# What makes cycling attractive in Yverdon-les-Bains? Willingness to detour for better routes


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## Abstract

Cities aim to increase cycling, but investment decisions are often made with limited evidence on what improvements cyclists value most. The most direct corridors are usually also the hardest places to build high-quality cycling infrastructure because road space is limited and competing needs are strong. An alternative is to develop parallel routes that may be slightly longer but offer better comfort and perceived safety. Whether this strategy works depends on how much detour people are willing to accept. This paper examines cyclists' willingness to detour in Yverdon-les-Bains, Switzerland. Through a large online survey, we document mobility patterns, cycling frequency, and the factors that encourage/discourage cycling. Participants also evaluate realistic route and parking situations and make choices between alternatives that trade off directness against route quality. The analysis quantifies how improvements such as better separation from traffic, smoother and more continuous routes, and more secure end-of-trip facilities influence people's willingness to cycle and their route choice. The findings provide evidence to guide investment choices for cycling infrastructure in Yverdon-les-Bains.

## Keywords

stated preferences; willingness to detour; cycling; route choice; parking choice

## Preferred citation

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# 1 Introduction

Promoting cycling as a sustainable mode of transport has become a central objective in many European cities. Recent initiatives such as the E-bike City project in Switzerland (ETH Zurich, 2025) and the European Reallocate project (Reallocate Project Consortium, 2025) have demonstrated the potential of reallocating urban street space to prioritize cycling and improve overall mobility system performance. These projects primarily focus on network-level redesign, capacity reallocation, and operational feasibility, providing valuable insights into how urban infrastructure can be adapted to support increased cycling demand. However, these approaches are characterized by specific scopes that limit their direct applicability to certain policy questions. The E-bike City project focuses mainly on electric bicycles, which may not fully represent the behavior and preferences of conventional cyclists. At the same time, the Reallocate project adopts a broader, cross-European perspective, which, while valuable, does not explicitly account for the institutional, spatial, and mobility-specific context of Swiss cities. As a result, there remains a need for context-specific and behaviorally grounded analyses that capture the preferences of cyclists (conventional and electric) within a Swiss urban setting.

In the city of Yverdon-les-Bains, strategic mobility plans aim to increase the share of soft mobility while preserving road capacity for public transport and bus operations. Given the importance of transit flows, large-scale reallocation of road space is constrained, requiring a more targeted approach to cycling promotion. In this context, understanding whether cyclists are willing to accept detours and how they value different infrastructure attributes becomes essential for designing effective interventions. To address these challenges, this study adopts a behavioral modeling approach based on stated preference (SP) experiments. We follow a two-stage approach in designing efficient experiments and this paper presents the results of a preliminary study and demonstrates how these results are used to design an extended SP experiment. We first conduct several interviews to design a preliminary route choice study combined with questions on barriers and motivations to cycling. The results of this study are then used as prior parameter estimates to design the extended SP experiment, thereby increasing statistical efficiency and the reliability of the results. Later, we expand the scope of the analysis by incorporating parking choice, following the results of the preliminary SP experiment. This allows for a more comprehensive understanding of cyclists' willingness-to-pay (WTP) when it comes to parking their bicycles. Incorporated with the refined barriers and motivations survey, the extended SP survey is prepared.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature on cycling behavior and SP methods. Section 3 presents the methodology, including both the preliminary study and the extended experimental framework. Section 4 discusses the results and their implications for extended study design. Finally, Section 5 concludes with key findings and discusses future research directions.

## 2 Literature review

Unlike motorized travelers, cyclists do not base their decisions solely on travel time minimization. Perceived safety, comfort, and infrastructure quality play a critical role and cyclists are willing to accept longer travel times in exchange for safer or more comfortable routes (Pucher and Buehler, 2008; Pisoni *et al.*, 2022). Dedicated cycling facilities, particularly physically separated lanes, are consistently associated with higher perceived safety and attractiveness while high traffic volumes, higher vehicle speeds, and on-street parking reduce utility due to increased perceived risk (Pucher and Buehler, 2008). Soft infrastructure elements, such as pavement markings and route continuity improve comfort and reduce cognitive effort. In Swiss contexts as well, the infrastructure quality, safety perception, and logistical constraints are key determinants of cycling adoption (Rérat *et al.*, 2018). Beyond route characteristics, bicycle parking also plays a critical role. Secure and convenient parking is an integral part of successful cycling systems (Pucher and Buehler, 2008), while barriers and motivations such as safety concerns, infrastructure availability, and policy support significantly influence cycling uptake (Rérat *et al.*, 2018, 2022). These findings highlight that both route conditions and end-of-trip facilities must be considered when analyzing cyclists' preferences.

SP methods are widely used to analyze cyclists' preferences and trade-offs between infrastructure attributes. With discrete choice theory (Ben-Akiva and Lerman, 1985; Train, 2009), it is possible to estimate WTP for improvements in safety, comfort, and infrastructure quality. However, the quality of SP results depends on the experimental design, with D-efficient designs and the use of prior information improving statistical efficiency (ChoiceMetrics, 2012). Traditional discrete choice models account for observed heterogeneity but fail to capture unobserved factors such as attitudes, perceptions, and preferences. ICLV models extend this framework by incorporating latent constructs into the utility specification. In the context of cycling, these may represent perceived safety, environmental awareness, motivations and barriers, or behavioral triggers such as life events and infrastructure changes (Chatterjee *et al.*, 2013), enabling for a more realistic representation of preference heterogeneity. While de Freitas *et al.* (2025) develop an ICLV model to analyze sustainable mobility transitions, their work focuses on mode choice under large-scale road space reallocation scenarios rather than route choice. This contrasts with route-choice literature (Menghini *et al.*, 2010; Meister *et al.*, 2023), which emphasizes infrastructure characteristics at a more disaggregate level.

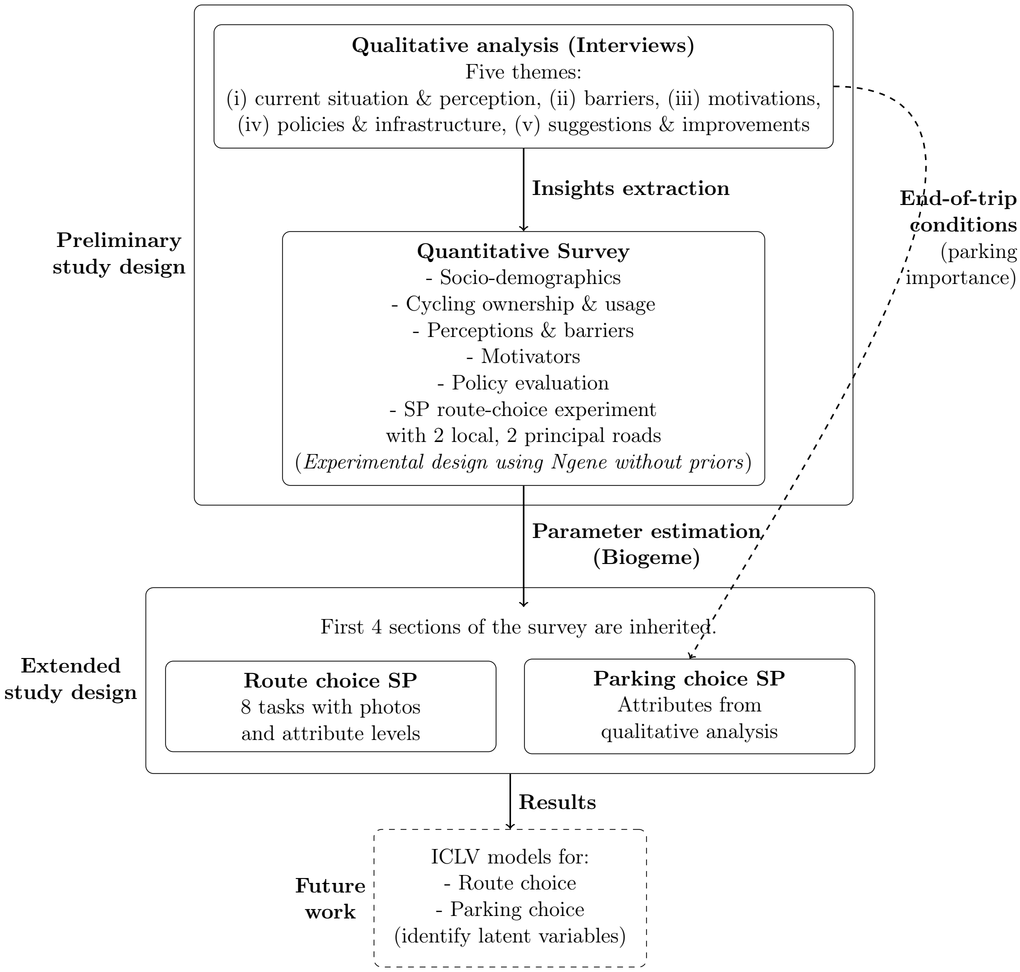
This study contributes by providing a context-specific analysis of cyclists' preferences in Yverdon-les-Bains, where mobility policies must balance the promotion of cycling with the preservation of road capacity for other transport modes. Building on a preliminary qualitative and quantitative study, the paper develops an extended stated preference framework using prior information to improve experimental design efficiency and behavioral relevance. In addition, barriers and motivations toward cycling are incorporated through attitudinal indicators designed to support the future estimation of an ICLV model. The study further extends the analysis beyond route choice by introducing a parking choice experiment, allowing for a more comprehensive assessment of cyclists' behavior and preferences. Finally, unlike large-scale transformation approaches such as the E-Bike City framework, this research focuses on localized route and parking decisions, providing a behaviorally detailed perspective for urban contexts where large-scale infrastructure reallocation may be constrained.

# 3 Methodology

The overall methodological framework can be seen in Figure 1. We conduct a preliminary study that investigates cyclists' route choice behavior in Yverdon-les-Bains, Switzerland. This study combines qualitative and quantitative approaches to identify key determinants of cycling behavior, including perceived barriers, motivations, and infrastructure preferences. The qualitative part is designed around five themes: (i) the current situation and perception of cycling in Yverdon-les-Bains, (ii) barriers, (iii) motivations and encouraging factors, (iv) policies and infrastructure, and (v) participants' own perspectives and suggested improvements (see Section A.1). A total of eleven one-to-one interviews are conducted with stakeholders related to cycling, including both cyclists and non-cyclists from diverse backgrounds. Each interview is analyzed to identify recurring patterns, which are then used to design attitudinal indicators (barriers and motivations) for the SP experiments.

The quantitative component collects information on socio-demographic characteristics, cycling ownership and usage, perceptions and barriers to cycling, motivators for cycling, and

Figure 1: Project framework




evaluation of cycling policies (see Section A.2) followed by an SP experiment. Respondents choose between hypothetical route alternatives in two settings: between (i) two local roads, and (ii) two principal roads. Each alternative is described by a set of attributes including travel time, traffic conditions, speed limits, bike lane symbols on the ground, and on-street parking. For principal roads, additional attributes capture infrastructure characteristics, namely lane type, lane width, and separation from traffic (Table 1). The experimental design is generated assuming an MNL model, which is a standard practice for constructing efficient SP designs, using a D-efficient design in `Ngene` (ChoiceMetrics, 2012).As there are no prior studies in the scope of Yverdon-les-Bains, no priors are set.

The route choice models are specified within a Multinomial Logit (MNL) framework. For the local vs. local experiment, the deterministic utility is specified as in Equation (1).

$$\begin{aligned} V_i^{\text{local}} =& ASC + \beta_{\text{time}} \cdot \text{Time}_i + \beta_{\text{traffic}} \cdot \text{Traffic}_i + \beta_{\text{zone30}} \cdot \text{Z30}_i \\ &+ \beta_{\text{parking}} \cdot \text{Parking}_i + \beta_{\text{symbol}} \cdot \text{Symbol}_i \end{aligned} \quad (1)$$

where $\text{Time}_i$ is the travel time, $\text{Traffic}_i$ represents traffic conditions, $\text{Z30}_i$ is a dummy variable equal to 1 if the speed limit is 30 km/h, $\text{Parking}_i$ is a dummy for on-street parking presence, and $\text{Symbol}_i$ indicates the presence of bicycle lane markings.

For the principal vs. principal experiment, additional infrastructure attributes, i.e., $\text{Separation}_i$, indicating physical separation from traffic, $\text{CyclePath}_i$, a dummy for cycle path infrastructure (vs. cycle lane), and $\text{LaneWidth}_i$, representing the width of the cycling lane, are included Equation (2).

$$\begin{aligned} V_i^{\text{principal}} = &\text{ASC} + \beta_{\text{time}} \cdot \text{Time}_i + \beta_{\text{traffic}} \cdot \text{Traffic}_i + \beta_{\text{zone30}} \cdot \text{Z30}_i \\ &+ \beta_{\text{parking}} \cdot \text{Parking}_i + \beta_{\text{symbol}} \cdot \text{Symbol}_i \\ &+ \beta_{\text{separation}} \cdot \text{Separation}_i + \beta_{\text{cyclepath}} \cdot \text{CyclePath}_i + \beta_{\text{lanewidth}} \cdot \text{LaneWidth}_i \end{aligned} \tag{2}$$

Table 1: Attribute levels considered in the preliminary SP route choice experiment

| **Attribute** | **Local roads** | **Principal roads** |
|---|---|---|
| Travel time (min) | 7, 10, 14, 15, 18, 21, 25 | 7, 10, 14, 15, 18, 21, 25 |
| Traffic conditions | Low, Moderate | Moderate, High |
| Speed limit (km/h) | 30, 50 | 30, 50 |
| On-street parking | Yes, No | Yes, No |
| Bike lane symbol | Yes, No | Yes, No |
| Separation from traffic | N/A | Yes, No |
| Lane type | N/A | Bike lane, Cycle path |
| Lane width | N/A | Minimal, large |

# 4 Results and building the extended SP experiment

The qualitative analysis reveals that perceived safety is the dominant factor influencing cycling behavior. Participants consistently emphasize the importance of separation from motorized traffic, with high traffic volumes and speeds identified as major deterrents. Discontinuous infrastructure, such as intersections and roundabouts, and interactions with vehicles are also perceived as reducing safety and comfort, motivating the inclusion of route continuity as an attribute in the extended experimental design. Conversely, participants reported environmental awareness, health benefits, and time efficiency as important motivators, although their influence varies across individuals, which shows the role of underlying attitudes and preferences in shaping behavior. End-of-trip conditions, particularly secure and accessible bicycle parking, are identified as important factors.

Therefore, we include a dedicated parking choice experiment in the extended study.

A total of 71 responses are collected for the quantitative survey. The sample is mostly composed of young adults (under 30), with a relatively balanced gender distribution. Of these, 42 identify as cyclist; however, cycling remains usually occasional, with only a few reporting regular use. This suggests that cycling is not yet established as a mode of daily transport. The behavioral models are estimated using Biogeme (Bierlaire, 2003). The results indicate that cyclists' decisions are strongly influenced by infrastructure characteristics and perceived safety, rather than travel time alone. Physically separated cycling lanes exhibit the highest positive utility (4.46 minutes), followed by painted lanes (2.22 minutes). This confirms a preference in terms of protection from motorized traffic. Moreover, traffic conditions significantly influence preferences. Respondents are willing to increase their travel time by approximately 2.95 minutes to ride in low-traffic areas rather than moderate-traffic areas on local roads, and by 3.15 minutes to ride in moderate-traffic conditions instead of high-traffic conditions on main roads. Speed limits play an important role, too. Low-speed environments are preferred, with respondents willing to increase their travel time by up to 3.60 minutes to use 30 km/h zones. Finally, on-street parking is associated with a negative effect (−2.08 minutes), indicating perceived risks such as dooring, while pavement markings have a positive but smaller impact (2.02 minutes).

Table 2: Parameter estimates for preliminary route choice experiments

| **Variable** | **Local roads** | **Principal roads** |
|---|---|---|
| Constant (ASC) | −0.146 | 0.212 |
| $\beta_{time}$ (min) | $-0.416^{**}$ | $-0.352^{\dagger}$ |
| $\beta_{parking}$ | $0.868^{**}$ | 0.465 |
| $\beta_{traffic}$ | $1.230^{**}$ | $1.110^{\dagger}$ |
| $\beta_{zone30}$ | $1.500^{**}$ | 0.579 |
| $\beta_{symbol}$ | 0.122 | $0.713^{**}$ |
| $\beta_{separation}$ | N/A | $1.570^{**}$ |
| $\beta_{cyclepath}$ | N/A | $0.783^{\dagger}$ |
| $\beta_{lanewidth}$ | N/A | 0.479 |

Notes: ** p<0.05, * p<0.1, $^{\dagger}$ p<0.1 (marginal significance)

The first four sections of the extended study remain similar to the preliminary study. The evaluation of cycling policies is removed to reduce cognitive load for the respondents. Two SP experiments, i.e., route choice and parking choice, are then presented to each respondent. Each experiment consists of 24 choice situations divided into 3 blocks, resulting in 8 choice situations per respondent.

Table 3: Priors and attribute levels used in route-choice experimental design

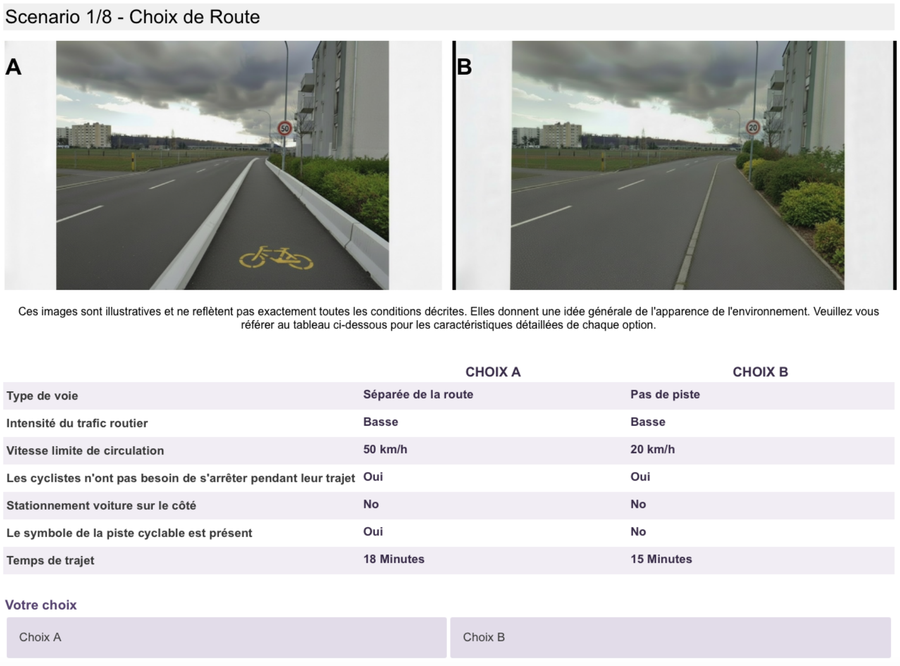
| **Attribute** | **Levels** | **Coding** | **Prior type** | **Prior point estimates** |
|---|---|---|---|---|
| Lane type | 0: Mixed traffic (Ref)<br>1: Painted lane<br>2: Separated lane | Dummy | Bayesian (Uniform) | $\beta_{L1}$: 2.22<br>$\beta_{L2}$: 4.46 |
| Traffic level | 3: Heavy (Ref)<br>2: Medium<br>1: Low | Dummy | Bayesian (Uniform) | $\beta_{T2}$: 3.15<br>$\beta_{T1}$: 6.10** |
| Speed limit | 50 km/h (Ref)<br>30 km/h<br>20 km/h | Dummy | Bayesian (Uniform) | $\beta_{S30}$: 3.60<br>$\beta_{S20}$: 4.50** |
| Continuity | 0: Discontinuous (Ref)<br>1: Continuous | Dummy | Fixed | $\beta_{cont}$: 0.20** |
| On-street parking | 0: No parking (Ref)<br>1: Parking present | Dummy | Bayesian (Uniform) | $\beta_{parking}$: -2.08 |
| Symbols on the ground | 0: Not present (Ref)<br>1: Present | Dummy | Bayesian (Uniform) | $\beta_{symbol}$: 2.02 |
| Travel time | -0.1, 0, 0.1, 0.2 (Pivot) | Linear | Fixed | $\beta_{time}$: -15.00 |
| Interaction | Separated Lane × 50km/h | - | Bayesian (Uniform) | $\beta_{int}$: 1.00** |

Notes: ** Inferred values

The route-choice experiment builds on the results of the preliminary study presented in Section 3. Respondents are asked to choose between two hypothetical routes (this time not differentiated by the type of the road), described by a set of attributes, such as infrastructure type, traffic level, speed limit, route continuity, presence of on-street parking, and bike lane markings (see Table 4). Travel time is included as a continuous trade-off variable using a pivoted approach around an average trip duration (self-reported values or 15 minutes if not provided). The respondents are also presented illustrative photos of the cycling environment to help them better visualize the environment (see Figure 2). Compared to the preliminary study, the attribute set is refined by retaining only statistically significant variables and extended by including route continuity and an interaction term between infrastructure type and speed, allowing for context-dependent preferences. In addition, one more level (20 km/h) is added to the speed limit attribute. Several constraints are imposed to ensure realistic and policy-relevant scenarios. Infeasible or contradictory combinations (e.g., very low speeds with high traffic, or separated lanes with right-side parking) are excluded.

The extended SP route-choice experiment uses estimated parameters to derive prior values, which are given in Table 3 and computed as $\beta_{attr}/|\beta_{time}|$. Presented point estimates

Figure 2: Example of a choice situation in the route choice experiment


Scenario 1/8 - Choix de Route

A

B

Ces images sont illustratives et ne reflètent pas exactement toutes les conditions décrites. Elles donnent une idée générale de l'apparence de l'environnement. Veuillez vous référer au tableau ci-dessous pour les caractéristiques détaillées de chaque option.

| | CHOIX A | CHOIX B |
|---|---|---|
| Type de voie | Séparée de la route | Pas de piste |
| Intensité du trafic routier | Basse | Basse |
| Vitesse limite de circulation | 50 km/h | 20 km/h |
| Les cyclistes n'ont pas besoin de s'arrêter pendant leur trajet | Oui | Oui |
| Stationnement voiture sur le côté | No | No |
| Le symbole de la piste cyclable est présent | Oui | No |
| Temps de trajet | 18 Minutes | 15 Minutes |

Votre choix

Choix A

Choix B

shown in Table 3 are used as the center of uniform distributions (±20%) in the Bayesian design. Uniform distributions are preferred over normal distributions for the priors to avoid imposing strong assumptions on parameter variance and overconcentrating probability mass around central values. This ensures a more robust design that remains informative across an acceptable range of parameter values. Some additional assumptions are introduced to complete the prior specification. The value for $b_{speed20}$ is inferred from $b_{speed30}$, assuming that cyclists prefer 20 km/h environments over 30 km/h, leading to a value of 4.5. Continuity of the route is incorporated as an attribute, capturing whether cyclists prefer traveling without interruptions such as traffic lights, pedestrian crossings, or roundabouts. The parameter for route continuity is set to a modest positive value, reflecting its expected but secondary importance compared to major safety-related attributes. Similarly, the parking parameter is set to a lower magnitude, consistent with its relatively smaller effect compared to infrastructure and traffic conditions. Finally, interaction effects, particularly between speed limits and cycling infrastructure, are explicitly included, allowing the model to capture how the perceived safety of a route depends on the combined presence of these attributes.

A second SP experiment, parking choice, is developed to investigate cyclists' preferences for bicycle parking following the responses obtained during the qualitative interviews. Respondents choose between two parking alternatives characterized by attributes including

Figure 3: Example of a choice situation in the parking choice experiment

Scenario 1/8 - Place de Parking

| | CHOIX A | CHOIX B |
|---|---|---|
| Type de couverture de stationnement | Espace fermé | Casier ouvert couvert |
| Accès sécurisé à la zone de stationnement | Non | Oui |
| Distance jusqu'au parking | 250 m | 100 m |
| Coût par mois | 20 CHF/month | 5 CHF/month |

Votre choix

Choix A
Choix B

facility type, level of security, distance to destination, and cost in CHF (see Figure 3). Logical constraints are imposed to ensure realistic scenarios, such as restricting free parking to open racks and associating closed facilities with costs.

## 5 Conclusion and future work

This study proposes a two-stage framework combining qualitative insights and a preliminary SP experiment to inform the extended survey design on cycling behavior in Yverdon-les-Bains. We observe that safety-related attributes such as infrastructure type, traffic conditions, and speed limits are the primary drivers of route choice. Furthermore, end-of-trip parking facilities are valued, which motivates the inclusion of a dedicated parking choice experiment in the extended study. By deriving informed priors from the preliminary analysis, the extended SP design achieves improved statistical efficiency despite limited sample sizes.

As part of the future work, the extended survey will be disseminated in May 2026 in several languages including French, English, Portuguese, and German. The model parameters will be estimated using an ICLV framework. The attitudinal indicators collected in the survey will serve as measurement variables for latent constructs such as perceived safety and behavioral motivation in the ICLV model. It will allow us to capture unobserved heterogeneity that traditional discrete choice models cannot represent (Ben-Akiva and Lerman, 1985; Train, 2009). In the context of cycling, where subjective perceptions influence behavior, this provides significant added value. Recent work by de Freitas *et al.* (2025) also supports the relevance of ICLV models for analyzing sustainable mobility choices.

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# A Preliminary study

## A.1 Qualitative part interview questions

As stated in Section 3, we conduct an open-question interview with eleven respondents. The 16 questions directed to the respondents are as follows:

- **Theme 1: Situation / perception of cycling in Yverdon-les-Bains**
  - Question 1: Do you practice cycling?
  - Question 2: Do you think cycling has its place in Yverdon-les-Bains? That it is relatively easy to use, that the available facilities are adequate, etc.?
  - Question 3: Do you think cycling has evolved since COVID?
  - Question 4: In your opinion, which categories of people use bicycles? Mainly children (up to 14 years old), young adults (up to 21 years old) / teenagers (from 15 years old), adults / families, or elderly people? If you had to rank the representation of these groups, in what order would you place them? (1 being the most represented profile, 4 the least represented.)
- **Theme 2: Barriers to cycling**
  - Question 5: In your opinion, what are the main barriers to cycling?
  - Question 6: If answer to Question 1 is yes, what are your personal barriers?
  - Question 7: In your opinion, what concrete measures could be implemented (by the city, for example) to strengthen cyclists' sense of safety and promote more comfortable daily cycling?
  - Question 8: I wonder whether the fact that Yverdon-les-Bains is located in Northern Vaud rather than in areas like La Côte or the Riviera might imply a different mindset among residents, and therefore a different perception of cycling culture. Although Yverdon is an urban center, it is surrounded by peri-urban and rural areas where car culture is more prevalent.
- **Theme 3: Motivations and factors encouraging cycling**
  - Question 9: In your opinion, what is most effective in encouraging people to cycle or at least enabling broader adoption?
  - Question 10: If you had to mention actions or infrastructures that have had a positive impact on cycling in Yverdon-les-Bains in recent years, what would they be?
- **Theme 4: Policy and infrastructure**
  - Question 11: In your opinion, is the current sustainable mobility policy in

Yverdon-les-Bains ambitious enough to promote the daily use of bicycles?
  - Question 12: If you had to choose two specific aspects that should be strengthened or improved by the city, which would they be from the following list: funding, infrastructure, intermodal coordination, awareness/communication, regulation/safety, monitoring and evaluation (feedback, performance indicators, etc.)?
  - Question 13: Do you consider the presence of cars in the city to be a barrier to the development of cycling? If yes, what measures could the city implement to reduce this impact?
  - Question 14: Considering the above, do you think the current infrastructure meets the needs of cyclists?
- **Theme 5: Your contribution / perspective on future developments**
  - Question 15: Do you think that your organization, or yourself, has a role to play in the development of cycling in Yverdon? If yes, in what way(s)? If not, who would be able to take on this role?
  - Question 16: Where would you place Yverdon-les-Bains on this scale in 2040?

## A.2 Quantitative part

This study relies on a structured questionnaire designed to capture socio-demographic characteristics, cycling behavior, perceptions, and preferences regarding cycling infrastructure and policies in Yverdon-les-Bains.

### A.2.1 Socio-demographic characteristics

Respondents are first asked about their background characteristics:

- **Age**: 11 categories ranging from “19 years or younger” to “65 years or older”
- **Gender**: Female, Male, Prefer not to say
- **Place of residence**: Yverdon-les-Bains, Lausanne, Renens, Morges, Montreux, Vevey, Fribourg, Neuchâtel, Geneva, or Other (with specification)
- **Occupation**: Full-time employed/self-employed, part-time employed/self-employed, student, working student, retired, unemployed, other (with specification)

- **Work/study location**: Whether located in Yverdon-les-Bains (conditional on being employed or studying)

#### A.2.2 Cycling ownership and usage

The second section focuses on bicycle access and usage:

- **Bicycle ownership**: Owns a bicycle, borrows/rents, uses bike-sharing, does not own a bicycle, other
- **Cycling frequency**: Daily or almost daily, several times per week, a few times per month, rarely, never
- **Trip purposes**: Respondents indicated whether they use a bicycle for:
  - Sport or exercise
  - Leisure
  - Visiting friends/family
  - Shopping
  - Escorting others (e.g., children)
  - Commuting to work or school
  - Accessing public transport
  - Professional or personal appointments
- **Cycling companions**: Alone, with family, friends, colleagues, or in organized groups
- **Childhood cycling experience**: Whether the respondent cycled regularly as a child

#### A.2.3 Perceptions and barriers to cycling

Respondents evaluated a series of statements using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

- **Infrastructure-related safety concerns**
  - Poor road conditions
  - Lack or discontinuity of cycling lanes

  - Absence of physical separation from motorized traffic
  - Sharing the road with cars
  - Unsafe intersections and roundabouts
  - Close overtaking by cars
  - Lack of respect from other road users
- **Time and distance constraints**
  - Travel distance is too long
  - Cycling takes too much time
  - Car or public transport is faster
  - Detours required for safe routes are too long
- **Personal and social factors**
  - Lack of childhood experience with cycling
  - Lack of cycling skills or confidence
  - Low motivation to change habits
  - Limited cycling culture in social environment
- **Weather-related barriers**
  - Rain or snow
  - Strong wind
  - Discomfort due to cold or humidity
  - (Reverse statement) Cycling is possible in all weather with proper equipment
- **Logistical constraints**
  - Transporting bulky items
  - Escorting children or dependents
  - Multiple stops during trips
  - Difficulty combining transport modes
  - (Reverse statement) E-bikes and cargo bikes simplify logistics
- **Security concerns**
  - Fear of theft or vandalism
  - Lack of trust in bicycle parking
  - Insufficient lighting or surveillance
  - Poor maintenance of parking infrastructure
  - Reluctance to invest in a bicycle due to risk

### A.2.4 Motivators for cycling

Using the same Likert scale, respondents evaluated factors that could encourage cycling:

- **Policy incentives**
  - Free trial of bicycles (e.g., cargo or electric bikes)
  - Purchase or rental subsidies
  - Participation in campaigns (e.g., Bike to Work)
  - Training programs for cycling
  - Availability of bike-sharing systems
  - Clear communication and signage
- **Infrastructure quality**
  - Good road surface quality
  - Continuous and visible cycling infrastructure
  - Physical separation from traffic
  - Well-designed intersections
  - Safe overtaking distances
  - Respect from other users
- **Time and efficiency**
  - Reasonable travel distance
  - Acceptable travel time
  - Cycling being as fast as or faster than alternatives
  - Direct and safe routes
- **Confidence and habits**
  - Early exposure to cycling
  - Feeling competent in urban cycling
  - Willingness to change habits
  - Social influence
- **Weather resilience**
  - Cycling in light rain or snow with equipment
  - Tolerance to moderate wind/cold
  - Adequate protective equipment
  - Acceptance of variable weather conditions
- **Logistical facilitators**
  - Ability to transport goods
  - Ability to transport children
  - Managing multi-stop trips

  - Integration with public transport
  - Use of e-bikes or cargo bikes

#### A.2.5 Evaluation of cycling policies

Respondents assessed the acceptability and desirability of various local cycling policies (4-point scale):

- Cycling paths along the Thièle
- Bicycle traffic lights
- Contraflow cycling under railway lines
- Cargo bike lending programs
- Bike rental programs (e.g., bikesLab)
- Purchase subsidies
- Promotional events
- Cycling training programs
- Infrastructure improvements (e.g., Buron area, lake access)
- Improved signage
- Dedicated cycling lanes on major roads
- 30 km/h zones
- Secure bicycle parking
- Continuous cycling network
- Employer incentives
- Construction of cycling bridges

#### A.2.6 SP experiment

The final part of the survey consists of an SP experiment. Respondents are presented with pairs of hypothetical cycling routes (Route A vs. Route B) and asked to select their preferred option.

Each alternative is described by attributes such as travel time, traffic level, speed limit, presence of car parking, road type, cycling infrastructure, available cycling space. Respondents are asked to complete multiple choice tasks, each requiring them to choose between two routes. These scenarios are generated using an experimental design ensuring variation in attribute levels across tasks.

# B Extended study

The extended survey includes additional questions that were not part of the preliminary study:

- **Daily travel modes**: Respondents indicated their usual modes of transport for daily trips (multiple choices possible):
  - Private or company car
  - Public transport subscription
  - Public transport without subscription
  - Bicycle without electric assistance
  - Bicycle with electric assistance
  - Car-sharing service subscription
  - Bike-sharing service subscription
  - Personal mobility devices (e.g., e-scooters, segways)
  - Motorized two-wheelers
- **Cycling practice type**: Whether respondents cycle and, if so, what type:
  - Yes, mainly non-electric bicycle
  - Yes, mainly electric bicycle
  - No
- **Household income**: Annual gross household income categories:
  - Less than 30,000 CHF/year
  - 30,000 – 49,999 CHF/year
  - 50,000 – 74,999 CHF/year
  - 75,000 – 99,999 CHF/year
  - 100,000 – 124,999 CHF/year
  - 125,000 – 149,999 CHF/year
  - 150,000 – 174,999 CHF/year
  - 175,000 – 199,999 CHF/year
  - 200,000 – 249,999 CHF/year
  - 250,000 CHF/year or more

- **Workload**: Respondents reported their employment rate (in percentage, from 0% to 100%).
- **Commuting frequency**: Number of days per week commuting from home to work/study location (1 to 7 days).
- **Education level**: Highest level of education attained:
  - Compulsory education
  - Apprenticeship / CFC
  - AFP (Federal vocational certificate)
  - Professional maturity
  - Academic maturity (baccalaureate)
  - General education school / ECG
  - Specialized maturity
  - Bachelor (HES)
  - Master (HES)
  - Bachelor (university / EPF)
  - Master (university / EPF)
  - Doctorate (PhD)
  - Other
- **Household structure**:
  - Living alone
  - Living alone with children
  - Living as a couple without children
  - Living as a couple with children
  - Other
- **Cycling in Yverdon-les-Bains**: Whether respondents cycle specifically within the city:
  - Yes
  - No
- **Typical travel time**: Average duration of usual trips:
  - 10 minutes
  - 15 minutes
  - 20 minutes

At the same time, we remove the evaluation of cycling policies to reduce cognitive load for the respondents.

Both the route choice and parking choice experiments consider two unlabeled alternatives (A and B), representing different route and bicycle parking options, respectively. Each design consists of 24 choice situations, divided into 3 blocks, resulting in 8 choice tasks per respondent per experiment. A D-efficient design under an MNL framework is generated using `Ngene` (ChoiceMetrics, 2012) for both experiments.

## B.1 Attributes considered in route choice SP experiment design

The selected attributes aim to capture key factors influencing cyclists' perceived safety, comfort, and efficiency.

- **Lane type (`lane`)**: Three levels are included: no lane (0), painted lane (1), and physically separated lane (2). This attribute captures infrastructure quality, with prior evidence suggesting strong positive preferences for separation from traffic.
- **Traffic level (`traffic`)**: Levels represent low (1), medium (2), and high (3) traffic conditions. This reflects perceived safety and stress associated with motor vehicle interactions.
- **Speed limit (`speed`)**: Speed limits of 20, 30, and 50 km/h are considered. Higher speeds typically imply greater perceived risk for cyclists.
- **Continuity (`cont`)**: A binary attribute indicating whether the cycling facility is continuous (1) or interrupted (0). Continuity improves comfort and reduces cognitive load during trips.
- **On-street parking (`park`)**: A binary variable indicating the presence (1) or absence (0) of roadside parking. Parking introduces potential conflicts such as dooring risk.
- **Symbols on the ground (`symbols`)**: Indicates the presence (1) or absence (0) of bicycle symbols on the road. This represents soft infrastructure that may increase perceived legitimacy and awareness.
- **Travel time (`time`)**: Pivoted around an average trip duration of 15 minutes, with levels expressed as relative deviations. This allows estimation of trade-offs between time and infrastructure quality.
- **Separated lane and 50 km/h zone interaction (`int`)**: Interaction term allowing estimation of the benefit of a separated lane in a 50 km/h traffic zone.

A Bayesian approach is used to account for uncertainty in prior parameter estimates. Most parameters are specified as random with uniform distributions bounded by values derived from a previous study. This allows for more robust and realistic design efficiency compared to fixed priors.

Table 4: Route choice experiment attribute levels

| Considered attribute | Levels |
|---|---|
| Lane type | None, Painted, Separated |
| Traffic level | Low, Medium, High |
| Speed limit | 20, 30, 50 |
| Continuity | Interrupted, Continuous |
| On-street parking | No, Yes |
| Symbols on the ground | No, Yes |
| Travel time | -10%, 0%, +10%, +20% |
| Interaction | Separated lane x 50 km/h |

### B.2 Attributes considered in parking choice SP experiment design

A second SP experiment is developed to analyze cyclists' parking choice behaviour at trip origins and destinations. The attributes included in the parking choice experiment reflect key dimensions influencing cyclists' parking preferences, namely convenience, security, and cost:

- **Parking type and coverage (`type_cov`)**: Three levels are defined—open rack (0), covered open rack (1), and closed parking facility (2). This attribute captures both physical protection (e.g., against weather) and perceived quality of the facility. Higher levels are expected to yield higher utility.
- **Security (`security`)**: A binary attribute indicating whether access is private (1) or public (0). Private access typically implies restricted entry and higher protection against theft, which is expected to positively influence choice.
- **Distance to destination (`distance`)**: Distance levels of 50, 100, 250, and 500 meters are included. This attribute captures convenience, with increasing distance expected to reduce utility.
- **Cost (`cost`)**: Monthly subscription costs are defined at 0, 5, 10, 20, and 40 CHF, considering paid parking in Yverdon-les-Bains is 20 CHF/month. This reflects realistic pricing schemes in the study context, with higher costs expected to decrease utility.

All parameters are specified with fixed priors consistent with expected behavioral responses:

Table 5: Parking choice experiment attribute levels

| Attribute | Levels |
|---|---|
| Parking type | Open, covered, closed |
| Secured | No, Yes |
| Distance (m) | 50, 100, 200, 400 |
| Cost (CHF/month) | 0, 5, 10, 20 |