



# Cycling to work: Meanings and experiences of a sustainable practice

Patrick Rérat

*Institute of Geography and Sustainability, University of Lausanne, Mouline – Géopolis, 1015 Lausanne, Switzerland*



## ARTICLE INFO

### Keywords:

Cycling  
Utility cycling  
Commuting  
Motivations  
Barriers

## ABSTRACT

This paper draws on Cresswell's conceptualisation of mobility as a combination of physical movement, meaning, and embodied and experienced practice. It addresses the motivations of and barriers to cycling to work in Switzerland based on a large questionnaire survey ( $n = 13,700$ ). Motivations to cycle to work refer to well-being (both physical and mental), independence and civic engagement. Four types of cyclist are identified according to their motivations: active, civic, independent and enthusiast. Barriers relate to weather conditions, safety, logistical constraints and comfort. A cycling policy could integrate these results and focus on movement (a network of direct and well-maintained routes), experience (safe and pleasant routes designed for all types of cyclist) and meanings (by promoting cycling to various audiences and assessing the legitimacy of cycling as a fully-fledged means of transportation).

## 1. Introduction

The potential positive impacts of an increase in cycling have been well documented. This is the case in terms of public health (in a context of sedentary lifestyles), ecological footprints (in a context of climate change and resource depletion), traffic regulation (in a context of increasing infrastructure congestion) and quality of life (in a context of air pollution, noise emission and space appropriation by motorised vehicles). Motivated by these political and societal rationales, a growing number of cities around the world are taking measures to promote cycling.

But what is happening at the level of the individual? What motivates people to cycle to work? To be motivated means *to be moved* to do something. Motivations may be categorised as extrinsic or intrinsic, based on the reasons or goals that give rise to an action. An extrinsic motivation is defined as the motivation “to do something in order to attain some external goal” (Hennessey et al., 2015) or “because it leads to a separable outcome” (Ryan and Deci, 2000). In contrast, intrinsic motivation is “the motivation to do something for its own sake, for the sheer enjoyment of a task” (Hennessey et al., 2015) or refers “to doing something because it is inherently interesting or enjoyable” (Ryan and Deci, 2000).

What about the adoption of a sustainable mobility practice such as cycling to work? What are the motivations of utility cyclists? What is the importance given to various intrinsic and extrinsic motivations? Are the global and social challenges mentioned above translated at the individual level? How do various barriers weaken these motivations?

Cycling practices have been widely studied, but researchers “have tended to focus on analysing modal choice or finding the best infrastructures to promote cycling” (van Duppen and Spierings, 2013, 234) and they have tended to neglect the embodied and sensory aspects of cycling (Liu et al., 2018; Spinney, 2009). This paper aims to address these questions and to identify the mechanisms behind utility cycling. To do so, I draw on Cresswell's conceptualisation of mobility as composed of three intertwined dimensions:

*E-mail address:* [Patrick.rerat@unil.ch](mailto:Patrick.rerat@unil.ch).

<https://doi.org/10.1016/j.tra.2018.10.017>

Available online 22 October 2018

0965-8564/ © 2018 Elsevier Ltd. All rights reserved.

physical movement, the representation or meaning of movement, and its embodied experience (Cresswell, 2010, 2006). This theoretical framework brings crucial and original elements to the understanding of the motivations for bicycle commuting – notably in terms of meanings and experiences – that are less present in the literature. It also informs the debates on policies, aiming to increase the practice of cycling and to extend it to more population groups.

This threefold approach of mobility has been applied to utility cycling and its underlying motivations and barriers, and was taken into account in the design and interpretation of a questionnaire survey filled in by almost 14,000 people taking part in the Swiss Bike to work campaign. In Switzerland, 7% of all journeys are made by bike according to the 2015 Mobility and Transport Microcensus (R  rat et al., 2019). This is higher than in most Latin and English-speaking countries, but (much) lower than in Northern Europe, where several countries have a more mature cycling culture (Pucher and Buehler, 2012). This intermediate position makes the Swiss case interesting, especially as the literature has mainly focused on countries where cycling is normalised (e.g. The Netherlands, Denmark) or where its modal share is quite low (e.g. English-speaking countries).

The next section reviews the literature on utility cycling and presents Cresswell’s conceptualisation of mobility, which I use to read the literature on utility cycling and its underlying motivations and barriers. The following section discusses the research design and the questionnaire survey, and then the empirical part of the paper conveys the results regarding motivations, identifies a typology of cyclists and explores the barriers faced by cycling commuters. In the conclusion, Cresswell’s conceptualisation of mobility and the empirical results are brought together, in order to discuss their political implications in terms of communication, road regulation and planning.

## 2. Theoretical discussion

### 2.1. Analysing utility cycling

Commuting by bicycle has been mainly addressed according to five groups of determinants: the built environment, the natural environment, socio-economic variables, psychological factors, and aspects related to cost, time, effort and safety (Handy et al., 2014; Heinen et al., 2010).

The first three determinants have usually been addressed from a macro perspective, where cycling is analysed on an aggregate level. Its modal share is put into perspective using variables linked to the urban form (density, size, etc.), the presence and quality of infrastructures (e.g. Buehler and Dill, 2016; Pucher and Buehler, 2012) and climate and weather characteristics (Nankervis, 1999). Other studies focus on the characteristics of bicycle commuters (such as age, gender and socio-economic status) and the way they differ between countries and cities (e.g. Garrard et al., 2012).

The last two determinants imply a micro-analytic perspective centred on individuals and their decisions. It may address their revealed (e.g. actual behaviour) or stated (e.g. intentions) preferences as well as the long-term impacts of events promoting cycling (e.g. Lee, 2015; Piatkowski et al., 2015; Rose and Marfurt, 2007). One of the core approaches centres on psychology-based individualist models of human behaviour – based on the theory of planned behaviour for example – where the focus is on the individual’s attitudes and perceived social norms (e.g. Nkurunziza et al., 2012). Another approach is based on utility theory (neoclassical approach) and assumes that an increase in the time, cost and effort of a travel option will result in a decrease in the likelihood of this option being chosen (Heinen et al., 2010).

Other researchers have called for a broadening of the scope of the analysis of bicycle commuting. On a macro scale for example, cycling has been addressed as a social practice, that is to say a combination of materials, competences and meanings (Spotswood et al., 2015), or as a diversity of (sub)cultures (Cox, 2015). On the individual level, more qualitative and ethnographic accounts have highlighted the importance of mobility as an embodied experience and as carrying various meanings (Spinney, 2009; van Duppen and Spierings, 2013).

To take into account these multiple dimensions, I draw on Cresswell’s conceptualisation of mobility, which I believe is particularly useful with reference to cycling. It has been applied to cycling from a transport planning perspective (Koglin and Rye, 2014), and I apply it here to commuting trips and to the way these are considered by cyclists. I argue that this conceptualisation enables us to address the various dimensions of utility cycling (that motivate or hinder cycling, including some that are less present in the literature) and therefore brings important insights to the political debates on how cycling may be promoted. The following section presents this theoretical framework both in general terms and in the context of cycling.

### 2.2. Cycling as an entanglement of movement, meaning and experience

According to Cresswell (2006, 2010), the first dimension of mobility is physical movement, the most readily visible aspect of mobility. Physical movement constitutes the simple fact of going from A to B and refers to elements that can be easily measured (distance, speed, frequency, motive, etc.). Movement is traditionally the focus of transport planning, which conceives mobility as either meaningless or as the practical outcome of “rational” decision makers who optimise variables such as time, cost and distance (Spinney, 2009). Without downplaying the deterring role of distance and time in cycling, this theoretical stance has received two main critiques. First, conventional models of modal choice are not sufficient for cycling, particularly given the importance of effort and weather (Heinen et al., 2010; Parkin et al., 2007). Second, it is necessary to explore the content of the line between A and B, to go beyond mobility as a rationalised and instrumental practice (Spinney, 2009).

The second dimension refers to the fact that mobility is also loaded with meanings – from an individual and social point of view – that may be found in representations, discourses and narratives about the fact of moving. The literature on automobility has

highlighted how the success of the car is also related to the images and imaginaries associated with it (Urry, 2004). Cycling also conveys a wide range of meanings, which vary depending on the periods of time and places (Cox, 2015). In mature cycling cultures such as the Netherlands, cycling is a ubiquitous and fully normalised mode of transportation (Fishman, 2016), even though some practices, such as using a cargo-bike, are seen as conveying symbols in terms of gender and class (Boterman, 2018). However, in most Western countries, people who cycle can be regarded as a minority or an out-group in a car-centric world (Prati et al., 2017). Cyclists may feel that they are “embodying citizenship” by enacting public policy or civic engagement and by reclaiming an alternative to the dominant system of automobility (Bonham and Koth, 2010; McKenna and Whatling, 2007). In developing countries, the bike is usually seen as a low-status means of transportation (Nkurunziza et al., 2012).

The third dimension refers to the experience of mobility, to the way it is lived and felt by individuals depending on the circumstances. Mobility is indeed physically implemented in everyday life. It is created through embodied and sensory engagement with the urban environment and woven into lives in contextually specific and personalised ways (Vivanco, 2013). An increasing number of qualitative accounts address the embodied experience of cycling, showing the extent to which cycling is an everyday practice mediated through the senses (van Duppen and Spierings, 2013), and demonstrating that the sensory response is “clearly a factor in motivation for choosing the bicycle as a mode of transportation” (Jones, 2012, 653). Day, for example, has addressed the sense of movement and flow of bicycle couriers, their interactions with the built and natural environment and the way they internalise and play with the rhythms of the street (Day, 2015). Some scholars have stressed that cycling enables social interaction and provides opportunities to meet others more than other means of transportation (te Br  mmelstroet et al., 2017). However, as will be discussed later in this paper, cyclists often feel themselves to be vulnerable road users in a challenging sensory environment within a car world (Lee, 2015).

A further notion developed by Cresswell (2010) is the “constellation of mobility” that he defines as a more or less enduring structure of the ways in which movements, meanings and experiences are related to each other. Cresswell identifies historically specific constellations of mobility that pervade a multitude of specific instances of people on the move. Such a perspective may also be applied to current practices in order to take into account their diversity, since the entanglement of movements, meanings and experiences differs between spaces and periods of time, and also between individuals and social groups.

The idea of a constellation of mobility echoes the calls to take into account the diversity of cyclists. It is necessary to disaggregate the analysis and to identify groups with similar attitudes and practices in order to reveal the various ways in which people use bicycles and to better understand the factors and needs associated with each group (Handy et al., 2014; Piatkowski et al., 2015). Categories are often defined according to the level of experience and frequency of cycling. For example, Piatkowski et al. (2015) distinguish year-round commuters, frequent commuters, occasional commuters, and people who only cycle during the Bike to Work scheme. Geller, a planner in Portland, proposed the following famous typology of transportation cyclists: “The Strong and the Fearless,” “The Enthused and the Confident,” “The Interested but Concerned” and, finally, the “No Way No How” group of non-riders (for a discussion and empirical survey, see Dill and McNeil, 2013). This typology is based on people’s relationships to bicycle transportation and highlights the differing needs of different types of cyclist in terms of bikeway treatment and infrastructures.<sup>1</sup>

While the literature has tended to focus on individuals and their choices, there is a growing body of work highlighting the fact that cycling is highly dependent on structural and contextual features and is the outcome of spatial, social and individual opportunities and constraints. This last dimension refers to the notion of friction (Cresswell 2010), which, as a social and cultural phenomenon attached to mobility, draws attention to the ways in which people are slowed down or stopped in their practices.

As a form of mobility, cycling faces various frictions, or *barriers*, to take a term that is more widely used in the literature. In a survey of participants in the Bike to Work day in Denver (USA), Piatkowski et al. (2015) identify three types of barrier: safety and infrastructure; convenience and climate; cost and concerns (e.g. fear of bike theft). The impacts of distance and topography (e.g. Kingham et al., 2001; Parkin et al., 2007) on cycling have been well documented. The same can be said of the role of dedicated infrastructures and separate bicycle facilities (e.g. Buehler and Dill, 2016; Pucher et al., 2010), even though their impact may be limited according to other constraints or shortcomings in the cycling culture (Morgan, 2017; Mueller et al., 2018). Available research on the effect of weather conditions is mixed (Piatkowski et al., 2015) and refers chiefly to discretionary travel (Nankervis, 1999).

Other scholars argue that the modal split is also determined by power relations in space (e.g. space allocated to motorised and non-motorised traffic) and representations of cycling in the public sphere and in transport planning (Koglin and Rye, 2014). The frictions faced by cycling are also symbolic in contexts where the system of automobility has been dominant for decades. Automobility is an assemblage that goes far beyond cars; it encompasses technologies, regulations, infrastructures, planning policy, markets, meanings and symbols (Urry, 2004). Differences in terms of barriers are hence found between spaces and points in history, and also between social groups. The variety of cycling practices and their barriers springs from profoundly differing experiences, personal and collective, that are shaped by national history, class, gender and ethnicity (Cox, 2015, 3).

This theoretical discussion identifies three characteristics of mobility: (1) the entanglement of movement, meanings and experiences; (2) the constellations of mobility and (3) the frictions/barriers associated with mobility. Re-reading the literature on utility cycling with Cresswell’s conceptualisation as a guiding thread, I argue that some dimensions of utility cycling have not yet been fully addressed. This is particularly the case in terms of meanings and experiences. Moreover, bicycle commuting may form various constellations of mobility, and tensions may emerge between motivations and barriers in the practice of utility cycling. The three

<sup>1</sup> Geller estimated the weight of these four categories in the case of the whole population of Portland to be less than 1%, 6%, 60% and 33% respectively. The present research addresses the first two categories as well as some of the most ‘interested’ members of the third group (as discussed later).

**Table 1**

Comparison between the sample of participants in Bike to Work, the labour force and users of a bike (source: questionnaire; Swiss Labour Force Survey; Mobility and Transport Microcensus).

Variable	Modality	Bike to work survey (2016)	Labour force (2016)	Users of a bike (2015)
Age	15–24 years old	3.9%	12.5%	15.4%
	25–39 years old	35.6%	32.2%	26.2%
	40–54 years old	46.0%	35.3%	31.6%
	More than 55 years old	14.5%	20.0%	26.8%
Gender	Women	42.0%	46.6%	45.3%
	Men	58.0%	53.4%	54.7%
Education	Compulsory school	1.5%	12.6%	10.5%
	Vocational training	44.5%	46.2%	51.5%
	Higher education	54.0%	41.2%	38.0%

characteristics of Cresswell's conceptualisation have structured the design and the interpretation of a study carried out among participants in the Swiss Bike to Work scheme.

### 3. Methodology

Organised by PRO VELO, the national bicycle advocacy association, the Swiss Bike to Work campaign has been in place since 2005 to promote utility cycling. Similar schemes exist in many countries, with some differences. In the Swiss case, participation is open to any company, in exchange for a small contribution. It is based on teams of usually four employees who commit to cycling as much as possible to work in May and/or June. The participants fill in a diary (number of trips, distances, etc.) and take part in a contest to win prizes. The objectives of the campaign are to make utility cycling more visible and to convince employees to try bicycle commuting in the hope that they will consider adopting this practice.

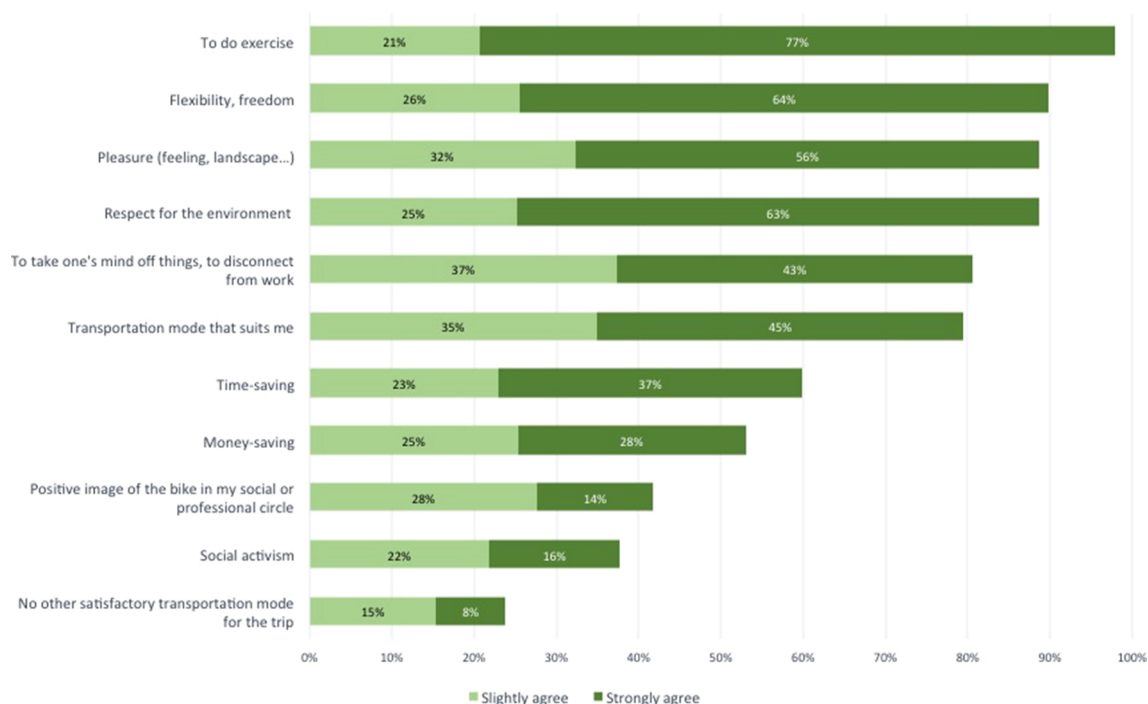
The goal of this study is not to assess the impact of the Bike to Work campaign, which would have implied another methodology to track changes among the participants (e.g. Lee, 2015; Piatkowski et al., 2015; Rose and Marfurt, 2007). The interest of the campaign for our research is twofold. On the one hand, it enables us to identify a large sample of people commuting by bike on a national scale (about 1800 firms and more than 50,000 participants). On the other hand, it reaches a variety of bike users. The formation of teams creates a motivational effect: regular cyclists encourage sport and leisure cyclists as well as less experienced colleagues to join in, and thus the scheme attracts both people who are already convinced by utility cycling and others who are interested in giving it a try.

For reasons of privacy, the online survey was sent by the organisers of Bike to Work after the 2016 edition, and not directly by the research team. As some participants did not provide their email address, a total of 44,726 emails were sent and 13,744 questionnaires were filled in (response rate: 31%). The questionnaire addressed various dimensions of cycling: the participant's profile, use of the bike and other means of transport, competences and skills, motivations and barriers to cycling to work, evaluation of the "bikeability" of the trip to work (e.g. infrastructures), participation in the Bike to Work scheme and measures advocated to promote cycling.

As a micro-analytical perspective, this approach assumes that individuals are able to reflect on their behaviour in a national context where bicycle commuting is a minority practice. Various criteria (motivations and barriers) were identified according to the literature on utility cycling and taking into account Cresswell's conceptualisation of mobility. Participants were asked to rate their level of agreement on a five-point Likert scale ("strongly disagree", "slightly disagree", "neither disagree nor agree", "slightly agree", "strongly agree"). The advantage of such questions is to make sure that respondents take into account a wide range of motivations, including secondary ones and not only the one(s) they think of straight away. The drawback is that it may not always present a clear hierarchy between criteria.

The Likert scale was considered as being continuous, and a principal component analysis was used to reduce the information and the number of motivations. A cluster analysis was then used to elaborate a typology of cyclists according to the components summarising their motivations. This typology unveils part of the heterogeneity of the cycling practice. A further source is made of qualitative material. In addition to closed questions, there were several spaces throughout the questionnaire that gave participants the opportunity to write comments (2600 were collected regarding motivations, and 1500 about barriers). Thirty semi-structured interviews were also carried out with students or members of staff at the University of Lausanne and who took part in Bike to Work. This qualitative material has been used to help interpret the statistical results and to highlight the various meanings that can be given to the same criterion.

It has to be noted that this sample does not reflect all cycling practices, since the focus here is on commuting trips and not on sport or leisure, and some (especially long) trips may be motivated by a particular contest or by the season. Moreover, the sample does not include the age groups under and above working age, those taking care of children or unemployed people. In addition, the sample differs from the general employed population in Switzerland and from the cyclists identified by the Mobility and Transport Microcensus (defined as people who used a bike the day before they were interviewed) (Table 1). The overrepresentation of men (58% in the sample) is explained by a higher participation in the labour force (53%) but also a more frequent use of the bike (55%).



**Fig. 1.** Motivations to cycle to work (percentage of “slightly agree” and “strongly agree” responses) (source: questionnaire). Note: The question was “Do these elements motivate you to use the bike in all or part of your home–work trip? Please indicate your degree of agreement with the following proposals”. Interviewees could respond “strongly disagree”, “slightly disagree”, “neither disagree nor agree”, “slightly agree”, “strongly agree”.

**Table 2**

Summary of exploratory factor analysis results for the motivations (source: questionnaire).

	Rotated factor loadings		
	Well-being	Civic engagement	Independence
Pleasure (feeling, landscape, ...)	<b>0.81</b>	0.07	0.07
To do exercise	<b>0.77</b>	0.10	0.04
To take one's mind off things, to disconnect from work	<b>0.70</b>	0.18	0.01
Social activism	0.02	<b>0.82</b>	0.14
Positive image of the bike in my social or professional circle	0.16	<b>0.79</b>	-0.03
Respect for the environment	0.39	<b>0.55</b>	0.25
Time-saving	-0.12	0.15	<b>0.86</b>
Flexibility, freedom	0.25	0.05	<b>0.84</b>

Note: Factor loadings above 0.5 appear in bold.

The overrepresentation of people with a university degree is mainly explained by a higher propensity of certain companies to take part in the Bike to Work scheme (e.g. overrepresentation of public administrations, higher educational and health institutions as well as big firms in the service sector). People aged between 40 and 54 are also more represented in the sample than in the labour force and than among regular users of a bike.

#### 4. The motivations to cycle to work

Participants rated to which extent they agree that various factors motivate them to cycle to work (Fig. 1). Almost all of them state the opportunity to do exercise. This is followed by flexibility and freedom (90%), pleasure (88%), respect for the environment (88%) and the opportunity to take one's mind off things and to disconnect from work (80%). Conversely, less than half of the participants mention social activism or the positive image of a bike among their friends or colleagues. Less than one in four considers the absence of other satisfactory means of transport as (very) important.

Some of these variables are related in terms of people’s reasons for commuting by bike. A principal component analysis summarises them with three axes (Table 2): well-being, civic engagement and independence<sup>2</sup>. These three components are quite similar to Cresswell’s conceptualisation: well-being refers to the experience of bicycle commuting, civic engagement refers to one of the general meanings given to cycling, and independence refers mainly to the dimension of movement.

#### 4.1. Well-being

The first component of the analysis refers to elements contributing to well-being: the opportunity to do exercise, the pleasure of riding a bike and the chance to take one’s mind off things and to disconnect from work. It relates to the experience of mobility, to sensations and more precisely to the benefits of cycling, both physical (exercise) and mental (pleasure, means of escape).

The meaning of the term ‘well-being’ is highly variable. Physical exercise, one of the factors contributing to well-being, appears here as the most important motivation and is frequently brought out in the comments. It takes varied forms, from brief and light activity (including for people suffering from health issues) to intense training:

*If you rest, you rust!*

*As I suffered a torn cruciate ligament, I can’t run anymore. The bike, even with electric assistance, enables me to do sport at least a little. I often combine the trip back home with a long training route (instead of 8 km, maybe 50–60 km) so that I can squeeze in endurance training while there is still daylight.*

Many participants outline the fact that time is a scarce resource. Commuting by bicycle allows them to combine exercise and compulsory trips and to integrate exercise into a daily routine. It is a “trick” to save time, not in terms of commuting travel time strictly speaking, but by avoiding spending extra time on doing sport (and on driving to the fitness centre for example). This optimisation of time makes it possible to stay at home with the family:

*I combine my trip to work and sport, so that I don’t have to use my lunch break or the evening to do sport. So more time remains for the family.*

*It is difficult to find time to do sport. Using my compulsory trips as an opportunity to cycle is an appreciated time-saving trick in my schedule, even if I have to spend more time to make the trip in comparison to the train or car.*

*It avoids me spending extra time doing sport after I drive back home from work... All in all I save time for something else.*

A further element related to well-being is the pleasure of riding a bike, the sensation of the body moving in the environment and the opportunity to enjoy the landscape:

*Biking is simply great fun!*

*VELOVE!*

*I often make detours of more than 1 h on my way to work just for pleasure.*

*In the morning, moving in the fresh air is the first highlight of the day!*

*It is quite simply fun and we discover things around about us that we would never have seen otherwise.*

Finally, the travel time by bike is valued because it is an opportunity to get away from the daily grind, to switch mentally from home to work and vice versa. It can be a breather in the day, a decompression chamber and a place to leave behind one’s worries and problems:

*I love my bike! To go to work by bike is an enjoyable moment in my day and makes me (almost) fully disconnect from work.*

*While I am on my way back home with my bike, I can “stamp” a whole series of issues in the pedals so that I don’t bring them with me. I arrive happier at home.*

*I could not use the car or buses every day (...), I would get depressed. The bike is a synonym of freedom and physical well-being but most of all it allows me to forget worries and negativity.*

On the whole, the experience of cycling stands out as being extremely beneficial for well-being. Commuting by bicycle represents the opportunity of – sometimes incidentally – doing exercise. It is a way of turning physical exercise into an enjoyable activity, while squeezing it into one’s spare time. This can enable regular exercise to become a habit rather than a chore (Walker, 2017). The feeling of well-being gained from cycling also has a psychological dimension. Far from being seen simply as a time-consuming activity,

<sup>2</sup> The PCA was conducted with SPSS on the 11 items with orthogonal rotation (varimax). An initial analysis was run to obtain eigenvalues for each component in the data; three components had eigenvalues over Kaiser’s criterion of 1 (2.69, 1.41 and 1.26 respectively). They explain 65% of the variance (33.5%, 17.6% and 14.1%) and their Cronbach’s Alpha ranges from 0.65 to 0.68, which can realistically be expected when dealing with psychological constructs and when there is a small number of items on the scale (Field, 2009). The variables “money-saving” and “no other satisfactory transportation means” are excluded as they only add a weak explanatory contribution (cut-off points for factor loading > 0.5). The variable “transportation mode that suits me” is set aside as there is no significant link with any of the three axes.



cycling is a practice that relates to pleasure, a positive sensory experience of one’s surroundings, and an opportunity to disconnect from work and find time for one’s self.

#### 4.2. Civic engagement

The second component of the analysis is civic engagement, which relates to social activism and respect for the environment as well as the image of the bike within the company and among friends and family members.

Cycling represents an ecological and sustainable mode of transport (“clean”, “CO2-free”) both on the local and global scales and a way to reclaim the – present and future– quality of life in the city:

*I hope that the bike will be used more in the future, and that we will breathe better, for us but mainly for our kids. Although I am not a sporty person at all, I love my bike. I like to do something for the environment, for the quality of life in a city, for our health, and I like the experience of being out in the open air (...). Unfortunately I understand that I put my own life at high risk while cycling, and this despite the helmet, the brightly coloured clothes and the lamps.*

Cycling is therefore a way of embodying citizenship and responsible action. It may also be a way to set an example (to colleagues, youngsters, etc.) of alternative ways of moving and living:

*The trip to work is much shorter by bike (...) and much more pleasant (...) And I think it is essential to set an example, to show that it is utterly possible to travel by bike, even to go to a business meeting and to move around in [a hilly city]. An additional motivation is the role model for my kids. I would like them to consider using a bike as a more obvious alternative for the journey to school/work.*

The bike may also be perceived as being more compatible with the “biological rhythm” of the human being:

*To ride a bike allows me to rediscover a speed of life adapted to a human biological rhythm... Completely to the contrary of the car, which transforms the human being into a stressed person. The increasing mobilisation through cars, motorbikes and lorries bothers me greatly. Against this I would like to set an example in terms of how I respect the environment and say: it is easy to do like this. To go everywhere powered by our muscles, so we are free, independent and stay fit. To be outside, to feel the sun and the rain on your skin, to let the wind whistle in your ears, to find your way in the fog. This is life!*

This echoes Illich’s writing (Illich, 2003), who says that to move with the “muscle energy” is considered a way to reconnect with the environment and to feel natural elements such as changing weather conditions (this also refers therefore to the dimension of sensory experience).

This second component, civic engagement, explicitly refers to extrinsic motivations, as civic engagement involves the pursuit of external goals. This is highlighted by expressions such as “for our kids”, “for the environment” or “for the quality of life” found in the quotes above. The adoption of a sustainable mode of transportation is reinforced by the desire to show that cycling is a coherent and credible alternative and sometimes by the advocacy of reconnection with the environment.

#### 4.3. Independence

This third component is correlated to the practical elements of the bike. It is time-saving and characterised by freedom and flexibility. The bike is seen as “simple”, “flexible”, “supple” and “quick”, enabling “door-to-door” and “round-the-clock” trips:

*Uncomplicated and flexible. I can quickly and simply stop at any shops, without looking for and paying for a parking space. It is possible to park everywhere, to quickly do some shopping or anything on the way...*

For some participants, commuting by bike is not a political act but a normal and efficient way of moving:

*Biking is simple and should stay so. I don’t do it for convictions, neither for political or other “deep” reasons.*

The advantages of the bike are often compared to practical constraints and difficulties associated with the car (congestion, search for parking space, etc.) and public transport (overcrowding, lack of spatial and temporal flexibility, etc.):

*A car is always stuck in a traffic jam. By bike I get everywhere without delay. I cycle because of laziness. All other means of transport are too constraining. Car: searching for a parking space, lines of vehicles, rush-hour traffic. Public transport: restricted by the timetable (or missing the bus), changing bus/train, nothing available overnight. Bike: door-to-door and round-the-clock!*

Independence is a characteristic of individual modes of transportation in opposition to public transport, as users may determine the start and end points of the journey as well as the timetable. In urban areas, the advantage of the bicycle is reinforced in

**Table 3**  
Typology of cyclists according to their motivations (source: questionnaire).

	% of the sample (number)	Well-being	Civic engagement	Independence
Active cyclists	29% (n = 3501)	+	0	– –
Civic cyclists	17% (n = 2009)	– –	+	0
Individualist cyclists	14% (n = 1684)	+	– –	+
Enthusiast cyclists	40% (n = 4837)	+	+	+ +

Note: “+”: more than average; “–”: less than average; “0”: on average.

comparison to motorised transport due to the short distances of most journeys, as well as the obstacles to car traffic (congestion, parking space availability, etc.).

#### 4.4. A typology of cyclists according to their motivations

As shown by various quotes, people who cycle to work do not constitute a homogeneous group. A typology reveals part of this diversity by identifying four categories of cyclists according to the importance given to well-being, civic engagement and independence<sup>3</sup> (Table 3). These categories represent various constellations in which movement, meanings and experiences are combined. They have then been crossed with socio-demographic characteristics, equipment and mobility practices in order to better understand their specificities (Table 4). According to statistical tests, the differences are significant; this is partly due to the large size of the sample. In the comments, only the most important differences are mentioned.

The first category gathers active cyclists, who represent 29% of the sample. They are more interested than average in elements of well-being, such as physical activity (from moderate to sporty) and the pleasure of riding a bike. Characteristics related to commuting time and flexibility are less important to them than to the other groups.

In this category, there is an overrepresentation of men, people over the age of 40, residents of suburbs and rural areas, those with a professional education, and participants living in households with children. Their commuting trips are much longer than the average of the sample.<sup>4</sup> This may explain why they are much less likely to cycle all year round than the other groups. Their cycling practice seems more recreational (leisure and sport) than utilitarian, and they are more likely to have a car at their disposal, which they use the rest of the year. Taking part in the Bike to Work scheme represents an opportunity to cycle in order to stay in good shape or to disconnect from daily life.

Civic cyclists (17%) form the second group. They mention extrinsic motivations, such as environmental issues and social activism, more than the other groups do, since for them, cycling carries a more political meaning. Independence is as important for them as for the whole sample, but the opposite is observed for concerns related to well-being: this category is the only one to be below average for this component.

In this group, men, urban dwellers, younger participants and people with a university degree are overrepresented. Their cycling practice is more utilitarian and less related to leisure or sport, they have less access to a private car and their commuting trips are the shortest on average. For this group, participating in Bike to Work seems to be based on the opportunity to reassert the importance of the bike as a fully-fledged mode of transportation and to recruit new utility cyclists among their colleagues.

The third category is composed of individualist cyclists (14%), who highlight the personal benefits of cycling in terms of both well-being (exercise and pleasure) and independence. For them, the bike is a way to move around in an enjoyable and pleasant as well as a practical and efficient way. The importance they place on civic engagement is much lower than in the other three groups.

In this group, people under the age of 40 and those with a university degree are somewhat overrepresented. The rest of the group is generally close to the whole sample in terms of gender, residential context, means of transport at their disposal, distance of the journey to work, etc. The bike is less associated with a sport or leisure activity but more with an efficient means of transportation. For them, participating in Bike to Work has less to do with eco-friendliness and who responded to their colleagues' invitation.

Finally, enthusiast cyclists constitute the biggest group (40% of the sample). They differ from the other categories by giving more importance than average to all three components: the independence provided by travelling by bike, civic engagement and well-being constitute the three pillars of a practice that is strongly embedded in everyday life.

Women and urban dwellers are overrepresented in this category, whose members use the bicycle most of or all the time and have less access to a car. Their cycling practice is in particular influenced by utilitarian motives, and the great majority use their bicycle all year round, commuting by bike most of the time. Their participation in Bike to Work aims to reassert the importance of the bike and to motivate their colleagues to adopt cycling.

<sup>3</sup> On the basis of the z-standardised factor loadings obtained by each participant for the three factors, a hierarchical cluster analysis (Ward logarithm) was conducted in order to establish a typology. The number of groups (4) was chosen by examining the agglomeration schedule. A demarcation point was observed between 4 and 5 groups.

<sup>4</sup> They are also quite long in comparison with the length average of bike trips made in Switzerland. This indicator is respectively 3.3 km and 4.4 km for bikes without and with electric assistance according to the Mobility and Transport Microcensus (OFS and ARE, 2017).



**Table 4**  
Main characteristics of the four types of cyclist (source: questionnaire).

		Active cyclists	Civic cyclists	Individualist cyclists	Enthusiast cyclists	Total
<i>Profile</i>						
Gender	Female	35.6%	35.9%	42.2%	48.9%	41.9%
	Male	64.4%	64.1%	57.8%	51.1%	58.1%
Age	15–24	4.2%	4.6%	4.3%	3.2%	3.9%
	25–39	30.2%	39.6%	41.8%	36.4%	35.9%
	40–54	49.9%	41.8%	42.7%	45.8%	45.9%
	55 and over	15.8%	14.0%	11.2%	14.6%	14.4%
Level of education	Low	21.3%	17.1%	14.4%	17.2%	18.0%
	Middle	32.7%	24.2%	27.3%	26.8%	28.2%
	High	46.0%	58.6%	58.3%	56.0%	53.8%
Residential context	Urban	22.5%	51.9%	39.6%	46.4%	39.5%
	Suburban	49.1%	38.4%	48.5%	44.0%	45.2%
	Rural	28.4%	9.7%	11.9%	9.6%	15.3%
Households	Without children	45.8%	53.7%	53.6%	50.9%	50.3%
	With children	54.2%	46.3%	46.4%	49.1%	49.7%
<i>Equipment</i>						
Car at disposal	Yes	63.9%	46.5%	50.1%	45.7%	51.8%
	No/on demand	36.1%	53.5%	49.9%	54.3%	48.2%
Yearly transit ticket	Yes	31.3%	38.8%	38.3%	32.7%	34.1%
	No	68.7%	61.2%	61.7%	67.3%	65.9%
<i>Cycling practice</i>						
Use of the bicycle	Only in the warmer months	44.1%	18.0%	22.9%	10.9%	23.4%
	All year round	55.9%	82.0%	77.1%	89.1%	76.6%
Commuting by bicycle	From time to time	42.4%	14.9%	16.1%	7.0%	19.9%
	Frequently or most of the time	57.6%	85.1%	83.9%	93.0%	80.1%
Commuting distance	Average duration (both ways)	8.2 km	4.1 km	5.8 km	5.0 km	5.9 km

Note: statistical tests (chi-squared with the exception of distance, for which an ANOVA was used) show that differences are significantly different for all variables ( $p < .001$ ).

## 5. The barriers to cycling to work

The results above are positive by nature as they refer to motivations, but cycling faces various frictions. The results regarding frictions, or barriers, are different from those regarding motivations. While barriers can be of a general scope (like motivations), they can also revolve around specific and temporary situations (such as the weather or the transport of goods), and thus may not apply to all journeys. In addition, the percentages of positive responses regarding barriers are much lower than for motivations, as all of this population adheres to this practice, albeit to varying degrees. It was nonetheless important to include barriers in the survey, as it is necessary to identify the barriers faced by current cyclists as well as the problems to overcome in order to extend bicycle commuting to a larger population. Indeed, potential cyclists (who are less competent and convinced) are likely to perceive these barriers as more important than current bicycle commuters (Heinen et al., 2010).<sup>5</sup> On the basis of the results of the survey and the qualitative material, four ranges of barriers are identified: weather conditions, logistical constraints, safety and comfort.

### 5.1. Weather conditions

The most important obstacle is (bad) weather, as more than half of the respondents agree that weather conditions may restrain them from cycling (Fig. 2). This is specific to active mobility and refers to the level of comfort in the case of rain and to issues of safety in the case of winter conditions (weak luminosity, risk of ice patches, lack of snow clearance):

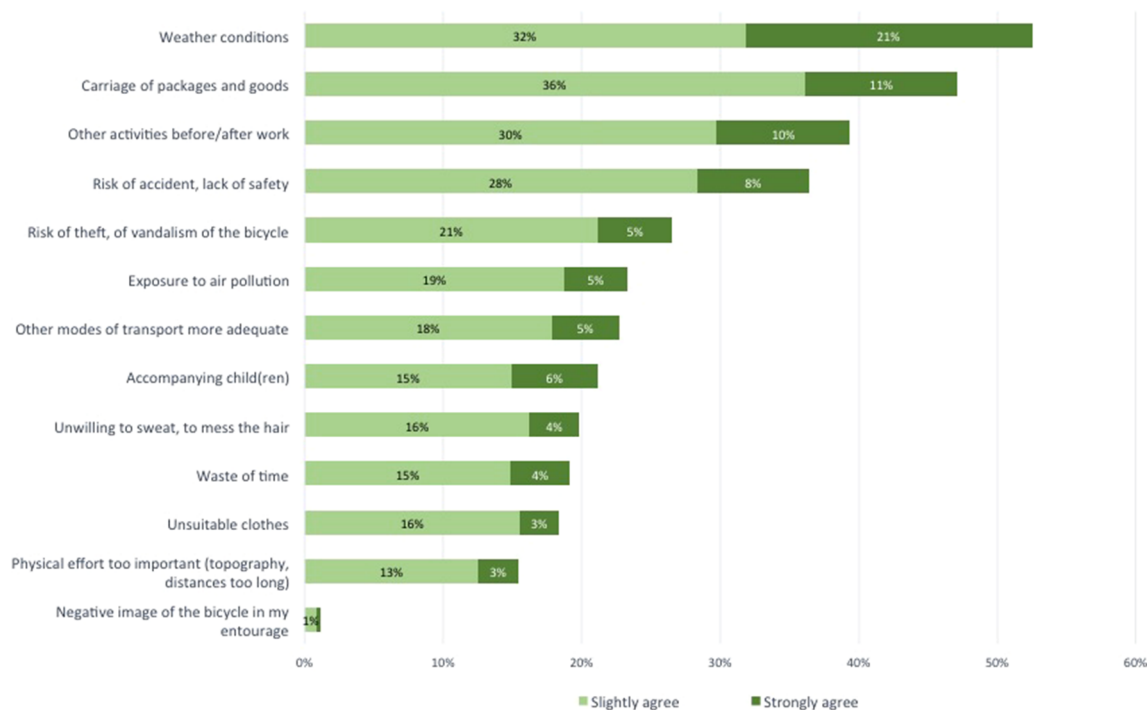
*What restrains me, it is the heavy rain, the snow when it settles, and worse is the ice. Otherwise neither the cold nor the heat prevents me from riding my bike.*

*For me the tram is a complementary means of travel. It replaces the bike in case of bad weather. I never ride in the city if the road is wet. I wear a suit and I do not want to get it dirty.*

*The winter months, when it is dark in the morning and in the evening, I take public transport because the bike is too dangerous. Car drivers do not see bikes and I almost got run over several times despite equipment that is appropriate for the night.*

Sensitivity to weather conditions differs between participants (3 in 4 claim to cycle all year round; Table 3), as do the strategies

<sup>5</sup> In this sample, barriers and motivations are not correlated. The most explanatory factor regarding barriers is the frequency of use of bicycle commuting before the Bike to Work campaign. The higher the frequency, the lower the importance of barriers.



**Fig. 2.** Barriers to cycling to work (percentage of “slightly agree” and “strongly agree” responses) (source: questionnaire). Note: The question was “Do these elements restrain you from using the bike in all or part of your home–work trip?”. Interviewees could respond with “strongly disagree”, “slightly disagree”, “neither disagree nor agree”, “slightly agree”, “strongly agree”.

they adopt. While some use other modes of transport according to the weather, others claim that appropriate equipment (clothes, hooded cape, etc.) is enough and that the real barriers are due to the lack of snow clearance on bike paths and to the behaviour of car drivers:

*No barriers because I only see the positive aspects of riding a bike, even in the rain. Only a big amount of snow prevents me from riding because car drivers control their vehicle with great difficulties and are more afraid, hence a higher risk of collision. Otherwise, when it is warm the bike gives some fresh air and when it is cold it warms you!*

*What stops me in winter when it's snowy are the roads and paths that are not cleared of snow. Bikes do not have any space on roads and paths in winter. The snow is mainly cleared for cars.*

### 5.2. Logistical constraints

Logistical constraints relate to the transport of large items (47%) and to activities carried out before/after work (40%) and those which, due to the distance involved, may make the use of a bike unsuitable.

Accompanying children appears further in the ranking (as it concerns only parents). Some parents opt for specific equipment (child seat, trailer, etc.) provided that the distance and the safety of the route are adequate:

*I have to bring my kid with me to the kindergarten that is close to my place of work. I do it with a trailer. That's the most important constraint in my use of the bike to go to work.*

*I would not ride a bike with a small kid in a trailer or child seat on the main roads but only for very short trips if it is possible to ride on residential streets (limited to 30 km/h). It is too dangerous to my mind, even though I always ride on main roads when I am alone.*

This last quote highlights the issue of safety, which varies according to the spatial context and the time of cycling and is often found in the comments.

### 5.3. Safety

Three elements are related to the safety of the person and his/her bike. These barriers are more long-term and diffuse than the previous ones. The importance of infrastructures and of cohabitation with car traffic is crucial. 36% of the participants agree that the risk of accidents and the lack of safety discourage them from commuting by bike. Comments touch upon the intensity of road traffic

and the behaviour of car drivers (lack of respect, aggressiveness, inappropriate driving, use of a smartphone, etc.), which may make cycling “a constant struggle”:

*I am generally afraid of car drivers with no regard for others. As a cyclist I often feel underestimated by car drivers. The most dangerous place on my way to work is in Baden [a German-speaking town]. There, I am always afraid. If I have enough time, I make a big detour, to give me more exercise and a safer route in regard to road traffic.*

*The EXCESSIVE speed of motorbike and car traffic (...) AND the absence of bike paths that are clearly delimited and where no other vehicle (...) may drive. (...) The last roundabout on my trip is located right after the exit of a highway. Although I am clearly visible in the traffic (fluorescent jacket and lights) cars cut me off 50% of the time.*

*I love the bike and that's why I use it a lot (130 min of daily trip) but in Geneva to ride a bike appears to be a constant struggle.*

Cycling often requires highly vigilant behaviour and the adoption of various tactics such as the careful choice of the route (according to road traffic or infrastructures), the non-respect of some traffic rules (e.g. right-turn despite red light) and the use of specific equipment (lights, high visibility clothes, helmet, etc.). These statements relate to other issues that were also addressed in the questionnaire, such as the experience of the commuting trip. A third of interviewees do not feel respected by other road users, and one in seven does not feel safe during their journey to work.

The feeling of being insecure is closely linked to what is seen as a lack of regard for cyclists and their needs in terms of infrastructures:

*Nothing restrains me from riding my bike (...). But in reality I get the jitters every day because infrastructures for bikes are put in place by people who do not ride a bike and they are very dangerous and, most of all, hugely inadequate.*

*I am feeling very uneasy with the “yellow bike lines” that abruptly stop where there are traffic lights or exactly at the most critical points (roundabouts, intersections)... It is very destabilising so that I prefer (for safety issues) to use the zebra crossings (pushing my bike), but this is also disturbing for pedestrians.*

*Cycle paths are catastrophic. While cars have flat and asphalted roads where they can drive fast, long-distance routes for bikes go uphill and down, across the fields, up, down, with detours, through villages, and sometimes over cobbled streets. We make life easy for the ones who provoke exhaust gas. We make it difficult for the ones who ride their bike and do something for the environment and their health.*

26% of cyclists mention the risks of theft or vandalism of their bike, and the costs and inconveniences that are borne by cyclists. This may be linked with the absence of a place to secure their bike at home or at the place of destination:

*The lack of place to park a bike in an adequate way, including near public buildings, administrations, train stations, is an obstacle to using a bike. Adequate means, for example, to be able to lock the bike to a hook, near the entrance to your office and not in an underground car park.*

*A secured garage (...) would be useful. (...) My first bike lasted two weeks in the parking station. My second one hasn't been stolen yet but I had to “sacrifice” it, that is to say I had to put graffiti all over it, even though it was new, in order to make it less tempting for thieves.*

Exposure to air pollution is also a problem for a quarter of the sample:

*Air pollution is in part really serious if we have to ride behind a line of cars and lorries. If it is uphill and we have to breathe deeply, it is even more serious...*

Safety concerns relate to the experience of being vulnerable in comparison to other road users, to the forced cohabitation with car traffic and to the lack of dedicated infrastructures (including a safe location to park a bike). It refers also to more symbolic issues, such as the perception of a lack of regard by drivers and a lack of legitimacy in the eyes of planners and politicians.

#### 5.4. Comfort

The other obstacles, which are quantitatively less important, touch upon comfort. Between a fifth and a sixth of interviewees mention issues related to physical effort, sweating, the type of clothing to wear for work (compulsory or chosen) and the duration of the journey (due to the distance or the topography):

*The main argument against using the bike is the logistics. I have to carry other clothes for work, including shoes, and at my workplace I need more time to change and to have a shower.*

*There are 500 m of difference in height between my work place and my home, so the outward trip takes 20 min, but the return trip takes 45 min ...*

*The travel time is too long and the physical effort too big, which restrains me from using a usual bike. With an e-bike these drawbacks are wiped out (that's why I have bought one).*

Comments left in the questionnaire also include thoughts on laziness and lack of desire, which affect the regular use of a bicycle:

*The biggest factor that prevents me from riding a bike is my own laziness.*

*It is so easy to jump behind the wheel of a car! It [cycling] requires some will and a willingness to renounce the comfort of the other forms of mobility.*

This issue of comfort may be addressed by specific equipment (adapted to the weather), and infrastructures (such as a shower at the work place). It explains the rise of the e-bike among bike commuters (16% of the sample).

## 6. Conclusion

A survey among 13,700 participants in the Bike to Work scheme highlights the mechanisms of utility cycling and identifies the motivations for and barriers to this mobility practice in the case of Switzerland. The aim of the research was to analyse the factors facilitating and hindering utility cycling, as stated by individuals in respect to their everyday practices. To address this issue I have drawn on Cresswell's conceptualisation of mobility into three dimensions – movement, meaning and experience – as well as his notions of the constellations of mobility and friction (Cresswell, 2010, 2006). After summarising and discussing the main results I will show how they could inform a policy of promotion of the bike in terms of communication and infrastructures.

Bicycle commuters highlight three main ranges of motivation. The first refers to well-being: the benefits of cycling can be physical (doing exercise, keeping fit) and mental (disconnection from work, pleasure, sensory experience, etc.). For some, commuting by bike is a way to squeeze an enjoyable and physical activity into a daily routine characterised by time constraints. While less present in the literature on bicycle commuting, the experience of cycling – mediated through the senses – stands out as being a crucial motivation in which the commuting time is seen not as wasted but as valuable. The pleasure linked to the experience of riding a bike refers to a “hedonistic sustainability”, in the words of Bjarke Ingels (quoted by (Fleming, 2012)). It represents an interesting argument to promote cycling in societies characterised by a high share of sedentary office jobs. The second type of motivation is independence. This relates to certain practical elements of cycling (freedom and flexibility) compared to the constraints of other modes of transportation (congestion, timetables, etc.). The third body of motivations is civic engagement. Cycling here embodies citizenship and is a way to promote respect for the environment on a global scale (in a context of climate change) as well as the local scale (reclaiming the quality of life in cities and reconnecting with the environment).

The first two of these ranges of commuters' motivations are intrinsic but intersect political issues. For example, doing exercise relates to public health issues, and cycling may alleviate traffic and public transport congestion and reduce the emission of pollutants and greenhouse gases. Cyclists are, however, far from being a homogenous group and give a varying degree of importance to the three ranges of motivations mentioned above. A part of this diversity is highlighted by the four categories (or constellations of mobility) I identified among Swiss commuters: active, civic, individualist and enthusiast cyclists. These groups are receptive to varying combinations of arguments, which are in turn explained by gender, life course position and residential location (other variables are likely to have an effect but could not be tested, such as attitudes, physical conditions or lifestyles).

Riding a bicycle involves obstacles in a country such as Switzerland, where the cycling culture is not as developed as in Northern Europe. Barriers relate to weather, logistical constraints, safety and comfort and are similar to results found in other contexts (e.g. Piatkowski et al., 2015). A tension arises between cycling as an enjoyable experience and cycling seen as an act of courage from vulnerable road users. This is also observable in the fact that a third of interviewees do not feel respected by other road users and one in seven does not feel safe on the commute to work. These results are obtained for a population who has adopted (or tried) cycling as a means of transport, and show that the current infrastructures in Switzerland, which may be sufficient for the most competent cyclists, are inadequate to encourage the wider population to take up cycling.

The paper is based on a population of users mainly employed in the service sector and in a country with an intermediate level of modal share of cycling in comparison with other Western countries. To what extent can these results be generalised? Some trends may change according to participants' profiles (e.g. students or low-income workers are likely to place more importance on money-saving issues) and the context (efficiency might be mentioned more by those in regions with a mature culture of cycling, while civic engagement may be more present where cycling is not yet recognised as a fully-fledged mode of transportation). More research – both quantitative and qualitative – would be needed in order to go beyond this case study and address these issues for a variety of population groups, spatial contexts and cycling practices (e.g. bike share). Children and teenagers would be an interesting group to study as they are the only age group for which cycling is declining notably in Switzerland (Sauter and Wyss, 2014). Other groups could be taken into account, such as students, homemakers and the elderly as well as people who do not yet use the bicycle as a means of transport but who may be contemplating the idea (Nkurunziza et al., 2012). Such analysis could not only be cross-sectional but also longitudinal, allowing the observation of potential changes over participants' life course and cycling trajectories (Jones et al., 2014). It would also be interesting to take into account the geography of cycling and to analyse the ways in which motivations and barriers vary according to the spatial context and the country.

Despite these limitations, the results on motivations and barriers and the three dimensions of mobility (movement, meanings and experiences) may inform public policy. These dimensions could be simultaneously integrated into policies promoting utility cycling in the fields of communication, road regulation and planning. In terms of infrastructures and planning (the “hardware”), the movement dimension requires direct, fast and well-maintained routes forming a network to make cycling an effective mode of transportation for a wider part of the population. This need has often been stressed by the literature and is evident in a country with an intermediate share of bicycle commuters. In terms of experience, these routes have to be designed to make cycling an embodied

practice that is both safe and pleasant for all types of cyclist.

In terms of communication (the “software”), a plurality of motivations (well-being, independence, civic engagement) has been observed among utility cyclists. For many, cycling is a means of transportation all year round that meets their needs. For others (mainly the active cyclists), it is more seasonal, and the frontiers are blurred between utility, leisure or sport cycling. Communication and promotion campaigns – by public authorities, non-governmental organisations or companies – could target groups including both actual and potential cyclists taking into account their various (intrinsic) motivations and barriers. They are also crucial on a societal and political scale. The barriers faced by cyclists show that they may feel like intruders on the road, resulting from cultural norms and unequal power relations in a car-centric world. Promotion campaigns but also traffic regulation and planning should assess the legitimacy of cycling as a fully-fledged transportation mode and should aim to normalise this practice.

### Acknowledgement

The author would like to thank Gianluigi Giacomel and Antonio Martin for their work on the statistical analysis of the survey and the three anonymous reviewers for their comments.

### Conflicting interests statement

No conflicting interests to declare.

### Funding

This work was supported by the University of Lausanne, the Canton of Vaud and Romande Energie in the frame of the Volteface programme.

### Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.tra.2018.10.017>.

### References

- Bonham, J., Koth, B., 2010. Universities and the cycling culture. *Transp. Res. Part Transp. Environ.* 15, 94–102. <https://doi.org/10.1016/j.trd.2009.09.006>.
- Boterman, W.R., 2018. Carrying class and gender: Cargo bikes as symbolic markers of egalitarian gender roles of urban middle classes in Dutch inner cities. *Soc. Cult. Geogr.* 1–20. <https://doi.org/10.1080/14649365.2018.1489975>.
- Buehler, R., Dill, J., 2016. Bikeway networks: a review of effects on cycling. *Transp. Res.* 36, 9–27. <https://doi.org/10.1080/01441647.2015.1069908>.
- Cox, P. (Ed.), 2015. *Cycling Cultures*. University of Chester Press, Chester.
- Cresswell, T., 2010. Towards a politics of mobility. *Environ. Plan. Soc. Space* 28, 17–31. <https://doi.org/10.1068/d111407>.
- Cresswell, T., 2006. *On the Move: Mobility in the Modern Western World*. Routledge, New York.
- Day, J., 2015. *Cyclogeography: Journeys of a London Bicycle Courier*. Nottling Hill Editions, Honiton, Devon.
- Dill, J., McNeil, N., 2013. Four types of cyclists?: Examination of typology for better understanding of bicycling behavior and potential. *Transp. Res. Rec. J. Transp. Res. Board* 2387, 129–138. <https://doi.org/10.3141/2387-15>.
- Field, A., 2009. *Discovering Statistics Using SPSS*. Sage, London.
- Fishman, E., 2016. Cycling as transport. *Transp. Res.* 36, 1–8. <https://doi.org/10.1080/01441647.2015.1114271>.
- Fleming, S., 2012. Cycle space: architecture & urban design in the age of the bicycle. nai010, Rotterdam.
- Garrard, J., Handy, S., Dill, J., 2012. *Women and Cycling*. In: Pucher, J., Buehler, R. (Eds.), *City Cycling*. MIT Press, Cambridge MA, pp. 211–234.
- Handy, S., van Wee, B., Kroesen, M., 2014. Promoting cycling for transport: research needs and challenges. *Transp. Res.* 34, 4–24. <https://doi.org/10.1080/01441647.2013.860204>.
- Heinen, E., van Wee, B., Maat, K., 2010. Commuting by bicycle: an overview of the literature. *Transp. Res.* 30, 59–96. <https://doi.org/10.1080/01441640903187001>.
- Hennessey, B., Moran, S., Altringer, B., Amabile, T.M., 2015. Extrinsic and Intrinsic Motivation. In: Cooper, C.L. (Ed.), *Wiley Encyclopedia of Management*. John Wiley & Sons, Ltd, Chichester, UK, pp. 1–4. <https://doi.org/10.1002/9781118785317.weom110098>.
- Illich, I., 2003. *La convivialité*. Points. Ed. du Seuil, Paris.
- Jones, H., Chatterjee, K., Gray, S., 2014. A biographical approach to studying individual change and continuity in walking and cycling over the life course. *J. Transp. Health* 1, 182–189. <https://doi.org/10.1016/j.jth.2014.07.004>.
- Jones, P., 2012. Sensory indiscipline and affect: a study of commuter cycling. *Soc. Cult. Geogr.* 13, 645–658. <https://doi.org/10.1080/14649365.2012.713505>.
- Kingham, S., Dickinson, J., Copsey, S., 2001. Travelling to work: will people move out of their cars. *Transp. Policy* 8, 151–160. [https://doi.org/10.1016/S0967-070X\(01\)00005-1](https://doi.org/10.1016/S0967-070X(01)00005-1).
- Koglin, T., Rye, T., 2014. The marginalisation of bicycling in Modernist urban transport planning. *J. Transp. Health* 1, 214–222. <https://doi.org/10.1016/j.jth.2014.09.006>.
- Lee, D.J., 2015. Embodied bicycle commuters in a car world. *Soc. Cult. Geogr.* 17, 402–420. <https://doi.org/10.1080/14649365.2015.1077265>.
- Liu, G., Krishnamurthy, S., van Wesemael, P., 2018. Conceptualizing cycling experience in urban design research: a systematic literature review. *Appl. Mobilities* 1–17. <https://doi.org/10.1080/23800127.2018.1494347>.
- McKenna, J., Whatling, M., 2007. Qualitative accounts of urban commuter cycling. *Health Educ.* 107, 448–462. <https://doi.org/10.1108/09654280710778583>.
- Morgan, N., 2017. Cycling infrastructure and the development of a bicycle commuting socio-technical system: the case of Johannesburg. *Appl. Mobilities* 1–18. <https://doi.org/10.1080/23800127.2017.1416829>.
- Mueller, N., Rojas-Rueda, D., Salmon, M., Martínez, D., Ambros, A., Brand, C., de Nazelle, A., Dons, E., Gaupp-Berghausen, M., Gericke, R., Götschi, T., Iacorossi, F., Int Panis, L., Kahlmeier, S., Raser, E., Nieuwenhuijsen, M., 2018. Health impact assessment of cycling network expansions in European cities. *Prev. Med.* 109, 62–70. <https://doi.org/10.1016/j.ypmed.2017.12.011>.
- Nankervis, M., 1999. The effect of weather and climate on bicycle commuting. *Transp. Res. Part Policy Pract.* 33, 417–431. [https://doi.org/10.1016/S0965-8564\(98\)00022-6](https://doi.org/10.1016/S0965-8564(98)00022-6).
- Nkurunziza, A., Zuidgeest, M., Brussel, M., Van Maarseveen, M., 2012. Examining the potential for modal change: motivators and barriers for bicycle commuting in Dar-es-Salaam. *Transp. Policy* 24, 249–259. <https://doi.org/10.1016/j.tranpol.2012.09.002>.

- OFS, ARE, 2017. Comportement de la population en mati  re de transports: r  sultats de microrecensement mobilit   et transports 2015. Office f  d  ral de la statistique et Office f  d  ral du d  veloppement territorial. ed. OFS, Neuch  tel.
- Parkin, J., Ryley, T.J., Jones, T.J., 2007. Barriers to cycling: an exploration of quantitative analyses. In: *Cycling and Society*. Ashgate, Farnham. p. 67–82.
- Piatkowski, D., Bronson, R., Marshall, W., Krizek, K.J., 2015. Measuring the impacts of bike-to-work day events and identifying barriers to increased commuter cycling. *J. Urban Plan. Dev.* 141, 04014034. [https://doi.org/10.1061/\(ASCE\)UP.1943-5444.0000239](https://doi.org/10.1061/(ASCE)UP.1943-5444.0000239).
- Prati, G., Mar  n Puchades, V., Pietrantonio, L., 2017. Cyclists as a minority group? *Transp. Res. Part F Traffic Psychol. Behav.* 47, 34–41. <https://doi.org/10.1016/j.trf.2017.04.008>.
- Pucher, J., Dill, J., Handy, S., 2010. Infrastructure, programs, and policies to increase bicycling: an international review. *Prev. Med.* 50, S106–S125. <https://doi.org/10.1016/j.ypmed.2009.07.028>.
- Pucher, J.R., Buehler, R. (Eds.), 2012. *City Cycling, Urban and Industrial Environments*. MIT Press, Cambridge, Mass..
- R  rat, P., Giacomel, G., Martin, A., 2019. Au travail    v  lo... La pratique utilitaire de la bicyclette en Suisse. Editions Alphil–Presses universitaires suisses, Neuch  tel.
- Rose, G., Marfurt, H., 2007. Travel behaviour change impacts of a major ride to work day event. *Transp. Res. Part Policy Pract.* 41, 351–364. <https://doi.org/10.1016/j.tra.2006.10.001>.
- Ryan, R.M., Deci, E.L., 2000. Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemp. Educ. Psychol.* 25, 54–67. <https://doi.org/10.1006/ceps.1999.1020>.
- Sauter, D., Wyss, K., 2014. *Etude pilote sur l'utilisation du v  lo chez les jeunes dans le canton de B  le-Ville*. D  partement des constructions et des transports du Canton de B  le-Ville, B  le.
- Spinney, J., 2009. Cycling the city: movement, meaning and method. *Geogr. Compass* 3, 817–835. <https://doi.org/10.1111/j.1749-8198.2008.00211.x>.
- Spotswood, F., Chatterton, T., Tapp, A., Williams, D., 2015. Analysing cycling as a social practice: an empirical grounding for behaviour change. *Transp. Res. Part F Traffic Psychol. Behav.* 29, 22–33. <https://doi.org/10.1016/j.trf.2014.12.001>.
- te Br  mmelstroet, M., Nikolaeva, A., Glaser, M., Nicolaisen, M.S., Chan, C., 2017. Travelling together alone and alone together: mobility and potential exposure to diversity. *Appl. Mobil.* 2, 1–15. <https://doi.org/10.1080/23800127.2017.1283122>.
- Urry, J., 2004. The 'system' of automobility. *Theory Cult. Soc.* 21, 25–39. <https://doi.org/10.1177/0263276404046059>.
- van Duppen, J., Spierings, B., 2013. Retracing trajectories: the embodied experience of cycling, urban sensescapes and the commute between 'neighbourhood' and 'city' in Utrecht, NL. *J. Transp. Geogr.* 30, 234–243. <https://doi.org/10.1016/j.jtrangeo.2013.02.006>.
- Vivanco, L.A., 2013. *Reconsidering the bicycle: an anthropological perspective on a new (old) thing*. The Routledge Series for Creative Teaching and Learning in Anthropology, Routledge, New York.
- Walker, P., 2017. *Bike Nation: How Cycling Can Save the World*. Yellow Jersey Press, London.