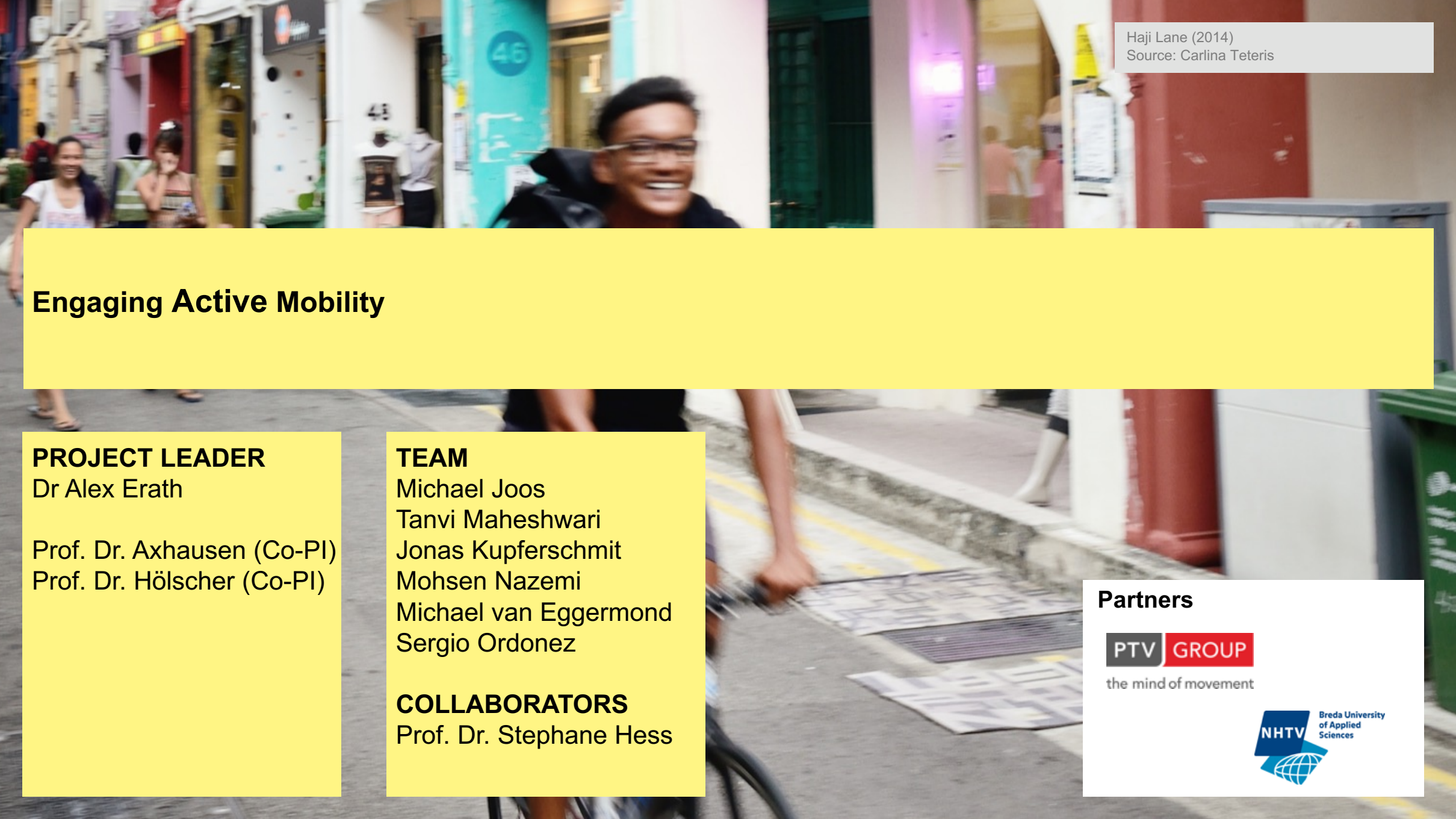
Engaging active mobility



Haji Lane (2014)
Source: Carlina Teteris

Engaging Active Mobility

PROJECT LEADER
Dr Alex Erath

Prof. Dr. Axhausen (Co-PI)
Prof. Dr. Hölscher (Co-PI)

TEAM
Michael Joos
Tanvi Maheshwari
Jonas Kupferschmit
Mohsen Nazemi
Michael van Eggermond
Sergio Ordonez

COLLABORATORS
Prof. Dr. Stephane Hess

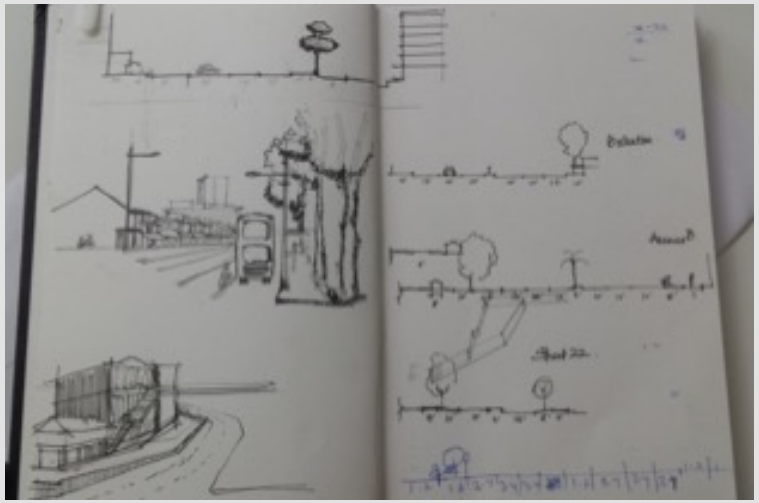
Partners

PTV GROUP
the mind of movement

NHTV Breda University of Applied Sciences

ENGAGING ACTIVE MOBILITY

L. Street design studies in Singapore (2016) Source: Tanvi Maheswari
M. Prototype of virtual cycling environment Source: Michael Joos (2016)
R. Testing cyling simulator prototype at NHTV Breda / Atlantis Games Source: Alex Erath (2015)



Objectives

- To understand what is needed to make walking and cycling viable modes of transport in the tropics.
- Develop street designs that are responsive to future forms of mobility

Methods

- Design Research
- Virtual Reality enhanced surveys
- Spatial analytics

Outcome

- Evidence-based design recommendations
- Explore Virtual Reality as a new tool for transport and urban planning

Partner

PTV GROUP
the mind of movement

NHTV Breda University of Applied Sciences

WHY VIRTUAL REALITY?

Studying behaviour

By capturing the multi-sensory experience of walking and cycling.

In a controlled and realistic environment.

With increasing affordable technology.

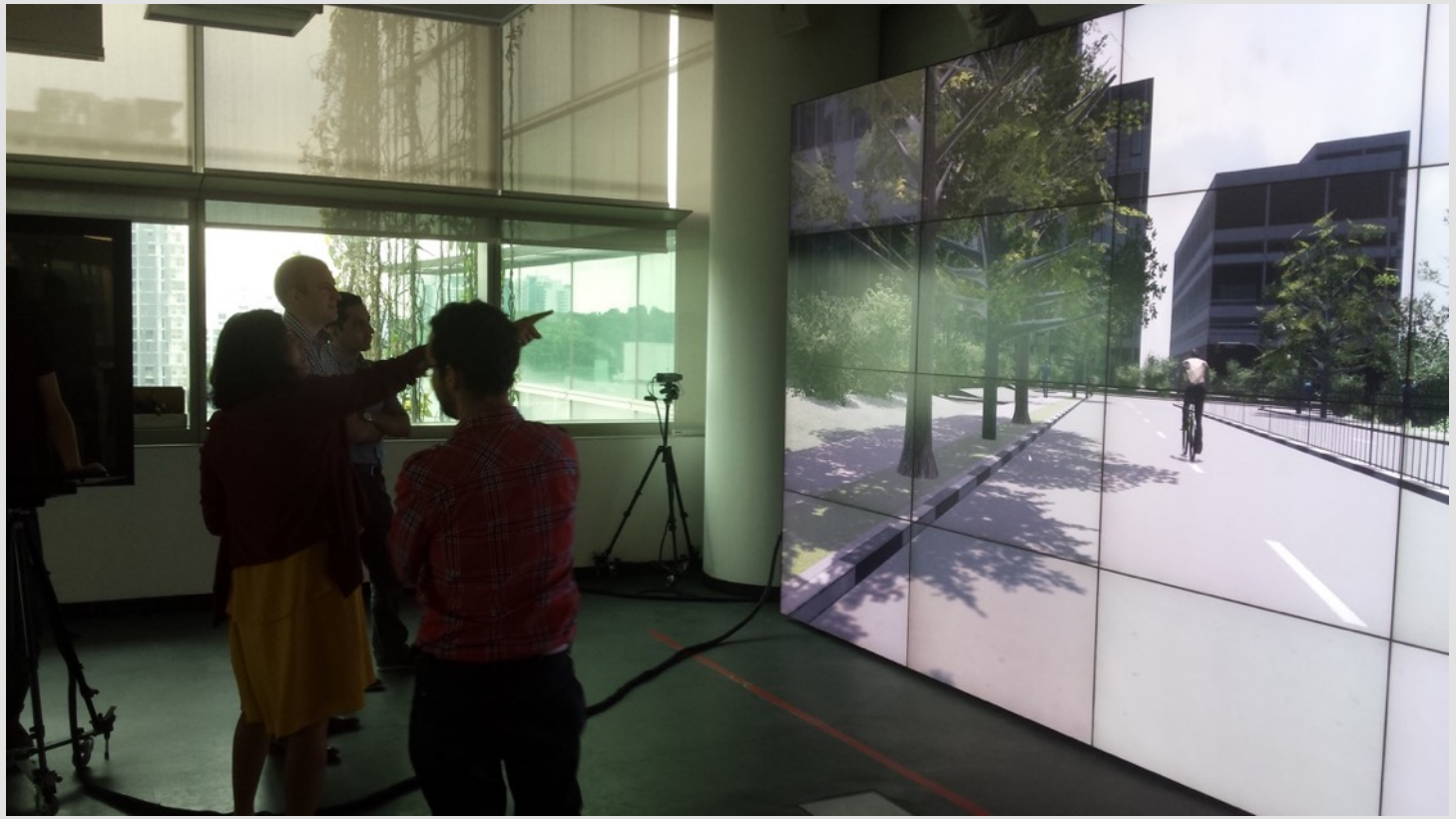
Research questions

How to employ virtual reality for research?

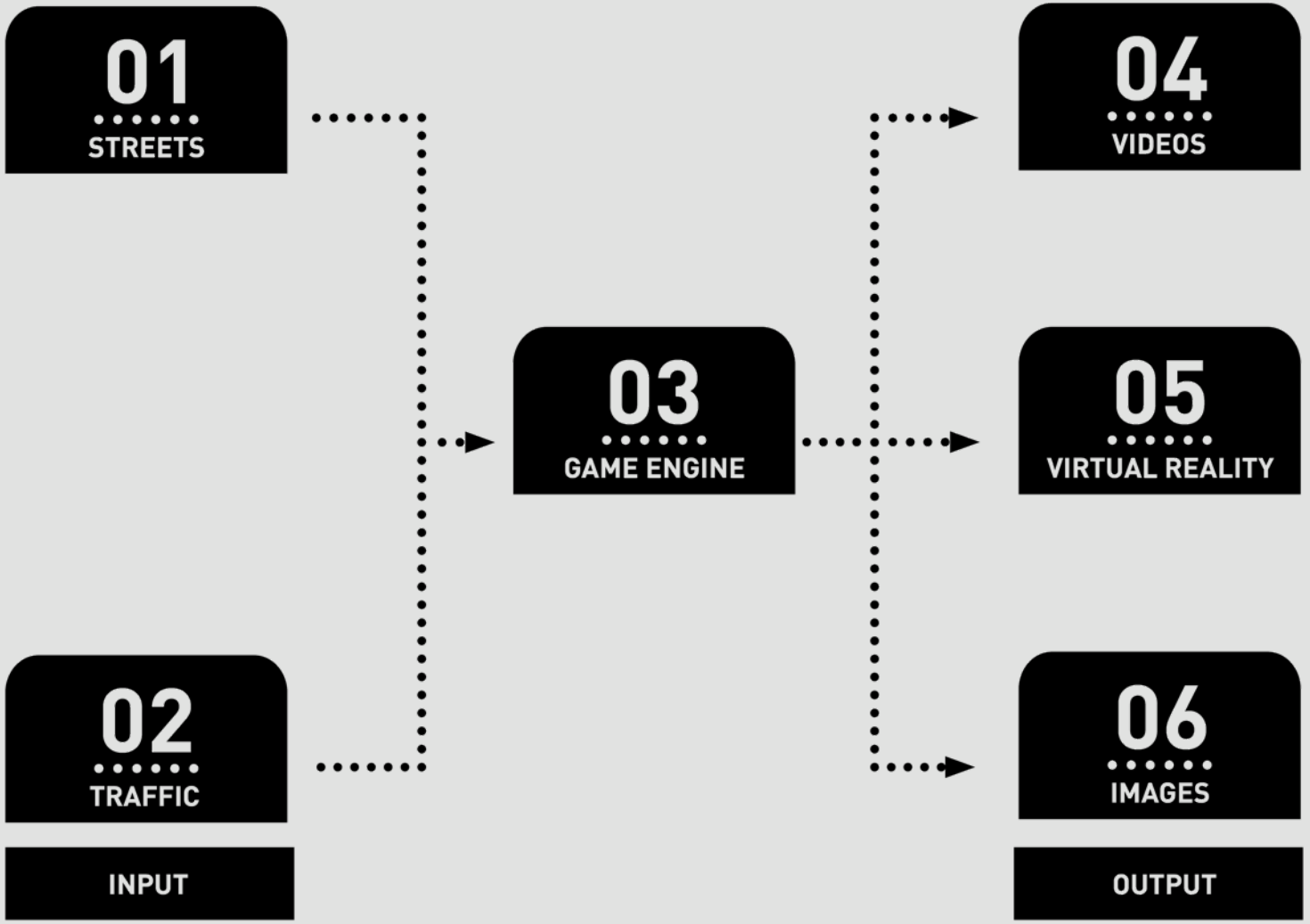
Reproducibility of real field observations

Limitations of VR in research?

How can sensors of physical reactions enhance survey methods?



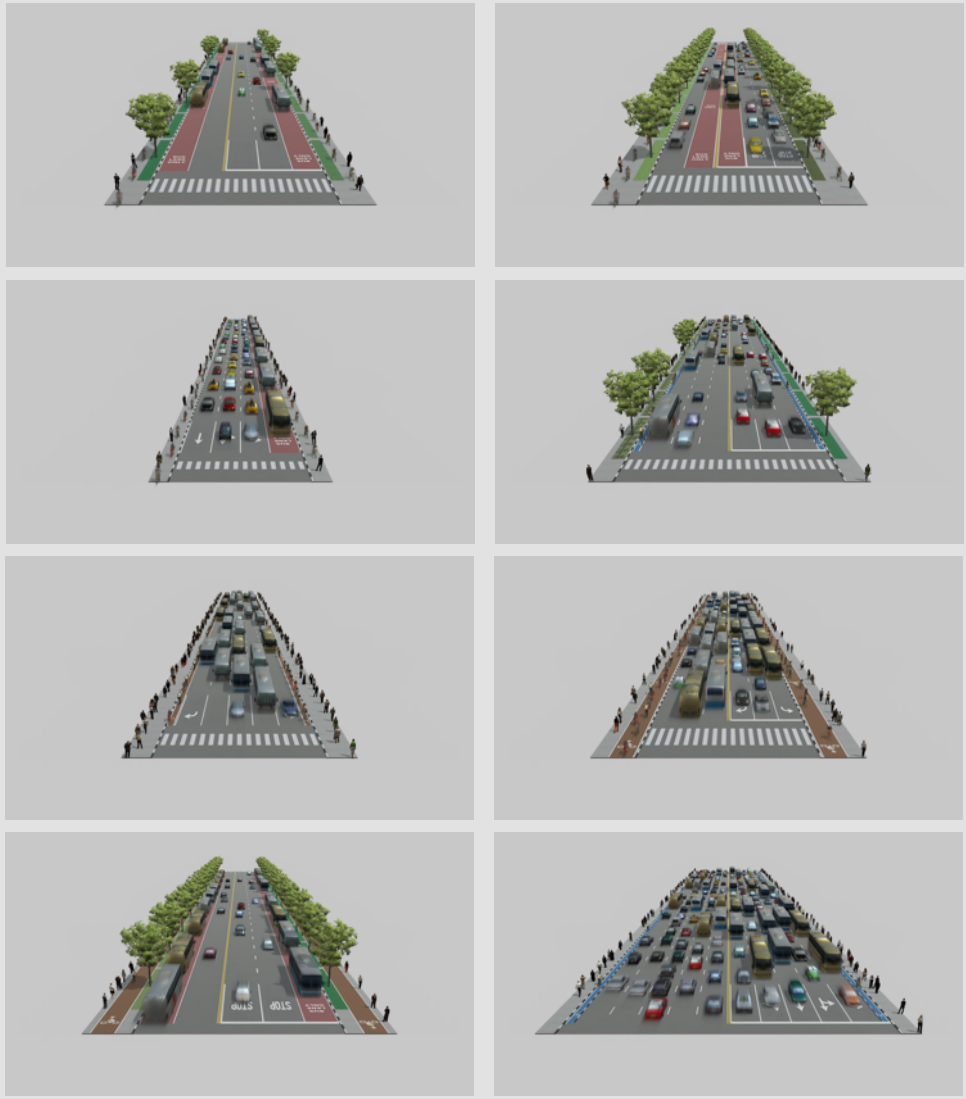
CREATING
VIRTUAL REALITY



STREETS

Existing 3D models

Procedural modelling



Modified complete streets rule for Singapore. Code available at https://github.com/fcl-engaging-mobility/Complete_Street_Rule

TRAFFIC MICROSIMULATION

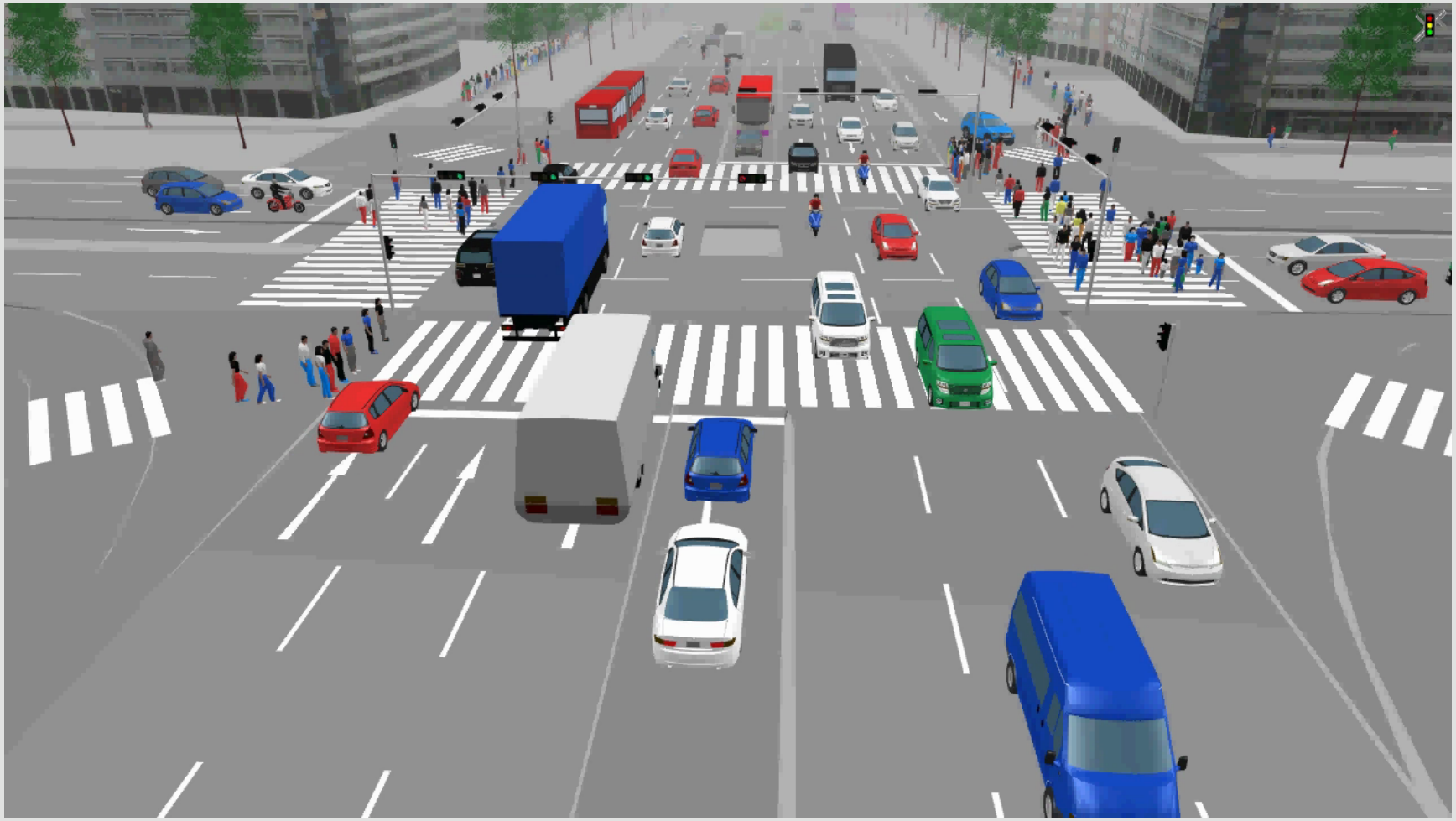
What is it?

Simulation of behaviour of cars, cyclists and pedestrians.

Research

Simulation of traffic in shared spaces.

Interaction of pedestrians, cyclists & vehicles.



Singapore intersection in Vissim. Video available at
https://www.youtube.com/watch?v=AmB_W5VbPNU&feature=youtu.be

GAME ENGINE

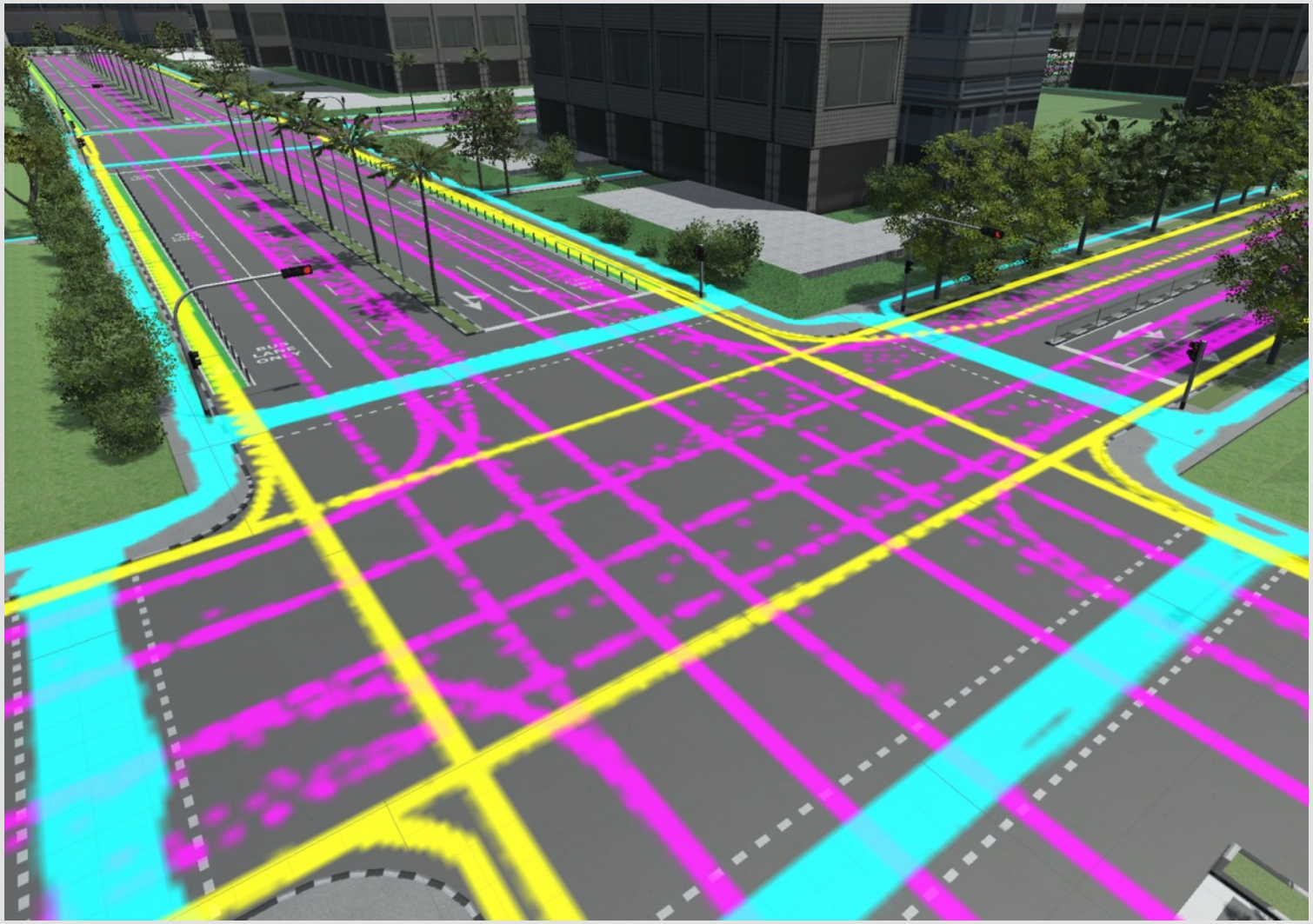
What does it do?

Combining 3D models and traffic microsimulations.

Research

Real-time interaction with controllers and simulation software.

Integration of **physiological** sensors



Heatmap of Vissim Simulation with Unity.
Code available at
https://github.com/fcl-engaging-mobility/UnityScripts

SURVEYS

Aims

Quantify factor that influence perception of safety and comfort when cycling

Understand influence of attitudes and socio-demographic profile

Method

Stated preference designs

Visualisation pipeline using City Engine and Unity

Web-based framework

Crowdsourced sampling?

Analysis using discrete choice theory

WHERE WOULD YOU / YOUR CHILD CYCLE?

Variables

Cycling lane type, separation from traffic, greenery, bus volume, car volume, bike volume pedestrian volume, street type, number of car lanes, availability of bus lane

Additional information

- Trip purpose
- Cycling distance
- Travel time with other modes

Method

Web-based stated choice experiment

Third option: would not cycle, but take other mode of transport

Ask from pedestrian, cyclist and motorist point of view

CYCLING SIMULATOR

VR Survey

Virtual reality enhanced survey with the use of a cycling simulator.

Users cycle along a predefined path to experience different cycling environments.

Quantitative analysis:
- skin conductance
- heartbeat variability
- eye tracking

Qualitative analysis:
- Talk aloud interview
- Before and after surveys

Cycling Simulator at Atlantis Games (2015)
Source: Dr Alex Erath

BIKE TO THE FUTURE

Redesign three streets around Tiong Bahru Market to accommodate cycling infrastructure.

Invite people to cycle on these three different streets designed for active mobility in Virtual Reality

Engage and get feedback on how **safe** and **comfortable** they feel cycling given the new design.

BIKE TO THE FUTURE

1
16 Sep 2016
Park(ing) Day
Tiong Bahru

2
5 Oct 2016
Archifest
Raffles Place

3
19-21 Oct 2016
SITCE Conference
Suntec Convention Center

THE VIRTUAL ENVIRONMENT

The Gear
1 HTC Vive
1 Oculus Rift

+

3D Model
Based on URA's existing high-definition models, modified on CAD software.

+

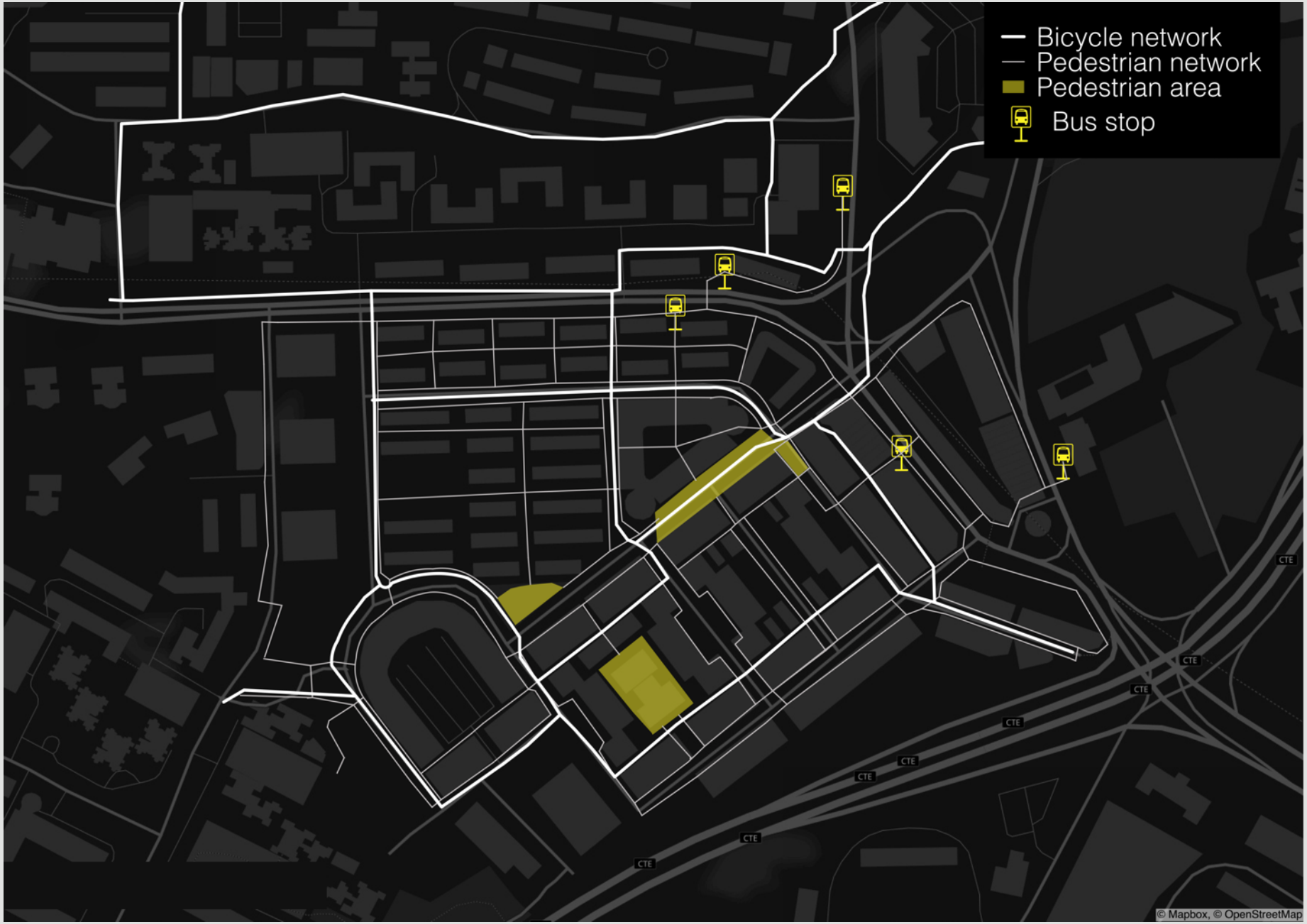
Traffic Simulation
Using PTV Vissim.
Adding Cyclists to segregated bike lanes

TIONG BAHRU: TRAFFIC CIRCULATION

Current

New design

DESIGN


Bicycle network
Pedestrian network
Pedestrian area
Bus stop
CTE
CTE
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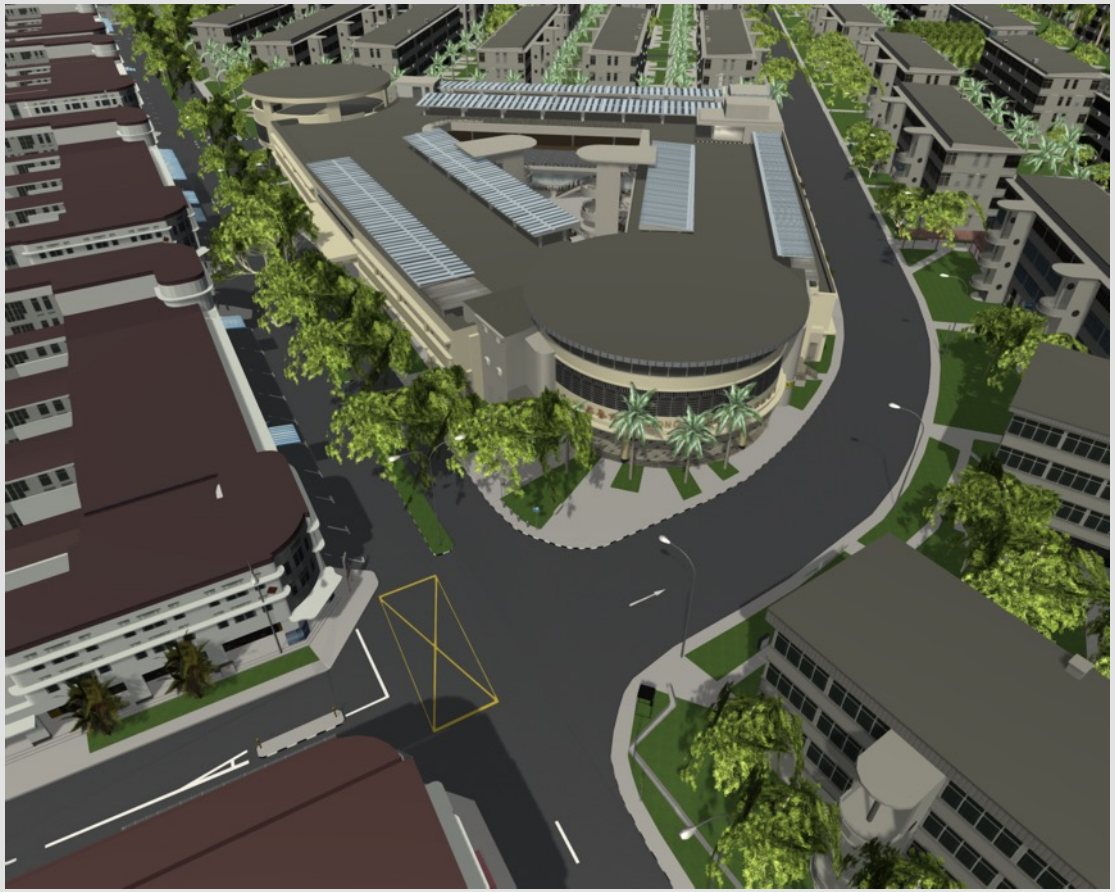
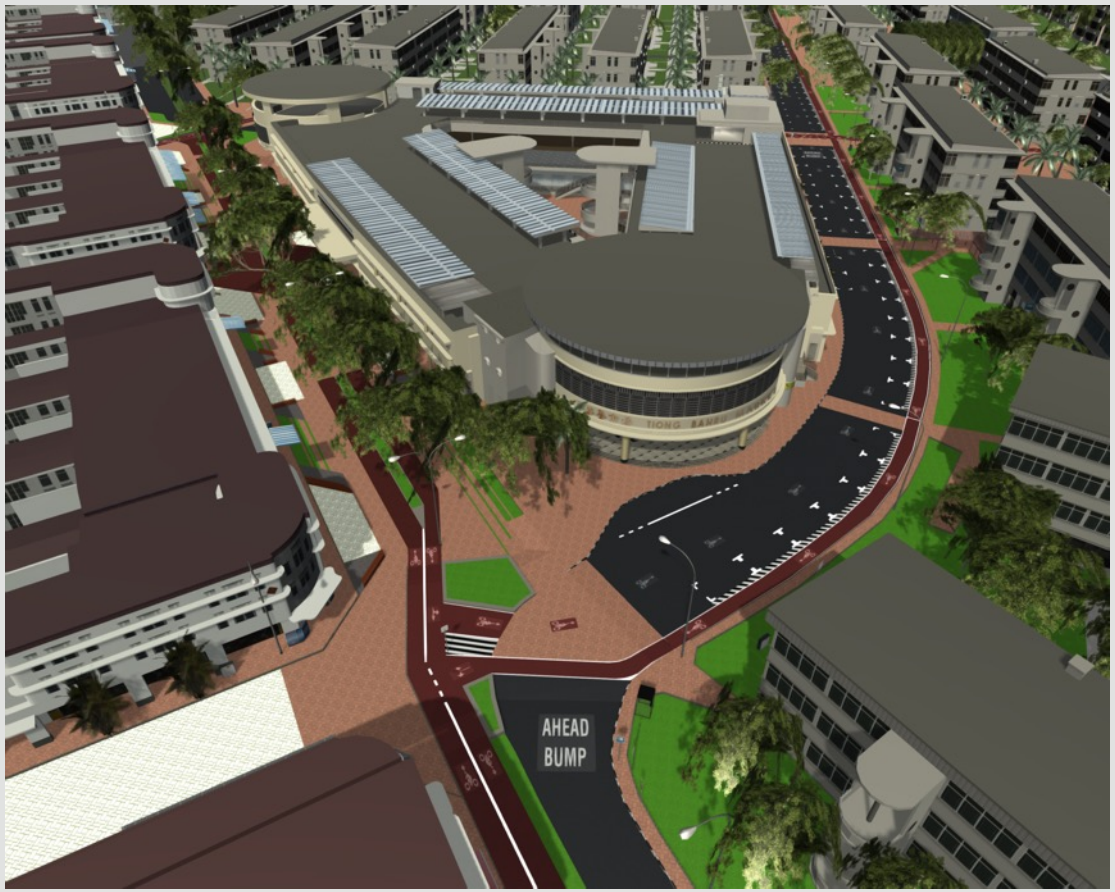
© Mapbox, © OpenStreetMap

DESIGN: INTERSECTIONS

.

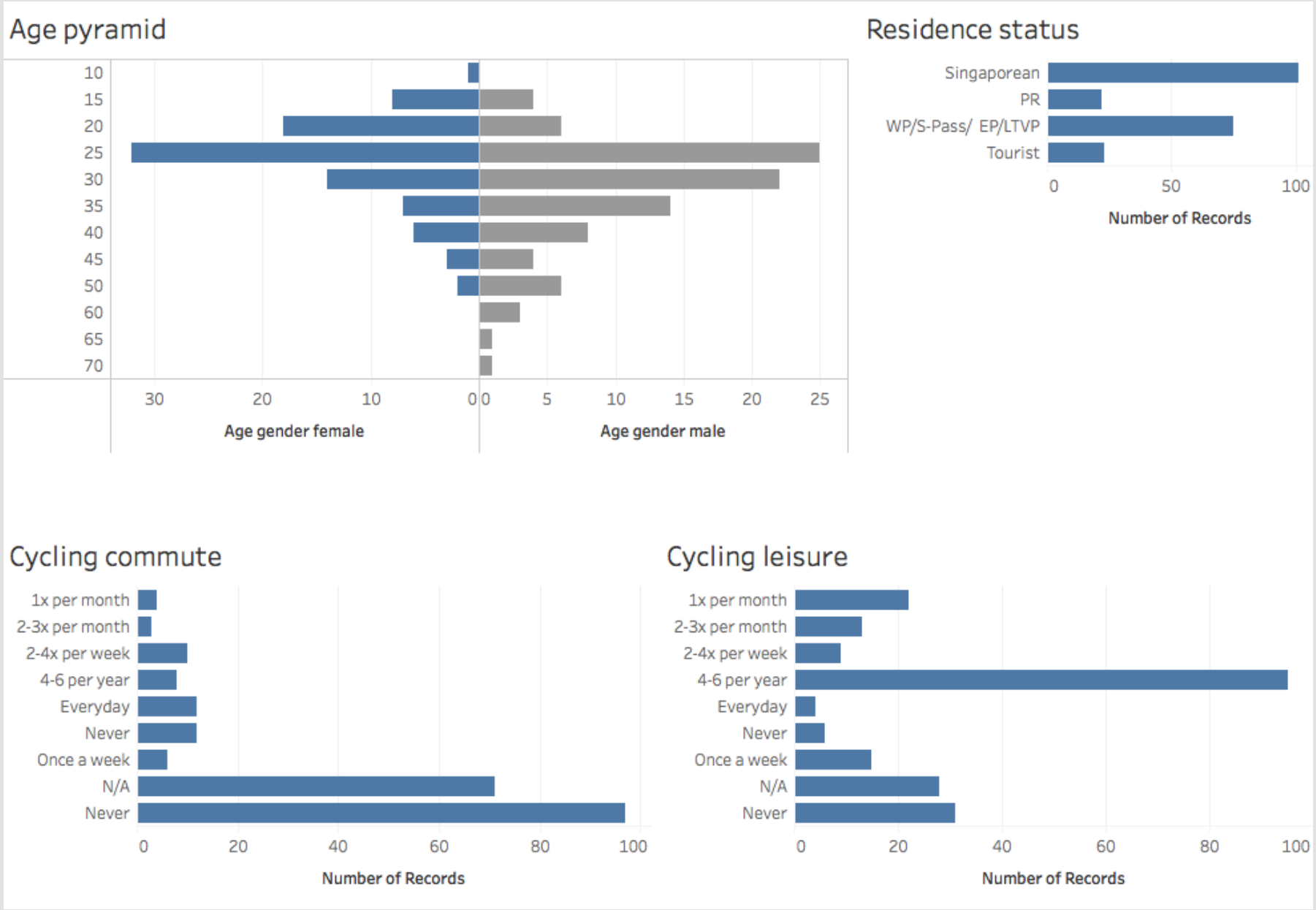




	Current	Rendering w/ traffic	New design
Lim Liak Street			
Kim Cheng Street			
Seng Poh Road			

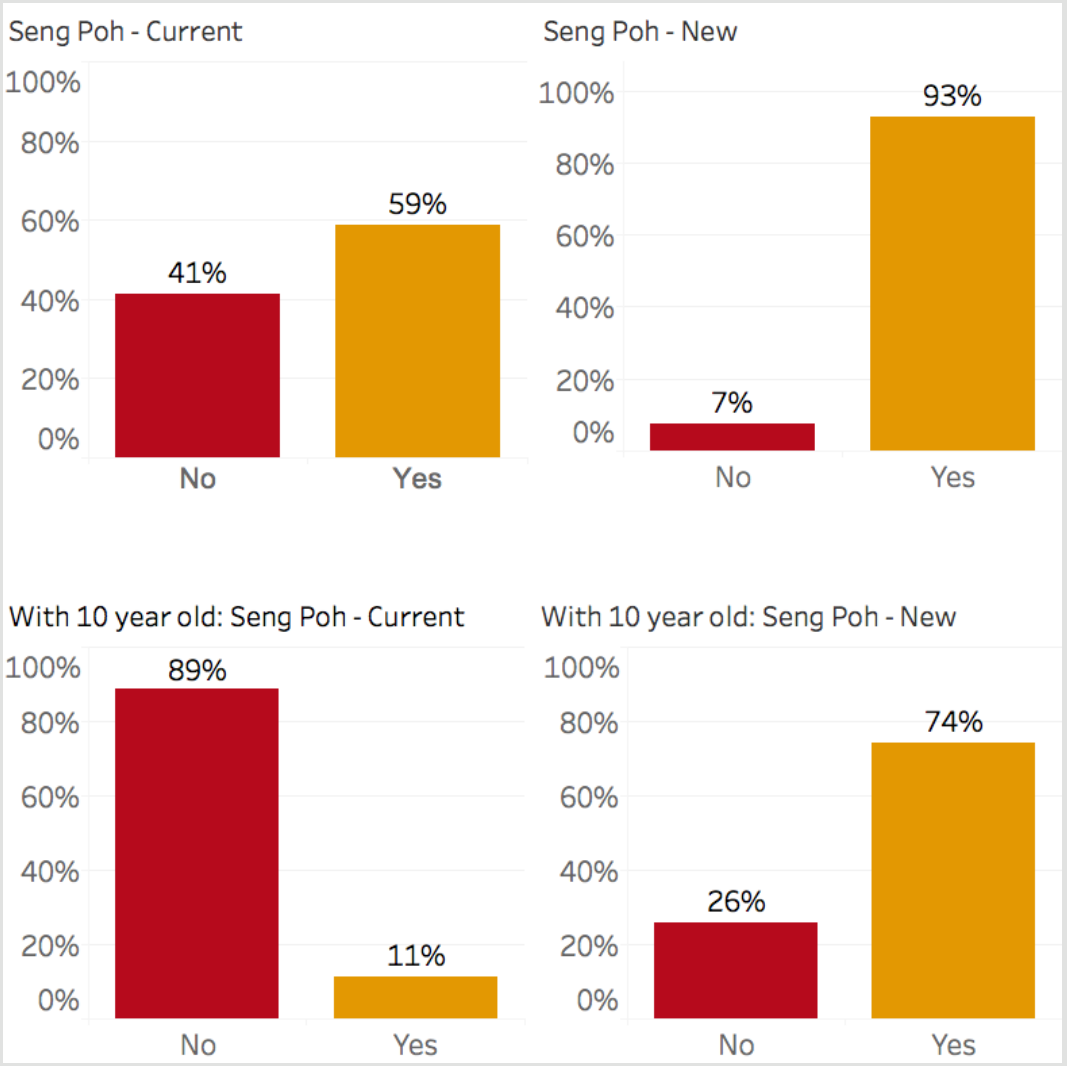

https://www.youtube.com/watch?v=sTmHHMcaHnA
TIONG BAHRU
LIM LIAK STREET
(FCL) FUTURE CITIES LABORATORY
未来城市实验室

QUESTIONNAIRE



QUESTIONNAIRE

Current



New design

LET’S RIDE!

FUTURE

Research questions:

Which infrastructure should be placed where, given budget and time constraints?

Who benefits from this new infrastructure?

What will be the uptake and where will new demand be?

Surveys:

Bike pulse
Development of survey for in-house VR experiments

Cycling simulator:

Stage 1: Safety:

- Sensors for pedalling
- Sensors for steering
- Sensors for braking

Stage 2: Comfort:

- Wind
- Adaptable resistance to simulate Pedelec e-bike
- Heat
- Sound

Parcours

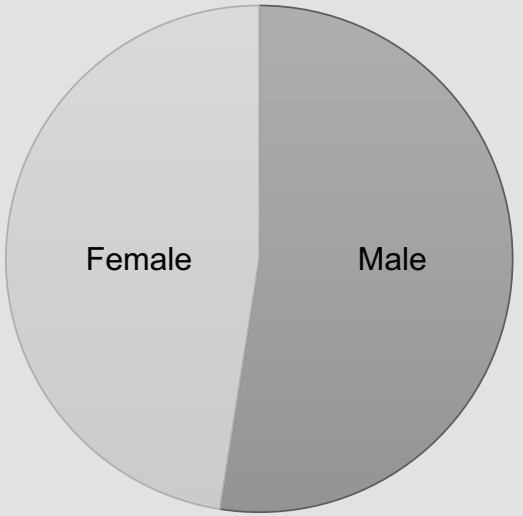
If time allows, will be extended to include a major road, like Tiong Bahru Road

NEXT STEPS

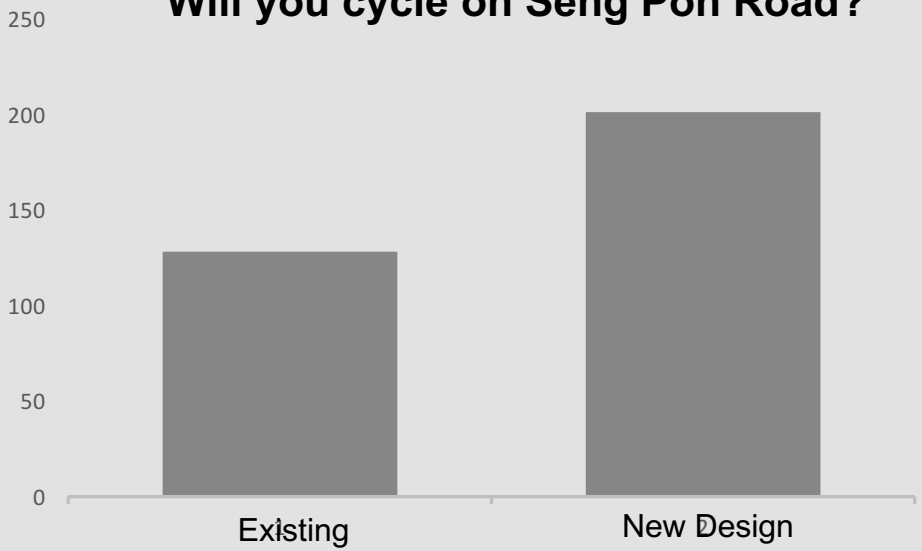
Analyzing Surveys

respondent_id	1_gender	2_yob	3_res_status	4_freq_vist	5a_type_cant_cycle	5b_type_leisure	5c_type_sport	5d_type_shopping	5e_type_commute	5f_type_other	5g_text_other	6a_infra_road	6b_infra_resid_street	6c_infra_sidewalk	6d_infra_pcn
af_55	Female	1996	Singaporean	2 - 3 times per month			2-4x per week					1 - not safe	2	7 - very safe	7 - very safe
af_56	Male	1983	WP/S-Pass/EP	2 - 3 times per month		4-6 per year						2	4	5	7 - very safe
af_57	Female	1995	WP/S-Pass/EP	Fewer times		Never	Never	Never	Never			1 - not safe	3	5	7 - very safe
af_58	Male	1987	WP/S-Pass/EP	Fewer times		Once a week	Once a week	Once a week	everyday			1 - not safe	3	4	4
af_59	Male	1985	WP/S-Pass/EP	2 - 4 times per week			Once a week					1 - not safe	1 - not safe	5	6
af_60	Female		Tourist	Fewer times			2-3x per month					1 - not safe	2	3	5
af_61	Male		PR	once a week		4-6 per year	Never	Never	Never			1 - not safe	4	1 - not safe	7 - very safe
af_62	Male	1989	Singaporean	Fewer times		4-6 per year	Never	Never	Never			2	3	4	5
af_63	Female	1988	Tourist	Fewer times		4-6 per year	Never	Never	Never			2	2	5	5
af_64	Male		Tourist	Fewer times				1x per month				1 - not safe	4	2	7 - very safe
af_65	Male	1992	Singaporean	Fewer times		4-6 per year	4-6 per year	4-6 per year	4-6 per year			2	3	4	7 - very safe
af_66	Male	1980	Tourist			Never	Never	Never	Never						
af_67	Male	1995	Singaporean	4 – 6 per year		4-6 per year	Never	Never	Never			3	7 - very safe	7 - very safe	7 - very safe
af_68	Male	1954	tourist	Fewer times		Never	4-6 per year	Once a week	Never			2	6	7 - very safe	7 - very safe
af_69	Male	1962	Singaporean	2 - 3 times per month		Once a week						3	5	6	7 - very safe
af_70	Female	1985	Tourist	Fewer times		Never	Never	Never	Never						
af_71	Female	1985	Tourist	Fewer times		Never	Never	Never	Never						
af_72	Male		Singaporean	Fewer times								2	6	6	6
af_73	Female	1989	WP/S-Pass/EP	once a week		1x per month	Once a week	1x per month	1x per month			1 - not safe	6	4	5
af_74	Male	1974	WP/S-Pass/EP	Everyday		1x per month	Once a week	Once a week	2-3x per month			3	5	3	6
af_75	Female	1979	WP/S-Pass/EP	Everyday		4-6 per year						1 - not safe	3	3	5
af_76	Male	1965	Singaporean	Everyday		4-6 per year	4-6 per year	4-6 per year	Never			4	5	6	7 - very safe
af_77	Female	1990	WP/S-Pass/EP	4 – 6 per year		2-4x per week		Once a week	2-4x per week			2	5	7 - very safe	7 - very safe
af_78	Male	1987	WP/S-Pass/EP	Fewer times		never	never	never	never			2	6	7 - very safe	7 - very safe
af_79	Female	1997	WP/S-Pass/EP	4 – 6 per year		4-6 per year	never	never	Never			3	5	4	6

About the Participants



Will you cycle on Seng Poh Road?



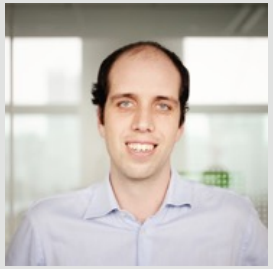
ENGAGING BRIGHT MINDS

Dr. Alex Erath
Project Leader

Pieter Fourie
Project Coordinator
Operations Research

Prof. Dr. K. Axhausen
Co-PI
Transport Planning

Prof. Dr. C. Hölscher
Co-PI
Cognitive Psychology



Michael v. Eggermond
Senior Researcher
Spatial Analysis

Tanvi Maheshwari
Researcher
Urban Design

Sergio Ordonez
Senior Researcher
Computer Science

Jonas Kupferschmid
Researcher
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Cuauhtémoc Anda
PhD Researcher
Big Data Analytics

Mohsen Nazemi
PhD Researcher
Traffic Simulation

Michael Joos
Senior Software Engineer
Gaming Developer

QUESTIONS

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Project Coordinator
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Prof. Dr. K. Axhausen
Co-PI
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Co –PI
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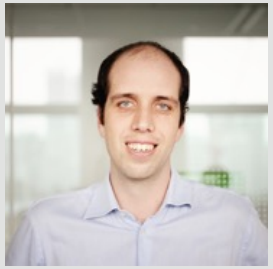

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MATSim & Virtual Reality

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Researcher
Traffic Simulation

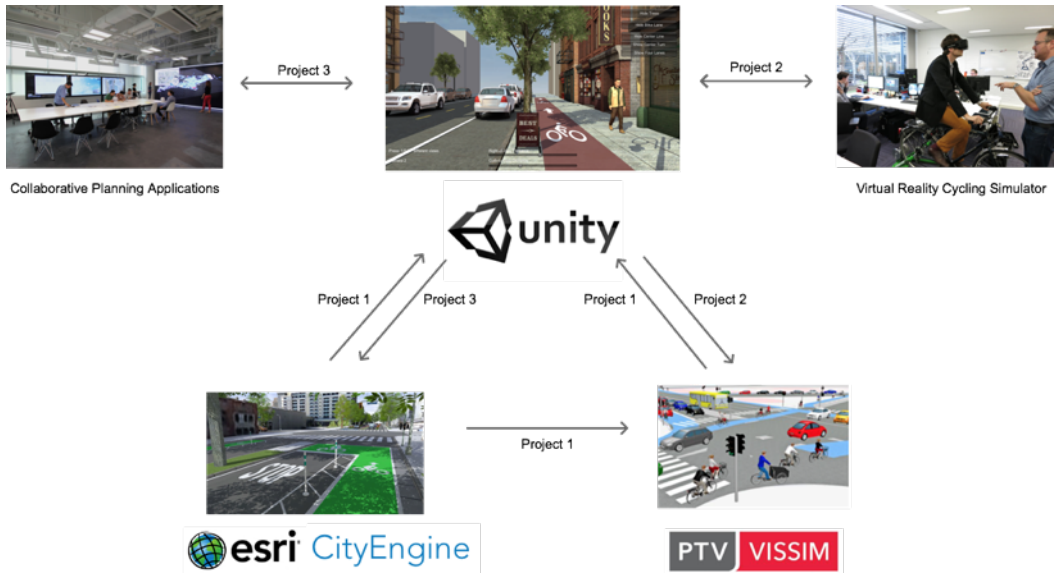
Cuauhtémoc Anda
PhD Researcher
Big Data Analytics

Mohsen Nazemi
PhD Researcher
Future Mobility

Michael Joos
Senior Software Engineer
Gaming

SYNERGIES

Integrating Procedurally 3D environments, with traffic micro simulation in a game engine.
Source: Alex Erath



Project 1

- Integration of City Engine and Vissim scenarios in Unity3d
- Exchange of 3d assets across research groups
- Relevant groups / people: Michael Joos, Cognition group

Project 2

- Virtual Reality Cycling Simulator
- Creation of procedural 3d city models
- NHTV Breda, CIVAL, FHNW

Project 3

- VR-based participatory planning and public engagement application
- CIVAL
- Potential case study: Showcase alternative street at PARK(ing) day (16 Sept)

Project 4

- Qualitative and quantitative surveys
- Apply approaches from environmental psychology
- Cognition group

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Proje Leader, Engaging Mobility

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