

Cyclists' perceived safety and its impact on bicycle mode choice

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MOTIVATION

An increasing uptake of **active mobility** will improve public health, address widespread levels of inactivity in the population and simultaneously reduces air and noise pollution by replacing car trips with walking or cycling. It is important to establish what increases the propensity to cycle to better encourage and foster this mode of transport.

Active mobility study address:

- **Macroscopic** level to build **strategic** plans
- **Microscopic** level to address **safety** and **comfort** issues

This study has a **microscopic point of view** and particularly focuses on cycling **perceived safety**, which has been constantly cited in the literature as one of the major barriers to increasing cycling.

In Singapore, the bicycle mode share is less than 1% (LTA, 2014). **Infrastructure, safety, and weather** are the main barriers of cycling in Singapore (Figure 1)

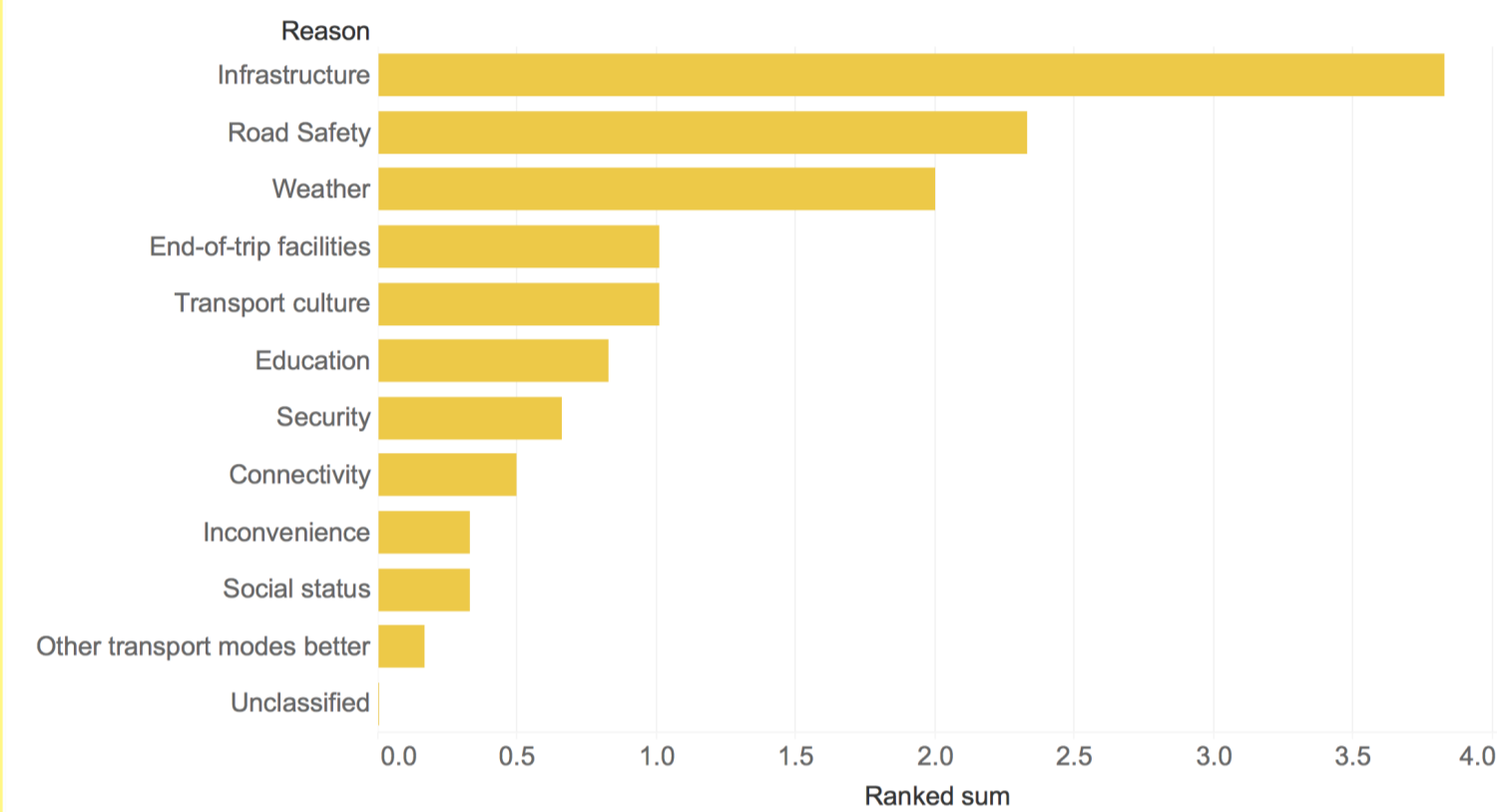


Figure 1. Expert interview results on the main barriers of cycling in Singapore. (Kupferschmid, 2016, paper under preparation)

These results are aligned with the factors cited in literature on individuals' decisions to cycle, which shows how availability of cycling **infrastructure**, cyclists' **safety** and **comfort** levels influence bicycle mode share (Figure 2).

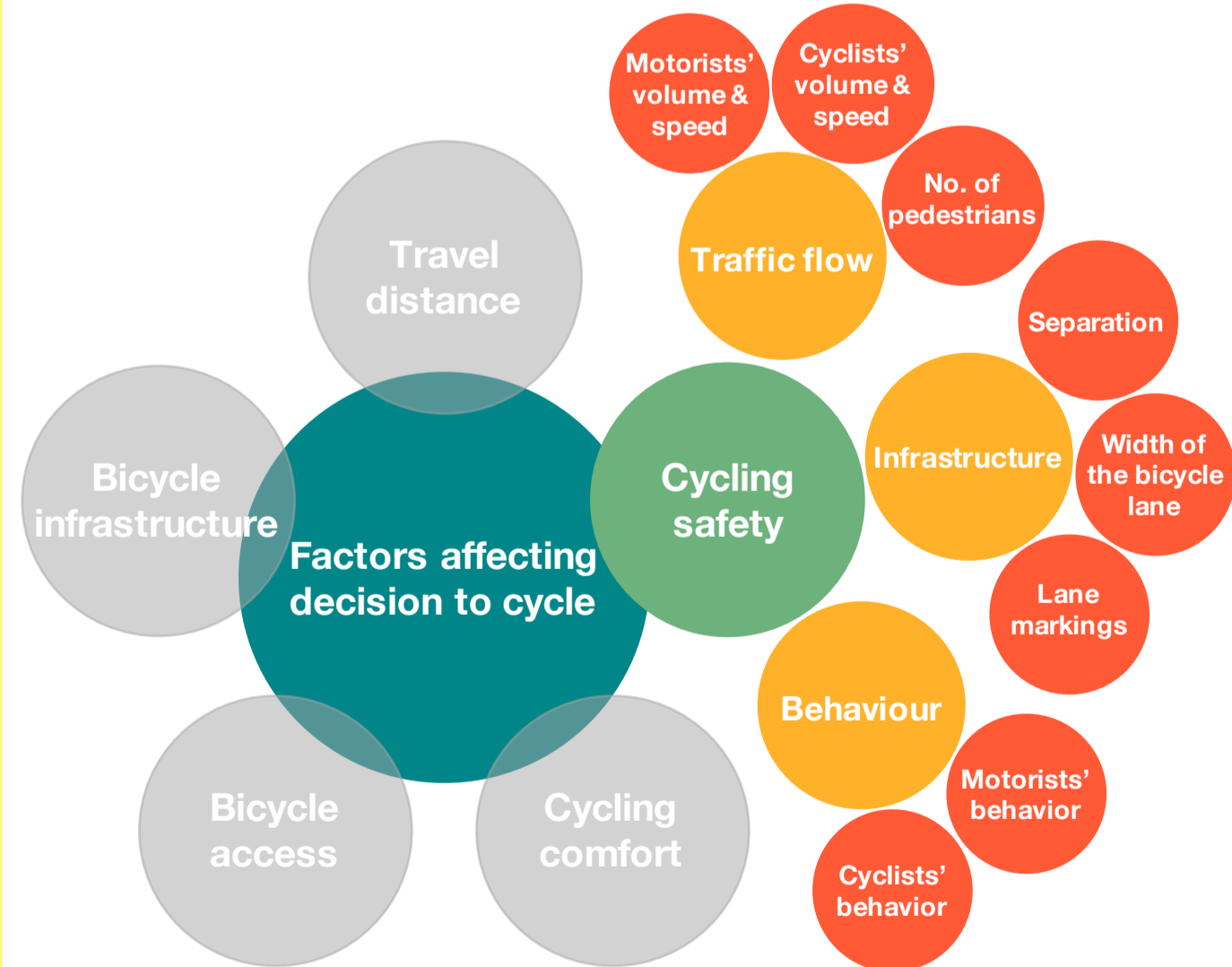


Figure 2. Factors affecting decision to cycle

This results in the following questions

- How to study and measure **safety** related attributes?
- What is the **relative importance** of each of these attributes?
- What **criteria** should decision makers consider to increase bicycle mode share in Singapore?

CASE STUDY 1: CYCLISTS' PERCEIVED SAFETY

Subjective methods to study cyclists' perceived safety:

- survey to study people's **preferences** in the a **non-naturalistic, controlled** setting.
- Sensors to observe cyclists' behaviour while cycling

Limitations of previous studies:

- **Different perception** of reality and what is perceived in text/pictures/videos used in SP surveys
- **Pictures cannot replicate** moving objects which highly influence cyclists' perceived safety
- It is not possible to provide the same cycling environment for all of the participants while they are cycling in naturalistic studies

Virtual reality added values:

Participant's point of view

- Eye-level perspective
- Better sense of the environment
- Better perception of speed, volume, and proximity of moving traffic

Modeller's point of view

- Building 3D in-existent scenarios
- Controlled environment to focus on the attributes of interest
- Better observation of the participant's behaviour in the laboratory setting

Cycling simulator at FCL (Schramka, 2017)



Figure 3. Cycling simulator

- VR hardware and sensors to replicate steering, speed, pedalling, and tilting
- VR model is based on a 3D model animated with traffic microsimulations to generate other agents' movements
- Game engine integrates scenes and traffic trajectories for a better graphic representation.

Figure 4 shows four of the designed scenarios for the cyclists' perceived safety experiment with different variations in infrastructure, traffic volume and traffic speed.



Figure 4. Designed scenarios of cyclists' perceived safety experiment

CASE STUDY 2: BICYCLE MODE CHOICE

To complement the virtual reality study outlined in case study 1, case study 2 will use parametric images (or 3D videos) in a stated preference experiment that will be conducted online.

Bicycle mode choice decision can be heterogeneous based on different perceptions of environment or different preferences. This difference may root in socio-demographic characteristics of the road users which will be investigated in this part of the research. A number of these attributes are presented in Figure 5.

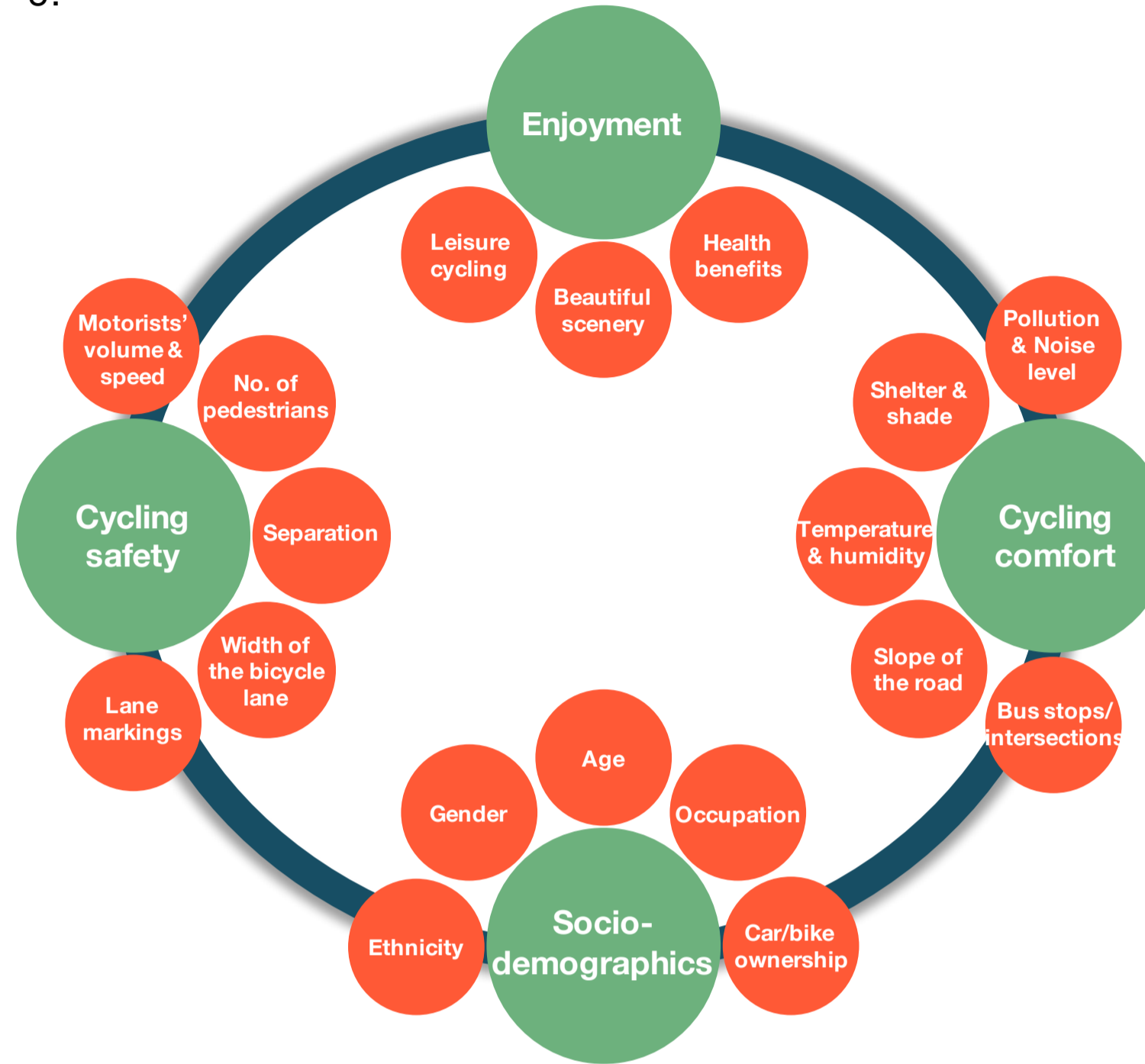


Figure 5. Attributes of interest in bicycle mode choice survey

The output of case study 2 identifies the relative importance of safety attributes in the choice of bicycle. Figure 6 shows a part of the survey.

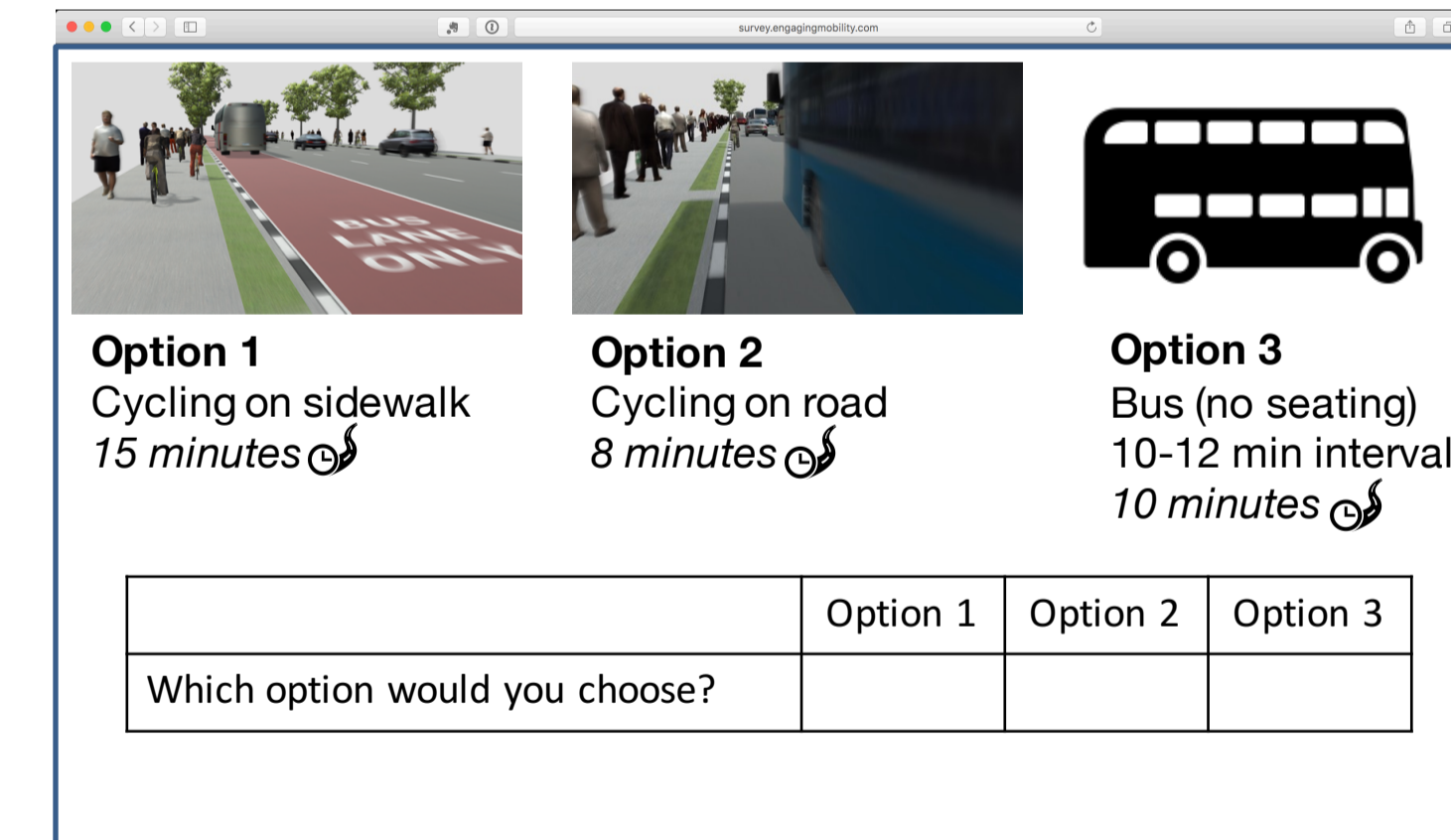


Figure 6. Bicycle mode choice survey

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Future Cities: Methodologies

Quantitative Models and Statistical Methods

Cyclists' Perceived Safety and its Impact on Bicycle Mode Choice

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Aims and Significance

- Study cyclists' perceived safety
- Explore virtual reality as a research tool
- Assessing role of safety in bicycle mode choice

Approach

- Virtual reality experiment along with survey to study cyclists' perception of safety
- Web-based stated preference survey to find out the relative importance of perceived safety in bicycle mode choice

Progress and Outcome

- Evidence-based design guidelines for planners
- Understand the added value of virtual reality
- Help decision-makers better understand cyclists' needs
- Find solutions to improve bicycle mode share

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