich et al., 2020) correspond well with stakeholder inclusion, and concepts of inclusive deliberation found in RI dimensions (Lubberink et al., 2017; Stilgoe et al., 2013). Indeed, one of the few contributions on responsible business models highlights the importance of stakeholder values to the business model design process (Hope and Moehler, 2015). However, such contributions are often focused on 'doing good', failing to conceptualise this deliberative inclusion process as one that also involves avoiding harm. Indeed, RI arguments that inclusive deliberation improves innovation outcomes and enhances societal embeddedness is corroborated by recent BMI research drawing on stakeholder theory (Freudenreich et al., 2020). Business modelling tools provide a rare exception, briefly highlighting the avoidance of harm, either through the concept of 'value destroyed' (Yang et al., 2017), which tries to capture negative impacts, within a value conception, or more broadly through negative externality conceptions (Bocken et al., 2013).

Yet, what a RI lens may add to the BMI literature are additional explanations for why positive 'do good' outcomes occur and/or are successfully embedded in society, or how BMI manages to avoid harm. Indeed, recent calls within the BMI literature highlight that there is a current lack of understanding why business models fail, including in terms of the design-implementation gap, both issues that can be attributed to socio-ethical factors, according to RI (Geissdoerfer et al., 2018; Stilgoe et al., 2013; Voegtlin and Scherer, 2017; Von Schomberg, 2013).

3. Methods

3.1. A framework for responsible BMI

In this section, we synthesise previous RI and BMI approaches to form a framework to explore how socio-ethical factors interact with BMI processes. A central tenet of our framework asserts that socio-ethical factors influence BMI and that BMI and the business models impact socio-ethical factors (see Fig. 1).

We incorporate the '3Ps' approach to RI as this provides a broad and inclusive framework able to capture input, process and impact factors of BMI (Stahl et al., 2017).

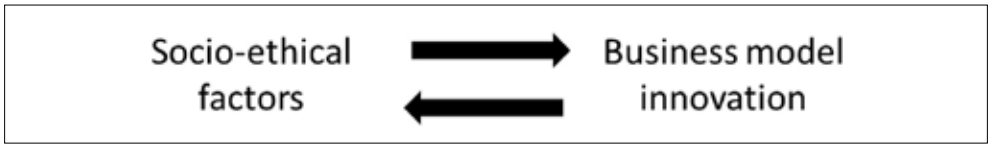

Fig. 1. Interaction between socio-ethical factors and business model design and operation.

Purpose considers input factors, highlighting the motivations for BMI, the extent of any initial awareness of socio-ethical factors, and to what extent grand societal challenges represented an input into the formation of the value proposition e a key similarity between RI and BMI (Boons and Lüdeke-Freund, 2013; Stilgoe et al., 2013; Voegtlin and Scherer, 2017). The context, motivations, values and philosophy of the organisation and its innovators are all key data, providing explanations for why certain processes were (or were not) undertaken and provides a point of departure. For instance, it is likely that the motivations and values of the entrepreneur (Bronson, 2019; Randles and Laasch, 2016) influence the innovation process, such as levels of inclusivity, and the outcomes.

Process focuses on how the BMI process unfolds. Here, we draw on the AIRR framework dimensions of anticipation, inclusivity, reflexivity and responsiveness (Stilgoe et al., 2013). Anticipation covers the extent to which companies consider and anticipate potential (socio-ethical) impacts of their BMI; here we seek to capture not just expected 'value' additions, to the innovators, users or stakeholders (Yang et al., 2017), but also wider socio-ethical impacts. Inclusivity considers who is deliberately included in the innovation process, and how. For example, whether stakeholders are just consulted versus being included in a co-creative approach. Stakeholder inclusion is a core component of BMI (Freudenreich et al., 2020; Stubbs and Cocklin, 2008), however, RI suggests that for successful innovation, stakeholder inclusion must include consideration of socio-ethical issues (Lubberink et al., 2017), where social and ethical aspects are explicitly considered. It should be noted that it is not the stakeholder inclusion that is seen as novel, but rather the explicit incorporation of social and ethical themes and topics in the process. Reflexivity is used to describe the extent to which companies' question or consider their role and relevant moral boundaries. Through the responsiveness dimension, we seek to capture adjustments to the business model and/or innovation process. The influence of these RI dimensions differs according to the values and motivations evident in the 'purpose' aspect (Bronson, 2019) and stage of the innovation process (Long et al., 2020a,b), for instance, responsiveness is likely to be more important towards the end of the innovation process, compared to anticipation, which may be more important towards the beginning. Fig. 2 provides a simplified representation of the conceptual framework, while Table 2 gives an overview of the key concepts and their operationalisation.
Product focuses on the output of the BMI process: the new business model launched. We utilise a simplified 'value' based approach in order to judge and structure how the business model interacts with its environment. We distinguish between the Value Proposition (what value is provided and to whom), Value Creation & Delivery (how is value provided) and Value Capture (how does a company make money and captures value), while incorporating principle of responsible and sustainable business models (Bocken et al., 2014; Boons and Lüdeke-Freund, 2013; Chesbrough, 2010; Hope and Moehler, 2015; Osterwalder and Pigneur, 2013; Von Schomberg, 2013).

3.2. Data collection and analysis

We explore how BMI interacts with socio-ethical factors through the context of bike sharing in three Dutch cities, illustrating different impacts and responses: Amsterdam, Rotterdam and Utrecht. This is an interesting setting as the Netherlands is a typical cycling country and the technology used (i.e. bicycle) is long-standing and widely accepted.[5] This allows business model effects to be isolated more easily from novel technological effects. We examine seven innovative bike sharing companies, analysing the BMI process (covering conceptualisation and implementation) and the socio-ethical impacts. We focus on 'one-way free-floating' bike sharing business models (van Waes et al., 2018a), which have been met with mixed results across cities. Given the novelty of these bike sharing systems and the propensity for start-up companies to be dynamic and subject to change, we took a case study approach (Yin, 2012).

Data was collected from 2017 to 2020 from primary and secondary sources. Semi-structured interviews were conducted in two rounds (See Table 1 for an overview. Interviews are referred to in the text as r1 through to r12). Two rounds of data collection allowed us to capture and reconstruct the unfolding of FFBS in different cities. During the first round (2017), FFBS was in the start-up phase and launched by different companies in Amsterdam, Rotterdam and later in Utrecht. Interviews were conducted with founders and/ or managers of FFBS companies. Interviews were structured according to the business model dimensions (mainly focusing on Input and Product factors in Table 2). One company was not open for an interview, so insights about this company (Obike) were generated through secondary data sources.

During the second round (2020), the bike sharing sector had stabilized. Market saturation took place (i.e. some of the early companies left and new companies entered) and municipalities implemented regulations. Table 2 shows the launching date per company in each city, illustrating their operating period. Policymakers were also interviewed during the second round to understand how municipalities dealt with the impacts of FFBS. This round of data collection was oriented at BMI and the end product (mainly focusing on Process and Product factors in Table 2).

Due to the dynamic character of the sector and the companies, the data collection approach had to be adaptive and flexible, and as such, was iterative in nature, with initial interviews informing subsequent ones (Easterby-Smith et al., 2012). Interviews took around 60 min, were conducted face-to-face or via video chat apps and recorded for transcription.

In addition to interviewing, market and regulatory dynamics were closely observed and monitored. For all cases, data was triangulated using secondary sources (newspaper articles, company websites & press releases, policy documents). Through triangulation we sought to further validate the data through cross verification of additional sources, using different instruments (secondary courses versus primary interview data). The interview and secondary data were used to reconstruct implementation strategies, explore the final business model configuration as well as give insights into the BMI process. The data allowed the impacts of the systems (positive and negative) and associated business models to be considered.

Analysis involved extracting relevant text fragments from the transcribed interviews and supporting documentary evidence that could help answer the research question. This text was then coded into the framework shown in Fig. 2, covering purpose (inputs), process (BMI) and product (the business model). Table 2 shows how the conceptual framework was used for coding the data. Following this, we sought to identify patterns among the companies (Yin, 2012), which produced unique case specific themes and patterns. These themes and patterns could then be compared between companies (companies compared to one another).

Fig 2. Conceptual framework.

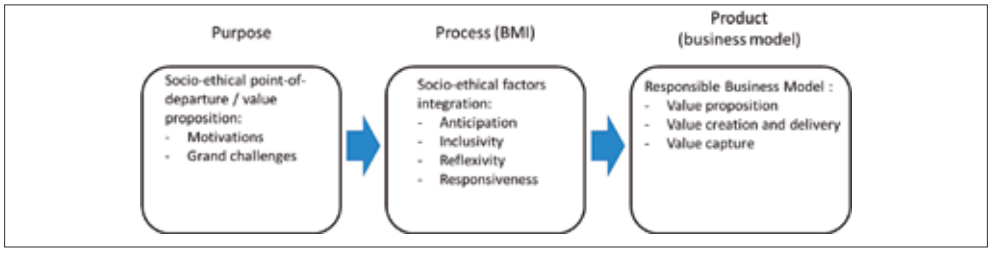

Table 1. Overview of interviewees.

		System	***Interviewee***	***Date***
Round 1	r1	Donkey Republic	CEO and co-founder	3-9-2017
	r2	HelloBike	Managing director	1-2-2017
	r3	FlickBike	Founder	27-9-2017
	r4	Ofo	Country manager	23-8-2017
	r5	Mobike	Advisor	15-2-2018
	r6	Donkey Republic	Local manager Amsterdam	8-2-2018
	r7	Donkey Republic	Local manager Utrecht	5-6-2019
Round 2	r8	Donkey Republic	CEO and co-founder	5-2-2020
	r9	City of Rotterdam	Project manager and advisor bike sharing	26-2-2020
	r10	City of Utrecht	Project manager bike sharing living lab	2-3-2020
	r11	Mobike	Manager Rotterdam	26-2-2020
	r12	Jump	Head of Benelux Policy	23-3-2020

3.3. Research context: business model launch and city responses

In this section we describe how FFBS was introduced and responded to in cities.

3.3.1. Introduction of free-floating bike sharing companies to the Netherlands

Bike sharing is nothing new to the Netherlands; the first public bike sharing system in the world (Witte Fietsenplan) was founded in 1965 in Amsterdam. Although this model ultimately failed, a radical idea was born. Since 2004, the national railways operate a successful system (OV-fiets) focusing on the last-mile for train passengers. This dominant model faced competition from 2016, as a new generation of bike sharing business models emerged, first in Amsterdam, and later in Rotterdam and Utrecht.

These new business models aimed at facilitating one-way journeys. The value proposition seeks to allow bike pick-up and drop-off anywhere in the city, providing more freedom than other models. Apps are used to highlight the location of available bikes, with the aim that there is always one within walking distance. This model also means there is limited-to-no physical infrastructure, but that parking space within public areas is an important resource. This contrasts to other, traditional bike sharing models, such as 'two-way station-based', where bikes are typically hired from a train station and must be returned to that point after (for example, the above mentioned Dutch OV-fiets), or 'one-way station-based' systems, with a network of physical docking stations in a city and the bike can be parked in these stations (for example, Santander Cycles in London and Ve´lib in Paris) (van Waes et al., 2018a).

One of the first new players was Hellobike (Amsterdam-based start-up founded in 2016) that placed 500 bikes at Zuidas business district having won a tender in 2016. From summer 2017, several other companies introduced bikes and within a few weeks 5000e7000 bikes were put on the streets of the city centre (Gemeente Amsterdam, 2017). The bikes were placed on the streets overnight, often without formal consent from the municipality. Among these companies were Flickbike (Amsterdam-based startup, founded in 2017), Donkey Republic (founded in 2015 in Denmark) and Obike (founded in 2017 in Singapore). The latter company was also active in Rotterdam. In this period, the two largest global bike sharing companies, Ofo and Mobike (both founded in China in 2016), opened offices in the Netherlands. Ofo operated in Rotterdam and since 2017, Mobike operated in Rotterdam, Delft and The Hague. Since 2019 e-bikes are provided in Rotterdam by Jump. Jump was originally founded as Social Bicycles in 2010. In 2018 the company rebranded into Jump, and was acquired by Uber in the same year. In 2020 the company was acquired by Lime, a micro mobility company from the U.S.

3.3.2. City responses

The three cities show different responses to FFBS (Table 3 provides an overview of FFBS entry and exit and municipal responses). Within a few months, the rapid growth and its impacts led to a ban on all FFBS companies in Amsterdam in October 2017 (See van Waes et al. (2018a) for a thorough description). FFBS had limited public and political support due to problems with bike parking and the management of public spaces (O'Sullivan, 2017). With no clear rules, the city initially proposed a two-year pilot with three providers, a maximum fleet of 3000 bikes and minimum use of bikes of 4 trips per bike per day (Gemeente Amsterdam, 2017).

In this institutional vacuum, companies tried to influence policy in Amsterdam, proposing alternative regulations and pilot projects. At the same time some companies relocated to other cities such as Rotterdam. Eventually the municipality decided in 2019 that FFBS would not be allowed due to limited public support,[6] likely impacted by the practices of many of the companies.

Table 2. Operationalisation of conceptual framework.

Socio-ethical factors and definitions	***Empirical evidence (i.e. examples of what to look for/indicators)***
Purpose Motivations and grand societal challenges: The extent of any initial awareness of socio-ethical factors, and extent grand societal challenges represented are an input into value proposition formation	• Motivations, values and philosophy of the organisation • Awareness of potential socio-ethical aspects related to business model • Mentions of links between BMI and grand societal challenges • Additional motives for operating business model (e.g. marketing, data collection, building a mobility platform, etc.)
Process Anticipation: efforts taken to consider and anticipate potential socio-ethical impacts	• Awareness about potential unforeseen impact of business model • Systematic efforts to think about and avoid potential negative impacts as well as highlight new innovation opportunities and what desirable futures look like - Formal or informal use of scenario planning, foresighting techniques, horizon scanning, or similar
Inclusivity: considers who is included in the innovation process, and how	• Efforts to include a diverse set of societal stakeholders in the innovation process (e.g. engagement with cities, companies, users, universities) • Engagement efforts through consulting, collaboration or other deliberative or dialogue-based approaches, which include consideration of socio-ethical issues • Efforts to manage stakeholders locally, including raising and discussing socio- ethical aspects
Reflexivity: extent to which companies question their own role and relevant moral boundaries	General reflections on industry, business models, current and future developments • Reflections and awareness about roles and responsibilities • Reflection and consideration of the internal and wider values and systemic aspects that influence socio-ethical aspects (e.g. contemporary industry practice around the collection of user data and the ethics attached to this, or reflection of societal impacts of regulation)

Socio-ethical factors and definitions	***Empirical evidence (i.e. examples of what to look for/indicators)***
Responsiveness: adjustments to the business model and/or innovation process in response to issues raised relating to anticipation, inclusivity and reflexivity	• Alterations made to the business model in response to: negative societal impacts, changing local circumstances (e.g. changing discourse, limited public acceptance, introduction of legislation) and stakeholder (community, regulator) feedback or responses.
Product Value proposition	• Degree to which applied value propositions incorporate grand societal challenges (e.g. linking to challenges such as health, environment, social inequality), For whom is value provided? • Socio-ethical impact of applied value proposition, for example, ensuring access for wide set of consumers (non-exclusion of disadvantaged groups) and consideration or recognition of impacts on local communities
Value creation & delivery	• Activities that reflect principles of sustainability and responsibility • Processes to manage and maintain bike sharing systems (e.g. redistributing bikes, managing disputes or complaints) • Practices that reflect responsible use of public parking space • Lifecycle: footprint and lifetime of bikes • Bike's user experience • Quality and safety standards • Handling of user data • Quality and safety standards
Value capture	• Primary (e.g. bike sharing fees and subscriptions) vs secondary or additional sources of income (e.g. advertisements, data collection) • Growth strategy and ethos

Rotterdam was more welcoming towards FFBS. Initially, in 2017, Obike, Ofo, Mobike and Donkey Republic operated in Rotterdam and the municipality was pleased with their presence (r9). During a pilot phase, the municipality consulted the companies (e.g. quarterly meetings), introducing a licensing system in 2019 which creates agreements with companies (e.g. minimum use per bike per day requirements, rules with regards to customer care, maintenance, redistribution, data sharing). This enables the municipality to intervene in case of nuisance, for example when shared bikes are lying around (NRC, 2019). In 2020, the market has changed e some companies left, and newcomers entered the city e with Mobike, Donkey Republic and Jump as the only remaining companies.

The Amsterdam FFBS ban also prompted companies to relocate bikes to Utrecht. Like Amsterdam, Utrecht is considered a typical cycling city as a substantial proportion of urban movements is done by bike (see footnote 4). However, the municipality was cautious following Amsterdam's experience and set up a two-year living lab experiment, in collaboration with Utrecht University, to learn if and how FFBS can contribute to urban mobility. Donkey Republic is the single FFBS company in Utrecht, operating 700 bikes. The company had to agree on requirements with regards to dedicated parking zones, maintenance and service and sharing user data (r10).

Table 3. Month of entry and exit of companies in Amsterdam, Rotterdam and Utrecht and local responses.

	Amsterdam	***Rotterdam***	***Utrecht***
Companies Hellobike	Nov 2016-current	e	e
Flickbike	Jun 2017e Oct 2017	e	e
Obike	Jun 2017e Oct 2017	June 2017eJune 2018	e
Donkey Republic	May 2017e Oct 2017	Aug 2017 e current	April 2019 e current
Mobike	e	Nov 2017 e current	e
Ofo	e	Nov 2017e2018	e
Jump	e	Oct 2019 e current	e
Municipal response	Banned FFBS within 3 months after	Welcomes multiple companies and has a licensing	Selected a single company based on a tender procedure
(policy)	introduction	system that sets rules	and set up a living lab

Fig.3. Analysis of FFBS business model interaction with socio-ethical factors.

Purpose	***Purpose***	***Purpose***
Motivations & societal challenges: • Solving 'last mile' issue • Sustainable mobility	**Inclusivity:** • (Shift to) cooperative/co-creative approaches (e.g. agreements, living lab **Responsiveness:** • Recognition of problems and BM adjustment **Reflexivity:** • Reflections about the field of bike sharing and regulations	**Value poposition:** • For users: flexibility and sustainable mobility • For cities: sustainable mobility without additional pulic funding **Value creation and delivery:** • Inclusive, co-creative approaches with cities, researchers and social working places (data sharing) • Maintenance, redistribution, reuse of bikes **Value capture:** • Fees and subscription
Underlying motives: • Technology companies: data driven business models • Transparency about hidden value proposition	**Not anticipated:** • Impacts on public space not anticipated **Non inclusive:** • Minimal engagement/ non-cooperative **Unresponsive:** • Failure to respond to issues (community backlash/ abuse of public spaces **Reflexivity:** • Limited	**Value creation and delivery:** • Uncooperative approache • Limited maintenance and bike not attuned to local standards **Value capture:** • Platform integration • Growth strategy: release first, ask permission later

4. Results and analysis

In this section, we apply the framework developed in section 2.3 e a populated version can be found in Fig. 3. We highlight motivations of different companies, key BMI events, before examining the key business model elements related to noted socio-ethical impacts.

4.1. Purpose

4.1.1. Motivation and grand societal challenges

As per the sampling strategy, all cases shared a basic business model e FFBS e aimed at providing first/last mile transportation and contributing to sustainable mobility, highlighting that all cases had a grand societal challenge motivation (or purpose). Companies also sought to address local (Dutch) challenges, such as the abundance of bikes, abandoned 'orphan' bikes, bike parking pressure or mobility poverty.[7] For example Ofo, Donkey Republic, Mobike and Flickbike aimed to solve the problem of 'orphan' bikes and decrease bike parking pressure (r1, r3, r4, r5) "If something breaks, people leave their bikes and buy a new one. If people from Amsterdam no longer have their own bike but rather have access to a shared bike, this will lead to more space in the long term". Besides start-ups, also existing companies entered the market, complementing existing mobility services. For example, the e-bikes of Jump are accessible through the Uber app. Bike sharing is an addition to their existing e rides e service: the bikes are mainly used for short trips, during rush hour in city centres (r12).

Remarkably, some cases show additional motives that raised potential socio-ethical issues. For example, Ofo views itself as part of a wider 'internet of things' ecosystem which values data collection. The company considers itself a platform e comparable with platform-based companies Uber and Airbnb e that connects bikes and bike sharing companies rather than just owning and producing bikes: ''We always say that we are a platform. Our dream is that in ten years, with one Ofo account, you can open all the bicycles on the streets, in every country.'' (r4). The company also highlights they differ from traditional bike sharing companies: ''We never call ourselves a bike rental business. Just like Uber never called themselves a taxi business. They call themselves an internet company. The business model of an internet company is based on volumes. The bigger volumes we get, the bigger the profit we will earn in the future.'' (r4). This quote highlights first, that the FFBS companies relied on high volumes for their profitability, which likely influenced their launch strategies. Second, this quote highlights the potential additional value propositions around data collection and digital payments, partly reflected by the close links between FFBS companies and large technology and e-commerce companies. The could change the aim to one of maximising interactions and use of the platform to create value, rather than providing bike sharing. Chinese e-commerce giant Alibaba invested in Ofo and since 2018 Mobike's parent company is Meituan-Dianping, China's largest provider of on-demand online services, such as food-delivery.[8] On a similar note, Mobike and Ofo are integrated with widely used Chinese social-media (such as WeChat e a multipurpose app by Tencent, one of the largest internet technology companies in the world), mobile payment (such as Ali-pay) and food-delivery platforms.

This integration enables a large group of potential users to be reached. Data obtained through users of FBSS - using an app to locate and (un)lock a bike - could be commercially valuable (e.g. geo-based advertising), showing a potentially 'two-sided' business model, with a hidden value proposition. The nature of the model and the collection and use of this data raises questions around transparency and privacy.

Purpose can also change over time. For example, Jump was founded as Social Bicycles, a FFBS company that e like any urban transportation company e collaborated and established long term partnerships (incl. contracts and agreements) with cities to operate bike sharing systems and contribute to sustainable mobility. However, after being acquired by Uber the approach somewhat changed from this collaborative approach to an approach that did not involve close engagement with authorities (rather followed a 'launch first ask questions later' approach).

4.2. Process

The elements of the BMI process were more varied, interacting with RI dimensions, which act as differentiators between the cases.

4.2.1. Anticipation

The failures to anticipate problems highlight issues of anticipatory capabilities in relation to the BMI process, including implementation of the business model via the entry strategy. Some companies did not recognise the potential problems that could result from releasing FFBS into space restricted streets. While these models may be appropriate in urban locations, such as Chinese cities with a prominent last-mile problem, limited use of private bikes and availability of parking space, within Amsterdam and Rotterdam they were problematic, causing congestion in public spaces (r9) (Koops, 2017).

Examination of the entry strategies suggests some companies (e.g. Obike) expected their FFBS system of thousands of distributed bikes to manage itself, without further human support on the streets (r9). Other cases were more aware of local contexts from the start. For example, the business models of Hellobike and Donkey Republic combined 'dockless' bike sharing with designated parking zones,[9] avoiding the 'uncontrolled' parking issues. Companies (e.g. Donkey Republic, Mobike, Flickbike) also had street operation personnel, responsible for maintenance and redistribution of bikes. This raises the question e to be tackled next e of why these cases seemed to have enhanced adaptive capacity, and so be better able to foresee potential issues and mitigate accordingly.

Inclusivity acts as a differentiator among the cases. Although some companies (i.e. Obike, Flickbike, Ofo) claimed they informed the city about their operations, there was no formal engagement or consent with the authorities (r3, r4). A 'launch first, answer questions later' approach helped capture market share, but also resulted in lower inclusivity levels.

The lack of a legal base to regulate these innovative business models (r9) meant there were no formal procedures for dialogue, showing how also urban authorities (i.e. Amsterdam and Rotterdam) were unprepared and lacked anticipative capacity (due to the very quick and unannounced launch). At the same time, these urban authorities were responsible for most of the engagement efforts, aimed at stimulating dialogue with companies and working towards a collaborative and inclusive approach to BMI, through established systems. In Amsterdam and Rotterdam, companies were consulted prior to decisions about regulatory frameworks (r9). In Utrecht, a single company was selected to participate in a living lab. This resulted in fewer issues and highlights co-learning from the Amsterdam experience regarding inclusivity and anticipation (r10) (Te Brömmelstroet et al., 2020).

The recruitment of local staff e which varied among the cases e emerged as a facilitating factor for foreign companies to engage with local authorities and try to establish longer term relationships. For example, Mobike hired a local bike sharing professional with an established network as a manager, enhancing sensitivity to the local (socio-political) context (r5). In stark contrast, Ofo sent a single Chinese employee to launch across the whole Benelux region in only three months (r4).

4.2.2. Reflexivity

The cases show varied reflexive capacity about roles and responsibility in the FFBS market. For example, some advocated a role for government regulation: 'A bike sharing system will only work when regulated by the municipality' (Cornelissen, 2017). In contrast, other companies did not understand measures taken. For example, Obike called Amsterdam's ban of FFBS a 'hate campaign'.

There was also recognition of the impact of irresponsible behaviour and the potential of reputational damage to FFBS in general: ''Since Obike launched in the Netherlands bike sharing got a negative reputation. They had a different approach: quickly making money by putting thousands of bikes on the streets without further management or maintenance and without taking the urban environment into account'' (r11).

4.2.3. Responsiveness

In response to unintended negative impacts of FFBS, several firms continued the innovation process, adjusting the BM. Municipalities played an important role in stimulating this subsequent BMI as they regulated bike sharing through pilots, living labs, assessments and monitoring. Companies can be split into those that responded and adjusted to issues, such as concerns around the use of public space, and those that did not.

In relation to the uncontrolled parking of bikes, and congestion of public spaces due to FFBS, some providers (e.g. Donkey Republic, Flickbike) proposed to work with designated public or private parking areas, adjusting their business models to align to the city's specific contextual needs (r3, r6) (Voermans, 2017).

Some companies adjusted their revenue model, taking local challenges as an opportunity to attract new users. For example, bike parking pressure at train stations can be relieved through bike sharing. Mobike and Donkey Republic collect private bikes (often a second bike parked at a train station) and in return owners could receive a subscription for bike sharing (r7, r9). In Rotterdam, these bikes were donated to social community projects and low-income families. Companies were also responsive to national and local governments' ambition for interoperable bike sharing enabled by an overarching platform allowing access to different systems. Several bike sharing companies took up this idea; Mobike: ''Eventually we want you to be able to access a bike everywhere with one account, whether this is a station-based bike like OV-fiets, a free-floating bike like Mobike or a lease bike like Swapfiets'' (Van Tongeren, 2018).

4.3. Product

The business models that emerged from the process described, went through adjustments in some cases. In the following section, rather than providing an exhaustive description, we draw attention to the most interesting aspects of the business models in relation to socio-ethical issues.

4.3.1. Value proposition

The value proposition of FFBS companies is similar across all cases: providing access to a bike that one can take and drop a bike anywhere in a city (flexibility).[10] For cities, FFBS companies provide an attractive proposition, as they do not demand public funding in contrast to the traditional bike sharing systems with physical docking stations. However, the 'free-floating' aspect was adjusted (in line with responsiveness dimensions) in some cases in response to restrictions by authorities. Although these adjustments e from free-floating to a system with dedicated parking zones e also raised viability questions, as highlighted by oBike: ''Our system works optimally when you are able to pick a bike every 200 m. Only then it's able to grow, we can see where there is a demand for bikes and where not. All the pilots in cities with only 20 bikes won't work. It is a pity that the municipality took this drastic measure. This gives bike sharing a bad name.'' (Voermans, 2017).

This exposes a tension between a 'responsible' value proposition e the ability to ride and park anywhere e and profitability. Additionally, value proposition aspects with questionable business ethics included: additional, hidden, value propositions around data and financing (creating two-sided business models), which drove some cites to ask for further compliance. And, excluding particular areas from bike sharing by the company. For example, the municipality of Rotterdam suffers with 'mobility poverty' in less develop areas, which could be alleviated through bike sharing (r9). There is evidence they do not provide their service in such areas, due to low demand and risk of vandalism (r11, r12) (van Veelen, 2020).

4.3.2. Value creation and delivery

Value creation and delivery aspects relevant to socio-ethical issues included engaging in and maintaining partnerships, the redistribution management of bike fleets, and repositioning disorderly parked bikes in response to complaints.

Collaborative and partnering activities emerged as a critical BMI aspect, differentiating companies who were able to adapt, and those who were not, reinforcing the importance of inclusivity and its links to anticipative capacity. In response to initial problems, collaborative activities have been established e often initiated by municipalities e with both local authorities and communities, through dialogue, market consultations and 'living labs'. The agreements made between municipalities and companies to share data to learn about FFBS is one example, where the municipalities of Rotterdam and Utrecht now require companies to share data through a national dashboard, so authorities can see where bikes are parked and how long they are inactive (r9, r10).

In the early phase, some companies failed to install adequate systems, inconveniencing others. Long-parked bikes cause most nuisance. To counter this, cities have set minimum use per bike requirements. After a while, bikes need to be replaced. But this redistribution is a relatively expensive activity for companies.[11]

Companies engage in several activities to adequately handle complaints, for example regarding long-parked unused bikes. Most companies have personnel on the streets for handling parking[12] or maintenance issues. Companies in Rotterdam are also obliged to have a telephone number through which citizens can file complaints. However, platform orientated companies (e.g. Mobike, Jump) criticize such a rule, as they prefer a cheaper digitized complaints system (for example through their own app with a chatbot) (r11, r12). The municipality doesn't realize the costs involved of a call center. These are quite high per individual bike ride. Usually, we take care of issues through the app. A human call center leads to more communication which is not handled efficiently (r12). This highlights that activity and resource decisions, critical for value creation and delivery, are influenced by economic concerns of the companies.

The need for maintenance is of course related to the quality of bikes, a key resource of companies. Whereas some companies provide bikes that meet local standards and practices, there were also some companies that introduced low-cost bikes not attuned to the local cycling experience. Especially, the type of bikes, of poor quality and lacked maintenance, caused controversy among municipalities and citizens.

4.3.3. Value Capture

Finally, the primary stream of income comes from bike sharing fees and subscriptions.[13] Companies compete with different fees.[14] But, for companies to maintain affordable FFBS proves to be challenging when they need to comply with requirements by authorities to prevent socio-ethical impacts. Companies are generally positive about such measures, although they could lead to more expensive (and thus less attractive/accessible) bike sharing. As Mobike highlights, "Nothing is for free. All extra efforts come with costs, which needs to be charged to our users in order to keep bikes sharing financially feasible" (NRC, 2019). According to Jump, such requirements need to be balanced with price and demand: ''If you set requirements that are not efficient, this will lead to increases in price, which makes the bike less accessible, leading to lower use rates and a less efficient system.'' (r12).

5. Discussion

In this research we sought to explore how BMI interacts with socio-ethical issues, including the role of socio-ethical issues in the innovation process, and the socio-ethical impacts of the BMI by presenting FFBS as an example of BMI, within a sharing economy context, we explore a case demonstrating unintended and negative consequences and the role that BMI processes played. In this section, key findings and implications for practices and future research are discussed.

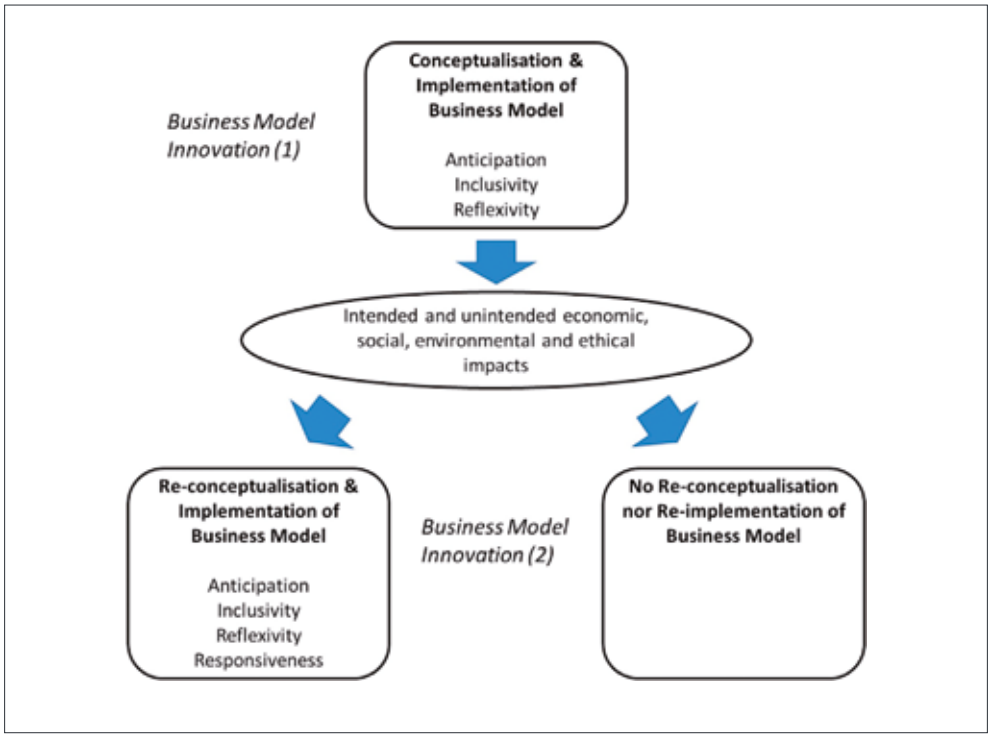

Fig. 4. How a responsible BMI processes unfolded in the case of bike sharing: interaction with socio-ethical issues.

5.1. Business model innovation interaction with socio-ethical factors

To address the research question of this paper, the results show how BMI interacts with socio-ethical factors, illustrating how these factors can play a key role in the success or failure of BMI. Almost all companies, as well as municipalities, within the case were initially unable to anticipate impacts during initial conceptualising and implementation of the business model. We see that following initial implementation there were both intended and unintended impacts, with unintended negative impacts of a socio-ethical nature leading to initial bans. Following this, our cases split one of the main negative side effects of FFBS. Municipalities encourage companies to incentivize responsible parking behaviour, for example by giving credits that can be used for bike sharing (r9, r11). This highlights how key activities are an area of the business model that interacted with (negative) socio-ethical factors. into those companies who were able to exercise 'inclusivity' and 'responsiveness' and adjust their business models, and those who either would or could not. This latter category of firms were inflexible in terms of 'incorporating local needs and market conditions' (which included limited bike storage space within the local environment and poor quality, inappropriate bike models).

We illustrate this in Fig. 4, highlighting the 'process' element of our framework. This shows how RI in our case is actually represented by a process of BMI implementation followed by learning and adjustment, with key RI dimensions operating at different points. BMI and socio-ethical factors interact: the implemented business model creates or aggravates socio-ethical issues,

which in turn motivate additional BMI and adjustment. Anticipation, inclusivity and reflexivity have relevance in the initial stage of BMI, while the fourth dimension, responsiveness, only becomes relevant once initial impacts were observable. This is somewhat at odds with the RI literature, which idealistically sees these processes occurring in a way that inhibits and prevents unintended and negative impacts (Lubberink et al., 2017; Stahl et al., 2017; Stilgoe et al., 2013), whereas, in our cases, these dimensions operate reactively, to socio-ethical impacts. We propose that in the absence of institutionalised RI e i.e. where RI is not a norm, nor embedded in organisational or governmental cultures, as is likely the case in many contexts e a period of business model implementation is required as a learning period. This highlights a potential key role for RI and sensitivity to socio-ethical issues during business model experimentation efforts, a burgeoning area of the literature (Bocken et al., 2019). Indeed, we observe that FFBS companies learnt from one another, alongside public authorities, who implemented 'learning' spaces aimed at monitoring and generating insights about impacts (such as the Living Lab in Utrecht and the pilot in Rotterdam).

In highlighting these core results, we empirically confirm our criticism that current RI literatures focus on technological innovation misses the key influence that BMI, and the business models it leads to, can have on the (socio-ethical) impacts of technologies (Jarmai et al., 2020; Long et al., 2020a,b; Stubbs and Cocklin, 2008). In doing so, we expand the number of contexts that RI approaches may be relevant to and the value of socio-ethical perspective. This raises the question of the extent to which an RI lens is applicable to other non-technical types of innovation, such as social innovation. We do recognise that anticipating repercussions of the implementation of innovative business models, such as FFBS (combined with the absence of established regulations), is challenging. Each city responded differently with local context specific measures (strict ban, pilot or living lab). Implementing a new business model in practice is guided by an iterative process of learning by doing and adjusting. In this sense, the processes in our case follow previously identified processes. The additional value of RI is its ability to highlight the role that socio-ethical issues specifically, play in these processes and introduces socio-ethical factors as an additional category for BMI failure and design-implementation gaps (Geissdoerfer et al., 2018), alongside existing failure reasons such as changing prevailing mind-sets, triple bottom line challenges or insufficient resource allocation (c.f. Evans et al., 2017). Hence, we acknowledge that BMI failure is not only due to socio-ethical issues, but that a RI lens highlights additional factors and presents a more holistic picture.

5.2. Locally embedded and top-down applied platform-based business models

The second observation concerns the influence of underlying motivations behind business models on responsible innovation outcomes. Analysis of the case highlights two types of FFBS companies that deploy business models with different underlying purposes, influencing processes and strategies of responsible innovation and outcomes differently. Hence, the ability and inclination to enact responsible innovation processes and strategies is arguably influenced by, the 'purpose' dimension of our framework.

On the one hand the FFBS field contains of companies that apply a two-sided business model seeking additional sources of value creation (e.g. Obike, Ofo, Mobike, Jump). These

companies associate themselves more with well-known platform-based businesses such as Airbnb and Uber rather than urban mobility providers.[15] They operate following a (top-down) platform logic that is reliant on acquiring large market share, leading to aggressive business model implementation strategies e 'launch first and legitimize later' e an approach often taken by platform-based businesses. The narrow profit margins of such platform-based mean high volumes (in this case bikes) are needed. Hence, rapidly reaching a large user base by putting large numbers of bikes on the streets was critical for these companies, which led to fierce competition and eventually could lead to a race-to-the-bottom. Backed by venture capital investors (with deep pockets), companies engaged in predatory pricing and shipped low-cost bikes with short life span, poor service, minimal redistribution and limited maintenance. These companies often also aim to minimise labour costs, often via minimising 'on the ground' personnel trough automation and digitization raising questions over the appropriate relationship with local regulators (Cohen and Kietzmann, 2014).

Their reliance on scale and the way they were run, suggests that their primary ambition (purpose) was not to provide a sustainable solution to mobility challenges, but rather to establish and operate a platform (i.e. ecosystem or app) that creates additional economic value through data collection, advertisements and integration with other services. This would create value for the companies and its shareholders, but little for any other stakeholders e additional economic value at the expense of social value e raising business ethics issues (Freudenreich et al., 2020; Yang et al., 2017). This observation aligns with studies stressing concerns around the entry of new types of actors that are behind the surge in bike sharing and their additional interests in data gathering (Duarte, 2016; Spinney and Lin, 2018).
On the other hand, there are companies with a more local origin and community-oriented approach focused on local challenges (e.g. Donkey Republic). These provide a service that is more attuned local contexts, with a bike that matches the experience of users and with a business model less reliant on platform dynamics (gradually scaling vs rapid scaling), highlighting a more collaborative and mission-driven logic (Nixon and Schwanen, 2019). These types of firms, whose primary purpose is to provide a local sustainability solution, are likely to be more open to, and more adept at engagement with key stakeholders. Although in our case these companies were still subject to the same BMI implementation mistakes as the platform-based companies, they were able to leverage their focus on the locality and its communities to engage in inclusive deliberation, and establish which parts of the business model needed further adjustment. Hence, these companies benefited from incorporating local stakeholder perspectives and needs (Bocken et al., 2013), as well as being able to adjust to these needs and produce a more locally relevant, socially desirable and ethically acceptable business model.

The RI lens enabled us to explore how additional purposes and different 'logics' (Stubbs and Cocklin, 2008) behind the BMI processes, let to different socio-ethical impacts, even while the core value propositions of all companies were the same.
The alternative purpose and underlying logic of the cases (Stubbs and Cocklin, 2008) can then be used as an explanatory factor influencing other aspects of the BMI process, including implementation, and the willingness and ability to enact subsequent BMIs. The underlying

logic of the business models influences the type and nature of socio-ethical impacts, creates business ethics issues, and due to a reliance on scale and an inability to adjust, in these cases failure of the business model.
Additionally, we also see how purpose and its influence may not be static, and changes over time, as was the case with Jump, moving from a community-based model, to one more associated with the impacts and effects of the platform-based models after its acquisition by Uber. BMI literature has shown how institutional logics impact development trajectories, and our results add by highlighting a link with socio-ethical factors (Stubbs and Cocklin, 2008; Vaskelainen and Münzel, 2017).

The poor fit of the platform-based business model, in conjunction with an aggressive business implementation strategy meant that after 2 years (most of) these companies went bankrupt or left the Netherlands. Obike went bankrupt in 2018 (leaving their bikes for trash on city streets across the world, including in Amsterdam and Rotterdam).[16] In 2019, both Ofo and Mobike ceased all international operations and put sole focus on the Chinese market (Liao, 2019; Moore, 2020).[17] However, Mobike is still active in the Netherlands, but since 2020 operating independently from the Chinese mother company following a management buyout (r11). The founding purpose of these platform-based business models e to operate on a large scale in population dense areas, with limited cycling e demanded a necessary adaptation to the local context (in this case, regulated pilots in NL) which meant that their financial viability was restricted. Our cases highlight how RI principles are relevant not just in the design or conceptualisation part of a BMI process, but also during implementation.

5.3. Place dependency of (ir)responsible business model innovation

A third observation is that (ir)responsible BMI is context dependent. Although this study did not compare business models between different international contexts, the case of FFBS in Dutch cities should be viewed against the backdrop of the emergence of bike sharing across cities globally. While these business models do not inherently imply socio-ethical problems, this research has shown that the application to the Dutch context led to particular issues, observable through RI dimensions. FFBS was invented and applied on a large scale in China and although it also led to unintended impacts there (such as an over capacity of bikes), there have been additional issues in European cities (such as concerns about data privacy). This business model addressed a recognised urban challenge in China and was socially supported. However, as is clear, it did not mean it could be easily implemented in other urban contexts.[17] This means that the promise of easy implementation and transferability across contexts of platform-based models is potentially naive and ignores the importance of local context. Different contexts appear to lead to specific socio-ethical issues and challenges. This has important implications for wider sustainability innovations. Many sustainability challenges have a global nature yet are likely to have similar local and contextual dynamics; this is likely to be especially true where socio-ethical issues are prominent adoption and diffusion factors. Hence, this highlights the importance of perspectives such as RI that are able to both recognise and take account of socio-ethical factors, producing more socially desirable and ethically acceptable innovations.

5.4. Implications for practice and future research

For FFBS companies, and managers working within other sharing economy applications our central recommendation is to apply RI principles to BMI processes. The sharing economy is characterised by high growth rates and often disruptive, technological and service innovations (Belk, 2014; Frenken et al., 2020; Owyang et al., 2013). This makes the sharing economy a prime candidate to experience socio-ethical challenges (Scholten and van der Duin, 2015); as our case shows, socio-ethical impacts are not isolated to high-tech innovations, they are also observable in disruptive non-technological innovations, highlighting the relevance of RI. Managers should ensure engagement and dialogue with stakeholders and implement internal innovation management processes that explicitly include socio-ethical issues, alongside more traditional financial and technological ones. These lessons could be particularly applicable to other innovative 'micro mobility' modes (including e-bikes and e-scooters), a rapidly growing sector with the potential of transforming urban mobility but also accompanied by irresponsible innovation dynamics, and provide an additional perspective to the burgeoning literature on bike sharing (Du and Cheng, 2018; Nikitas, 2019; Ricci, 2015; van Waes et al., 2018a). A limitation with regards to generalizability of the results is that this research focused particularly on BMI in the urban mobility domain within Dutch cities. Therefore, studying cases of (ir)responsible business model innovation in other domains within different spatial contexts may reveal different types of socio-ethical issues. Indeed, this research highlights the importance of socio-ethical factors for wider sustainable innovation diffusion and adoption. Broader research questions that require attention concern the types of innovation and contexts in which socio-ethical factors are likely to be important, as it is in these contexts that RI approaches will be most needed in order to enhance sustainable outcomes.

A key area for future research concerns the institutionalisation of responsible BMI processes, and the development of innovation governance systems (Voegtlin and Scherer, 2017). Our examples raise questions of how responsibility is and should be distributed between companies, regulators, and wider society (including users and researchers). This could include facilitating inclusive deliberation efforts and contributing towards anticipative capacity, through to the co-creation of experimental spaces aimed at learning about the innovation, as seen in Utrecht and Rotterdam. In other contexts however, institutionalisation process may rely more on firms themselves, drawing on self-regulatory types of approaches (Scherer and Voegtlin, 2020; Stilgoe et al., 2013). Linked to this is the issue of speed and scaling. The severity and urgency of sustainability challenges increasingly argues for more rapid innovation diffusions and scaling. Within this context, one can imagine supporting the rapid launching strategies seen within some of the cases. Indeed, rapid experimentation, enabling fast learning of what works and does not. However, this should be seen as distinct from the non-inclusive launch first, ask questions later strategies, which although rapid, face additional socio-ethical challenges. Future research should explore how rapid experimentation can be connected to rapid scaling strategies that are also able to integrate RI principles, and in so doing, reap the innovation diffusion benefits. Another fertile topic for future research would be the interconnection of Design Thinking approaches for BMI and their ability to integrate RI principles. This has received some initial attention within the RI domain, and the BMI context could be an especially interesting avenue (Nathan, 2017; Pavie and Carthy, 2015).

6. Conclusion

In conclusion, we show that BMI processes interact with socio-ethical issues, affecting the relative success or failure of the business models that result. That BMI seems subject to the influence of socio-ethical issues, highlights a potentially new area for the application of responsible innovation, involving companies, regulators and communities. The case of FFBS shows that in the end, cities and their communities are key stakeholders in the BMI process, reiterating the importance of anticipation, inclusive deliberation and responsiveness.

Credit author statement

Thomas B. Long: Conceptualization, Methodology, Analysis, Draft Writing, Reviewing and Editing.

Arnoud van Waes: Conceptualization, Data Collection, Meth- odology, Analysis, Draft Writing, Reviewing and Editing.

Declaration of competing interest

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

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Notes

[1] Both authors contributed equally to this manuscript.

[2] We define BMI as "the conceptualisation and implementation of business models. This can comprise the development of entirely new business models, the diversification into additional business models, the acquisition of new business models, or the transformation from one business model to another" (Geissdoerfer et al., 2018).

[3] This aligns with the field of sustainability transitions, where research tends to focus on hopeful developments, but 'unsustainable trends' and the shadow side of innovation is often understudied (Antal

et al., 2020; Shove and Walker, 2007). This is problematic as scaling up sustainable innovation may solve one problem, but may create or intensify another one (Van den Bergh et al., 2015).

[4] Although the term 'free-floating bike sharing' includes of the word 'sharing', in principle these systems are about rental. The service bikes sharing systems provide is to make bikes available for shared use, based on tariff and a short period of time.

[5] Proportion of bike use in Amsterdam, Rotterdam and Utrecht (other modes: walking car, tram, metro and bus), respectively: 25%, 19% and 29% (Kennisinstituut voor Mobiliteitsbeleid, 2019).

[6] Only Hellobike was allowed to stay as they got formal permission to operate at a business district outside the city centre.

[7] These are also identified by municipalities as key cycling related challenges (Gemeente Amsterdam, 2017; Gemeente Rotterdam, 2018; Gemeente Utrecht, 2015).

[8] After this acquisition, Mobike was renamed Meituan Bike in China.

[9] Bikes can only be parked and (un)locked within these 'geographically fenced' zones which are shown in the bike sharing app.

[10] This study does not primarily focus on users and their experience in using these bikes. Nevertheless, evidence from the Netherlands e where bike ownership is the norm eshows there is a demand for this form of bike sharing, but it mainly replaces walking, cycling (with a private bike) and public transport trips (Farla, 2019; Ma et al., 2020; Van Waes et al., 2018a,b).

[11] A bike stands still for too long signals limited demand. To prevent this, companies limit parking zones to areas with high demand for shared bikes.

[12] Users have a key role to play when it comes to parking. Disorderly parking is.

[13] In section 4.1 we discussed how some companies may have hidden value proposition with an additional revenue model besides bike sharing fees.

[14] Tariffs varied: V0,50/30 min with Mobike or Obike; V0,20/minute for a Jump e- bike.

[15] Whereas they can be considered more related to traditional public transport companies (a sector with its own logic, rules and practices).

[16] In Amsterdam, the redundant bikes that were left for thrash and removed by the city were offered for sale at a local thrift store (AT5, 2018).

[17] This aligns with van Waes et al. (2020) that highlight that for effective business model implementation, both local institutional and physical aspects should be taken into account.

HOOFDSTUK 06

Geeft fietsen vrijheid? Evaluatie van **fietslessen** *aan nieuwe Zwollenaren in de wijk Holtenbroek*

Hugo Kampen, Inge Helbers-Bonte, Marcus Popkema

Te verschijnen als congrespaper voor het Colloquium Vervoersplanologisch Speurwerk (CVS) 2021 (25-26 november 2021).

Samenvatting

In 2018 is gestart met een fietsstimuleringsprogramma voor nieuwe Zwollenaren in de wijk Holtenbroek. Bij dit programma is de fiets een middel om gezondheid en maatschappelijke participatie te bevorderen. De doelgroep bestaat uit vrouwen met een migratieachtergrond. In een living lab setting is een werkwijze ontwikkeld en uitgeprobeerd die is toegesneden op de kenmerken van de doelgroep. De werkwijze karakteriseert zich door ruimte geven aan eigenheid en het zoeken van verbinding. In dit paper is te lezen op welke wijze de aanpak is opgezet. De hierbij beschreven evaluatie van de werkwijze geeft inzicht in de succesfactoren van het programma.

Introductie

Vele partijen beschouwen de fiets in toenemende mate als een middel om uiteenlopende vraagstukken aan te pakken. Bevordering van het fietsen draagt bijvoorbeeld bij aan filebestrijding en bereikbaarheid van steden en regio's (Van Esch et al., 2013). Ook biedt de fiets waarde voor gezondheid, duurzaamheid en leefbaarheid. De positie van de fiets wordt sinds 2015 onder meer bevorderd door de Agenda Fiets van de Tour de Force (Tour de Force, 2018). Onderzoek naar vernieuwingen op het gebied van de fiets dragen potentieel bij aan het vinden van oplossingen voor genoemde problemen.

Het living lab Fietsen geeft Vrijheid is een fietsstimuleringsprogramma in de Zwolse wijk Holtenbroek. De centrale vraag hierbij is of – en op welke wijze – fietslessen en andere fietsactiviteiten kunnen bijdragen aan het bevorderen van het fietsgebruik, zodat de gezondheid en maatschappelijke participatie van de deelnemers wordt bevorderd. Migrantenvrouwen met beperkte fietsvaardigheden vormen de belangrijkste doelgroep in dit project.

Fietsen geeft Vrijheid sluit aan bij het Nationaal Preventieakkoord, vanwege de mogelijkheden die de fiets biedt om gezond naar werk en school te reizen (Nationaal Preventieakkoord, 2018). Door gerichte fietsstimulering sluit het project daarnaast aan bij de doelen van Tour de Force 2020 (Tour de Force, 2018). De fiets wordt in het project ingezet als motor om gezondheid en participatie te verbeteren.

De voorbereiding van Fietsen geeft Vrijheid is vroeg in 2018 gestart. In wisselwerking tussen een aantal betrokkenen van welzijnsorganisatie Travers Welzijn, gemeente Zwolle en Tour de Force groeide het idee om een project te starten waarbij aan nieuwe Zwollenaren een fiets en fietslessen aangeboden zou worden. Met een subsidie van Tour de Force kon bij Travers Welzijn een projectleider worden aangesteld om het project daadwerkelijk te organiseren. De onderzoekers van Hogeschool Windesheim kwamen aan tafel vanwege hun samenwerking met de gemeente Zwolle in het onderzoeksproject Smart Cycling Futures.

Smart Cycling Futures is een vierjarig Nederlands onderzoeksproject met aandacht voor innovaties op het gebied van fietsen. De centrale vraag van het project is op welke wijze de innovaties bijdragen aan het bevorderen van stedelijke vitaliteit. Het project loopt in de steden Amsterdam, Eindhoven, Utrecht en Zwolle. In Smart Cycling Futures werken de genoemde steden samen met de regio's/provincies waarin ze liggen en de kennisinstellingen Universiteit van Amsterdam, Universiteit Utrecht, TU Eindhoven en Hogeschool Windesheim Zwolle. Het project wordt gefinancierd door NWO en SIA Raak en heeft als looptijd van september 2016 tot september 2020. De verbinding van Fietsen geeft Vrijheid met Smart Cycling Futures bood kansen om een interessant living lab te ontwikkelen, te meer omdat de werkwijze van leren door co-creatie bij Travers Welzijn onderdeel uitmaakt van de reguliere aanpak in projecten (Popkema en Kampen, 2019).

In 2019 is een paper over Fietsen geeft Vrijheid verschenen bij het Curriculum Vervoersplanologisch Speurwerk (CVS-congres). Daarin is de opzet van het project beschreven en is ingegaan op de organisatie van de leerprocessen (Popkema en Kampen, 2019). Het voorliggende paper gaat over de opbrengst van het project en bespreekt de succesfactoren. Voor dit paper zijn interviews gehouden met de centrale personen in het project en gesprekken gevoerd met een aantal deelnemers. De vorderingen van de deelnemers zijn bijgehouden in een database.

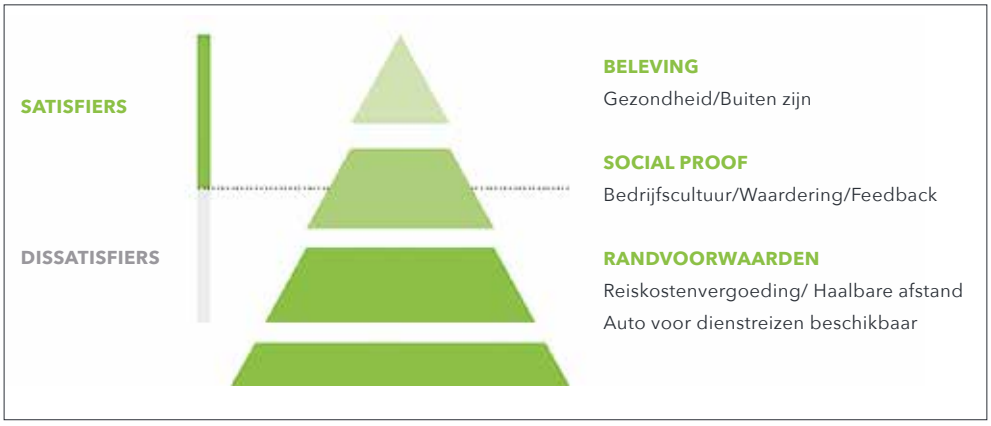
Organisatie

Hoewel fietslessen de kern van de activiteiten van het project vormen, heeft Fietsen geeft Vrijheid geen verkeerseducatief karakter. Juist door het inzetten op het verbeteren van de gezondheid en de participatie van de deelnemers in de maatschappij, heeft het project een duidelijke inclusiviteitsbevorderende opzet. Dat komt ook tot uiting in de deelnemende partijen, zoals welzijnsorganisatie Travers, verschillende afdelingen van de gemeente Zwolle en hogeschool Windesheim. Vanuit laatstgenoemde organisatie zijn behalve mobiliteitsonderzoekers van Smart Cycling Futures tevens studenten van de opleiding Psychomotorische Therapie betrokken bij het verzorgen en verder ontwikkelen van de fietslessen.

Het programma bevat drie onderdelen, welke hieronder op hoofdlijnen worden beschreven. Een nadere uitwerking van de onderdelen volgt daarna.

1. Fietslessen. De deelnemers leren fietsen onder begeleiding van een docent. Op deze manier werken ze aan hun fietsvaardigheid. Daarnaast maken de migrantenvrouwen kennis met de theorie, zoals de verkeersregels.
2. Fietsreparatie. De deelnemers leren hoe ze zelf kleine reparaties, zoals het plakken van een band en het smeren van een ketting, kunnen verrichten.
3. Fietsactiviteiten. Om daadwerkelijk deel te nemen aan het verkeer is het van belang om fietservaringen op te doen. Samen met een docent maken de deelnemers fietstochten naar zogeheten hotspots in Zwolle.

De keuze voor deze activiteiten is gebaseerd op de motivatietheorie van Herzberg (zie afbeelding 1). Volgens deze theorie is de kans groot dat mensen worden gemotiveerd tot gedragsverandering als ze vanuit verschillende kanten worden gestimuleerd om hun gedrag aan te passen. De randvoorwaarden voor het gewenste gedrag moeten worden gecreëerd, de sociale norm van het gewenste gedrag moet worden versterkt en het gewenste gedrag moet plezier opleveren. In het model wordt gesproken over het wegnemen van dissatisfiers, het bevorderen van satisfiers en het versterken van de sociale norm.



Afb. 1. motivatietheorie van Herzberg (Bron: XTNT et al 2016, p.6).

De meeste acties van 'Fietsen geeft vrijheid' kunnen worden gezien als het wegnemen van een dissatisfier: het hebben van een fiets, het bekwaam voelen om daarmee om te gaan (fiets- en verkeersveiligheidslessen volgen), het leren om de fiets te onderhouden. De activiteiten in het programma lijken daarmee op het eerste oog misschien niet zo vernieuwend. In Fietsen geeft Vrijheid is hier een eigen invulling aan gegeven die in samenhang tot een ander geheel leidt, waarbij gaandeweg de satisfiers in beeld komen. Aan de hand van zeven kenmerken wordt de eigenheid van de gehanteerde aanpak toegelicht.

1. Werving en campagne

Ter promotie van de fietslessen wordt op een laagdrempelige manier 'reclame' gemaakt. In de wijk, bij het wijkcentrum, scholen, huisartsen en verloskundigen worden flyers verstrekt en posters opgehangen waarin de fietslessen worden aangeprezen. Daarnaast worden bijeenkomsten van Taal en Gezin of van het Sociaal Wijkteam gebruikt om mensen te wijzen op het bestaan van de fietslessen. De beste reclame blijkt ook hier de mond-tot-mondreclame te zijn, waarbij (oud)deelnemers vertellen over hun positieve ervaringen. Op deze manier trekken zij anderen over de streep om toch een keer een kijkje te komen nemen bij een bijeenkomst.

2. Sfeer

Aangekomen bij zo'n bijeenkomst wordt getracht de drempel zo laag mogelijk te houden. Zo start iedere fietsles met een samenzijn onder het genot van koffie of thee, waarin de deelnemers elkaar kunnen leren kennen. De fietsles staat niet enkel in het teken van het leren fietsen, het sociale contact is minstens zo belangrijk. Potentiële deelnemers ontmoeten anderen die net als zij nog niet kunnen fietsen en wellicht de Nederlandse taal niet helemaal onder de knie hebben. Dit zorgt voor herkenning en gelijke stemming.

Een ander punt is dat eventueel ongemak tussen de seksen geen rol speelt omdat mannen niet deelnemen aan de fietslessen in Holtenbroek. Dit is niet omdat ze zijn uitgesloten. Er melden zich geen mannelijke deelnemers aan. Wat ook de reden hiervoor is, de afwezigheid van mannen heeft een positief effect op de migrantenvrouwen. De laagdrempelige toegang en de veilige omgeving vermindert de schroom om aan te schuiven, met tot gevolg dat nieuwkomers vaak een week later weer op de stoep staan.

3. Deelname

De fietslessen kosten de deelnemers geen geld en er is geen formele aanmeldingsprocedure of intake. Een keer overslaan is niet erg en een officiële afmelding is niet nodig. Ook is er geen vooraf vastgesteld aantal lessen waarin de deelnemer wordt verwacht voldoende fietsvaardigheid op te doen. Al deze punten zorgen voor een lage drempel om deel te blijven nemen. Er rust namelijk geen tijds- of financiële druk op hen.

4. Theorie en praktijk

De fietslessen omvatten zowel theorie als praktijk. De theorie is opgenomen in boekjes met afbeeldingen en korte teksten die beschikbaar zijn in het Nederlands, Engels en Arabisch. Tijdens de lessen is ook een tolk aanwezig om begrippen te vertalen. De beginnerslessen

starten met een uitleg over de fiets. Waarvoor is de rem, wat is een zadel en waar zit de verlichting? Alle onderdelen van een fiets zijn met pijltjes aangegeven in het boekje. Vervolgens worden de verschillende soorten remmen uitgelegd, wat is het verschil tussen handrem en terugtraprem. Daarna volgt een onderdeel verkeerseducatie. Er is een grote puzzel met speelgoedauto's, miniatuurfietsen en verkeersborden. Hierop wordt uitgelegd aan welke kant van de weg moet worden gefietst en hoe je goed en veilig over een kruispunt kan fietsen. Er wordt besproken waarom en hoe je je hand moet uitsteken, hoe de voorrang werkt, dat er niet op de stoep gefietst mag worden en hoeveel afstand je tot je voorganger moet houden.

Tijdens het praktijkdeel leren de deelnemers in een veilige omgeving de tweewieler kennen. De eerste fietslessen vinden plaats op en rond een basketbalveld in een park. De deelnemers leren als eerste om balans te kunnen houden, dit wordt meestal geoefend op een step. Vervolgens gaan de beginnende deelnemers naar een fiets met een heel laag zadel, waardoor zij goed met de voeten bij de grond kunnen. In deze eerste fase wordt ook het sturen met een fietsstuur en het vloeiend remmen geoefend, terwijl de deelnemers in rondjes gaan op het basketbalveld. De gevorderde groep mag starten met rondjes buiten de hekken van het basketbalveld. Dit is voor hen meestal een grote stap. Rond het basketbalveld lopen en fietsen soms andere mensen, wat voor eerste verkeersontmoetingen kan zorgen. Wanneer ook dit rondje vloeiend verloopt, mag de deelnemer door de wijk Holtenbroek gaan fietsen. In het begin gaat een begeleider mee, maar uiteindelijk kan de deelnemer het gebied alleen gaan verkennen. In de wijk komt de gevorderde deelnemer kruispunten en andere mensen in het verkeer tegen, maar nog geen drukke en complexe verkeerssituaties.

Wanneer een deelnemer naar het competente niveau mag, zal zij zich langzaam in steeds moeilijkere situaties verplaatsen. Samen met een begeleider wordt bijvoorbeeld voor het eerst door tunnels gefietst. Ook wordt vaker naar drukkere plekken, zoals het centrum, gefietst. De deelnemer wordt steeds zelfstandiger en mag ook af en toe moeilijke stukken alleen fietsen. Deelnemers mogen de fietslessen afronden als zij de verkeersregels kennen en zich veilig en zonder angst in het verkeer kunnen bewegen. Ze moeten bijvoorbeeld vloeiend kunnen op- en afstappen, weten hoe het verkeer werkt en aan welke kant er moet worden gefietst.

5. Zelfredzaamheid

Fietsen heef een positieve invloed op de sociale ontwikkeling. Het kunnen fietsen draagt bij aan iemands zelfredzaamheid, omdat ze eigenstandig grotere afstanden kunnen afleggen (VHZ-online.nl, 2019). De actieradius voor bezoek aan winkels, school of werk, kerk, theater, bioscoop, sportgelegenheden en vrienden wordt erdoor vergroot.

De zelfredzaamheid wordt verder vergroot door de fietsreparatie die onderdeel is van het programma. In deze cursus leren de deelnemers kleine reparaties en onderhoud te verrichten aan hun fiets. Ze krijgen tevens een certificaat van deelname aan deze reparatieles. Dat vergroot de trots en de eigenwaarde van de deelnemers. De opgedane vaardigheden stellen hen in staat om zelfstandig te kunnen blijven fietsen en geen kosten te maken voor reparaties bij een fietsenmaker.

6. Eigen fiets

Wanneer de deelnemers de fietslessen goed hebben afgerond, is de beloning groot. De deelnemers krijgen een fietspaspoort en ontvangen kosteloos een eigen fiets. Deze eigen fiets mogen de deelnemers samen met de fietsdocent bij Dock24 ophalen. Dock24 is het startpunt in Zwolle voor sociale en maatschappelijke participatie. Zij ontvangen fietsen via het ANWB Kinderfietsenplan, het AFAC of donatieacties. De aangeleverde fietsen worden opgeknapt bij Dock24 zodat ze weer klaar zijn voor gebruik. Nadat de deelnemers een eigen fiets hebben opgehaald, doen ze nog mee aan één of twee fietslessen om met de eigen fiets om te leren gaan en dan zijn ze klaar. De deelnemers hebben succesvol leren fietsen en door de reparatielessen weten de deelnemers ook hoe zij de fiets kunnen onderhouden en repareren. Hierdoor kunnen zij nog langer van hun fiets gebruik maken.

7. Fietsactiviteiten

Na afronding van de fietslessen en de fietsreparatiecursus zijn deelnemers in staat om te fietsen en kleine reparaties aan hun fiets te verrichten. Om ervoor te zorgen dat de deelnemers blijven fietsen, worden fietsactiviteiten georganiseerd. In kleine of grote groepen gaan de deelnemers gezamenlijk een fietstocht maken, bijvoorbeeld naar het centrum of een andere plek in de stad. Het effect van deze activiteiten is breed. De groep blijft elkaar op deze manier met enige regelmaat ontmoeten en blijft gezamenlijk fietsen. Dat vergroot de fietsvaardigheid in het dagelijks verkeer en zorgt voor een band tussen de deelnemers en de fietsdocenten.

Werkzame ingrediënten

Inmiddels hebben sinds oktober 2019 ongeveer vijftig deelnemers de fietslessen afgerond. Uit interviews met de fietsdocenten zijn een aantal werkzame ingrediënten te destilleren. Daarnaast is tijdens het project een database bijgehouden met de uitstroom van deelnemers. De fietsdocent heeft nog regelmatig contact met de meeste deelnemers en is op die manier op de hoogte van wat ze doen na afronding van de fietslessen.

De deelnemers hebben leren fietsen en er is een wereld voor hen opengegaan. De ex-deelnemers kunnen nu naar de markt, naar vrienden, de kinderen op de fiets naar school brengen en bij mooi weer met het hele gezin een stuk fietsen. Ze zitten niet meer thuis en zijn uit hun isolement gehaald, met bijbehorende psychische voordelen. De eenzaamheid is verminderd, er worden nieuwe vriendschappen gesloten, sommigen vinden een baan en stromen door naar de Nederlandse taallessen en/of de handwerkclub. In termen van de motivatietheorie theorie van Herzberg: de deelnemers hebben satisfiers ervaren. Tijdens de lessen wordt bovendien gewerkt aan de beheersing van de Nederlandse taal en vallen de vrouwen af omdat ze meer gaan bewegen. Het hele gezin ervaart vervolgens een positief effect als de moeder nu ook mee kan gaan fietsen.

Als de vrouwen beginnen met de fietslessen is er veel angst, onzekerheid en spanning. Wanneer ze echter zien dat er geen druk is, geen tijdslimiet is en geen verkeer is op het oefenterrein groeit het zelfvertrouwen. Ze ontspannen meer en meer en beginnen gaandeweg van het fietsen te genieten.

Studenten van de opleiding Psychomotorische Therapie van Hogeschool Windesheim hebben meegedacht bij de ontwikkeling van de fietslessen. Ze hebben het leerproces van de deelnemers verder uitgesplitst in verschillende fasen en interventies aangereikt voor als het even iets minder goed gaat. Eenvoudige oefeningen als het schudden van de armen, het uitrekken van het lichaam en het losrollen van de schouders kunnen helpen bij het verminderen van spanning. Als de fietsdocent merkt dat een deelnemer 'vast zit' dan kan het oefenen met de fiets worden afgewisseld met dergelijke activiteiten (Hoolsema et al, 2019).
Het grootste succes van de fietslessen in Holtenbroek is te danken aan de laagdrempeligheid. De setting is informeel, er zijn geen moeilijke formulieren en er is geen tijdsdruk. De inhoud van de lessen wordt afgestemd op de deelnemers, niet andersom. Dat zorgt ervoor dat de deelnemers geen druk ervaren om te presenteren. De vrouwen mogen zichzelf zijn, ook als ze niet kunnen lezen of niet kunnen fietsen. Het is belangrijk dat ze in hun eigenheid gezien en gehoord worden. Ze krijgen de ruimte om in hun eigen tempo en op hun eigen wijze te leren omgaan met de fiets. Dat de deelnemers aan het einde worden beloond met een eigen fiets is dan de kers op de taart, "dat is dé beloning na wekenlang ploeteren". Bovendien zou het spijtig zijn als de deelnemers wel leren fietsen, maar geen geld hebben om vervolgens een eigen fiets aan te schaffen.

Dat de fietslessen gratis en onbeperkt worden aangeboden is een tweede punt van succes. Veel mensen in de doelgroep hebben een laag inkomen en kunnen geen fietslessen betalen, laat staan een fiets of fietsreparatie. Daarnaast is het belangrijk dat de fietsdocenten kennis hebben van de andere culturen. Dit wordt erg gewaardeerd door de deelnemers en maakt de communicatie en gebruiken soms makkelijker te begrijpen.

Het aanbieden van fietsactiviteiten draagt bij aan het blijven fietsen, het ontdekken van nieuwe plekken in een stad en aan het creëren van een groep die elkaar blijft ontmoeten, ook op andere manieren dan bij het leren fietsen.

Opbrengst

Het project heeft de naam 'Fietsen geeft Vrijheid'. Bij de start van het project was het doel om de deelnemers de vrijheid te geven om zich zelfstandig te kunnen verplaatsen en zich maatschappelijk te ontplooien. Het middel om dit te bereiken is het leren hanteren van de fiets. De evaluatie leert dat deelnemers gezonder zijn en zich fitter voelen. Ook zijn ze zelfredzamer geworden en is hun sociale netwerk vergroot. Het stelt hen in staat om aan het werk of naar school te gaan. Het project is voor de deelnemers verder soms een opzet om meer activiteiten binnen Travers volgen, zoals het volgen van taallessen en beweegactiviteiten. De fiets is een ideaal en goedkoop middel om een dergelijke verandering teweeg te brengen, helemaal wanneer je als deelnemer na afronding van de cursus kosteloos een fiets krijgt. De fietslessen hebben de deelnemers zowel letterlijk als figuurlijk in beweging gebracht.

De hier gepresenteerde werkwijze van Fietsen geeft Vrijheid heeft dus daadwerkelijk een positief effect op de vrijheid van degenen die er leren omgaan met de fiets. Afgelopen jaren is het programma in de Zwolse wijk Holtenbroek aangeboden. De specifieke ingrediënten maken deze aanpak onderscheidend ten opzichte van 'gewone' fietslessen en stellen de deelnemers in staat om te gaan fietsen en de fiets te beheren.

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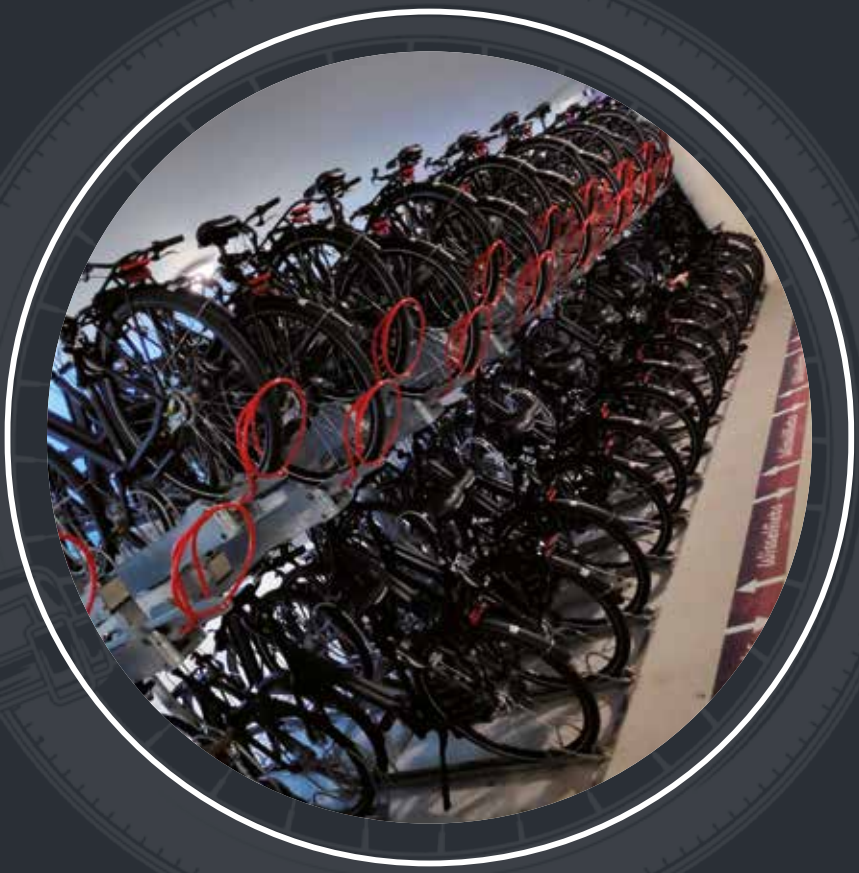

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Challenges and dilemmas in **strategic urban experimentation**

Arnoud van Waes[a,1], Anna Nikolaeva[a,b], Rob Raven[a,c]

[a] Utrecht University, Copernicus Institute of Sustainable Development | [b] University of Amsterdam, Department of Geography, Planning and International Development | [c] Monash University, Monash Sustainable Development Institute

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Abstract

Living labs have emerged as a form of strategic urban experimentation in sustainability transitions governance among policy makers and researchers. Limited attention has been given to the various challenges and dilemmas when doing LLs in relation to enabling urban transitions. This paper unpacks 16 challenges and dilemmas that arise for different actors in the process of living lab experimentation. The paper combines theoretical insights from Strategic Niche Management literature and insights from transdisciplinary research on living labs with empirical data from a qualitative case study analysis of four cycling innovation living labs in the Netherlands. By contrasting challenges and dilemmas identified in literature and those derived from our data, we reflect on key gaps between conceptual aspirations and empirical realities of strategic urban experimentation in sustainability transitions.

1. Introduction

Urban experimentation and living labs (LL) have been heralded in sustainability transitions literature as a way to trial, learn from and govern socio-technical innovations and urban transformations in cities to address local sustainability challenges (Bulkeley et al., 2016; Voytenko et al., 2016). We refer to such initiatives as 'strategic urban experimentation'. We consider experimentation 'strategic', because it is intended to enable exploration and learning about long-term challenges, uncertainties and ambiguities in short-term projects. Navigating experimentation and innovation in cities is a complex endeavor (Hommels, 2005). Unlike traditional laboratories, cities lack ability to fully control conditions in which innovations can be researched and tested (May & Perry, 2016). Cities are characterized by diverse local challenges, multiple stakeholders, multilevel-interdependencies, technological uncertainty and fragmented decision-making. In response, LLs – as a new and open way of governing socio-technical experiments in cities aimed at cocreation – have received much attention in academic and policy spheres (Evans, Karvonen, & Raven, 2016; Turnheim, Kivimaa, & Berkhout, 2018).

Research on strategic urban experimentation in urban sustainability transitions is increasing (Marvin et al., 2018). Literature has addressed the design of LLs (Bulkeley et al., 2018; Voytenko et al., 2016), favorable contextual conditions for experimentation (van den Heiligenberg et al., 2017), and scaling up, broader impacts and socio-spatial embedding (Frantzeskaki et al., 2018) or institutionalized (Raven et al. 2019). The sustainability transitions research agenda calls for more attention to conditions, processes and pathways through which urban experimentation emerges (Köhler et al., 2019). Our starting point here is that challenges and dilemmas of LL experimentation are discussed only to a very limited extent in this literature (Hossain, Leminen, & Westerlund (2019)). It is pertinent for living labs to learn about what works and what does not over time, and yet monitoring and evaluation required to make this happen often attracts less budget (Evans, 2015; Von Wirth et al., 2019).

We undertake long-term analysis "from within" four strategic urban experiments in the Netherlands. This provides insight into how strategic urban experiments unfold and evolve, what sort of practical challenges emerge in and through strategic urban experimentation, and how these are navigated. Our research question is: *what are challenges and dilemmas in doing strategic urban experimentation?* To answer this question, four LLs in four cities in the Netherlands are closely followed over a period of three years – from the selection of an experiment to implementation. We combine Strategic Niche Management (SNM) literature with insights from transdisciplinary research in living labs to develop a tentative framework of challenges and dilemmas

Section two reviews relevant literature and builds the framework. Section three outlines the research design and empirical background. Section four presents empirical insights from the four cases. Section five discusses similarities and differences between the insights derived from the literature and the empirical insights. We explore how and why challenges and dilemmas are similar or different across the cases, with reference to differences in place-specific conditions. Section six concludes and discusses implications of this research for research and practice.

2. Experimentation: challenges and dilemmas

This section builds a framework for identifying challenges and dilemmas in strategic urban experimentation.[2] We adopt the following definition of an experiment in sustainability transitions: *'an inclusive, practice-based and challenge-led initiative, which is designed to promote system innovation through social learning under conditions of uncertainty and ambiguity'* (Sengers et al., 2019). Urban LLs can be considered a sub-set of the general definition above in the sense that urban LLs are set within urban contexts, aim to transform urban (infra)structures, are performed particularly by urban actors and aim to resolve urban challenges.[3]

SNM is a well-established approach in experimentation literature, which conceptualizes experimentation as a strategic approach to niche creation and provides guidelines to set up and manage experiments (Schot & Rip, 1997). SNM research emphasizes three key processes of experimentation: articulation of expectations and visions, building of social networks and learning processes (Berkhout et al., 2010; Kemp et al., 1998). SNM suggest to design and manage experiments in such a way that they contribute positively to these three processes, which in turn will lead to establishing market niches, and eventually contribute to transforming incumbent socio-technical regimes. Later, focus in SNM shifted from individual experiments to series of experiments (e.g. Geels & Raven, 2006; Raven, 2005). Again later, SNM research explored how socio-technical innovations can move from niche level to the socio-technical regime by asking questions about niche-regime interactions (e.g. Raven, 2006; Smith, 2007; Smith & Raven, 2012). In this research we are interested in what happens at the level of individual experiments (the 'local level' in Geels & Raven (2006) rather than dynamics at the level of niches (the 'global level' in Geels & Raven (2006). While it would be interesting to also explore challenges and dilemmas of niche development, this is outside the scope of the paper, and would require longer time frames than we have access to, given that niche development is a process routinely identified over a 10-15 year period.

In the remainder of this section, each process is discussed in more detail, i.e. what is it about, why it is important and what do we already know about potential challenges and dilemmas of these processes in practice from literature. Based on a Scopus literature search, 52 articles were identified about SNM processes, which will provide the basis for our literature review. See Appendix A for the details on the method of this literature search. The SNM literature has been enriched with insights from additional relevant writings on LLs, and in particular from recent studies on transdisciplinary challenges and dilemma's related to transdisciplinarity. These studies were identified by following up on references as well as expert knowledge available in the author team and reviewer feedback. Table 1 provides an overview each concept and related challenges and dilemmas identified in the literature. In the discussion section we reflect on this methodology and its implications for future work.

2.1 Visions and expectations

In early stages of socio-technical innovation, benefits are often not evident and its value has yet to be proven. Interested actors articulate promises and create expectations to provide direction to learning processes, attract attention and legitimate protection and nurturing (Weber et al., 1999; Geels, 2012).

From the literature two distinct challenges, related to visions and expectations, are identified. The first is a lack of a vision or concrete expectations about the socio-technical innovation. This results in a lack of direction to learning and does not allow to attract attention (ibid). The second challenge is to ensure and create robust expectations. Non-robust expectations – not shared among stakeholders– hamper strategic experimentation, because they reflect varying dispositions about the future of a socio-technical innovation, which limits capacity to collectively drive developments. Underlying these non-shared expectations are often different understandings or interpretations of the innovation and its (future) contexts of application. Studies show examples of how different interpretations of smart grids (Naber et al., 2017), eco-industrial parks (Susur et al., 2019) or district heating (Bush et al., 2017) hindered strategic experimentation.

SNM literature also reveals three dilemmas related to visons and expectations. The first is a broad vs specific vision about the experiment. Research showed that visions should be broad enough to allow for multiple solutions, but at the same time, specific enough to offer plausible promises to stakeholders to gain credibility (Weber et al., 1999). Selecting a socio-technical innovation for experimentation and at the same time trying to avoid lock-in and path dependency, is one of the main dilemmas in SNM (Kemp et al., 1998). A bold vision, will mobilise a great variety of stakeholders, however, if it is too broad or general it does not provide clear guidance (Lente, 1993; Schot & Geels, 2008). The second dilemma is the attitude towards this vision. A flexible attitude allows for learning, adjusting visions to circumstances and taking advantage of windows of opportunity, but risks to dilute visions to a point where they are no longer transformative. A persistent attitude may impede flexibility, but enables a more consistent approach that maintains the transformative potential of the experiment (Schot & Geels, 2008). The third dilemma concerns too high expectations versus too low expectations. Making high promises early on to attract attention and funding can trigger enthusiasm for some time, but can subsequently be followed by disappointing results and the need for adjusting expectations (Verbong et al., 2008). Thus, expectations should be credible and of high quality i.e. supported by facts, tests and ongoing projects.

Similar observations have been made in transdisciplinary approaches in relation to urban experimentation. Challenges and dilemmas include overcoming conflicting stakes, priorities, expectations or problem definitions in transdisciplinary research (Culwick et al., 2019; Hessels et al., 2018; Scholl et al., 2018). Jahn, Bergmann, & Keil (2012), Lang et al. (2012) and Hessels et al. (2018) argue that a defining feature of transdisciplinary research such as urban experimentation is the challenge of integrating different bodies of knowledge (epistemic level), different interests (socio-organizational level) and establishing a common language that advances mutual understanding (communicative level). In fact, such differences are likely to inform contrasting expectations about what a living lab is about or should serve.

2.2 Social network building

Social network building, collaboration and forging alliances are among the key factors for setting up an experiment because it is important to create support for the socio-technical innovation, facilitate stakeholder interaction and provide necessary resources (e.g. time,

money, people, expertise) (Berkhout et al., 2010). SNM literature distinguishes between local and global actor networks: local networks consist of actors who work on a specific experiment, whereas global networks consist of actors who have some distance to the experiment, but are related through providing resources such as financial or political support, technical specification and by generating a space in which local actors work. At this global level, abstract, generic knowledge is shared within the (emerging) community. At the local level, specific knowledge, skills, hands-on-experiences and practices are generated (Geels & Raven, 2006).

Extant literature shows five challenges and two dilemmas in creating a network for successful experimentation. The first challenge is to facilitate and create a broad and diverse network. Narrow and closed networks are challenging because they do not include a variety of stakeholder perspectives which leads to limited learning possibilities. Particularly, user involvement is important for socio-technical experimentation (Weber et al., 1999). Second, a challenge is how to enable a deep network with relevant and committed actors. In a deep network stakeholders are able to mobilize commitment and resources within their organization (Schot & Geels, 2008; Weber et al., 1999). Lack of a deep network can impede experimentation because it affects access to necessary resources. A third challenge is to create a harmonious network and to navigate tensions between actors. Networks are not always be harmonious. Internal tensions between network members pose challenges for experimentation. For example, governments' and technology developers' views may clash, which damages willingness to cooperate (Verbong et al., 2008). Navigating tensions and overcoming different views contribute to achieving valuable outcomes. A fourth challenge is to generate public acceptance around the experiment. For instance, although renewable energy in general is widely supported, specific options in particular locations can be contested. This can lead to protest and resistance to an experiment (Verbong et al., 2008). A fifth challenge is to organize leadership and local coordination of the experiment (Seyfang et al., 2014). Limited leadership or management of the experiment hampers continuity.

A network-related dilemma is engaging with 'regime' insiders (the status quo) versus outsiders. Including relative outsiders broadens visions and allows for 'radical' ideas whereas vested interests hinder innovation, even though working with incumbents enables access to resources and competences (Weber et al., 1999). The second dilemma relates to resources and concerns dependency vs autonomy. Support and access to resources (e.g. social, human, political, organizational and financial) is crucial as it helps to protect experimentation from too early rejection in mainstream markets. However, a balance must be struck between too much and too little protection. Support and protection can be of crucial importance in order to give an experiment legitimacy and stability in the start-up phase. On the other hand, reliance on protection may weaken autonomous learning processes (Hommels, Peters, & Bijker, 2007).
Similar types of challenges and dilemmas are identified in studies on transdisciplinary approaches. As transdisciplinary research involves collaboration between scientific disciplines and collaboration between science and society actors (Jahn et al., 2012), building a diverse network of engaged actors is key. However, insufficient legitimacy of actors involved, unbalanced problem ownership and limited capacity to engage in transdisciplinary research

collaborations is challenging (Hessels et al., 2018; Lang et al., 2012). For urban labs, the mode of working of academics can undermine the ease of non-academics to participate (Culwick et al., 2019). In addition, Scholl et al., (2018) show that a challenge for urban labs is to have linkages with formal government structures to facilitate embedding lessons learned into practice.

2.3 Learning

Learning processes are important for experimentation as they enable the generation of knowledge about needs, problems and possibilities of the innovation (Kemp et al., 1998).[4] Literature discusses one dilemma and four challenges related to learning. A dilemma is to enable broad learning, i.e. learning that is focused on aligning lessons about technical (technology, infrastructure) and social aspects (e.g. user context, markets, policy, regulation, societal impact) (Van der Laak et al. 2007), without watering down focus. In practice, learning in experiments if often focused too much on technological or economic aspects. On the other end of the dilemma, however, is the observation that when experiments are designed with too many learning ambitions in mind, choices and commitments are hampered or delayed (Schot & Geels, 2008).

The first challenge is to facilitate reflexive learning, i.e. learning that challenges deeper held values, believes and assumptions (Schot & Geels, 2008). Through such learning, fundamental conceptions about technology, users, demands and regulations are questioned and explored. It may lead to changes in cognitive frames, underlying assumptions and ways of looking at problems or solutions (Hoogma et al., 2002). Reflexivity requires trust and engagement trough interaction and dialogue. Reflexive learning is enabled by continuous evaluation of experiments and learning across experiments, but this is often challenging in practice, e.g. because of a lack of resources for monitoring, a lack of clear responsibilities, political need to demonstrate success, or a lack of reflexive capabilities.

A second challenge is to align learning across organizations with different learning goals. Varying learning goals stand in the way of fruitful experimentation. For some stakeholders, learning might be a secondary rather than a primary goal. They rather make concrete achievements than learn about possibly unfeasible options (Heiskanen, Jalas, Rinkinen, & Tainio, 2015).

A third challenge is to facilitate learning across different experiments. Learning across different experiments helps foster sustainability transitions (Luederitz et al., 2016). However, in transferring and applying generic knowledge to specific contexts, local networks often need help and support to translate those lessons into their specific contexts. Learning from experiments – transforming outcomes into generic lessons – requires dedicated 'aggregation activities' (e.g. standardization, codification, model building, formulation of best practices) and circulation of knowledge to enable comparison between local practices (e.g. conferences, workshops, technical journals, proceedings, newsletters) (Geels & Raven, 2006). However, stakeholders can be reluctant to share data and insights across the network, for example due to a lack of trust or competition.

In line with the abovementioned challenges and dilemmas, studies on transdisciplinarity also stress the importance of reflexivity about learning and the role of researchers (Jahn et al., 2012). In the context of urban experimentation, Scholl et al., (2018) found that a lack of clear and shared focus on learning about new forms of governance can be a key challenge, as well as, too much focus on operational issues rather than capturing lessons learned. Transdisciplinary approaches aim at enabling mutual learning between science and society. However, being an engaged researcher can be challenging as one has to maintain some critical distance (Wickson, Carew, & Russell, 2006). To be able to work with these potentially conflicting agendas, actors should 'nurture reflexive research habits'. For urban experimentation, this means that a key challenge is learning goals should be aligned and that the position of researchers may influence LLs.

Table 1: Challenges and dilemmas derived from the SNM literature

Process	***Challenges and dilemmas identified in literature***		***Reference***
Vision and expectations The articulation of expectations and the creation of visions is an important process in stablishing an experiment as it provides directions to learning processes, attracts attention and legitimates protection and nurturing	Challenge	1. Create a vision and/or concrete expectations	(Hatzl et al., 2016), (Jain et al., 2017), (Wolfram, 2018), (Elmustapha et al., 2018), (Susur et al., 2019)
		2. Ensure robust visions and expectations	(Weber et al., 1999), (Weber, 2003), (Caniëls & Romijn, 2008), (Ceschin, 2013), (Xue et al., 2016), (Naber et al., 2017), (Bush et al., 2017), (Imbert et al., 2019), (Susur et al., 2019)
	Dilemma	1. Broad vs specific experiment	Kemp, Schot & Hoogma (1998) (Weber et al., 1999)
		2. Flexible vs persistent attitude towards vision	(Schot & Geels, 2008), (Hatzl, Seebauer, Fleiß, & Posch, 2016), (Turnheim & Geels, 2019)
		3. Too high vs too low expectations	(Verbong et al., 2008), (Caniëls & Romijn, 2008), (Verbong et al., 2010), (Seyfang & Haxeltine, 2012), (Heiskanen, Nissilä, et al., 2015)

Network, actors and resources Network building is important to create support for the new socio-technical innovation, facilitate stakeholder interaction and provide necessary resources	Challenge	1. Building broad networks	(Weber, 1999), (Weber 2003), (Schot & Geels, 2008), (Verbong et al., 2008), (Hoppe et al., 2015), (Xue et al., 2016), (Naber et al., 2017), (Verbong et al., 2010)
		2. Enabling deep networks	(Hatzl et al., 2016), (Naber et al., 2017)
		3. Navigating network tensions	(Verbong et al., 2008)
		4. Generating public acceptance and support	(Verbong et al., 2008)
		5. Organizing leadership and/or local coordination	(Seyfang et al., 2014), (Hoppe et al., 2015), (Bush et al., 2017), (van der Grijp et al., 2019)
	Dilemma	1. Incumbents vs challengers	(Weber et al., 1999)
		2. Dependency vs autonomy	(Weber et al., 1999), (Seyfang et al., 2014) (Kemp et al. 1999)
Learning Broad learning, encompassing first order and reflexive learning processes	Challenge	1. Facilitate reflexive learning	(Weber et al., 1999), (Wiskerke, 2003), (Schot & Geels, 2008), (Regeer, de Wildt-Liesveld, van Mierlo, & Bunders, 2016), (Naber et al., 2017), (Wolfram, 2018), (Elmustapha et al., 2018)
		2. Aligning learning goals across organizations	(Heiskanen, Jalas, et al., 2015)
		3. Learning across experiments	(Seyfang et al., 2014), (Heiskanen, Nissilä, et al., 2015) (Luederitz, et al. 2016), (Weber et al., 1999), (Weber, 2003), (Schot & Geels, 2008), (Caniëls & Romijn, 2008), (Verbong et al., 2008), (Huijben & Verbong, 2013), (Hatzl et al., 2016), (Bush et al., 2017), (Bush & Bale, 2019), (Susur et al., 2019)
	Dilemma	1. Enabling broad learning	(Caniëls & Romijn, 2008), (Verbong et al., 2008), (Schot & Geels, 2008), (Verbong et al., 2010), (Hatzl et al., 2016), (Jain et al., 2017), (van der Grijp et al., 2019)

3. Research design

This research is embedded in a transdisciplinary research project running from 2016 to 2020.[5] The project explores cycling innovation in the context of sustainable mobility transitions and livable urban regions. Strategic urban experiments in four cities were established in a transdisciplinary manner (te Brömmelstroet et al., 2020). The research design is exploratory. We aim to determine particular aspects of a phenomenon, in our case challenges and dilemmas in living labs, where we have (some) control over behavioral events (through co-creation of the labs), with a focus on contemporary events. Our case study strategy is a mix of what Yin (2003) terms an 'experiment' and 'case study'. Because our cases are situated in the same national context, but within different local and regional context, we characterize our research strategy as a multiple-case study design, which allows us to contrast the findings on the basis of key concepts in our framework.

3.1 Case study characterization

The cases of this study are four LLs, described in box 1.

Box 1: Cases of strategic urban experimentation: cycling innovation living labs

Living Lab 1: Exchange bikes in Amsterdam

This LL is situated at the train station of the Zuid-as business district, close to the city. 200 selected commuters from and to this train station received a free bike – out of a pool of 120 bikes. One group of people who travel to the train station by train can take a bike upon arrival at the train station and use it to travel to their final destination. The other group of people, who live close to the train station, use this bike from their homes to travel to the train station. In theory, this idea could drastically reduce (50%) parked bikes at train stations. Bike parking capacity at train stations is a pressing challenge in many Dutch cities, and mainly at train stations. Throughout the whole country, bike parking capacity at train stations is being expanded. However, often, these parking facilities will reach full capacity soon after they are delivered. Moreover, such publicly funded parking infrastructure is costly. Stakeholders involved in the LL are a bicycle producer providing the bikes, the national railway company (which also operates a nation-wide station-based bike sharing system), the rail infrastructure company (owner of the parking facility), the municipality of Amsterdam, two research institutes (a local university and university of applied sciences) and the regional transport authority who manages the project.

Living Lab 2: Free-floating bike sharing in Utrecht

This LL is about testing the potential of free-floating bike sharing for a period of two years. The municipality of Utrecht selected one bike sharing provider that has the sole right to provide this service to users in the city. The city's goal is to learn about the potential and implications of free-floating bike sharing, as a solution to address local urban challenges such as accessibility and bike parking. The city is also interested in learning from the LL as a method. Researchers of the local university and a university of applied sciences are involved in the LL to study parking conditions and to conduct a user survey. The LL is managed by the municipality.

Living Lab 3: Researching bicycle highways in Eindhoven

This LL involves a cooperation between the regional government (province of North Brabant), the municipality of Eindhoven and other principal cities of the province. The LL involves empirical research into bicycle highways as a new form of bicycle infrastructure and what design and governance principles are necessary both to develop a comprehensive network and to integrate this into the existing bicycle infrastructure. Unlike the cities of the other LLs, here the focus is more on offering attractive alternatives to driving rather than accommodating cycling growth. Another focus is on best practices for integrating feeder routes with bicycle highways. Between the major cities of the province of Brabant there is a network of bicycle highways.

Living Lab 4: Monitoring cycling infrastructure in Zwolle

This LL links to an existing infrastructural project that aims to upgrade a cycling road between a the city of Zwolle and the village of Dalfsen. In this LL, the regional government is involved as well as both municipalities that are linked through the cycling road. The focus of the living lab is particularly related to learning about processes of collaboration between different governmental stakeholders.[6]

The cases are situated in the Netherlands, where cycling rates are high, although different per city. In Amsterdam (821.752 inhabitants) the share of cycling in transport use is 36%; in Utrecht (334.176) it is 41%; Eindhoven (223.209) it is 33% and in Zwolle (123.861) it is 49%. (Kennisinstituut voor Mobiliteitsbeleid, 2019). Amsterdam and Utrecht have rich local cycling cultures. In these cities, ambitions, policy plans and priorities related to cycling are not necessarily aimed at increasing cycling rates more, but at improving the quality of cycling and tackling cycling related urban challenges. In Amsterdam, the municipality wants to create more space trough cycling infrastructure and increasing parking capacity for bikes. Utrecht wants to maintain its position as a world class cycling city by improving accessibility and existing infrastructure. In Eindhoven, historically more a car-oriented city, emphasis of cycling policy is on stimulating cycling and improving accessibility and connection with the region. Zwolle has the highest cycling rates of the Netherlands (and world). The starting point of cycling policy plans are improving speed and comfort of the cycling infrastructure.

3.2 Data collection and analysis

For this study, a qualitative case study approach was carried out, following conventions in interpretative and qualitative research (Yin, 2003) and participatory action research (Brown & Tandon, 1983). The whole process of initiating, designing, establishing and implementing a LL was studied. Closely monitoring the sequence of events was possible as the authors of this paper were involved in the organization of LLs. This engagement consisted of organizing four public kick-off events, initiating and coordinating local meetings with stakeholders (i.e. cities, regional governments, innovators), organizing project meetings in which research insights were shared policy-decisions were informed. Researchers had a two-fold role as participants in the LL and observers of the process. This double role will be reflected upon in the discussion section.

Empirical data was collected through interviews and participant observation during October 2016 until the end of 2020. The interviews were conducted in two rounds: February – March 2018 and May – August 2019. In total, 26 semi-structured stakeholder interviews were conducted, audio-recorded and transcribed. In the first round of interviews, questions were structured along key experimentation processes (i.e. visions, actors & resources, learning, context), but expressed verbally in a way that prevented the use of scholarly jargon. This provided general insight in how the LLs were designed and implemented. The second round of interviews—when the LLs were established—focused on progress, challenges, dilemma's and reflections about the LL process. LL stakeholders in four cities were interviewed representing municipalities (n=10), provinces (n=5), universities (n=7), transport authority (n=2), intermediary (n=1) and the private sector (n=1). See appendix C and D for the overview of interviewees and the interview protocol respectively. Interviews per cases are referred to by a1-a6 (LL1), b1-b6 (LL2) c1-c7 (LL3), and e1-e6 (LL4).

The interviews were analyzed and structured with Nvivo. A hybrid approach of inductive and deductive coding was used (Fereday & Muir-Cochrane, 2006). With inductive coding, recurring themes in the data that are not directly linked to the conceptual framework are labeled. In the deductive coding approach we identified the three experimentation processes and related challenges and dilemmas (see table 1), which were used as labels. Combining both approaches allowed for a focused analysis along the framework concepts while at the same time having an open attitude towards new, additional challenges and dilemmas outside the scope of our tentative framework.

4. Results

In this section, challenges and dilemmas, derived from the analysis of four cases, are outlined. The 16 challenges and dilemmas identified in section 2 are referred to in italics. For each of the three SNM processes we discuss key insights in terms of known challenges and dilemmas from the literature that stand out in our analysis of the cases, challenges and dilemmas that were not found in our analysis and new challenges and dilemmas, not covered by SNM literature.

4.1 Visions and expectations

A challenge that stood out was the *creation of visions and expectations* about specific LLs. The LLs evolved against the background of an overarching transdisciplinary research project. A broad and robust vision was shared among all stakeholders participating in this project. This vision was that cycling positively contributes to cities and that cycling innovation should be stimulated and researched.[7] LLs were proposed as a method to experiment with cycling innovations in practice. The establishment of LLs was received with enthusiasm and created high promises: a variety of actors were willing to join at the beginning of the project.[8] Even after three years of collaboration most stakeholders perceive LLs as a fruitful approach because it helps to address local challenges, create knowledge and build relationships with cycling researchers (c6, b4, d5). Expectations were high enough to attract stakeholders, but were not unrealistically high to lead to disappointments. This reflects a *flexible attitude towards the vision* among stakeholders. However, *ensuring robust expectations* about local

LLs was challenging in the beginning. Transforming an overarching vision, a variety of ideas and innovations, and diverse group of actors into four local LLs appeared challenging.

One reason for that relates to the ambiguous concept of 'cycling innovation', which was interpreted in various ways. Different expectations existed about what should be tested in the LL (c4, c5, d1, d2). Stakeholders mostly envisioned testing a physical innovation. For example, in the LL in Eindhoven, a city representative expected a high-tech driven innovation: *"I think I was fixated on technological innovation because they are very tangible. There were cycling innovations such as BikeScout – a smart lighting system that warns cars for approaching cyclists at crossings – or apps. I expected these types of innovation would play a more important role"* (c4). In contrast, some interviewees envisioned a social innovation such as a new way of governing cycling infrastructure projects (c6).

Selecting experiments for all LLs – and thereby *turning a broad vision into concrete experiments* with cycling innovation – was challenging. Local urban challenges and contestation played an important role. LLs are challenge-led and thus the selection of an experiment in Amsterdam and Utrecht was directed by the need to address local challenges. In Amsterdam, optimal use of bike parking facilities was a key challenge for the improvement of the regional cycling system and accessibility. This led to an experiment aimed at testing a potential solution to this challenge. In Utrecht, accessibility, bike parking and abundance of bikes were identified as key challenges, resulting in an experiment to test the potential of free-floating bike sharing (FFBS). In Eindhoven and Zwolle, linking the experiment to local urban challenges was more challenging. In these cases, involved actors (municipalities, provinces and researchers) had difficulties in reaching consensus regarding which specific questions and urban challenges to address, struggling to come to decisions what experiments to select and implement (c7, d6). A collective search process resulted in linking research capacity to existing cycling related projects, rather than co-creating new LL experiments.

Experiment selection was influenced by local contestation. In Amsterdam, initially FFBS was considered for experimentation. But FFBS had become a contested and politically sensitive topic because of disruptive launching strategies and the negative impact of free-floating bikes on public space.[9] Therefore, the municipality did not want a FFBS LL experiment in public space. Also, it was not willing to choose one company in a LL over others interested (c4). Eventually, a politically less sensitive bike parking innovation was selected situated in a train station). This political sensitivity around FFBS also affected experiment selection in Utrecht, but in a different way. The fact that FFBS had become controversial in Amsterdam (FFBS was banned), made it an interesting opportunity to explore this cycling innovation in Utrecht. Especially because firms were looking to relocate to another city after the ban in Amsterdam (b1, b4). In Utrecht, this political sensitivity was used to engage with FFBS firms and explore conditions under which FFBS can operate in line with city needs. Through a tender procedure one firm was selected.

A challenge not yet discussed in SNM literature was that – besides different interpretations of a cycling innovation experiment – also ambiguity existed among stakeholders in relation to

the general concept of 'LLs' (What it can do? What it is about? Who will do what?) in the first part of the project (c, d1, d2). The concept was not entirely clear and was open to different interpretations. Two defining dimensions were identified in the project[10]: 1) the creation of an "experimental space"– a physical location to trial socio-technical innovations in practice 2) LLs as a method or new way of working and organizing an innovation process and collaboration between universities and urban and regional authorities.

This led to a challenge that roles and responsibilities were not clearly articulated. In all LLs unclear role expectations were recognized as a key challenge (a, b, c, d). In Amsterdam, Eindhoven and Zwolle, it remained unclear for a long period who would do what. Actors eventually took up roles depending on their own interest and expertise. Some stakeholders expected others to take up a specific role: e.g. researchers expected practitioners to lead in selecting an urban challenge, facilitate and/or take the lead in setting up the LLs; practitioners on the other hand assumed researchers to have a proactive role given they were in the lead of the project proposal, provide applicable knowledge and clear-cut solutions to their problems and manage the LL process. In the end, researchers took up multiple roles: initiator of LL meetings, building a network, sharing knowledge, critical observer and active LL stakeholder. In Amsterdam this led to frustration among practitioners as they felt they were being observed rather than provided with solutions to their problem: *"I sometimes felt a bit observed when I was arguing with the city or railway company. I was doing that on a table where also a couple of academics were thinking, oh, that, wow, interesting. It was almost like a camera observing how we were failing in our communication and everything. It felt a bit peculiar sometimes."* (a3).

4.2 Social network building, actors and resources

The most prominent challenge that stood out from the cases – and also identified from the literature – was *creating broad networks*. As described in the previous section, attracting a broad variety of interested actors was not a problem given the high promises of the project. Especially in the beginning, in each region broad networks of potentially relevant stakeholders were formed. A variety of stakeholders joined LL meetings, exploring whether they might want, or could play, a role in the LL. In this period, LLs meetings were held, without formal structures (no formal decision-making procedure or rules of the game). The LL was in this phase a platform where stakeholders could meet and discuss progress (e.g. roles, what to experiment with, which stakeholders to attract, etc.). After roughly two years, four solid and harmonious local networks were formed (see Box 1 for a description of different actors). Navigating network tensions within LLs was not an issue.

Although LL networks were formed, the early involvement of users – assumed important for a broad network for experimentation – on a local level appeared challenging. The relevance of involving users in an early stage did not come forward during the development stage, and consequently, direct user involvement remained very limited. Attempts to involve users were more indirect and on a project level, through cyclists representative groups such as Cyclists Union (Fietsersbond in Dutch) and Cycling Community (Fietscommunity in Dutch). The latter organization engaged with the research project in knowledge sharing (e.g. organizing workshops). Limited user involvement was generally not seen as problematic in the early

phase of setting up LLs by most actors. Some stakeholders see users indirectly represented through city actors (e6).

Another key challenge concerned *enabling deep* networks and mobilizing political and financial resources. For the LLs, this meant finding the right representatives within a municipal or regional authority, with decision-making power and/or access to financial resources for the establishment of LLs (b5). Financial resources for doing LLs were initially lacking in all regions. Part of the misunderstanding about role expectations described earlier, was misunderstanding about financial resources needed to set up and manage LLs. In the project proposal, it was not clarified who should provide these resources and no budget was allocated for implementing LLs (c5). This led to a temporary deadlock in establishing LLs. Practitioners expected researchers to take up a proactive role in setting up LLs (c5, d3). However, besides research capacity, no financial resources were available for implementing LLs from the university-side.

Too much *dependency on resources* and external protection did not come forward as a key dilemma. Financial and political support played an important role in LLs in Amsterdam and Utrecht. Policy networks proved important for generating wider support. Both cases also show a local sense of urgency in solving urban mobility related challenges and the contribution of cycling innovations. In Utrecht this translated into high level support for bike sharing and urban experimentation, formalized in a policy letter (b1). This political support translated in into financial support. Financial resources provided a solid breeding ground for the establishment of LL2. A budget (part of a national program to improve accessibility) spurred development as it was used to appoint a project manager (b1). In Amsterdam financial resources were mobilized that should address parking capacity, which is identified as a regional issue in an administrative agreement[11] (a8). In contrast, the municipality of Eindhoven dealt with budget cuts (new pilots were critically assessed, including LLs) and limited human capacity affecting the local LL. The city spent more hours and budget on the LL than was budgeted beforehand (c4). Across all LLs *generating public support* for the experiments was not a clear challenge.

Organizing leadership was a challenge in all LLs. Limited leadership or coordination was perceived as a hampering factor in the set-up phase, as reflected by a practitioner: *"It's quite difficult to navigate in between the practical side and the academic side. Somebody taking the lead would be really helpful in future living labs. Both sides could really help each other much more. I think it has a lot of potential if you put these together. The academic world having the theoretical knowledge and us being practical and having less of this knowledge."* (a3). This insight improved understanding about the need for a dedicated LL project manager as this was recognized as a necessary strategy to continue LL development.

Appointing a LL manager was facilitated in two cases by the mobilization of financial resources (provided by governments). This led to immediate progress in Amsterdam and Utrecht as a dedicated manager took the co-creation phase into a more traditional project form. In Amsterdam, this was a regional transport authority, not hindered by political tensions around FFBS experimentation unlike the municipality. In Utrecht, the municipality appointed a dedicated project manager. Stakeholders in these LLs experienced this as a positive and

necessary contribution that provided clarity, direction and action to the LLs (a5, a,6, a7, b6, b7).

Engaging with 'regime' insiders and/or outsiders only occurred in LLs in Amsterdam and Utrecht in which the LL innovation could challenge vested interests. In Utrecht, a relative newcomer was selected to operate a FFBS in the city, even though the national railway company operates the largest (station-based) bike sharing system in the Netherlands. The LL in Amsterdam can be viewed as a more radical socio-technical experiment in which also incumbent actors (such as the national railway company and the rail infrastructure owner) are involved. Involving them was both challenging and necessary as they own and manage parking space needed for the placement of the bikes. But their involvement also influenced the experiment (a7). For example, it was not possible to use bikes of the existing (station-based) bike sharing system (operated by the railway company) for this experiment because it was worried that negative results of the experiment would affect their reputation. Nevertheless, such interference did not pose a clear dilemma for experimentation.

4.3 Learning

All learning dilemma and challenges identified from literature occurred in the LLs. Closely related were the dilemma to *enable broad learning* and the challenge of *aligning learning goals across organizations*. For some the goal of LLs was about (first order) learning about practicalities of the innovation. Municipalities, practitioners, innovators and applied researchers were interested in the practical implications of LLs (e.g. what is the impact of bike sharing on modal shift? What are user motivations?). Researchers and some municipalities also aimed at reflexive learning i.e. learning about the broader problem, the LL process as an approach to organize urban innovations and learn from collaboration between practitioners and universities. These actors were mostly interested in more fundamental questions (e.g. what can we learn from the LL as a method of reflexive governance and for urban innovation?). The municipality of Utrecht endorsed both goals: *"It would be nice that the innovation will become a success. And it would even be nicer that this urban living lab process has contributed to that. Although personally I would like that bike sharing system will be successful. However, professionally, I'd rather see that the process will teach us many new things such as what went wrong and how we can embed this process in in future policy within our organization."* (b3).

A tension between l*earning goals* was that for researchers it did not really matter whether LLs were successful or failed, as they were primarily interested in drawing lessons. For practitioners, there was more at stake as they can be held accountable. *"For academics, failure also provides insight. Municipalities don't have that luxury situation."* (c6). However, for some government actors, the LL approach enabled them to allow for failure (b4). Tension between different interests created disruptions in the LL process.

An important challenge was to *facilitate reflexive learning* within all LLs, in particular in relation to each other's backgrounds. LL participants are grounded in different contexts representing different professional 'worlds', with different languages and professional jargon (English vs Dutch; abstract vs practical) different outputs (policy & concrete plans vs scientific articles) and

timeframes (long vs short term). Misunderstanding of these different working environments was emphasized by one practitioner: *"One of my assumptions is that scientists have less affinity with the erratic and unruly reality we deal with in practice. We are hands-on and not just sitting behind a desk. We are the ones sitting at the table with our inhabitants, and have to prepare plans and decisions with our administrators. We have to deal with angry citizens. So these are different worlds."* (d2). Learning about different backgrounds and disciplines can be challenging, as shown in LLs in Eindhoven and Zwolle. Practitioners tended to struggle with learning from academics as they were working on more fundamental questions, less relevant to daily practices of local governments. This limited understanding was emphasized by a practitioner: *"I don't have an academic background and like me, most colleagues at our department have a more practical background so we don't know how the university works. When you distinguish fundamental and applied research, we don't know. So expectations don't match. I just think: I have some societal questions that I would like to get investigated. But researchers have their PhD projects, which have their own requirements. It took us two years to understand this"* (c1). Also different stakeholders use different professional jargon and may take for granted background knowledge that is not shared by others.

According to most stakeholders, more learning across LLs took place, in particular about experimentation processes (a3, c2, d5). All stakeholders were struggling in the startup phase. Sharing insights about what worked and what did not contributed to local LL development. To facilitate this learning process, a number of workshops were organized, prior to which interviews were held to obtain lessons about practicalities and experiences.

5. Discussion

5.1 Contrasting challenges and dilemmas across cases

Table 2 shows that most of the known challenges and dilemmas from literature also occurred across the four LLs.[12] However, differences between LLs can be observed, which suggest the importance of place-based aspects in strategic urban experimentation (Hansen & Coenen, 2015; van den Heiligenberg et al., 2017). Here we discuss similarities and differences across LLs, including potential reasons for these differences, grounded in an understanding of different place-based conditions.

Table 2: Challenges and dilemmas from SNM in LLs (•=strong, ○ =occurred but no major issue, – =not occurred).

			LL1	LL2	LL3	LL4
Vision and expectations	Challenge	1. a vision and/or concrete expectations	•	•	•	•
		2. Ensure robust visions and expectations	•	•	•	•
	Dilemma	1. Broad vs specific experiment	•	•	•	•
		2. Flexible vs persistent attitude towards vision	–	–	–	–
		3. Too high vs too low expectations	○	○	○	○
Network, actors and resources	Challenge	1. Creating broad networks	○	○	○	○
		2. Enabling deep networks	○	○	•	•
		3. Navigating network tensions	–	–	–	○
		4. Generating public support	○	○	–	–
		5. Organizing leadership and/or local coordination	○	○	•	•
	Dilemma	1. Engaging with 'regime' insiders vs outsiders	○	○	–	–
		2. Dependency vs autonomy	–	–	–	–
Learning	Challenge	1. Facilitating reflexive learning	•	•	•	•
		2. Aligning learning goals across organizations	○	○	•	•
		2. Aligning learning goals across organizations	•	•	•	•

First, we observe that creating a robust vision and expectations about the socio-technical innovation was challenging in all LLs. In contrast, none of the LLs faced the dilemma of flexible vs persistent attitudes towards LLs. No notable differences in challenges and dilemmas related to visions and expectations between LLs were identified.

Second, creating broad networks and enabling deep networks was challenging but was not a major issue. Also, LLs did not suffer under too much or too little protection (dependency vs autonomy). However, creating broad networks, enabling deep networks and organizing leadership and coordination was less challenging in Amsterdam and Utrecht - cities that have a long cycling history – than in Eindhoven and Zwolle. A hypothesis is that these mature cycling environments are characterized by existing social networks around cycling, which are historically better developed and better equipped to support strategic urban experimentation with cycling innovation. Both cities also have more pressing cycling related issues such as parking problems and the abundance of bikes, hence there is a sense of urgency to

experiment with cycling innovations. This is translated in supportive political agendas and financial means for experimentations. Related to these strong local networks, results show that aligning learning goals between organizations in a LL was less challenging in cycling cities. A possible explanation is that pressing cycling related issues in these cities created a shared understanding and interest in tackling these problems which translates into a relatively easy alignment of learning goals.

Third, strategic experimentation is entangled with local political agendas and resources. Supportive regional or urban visions can help stimulate experimentation (van den Heiligenberg et al., 2017). Part of what makes experimentation become *strategic* is when it gets linked to political agendas.[13] For example, agendas around cycling stimulation, improving accessibility and parking capacity at train stations have positively influenced LLs in Amsterdam and Utrecht. However, lack of such linkages negatively affects the capacity for strategic urban experimentation. For instance, in Eindhoven cycling is still marginal in terms of political priority, which means that local agendas can only to a limited extent be mobilized.

Fourth, a supportive environment for strategic urban experimentation also enabled building unconventional coalitions in which both innovators and incumbent actors collaborate. At the same time, a strong local cycling culture in these cities meant that experiments and innovations challenge the prevalent norms of private bike ownership could lead to limited support, but it did not. Although Zwolle today is also an ambitious cycling city, its ambition has only relatively recently become more explicit and politically enacted. There are no pressing cycling related issues as observed in Amsterdam or Utrecht. Hence, there are other policy priorities, such as speed and comfort of cyclists using the cycling infrastructure. At the other end of the spectrum there is Eindhoven, a city historically more car-oriented, at least relative to the other three cities. Here, cycling is less prominent as a political priority, which leads to limited resources to support cycling innovation experiments.

Finally, similarities in challenges and dilemmas across different LLs may be partly influenced as they are connected through the overarching research project consisting of a network of academic researchers. This connection has influenced strategies to respond to challenges. For example, it allowed to recognize that a successful intervention in one living lab (appointing a project manager) could also be applied in other living labs.

5.2 General reflections about challenges and dilemmas

In addition to these similarities and differences across the cases, and the relevance of taking a place-based approach to strategic urban experimentation, we discuss two broader reflections about challenges and dilemmas as observed in the current literature and the results from our analysis.

5.2.1 Strategic urban experimentation processes

We observed a difference concerning articulating (and managing) robust expectations about processes of strategic urban experimentation. Whereas extant niche experimentation literature points at the importance of articulation of visions and robust expectations about the

socio-technical innovation, the cases show that aligning visions and expectations about the concept of LL experimentation itself (e.g. its methods, roles, responsibilities, procedures) is critical, too.

Our findings suggest that different interpretations of what LLs should be and enable existed. Shared visions and expectations about the concept of LLs were created in the process of setting them up. It took two years for LLs to become robust projects in which expectations, goals, roles and the approach became established among the stakeholders. This resonates with Verbong et al. (2008) who recognizes that experiments often start as platforms for interaction and establishing them is a process of muddling through, understanding each other and learning by doing rather than a clearly defined process with strict agreements. Research on transdisciplinarity also highlights that lack of a clear and shared focus about new forms of governance (in our case LL experimentation) is a key challenge (Scholl et al., 2018).

A notable observation is that LLs in Amsterdam and Utrecht evolved from a typical LL approach (i.e. co-creation, broad vision, open to a variety of perspectives, ideas and initiatives, high level of uncertainty) to a more traditionally structured project-based approach (i.e. clear defined goals, clear roles and responsibilities, certainty) which enabled a more effective collaboration among LL actors. The LL became embedded in existing organizational structures, and the more established the LL became, the less open and emergent the LLs became. This development coincided with the appointment of LL project managers. Indeed, earlier research suggested that linkages with formal government structures and clear leadership are crucial aspects for LL development (Scholl et al., 2018; Voytenko et al., 2016).[14] This insight – transforming LLs into more a clear-cut projects facilitates embedding in organizational structures – also contributes to literature that recognizes the challenge of institutionalizing experimentation as a mode of governance in organizational structures (Sengers et al., 2019; Voytenko et al., 2016). A question remains whether this creates a new dilemma of maintaining the innovative and transformative potential of a LL, while adapting to and embedding it into existing practices and institutions.

5.2.2 Stimulating transdisciplinary reflexivity

We want to highlight transdisciplinarity as a critical challenge that future work on strategic urban experiment should engage with. From SNM we know that reflexive learning is important for experimentation. A key observation and dilemma concerns reflexivity in transdisciplinary research collaborations between universities and urban practitioners. Reflexivity means that actors turn a critical gaze upon themselves (Finlay & Gough, 2008). For example, our research demonstrates that potentially conflicting learning goals within such a research collaboration can impede fruitful learning and experimentation, and should therefore be reflected upon. In particular, we discuss here our own position and role in the living labs.

Reflexivity about the role of researchers is a key insight from literature on transdisciplinary research (Jahn et al., 2012; Lang et al., 2012). Transdisciplinary research requires scholars to reflect on their role as researchers, their research focus and methodology and their relation to academia and society (Knaggård et al., 2018). When participating in transdisciplinary research,

researchers are not just knowledge makers, but facilitators of change, and hence consciously or not, they are changing their own roles, identities and values in the process (Pereira et al., 2019). Likewise, research suggests that transitions' researchers can have different roles: reflective scientist, process facilitator, knowledge broker, change agent, and self-reflexive actor which refers to being reflexive about one's positionality and normativity, and to seeing oneself as part of the dynamics that one seeks to change (Wittmayer & Schäpke, 2014).

Researchers committed to not only describing transformation processes but also initiating them face the engagement vs distance dilemma (Köhler et al., 2019).[15] The dilemma is how to be an engaged participant while also be able to take some distance to critically observe. Positionality – the stance of the researcher in relation to the object of study– is therefore key to reflect upon (Coghlan & Brydon-Miller, 2014). The position adopted by the researcher affects every phase of the research process: from problem definition to research design to how other are invited to participate. To work with the engaged researchers dilemma, Wickson et al., (2006) suggest researchers should nurture reflexive research habits.

Being engaged in strategic urban experimentation, we suggest that our position as researchers has influenced the research process and the development of LLs, which in turn have influenced research outcomes. We took up and navigated between different roles (e.g. initiating the research project, setting up local LL experiments, facilitating learning across LLs, examining its progress and sharing insights). Being both observers and participants, we have continuously faced the engagement-distance dilemma. To what extent should we intervene in the course of events?[16]

6. Conclusion

In this paper, we asked the question: what are challenges and dilemmas in doing strategic urban experimentation? To this end, we systematically reviewed SNM literature to develop a tentative framework of challenges and dilemmas, enriched with recent insights from transdisciplinary research on living labs. This framework was tested through transdisciplinary case-study research in four cycling innovation LLs. We unpacked place-based dimensions and provide an additional set of explanatory arguments of why the cases unfolded as they did in terms of challenges and dilemmas. As such, this framework has proved useful as a sense-making and analytical device for exploring challenges and dilemmas in strategic experimentation. Future studies could use the framework for similar analysis in other domains or geographies. Future studies could also explore the usefulness of this framework beyond analytical purposes by using it to design the (governance of) strategic experimentation. Finally, the framework was designed to make sense of challenges and dilemmas at the level of local experiments. As such, future work could explore challenges and dilemmas at the level of 'global niches' (Geels and Raven, 2006), including challenges and dilemmas related to empowering niches (Smith and Raven, 2012).

A new challenge concerns articulating and managing expectations about processes of strategic urban experimentation itself. LLs started as open processes but along the way turned into more closed projects. Managing this process involves balancing between embedding

LLs in existing structures while maintaining openness to new ideas. We also found that engaging in strategic urban experimentation brings new dilemmas for researchers being both observers and facilitators of strategic urban experimentation. Further research could focus on systematically investigating strategies to deal with the identified challenges and dilemmas and the broader impact and upscaling dynamics of strategic urban experimentation. While this study has made use of recent insights from transdisciplinary research on living labs, there is considerable scope for a broader and more systematic discussion of how transdisciplinary approaches can enrich sustainability transitions research.

7. Appendix

A: Literature review

A literature search was carried out to identify relevant articles that discuss Strategic Niche Management and experimentation processes. This search encompassed the following steps. In the first step key words were defined and used to search for matching articles with these words in the titles, abstract or key word section. The following query was used in Scopus: TITLE-ABS-KEY (''strategic AND niche AND management'' AND (learn* OR network* OR expectations* OR vision*)) AND (LIMIT-TO (DOCTYPE , "ar")). This led to a first result of 132 articles (august 14th 2019). This set was further narrowed down by reading the abstracts. When the articles show a meaningful relationship with SNM literature and its processes, it was selected as a contribution to the literature review. This selection procedure resulted in 53 articles. This set of articles was coded in Nvivo with the aim of identifying challenges and dilemmas of experimentation. Hence, aspects were labeled as a challenge or dilemmas related to visions and expectations, actors and network building or learning (resulting in six different labels). Reading and coding the articles, the ones that did not show a meaningful relationship with the aim of our paper were excluded from the analysis. Eventually 29 articles were selected for the analysis. The three experimentation processes were labelled and categorized as a challenge or dilemma, based on the definition provided in footnote 2.

B: Operationalization table

	Challenges and dilemmas	***Signifying terms / key words in data (examples what to look for)***
Visions & expectations	1. Create a vision and/or concrete expectations	• Mentions of broad and/or concrete visions and expectations • Stakeholder goals of participating in LLs
	2. Ensure robust visions and expectations	• Varying visions and expectations of the project and LLs • Different understandings/interpretations of LL and socio-technical innovations
	3. Broad vs narrow vision and experiment (selection)	• LL definitions among stakeholders
	4. Flexible vs persistent attitude towards vision	• Changing responses to LL developments
	5. Too high vs too low expectations	• Varying expectations at different phases of LL development
Network	1. Creating broad network	• Involvement of a variety of stakeholders and perspective (e.g. governments, companies/ innovators, universities, users etc.)
	2. Enabling	• Involvement of stakeholders and ability to mobilize resources (e.g. political, financial)
	3. Navigating network tensions	• Conflicts within LLs
	4. Generating public acceptance and support	• Limited support about LLs how it is received among the broader public
	5. Organizing leadership and/or local coordination	• Role and presence of a local manager or coordinator of LLs
	6. Engaging with 'regime' insiders vs outsiders	• Involvement of incumbent actors (e.g. public transport companies) or outsiders (e.g. innovators/ entrepreneurs)
Learning	1. Facilitating reflexive learning	• Reflexive learning processes taking places
	2. Aligning learning goals across organizations	• Mentions of learning goals of different stakeholders
	3. Learning across experiments	• Processes of learning between LLs
	4. Enabling broad learning	• Different learning aspects: technical (about the innovation) and social (about broader conceptions of the innovation and experimentation in general)

C: Overview of interviewees

LL	Round	Interviewee	Reference	Date
1	1	Municipality	a1	26-2-2018
		Municipality	a2	20-3-2018
		Regional Transport Authority	a3	21-2-2018
		University- Urban Planning Department	a4	27-2-2018
	2	Municipality - project manager bike parking	a5	19-7-2019
		Regional Transport Authority	a6	3-7-2019
		University – Urban Planning Department	a7	21-5-2019
		Consultant – temporary project manager	a8	27-5-2019
3	1	Municipality – cycling policy maker	e1	27-8-2018
		Province- policy maker	e2	27-8-2018
		University – Innovation Sciences Department & Urban Planning Department	e3	26-3-2018
	2	Municipality – cycling policy maker	e4	16-8-2019
		Province – policy maker	e5	16-8-2019
		University – Innovation Sciences Department	e6	12-8-2019
		University – Phd Candidate	e7	6-8-2019
2	1	Municipality – project leader cycling program	b1	1-3-2018
		Municipality – project manager living lab	b2	1-3-2018
		Province – policy maker	b3	2-3-2018
	2	Municipality – project manager living lab	b4	14-5-2019
		University – Innovation Studies Department	b5	4-6-2016
		Bike sharing firm – local project manager	b6	5-6-2019
4	1	Municipality A	d1	5-3-2018
		Municipality B	d2	5-3-2018
		Province – department of	d3	5-3-2018
	2	University of applied sciences – researcher	d4	19-8-2019
		Municipality B – project leader	d5	7-8-2019
		Province – department of	d6	7-8-2019

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Notes

[1] Corresponding author: a.h.m.vanwaes@uu.nl,Vening Meinesz building, Princetonlaan 8a, 3584 CB Utrecht

[2] This distinction is based on definitions from Cambridge Dictionary. We define a challenge by a situation being faced with something that needs (great mental or physical) effort in order to be done successfully (and therefore tests a person's ability). We view dilemmas as circumstances in which a difficult choice has to be made between two different things you could do.

[3] We note that not all urban LLs might be challenge-led. This particular characteristic was derived from a systematic review of experimentation in the context of sustainability transitions (Sengers et al., 2019). Urban LLs on the other hand may in fact also be established for other reasons, such as economic

opportunities to attract foreign investment, or as part of city marketing purposes.

[4] Hoogma (2002) identified five learning dimensions: technical development and user infrastructure, user context, societal and environmental impact, industrial development and policy and regulations (see Jain, 2017).

[5] The co-creation process of LLs is the result of a successful grant application, driven by the different universities participating in this project. Hence, the authors of this paper also initiated the project and encouraged the authorities to engage in and start LLs.

[6] A second LL was developed around cycling lessons for immigrants. Because this LL was established later in the project, data collection did not cover this case.

[7] Since the Netherlands already has very high cycling rates, though they are uneven across different areas, the reasons why different urban and regional authorities take interest in cycling innovation are diverse and relate to high intensity of cycling in some areas (which e.g. generates parking capacity issues), yet to be achieved potential of some cycling routes and some inflexibility in multimodal journeys (combining cycling with other modes of transport, primarily train, in commuting between cities).

[8] o get a grasp of types of cycling innovations, four local kick-off pitch events (one in each city) were organized with entrepreneurs and innovators pitching 'cycling innovations' to cities. The events attracted approximately 50 cycling innovations (varying from smart locks, to peer-to-peer bike sharing systems, to smart parking infrastructure) attuned to local urban challenges. See https://www.smartcyclingfutures.nl/events/ for brief reports of these events.

[9] In October 2018, three months after their entry in the city, free-floating bike sharing firms were banned by the municipality of Amsterdam. Multiple firms introduced large numbers of bikes without formal consent onto the city streets leading to impact on public space and conflict with parking legislation (see van Waes et al., (2018, 2020) for an elaborate case studies).

[10] This dual definition also translates into learning goals and expectations of stakeholders i.e. they aim to learn about the cycling innovation in practice and about the LL as a method.

[11] The agreement – 'Bestuursakkoord Fietsparkeren' – was signed by actors including Municipality, Regional Transport Authority, and railway and rail infrastructure companies.

[12] The identified challenges are in line with Hossain et al (2019) who recognizes similar living lab challenges such as governance, efficiency of learning, temporality and scalability.

[13] In practice, getting commitment from partner organizations can be a timely but crucial, process as often agreement has to come from different levels within the organization.

[14] For most municipalities, LLs were also governance experiments, which has the ability to bring about change of formal governance structures (Bos & Brown, 2012).

[15] This dilemma relates to a broader debate about the relation between science and society. A key question is how researchers can respond to societal challenges. According to Kueffer et al. (2012) researchers face three challenges: the complexity challenge (i.e. how to combine various disciplines, also from outside academia), the impartiality challenge (i.e. how to ensure research serves common interests when knowledge is used in decision-making) and the salience challenge (how to produce useful knowledge for decision makers or practitioners).

[16] On a more mundane level that can translate into a question such as whether one should focus on listening during a meeting or actively interact and shape the conversation. A partial solution to that dilemma would be to split roles with some researchers taking notes and observing everyone while others participating more actively.

Over **Smart Cycling Futures**

Vraagstelling

Fietsen heeft enorme potentie voor leefbare en duurzame stedelijke regio's. Smart Cycling Futures (SCF) onderzocht de mogelijkheden voor en effecten van een 'slimmer' fietssysteem. Wetenschap en praktijk werkten nauw samen in 'living labs', waar sociale en technologische innovaties worden uitgeprobeerd en geëvalueerd. Stedelijke en regionale beleidsmakers hebben de fiets (her)ontdekt als belangrijk middel in het aantrekkelijker maken van de stad. Ondernemers met slimme fietsinnovaties staan te dringen om aan de slag te gaan met allerlei nieuwe ideeën, zoals het slimmer maken van de fietsinfrastructuur (bijvoorbeeld een groene golf voor fietsers), het ontwikkelen van deelfietssystemen en het stimuleren van fietsgebruik via slimme apps. Toch blijkt het in de praktijk vaak moeilijk om een transitie in (stedelijke) mobiliteitssystemen te stimuleren. Er is sprake van een 'harde lock-in' in bestaande stedelijke infrastructuren en een 'softe lock-in' in instituties (bijvoorbeeld standaarden, manieren van samenwerken) en gedrag. SCF probeerde de institutionele lock-in te doorbreken door al in een vroeg stadium nieuwe samenwerking te stimuleren in 'living labs' tussen kennisinstellingen, overheid, innovatoren en gebruikers.

Consortium

SCF is samengesteld uit de volgende kennis- en praktijkpartners: Universiteit Utrecht (penvoerder), Universiteit van Amsterdam, Technische Universiteit Eindhoven, Hogeschool Windesheim, Gemeente Amsterdam, Gemeente Eindhoven, Gemeente Utrecht, Gemeente Zwolle, Provincie Noord-Brabant, Provincie Overijssel, Provincie Utrecht, Vervoerregio Amsterdam, CROW-Fietsberaad en Fietscommunity 2.0.

Onderzoeksteam:
Rob Raven (projectleider)
Monash University (Melbourne, Australië), Universiteit Utrecht
Erwin Bezembinder
Hogeschool Windesheim
Marco te Brömmelstroet
Universiteit van Amsterdam
Matthew Bruno
TU Eindhoven
Jaco Farla
Universiteit Utrecht
Hugo Kampen
Hogeschool Windesheim
George Liu
TU Eindhoven
Samuel Nello-Deakin
Universiteit van Amsterdam
Anna Nikolaeva
Universiteit van Amsterdam, Universiteit Utrecht
Ruth Oldenziel
TU Eindhoven
Marcus Popkema
Hogeschool Windesheim
Frank Schipper
TU Eindhoven
Hugo van der Steenhoven (procesmanager)
Hugo Cycling
Friso de Vor
Hogeschool Windesheim
Arnoud van Waes
Universiteit Utrecht
Pieter van Wesemael
TU Eindhoven

Smart Urban Regions of the Future (SURF)

SCF maakt deel uit van het onderzoeksprogramma 'Smart Urban Regions of the Future' (SURF) van het kennisinitiatief Verbinden van Duurzame Steden (VerDuS). Hierin werken de ministeries IenW, BZK en EZK samen met NWO, Platform31 en het Nationaal Regieorgaan Praktijkgericht Onderzoek SIA.

Publicaties

Auteur(s)	*Titel*	*Jaar*	*Uitgave*
Van de Schraaf, D. & De Vor, F.	Handreiking fietsstimulering snelfietsroutes	2021	SCF-Brochure
Van Waes, A.	Platform innovation in urban mobility transitions. The case of platform enabled bike sharing	2021	PhD thesis
Nello-Deakin, S.	More than bike lanes: Recognising the physical and social characteristics of urban cycling environments.	2021	PhD thesis
Van Waes, A., Nikolaeva, A., & Raven, R.	Challenges and dilemmas of strategic urban experimentation. An analysis of four cycling innovation living labs.	2021	Technological, forecasting & social change
Long, B., & Van Waes, A.	When bike sharing business models go bad: Incorporating responsibility into business model innovation	2021	Journal of Cleaner Production
Bruno, M., Liu, G., Nello-Deakin, S. & De Vor, F.	Nieuwe fietsinfrastructuur voor fietsgeluk en een duurzame stad	2020	SCF-brochure
Van Waes, A., Farla J., & Raven, R.	Why do companies' institutional strategies differ across cities? A cross-case analysis of bike sharing in Shanghai & Amsterdam	2020	Environmental Innovation and Society Transitions
Popkema, M. & De Vor, F.	Vier lessen uit SURF-project Smart Cycling Futures	2020	Nationaal Verkeerskunde Congres (NVC)
Te Brömmelstroet, M., Nikolaeva, A., Nello-Deakin, S., Van Waes, A., Farla, J., Popkema, M., Van Wesemael, P., Liu, G., Raven, R., De Vor, F., & Bruno, M.	Researching cycling innovations: The contested nature of understanding and shaping smart cycling futures	2020	Transportation Research Interdisciplinary Perspectives

Auteur(s)	*Titel*	*Jaar*	*Uitgave*
Bruno, M.	The Challenge of the Bicycle Street: Applying collaborative governance processes while protecting user centered innovations	2020	Transportation Research Interdisciplinary Perspectives
Bruno, M., & Nikolaeva, A.	Towards a maintenance-based approach to mode shift: Comparing two cases of Dutch cycling policy using social practice theory	2020	Journal of Transport Geography
Nello-Deakin, S.	Environmental determinants of cycling: not seeing the forest for the trees?	2020	Journal of Transport Geography
Nikolaeva, A., Van Waes, A., Kampen, H., Popkema, M., & De Vor, F.	Fietsinnovatie: leve het living lab!	2020	SCF-brochure
Van Waes, A.	Fiets is ideale anderhalvemeter-mobiliteit en biedt garanties voor de toekomst	2020	Elsevier Weekblad
Nello-Deakin, S., & Nikolaeva, A.	The human infrastructure of a cycling city: Amsterdam through the eyes of international newcomers	2020	Urban Geography
Van der Steenhoven, H.	Nee, niet weer die auto in. Pak de fiets of ga lopen	2020	Trouw
Van Waes, A. & Farla, J.	Deelfietsen voor een duurzame stad	2019	SCF-brochure
Liu, G., Te Brömmelstroet, M., Krishnamurthy, S., & Van Wesemael, P.	Practitioners' perspective on user experience and Design of Cycle Highways	2019	Transportation Research Interdisciplinary Perspectives
Nello-Deakin, S.	Is there such a thing as a 'fair' distribution of road space?	2019	Journal of Urban Design

Publicaties

Auteur(s)	*Titel*	*Jaar*	
Nello-Deakin, S., & Harms, L.	Assessing the relationship between neighbourhood characteristics and cycling: Findings from Amsterdam	2019	Transportation Research Procedia
Popkema, M. & Kampen, H.	Leren in een living lab: de organisatie van leerprocessen bij fietslessen aan nieuwe Zwollenaren	2019	Colloquium Vervoersplanologisch Speurwerk (CVS)
Kampen, H., De Vor, F. & Blink, B.	Het creëren van vuistregels voor plaatsing van hub-centric deelfietsen	2019	Colloquium Vervoersplanologisch Speurwerk (CVS)
Nikolaeva, A., & Nello-Deakin, S.	Exploring velotopian urban imaginaries: Where Le Corbusier meets Constant?	2019	Mobilities
Nikolaeva, A., Te Brömmelstroet, M., Raven, R., & Ranson, J.	Smart cycling futures: Charting a new terrain and moving towards a research agenda	2019	Journal of Transport Geography
Nikolaeva, A.,	Commoning mobility: Towards a new politics of mobility transitions	2019	Transactions of the Institute of British Geographers
Liu, G., Krishnamurthy, S., & Van Wesemael, P.	Conceptualizing cycling experience in urban design research: a systematic literature review	2018	Applied Mobilities
Te Brömmelstroet, M., & Nello-Deakin, S.	Towards a pattern language for cycling environments: merging variables and narratives	2018	Applied Mobilities
Popkema, M., Kampen, H. & De Vor, F.	Lessen uit een living lab: de ontwikkeling van de regionale fietsroute Dalfsen-Zwolle	2018	Colloquium Vervoersplanologisch Speurwerk (CVS)

Auteur(s)	***Titel***	***Jaar***	***Uitgave***
Te Brömmelstroet, M., Nikolaeva, A., Glaser, M., Skou Nicolaisen, M., & Chan, C.	Travelling together alone and alone together: mobility and potential exposure to diversity	2017	Applied Mobilities
Nello-Deakin, S.	Book review: Velotopia: The Production of Cyclespace in Our Minds and Our Cities, S. Fleming (2017)	2017	Journal of Transport Geography
Boekhoudt, C.C.M., Te Brömmelstroet, M., & Thüsh, M.	De tijd vliegt als je plezier hebt: reistijd op de fiets is persoons-, locatie en tijdsafhankelijk	2017	Verkeerskunde
Van Waes, A.	Gaan deelfietsen de weerstand overwinnen?	2017	NRC Handelsblad
Van Waes, A.	Geef deelfiets de ruimte	2017	NRC Handelsblad

Ruim vier jaar onderzoek naar de mogelijkheden voor en effecten van een ‘slimmer’ fietssysteem is afgerond. In het onderzoeksproject Smart Cycling Futures (SCF) werkten wetenschap en praktijk nauw samen bij het uitproberen van uiteenlopende fietsinnovaties. Tegen de achtergrond van de uitdaging van steden en regio’s om leefbaar te blijven en zich duurzaam te ontwikkelen, is vanuit verschillende disciplines ingegaan op de vraag hoe de transitie naar een slimmer fietssysteem hierbij een rol kan spelen. Een bont team van onderzoekers heeft zijn tanden gezet in allerlei vraagstukken die spelen op het snijvlak van fietsen, innovatie en stedelijke en regionale (vervoers)vraagstukken.

Met deze Capita Selecta wordt een glimp getoond van de rijkheid en veelzijdigheid van de opbrengsten van ruim vier jaar SCF-onderzoek. Het heeft geleid tot een gebundelde mix van artikelen, Engelstalig en Nederlandstalig, dat het brede spectrum bestrijkt van wetenschappelijke beschouwing en reflectie tot lessen en oplossingsrichtingen voor de (beleids)praktijk.