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The contrasted evolution of cycling during youth. Determinants of bicycle ownership and use

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ABSTRACT

Cycling during youth is characterized in many countries by two trends: its decline over the course of several decades (termed the generation effect) and its decline over the life course of individuals (the age effect). This paper addresses the age effect through a survey carried out among young people aged 12–20 ($n = 1,358$) in a Swiss city. It goes beyond the cyclist/non-cyclist dichotomy and identifies several cases in terms of skills (ability to ride a bike), access (ownership of a bike), and uses (reasons for and frequency of cycling). While most young people (98%) learned how to ride a bike as a child, an important minority do not continue cycling beyond childhood. Among those who continue, the use of the bike often changes over time to become less utilitarian and more recreational and occasional. The main determinants explaining cycling practices among young people are socialization (the parents' cycling practices and level of education), gender, and the spaces of everyday life (place of residence and school). The results point to several levers to foster cycling among young people, to anchor sustainable mobility practices for years to come.

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1. Introduction

The cycling practices of young people differ from country to country, and while cycling is popular in some countries, in others it is less so. In the Netherlands, for example, 52% of middle- and high-school children cycle to school (McDonald, 2012), and in Denmark, 37.4% of 6–17-year-olds cycle to school (Christiansen & Baescu, 2021). However, these numbers are more of an exception. Indeed, while cycling is experiencing a renaissance in many Western cities (Buehler, 2018), cycling among children and young people (from 6 to 20 years old) has declined in many countries in the last few decades (Cardon et al., 2012).



This decline can be observed in several European countries—in a French city (Lille), cycling among under 18-year-olds decreased four-fold between 1987 and 2016 (Richer & Rabaud, 2019); in Ireland, 15.3% of 13- to 15-year-olds were cycling in 1986, compared to 2.1% in 2016 (Central Statistics Office, 2017); and in Switzerland, on which this paper is based, cycling declined from 32% to 19% of all trips among 13- to 15-year-olds and from 18% to 6% among 16- to 18-year-olds (Sauter, 2019). The United States, where cycling is less common to start with, has also seen its share of high-school students cycling to school fall, from 2% in 1977 to 0.8% in 2017 (Kontou et al., 2020). What's more, these trends can even be observed in cycling-friendly countries, such as Denmark, where cycling decreased among

11- to 17-year-olds by 24.5% between 2009 and 2019 (Christiansen & Baescu, 2021).

At the same time, an increasing number of children and adolescents are taken to school in their parents' car. As a result, the car is more dominant in public space, leading to decreased safety around schools and, in turn, to a decrease in active travel to school (Buehler et al., 2020; Cardon et al., 2012; Sallis et al., 2000). Both cycling and physical activity in general are affected by this vicious circle (Rothman et al., 2020).

The decline in cycling is thus observed across generations, but we also encounter a shift between different ages within the current generation of children and young people. In Canada, 25% of 5- to 12-year-olds and 23% of 13- to 17-year-olds cycle to school (McDonald et al., 2021), while in Switzerland, 16- to 18-year-olds are three times less likely to cycle than 13- to 15-year-olds (Sauter, 2019). However, this age effect is not universally observed. In the UK, cycling doubles between 5- to 10-year-olds (1.4%) and 10- to 16-year-olds (2.7%) (Department of Transport, 2021). This is also the case in the Netherlands, from 29% among 0- to 11-year-olds to 52% among 12- to 17-year-olds (McDonald et al., 2021). In Ireland, cycling to school increases with age, from 4.1% in primary school to 6.5% in tertiary education (Central Statistics Office, 2017).

These trends are particularly significant in a context where the energy transition calls for the adoption of more sustainable mobility practices (Givoni & Banister, 2013), which it is important to encourage during childhood and

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youth, since modal practices developed earlier in life are likely to last for years to come and contribute to defining practices as adults (Delmelle & Delmelle, 2012; Hume et al., 2009; Janke & Handy, 2019).

Few studies have addressed the issue of how cycling evolves among young people. Most research focuses on younger children or relies on secondary data (e.g. national statistics) that do not always distinguish between age groups or that do not go beyond the cyclist/non-cyclist dichotomy. This article fills this gap by identifying several mechanisms in terms of skills (ability to ride a bike), access (ownership of or other access to a bike), and uses (reasons for and frequency of cycling). We analyze the cycling practices of young people aged between 12 and 20 in the city of Yverdon (30,000 inhabitants) in the French-speaking part of Switzerland through a cross-sectional study carried out in 2020. Our study seeks 1) to analyze how cycling among young people varies with age, and 2) to identify the factors which explain these variations.

In the following section, we present our approach and a literature review on youth cycling and its determinants (Section 2). We then consider the case study, methods, and dataset (Section 3). The fourth section contains our findings on the evolution of cycling during youth, and in Section 5 we discuss the main results, draw general conclusions, and offer recommendations to increase cycling among young people.

2. Theoretical discussion

This chapter presents a review of the literature on cycling among young people, using the system of velomobility as a framework (the term ‘velomobility’ is defined below). We also include the concept of socialization and analyze its effects on young people’s mobility. We conclude the chapter by revealing the explanatory variables selected in our study and taken from our literature review.

2.1. The concept of velomobility

To understand the different individual and contextual components that lead to cycling, we use the theoretical approach of velomobility, which can be defined as “the assemblage of rider, machine and space and the systemic relations of society, economy, polity and history within which they are performed” (Cox, 2019, p. 28). We conceptualize velomobility by drawing on Kaufmann’s three dimensions of mobility (Kaufmann, 2017): movements in physical space (uses of the bike), the aptitude for movement—or motility (an individual’s cycling potential), and the hosting potential of a context for cycling (its bikeability) (Rérat, 2021a; Rérat et al., 2022).

As young people’s mobility is strongly dependent on their parents and their peers, we add the notion of socialization to the concept of velomobility. Thus, we organize the literature review on youth and cycling according to velomobility (individual cycling potential and the hosting potential of the context) and socialization processes.

2.1.1. The individual’s cycling potential

The individual’s cycling potential is composed of three dimensions based on the concept of motility developed by Kaufmann (2017), which we apply to cycling (Rérat, 2021b): skills (the ability to move, like ride a bike—“know-how”), access (ownership of or other access to mobility instruments—“being able to use a means of transport”), and appropriation (perceptions of different modes of transport and how individuals choose between them according to their goals, their plans and their habits—“wanting”). According to the literature, individual cycling potential is influenced by three socio-demographic characteristics: (1) age, (2) gender, and (3) education.

Firstly, age may have two effects on cycling during youth. A decline is observed in cycling practices as young people get older and have access to new transport modes, as seen in American and Dutch studies that show the negative impact of access to a driver’s license on cycling and walking (Emond et al., 2009; van der Waerden et al., 2003). Young people’s perceptions of cycling also change as they get older: the “fun” side of cycling in childhood takes on a negative connotation during adolescence in favor of the car (Underwood et al., 2014). However, these trends should not be generalized, as a decline in youth licensing is also observed in many countries (Haldimann & Rérat, 2020) and a Flemish study found an increase in cycling during youth, particularly as a way to get to school (Cardon et al., 2012, p. 379). Furthermore, young people become more autonomous with age, and often prefer to walk or cycle as a way of exercising their independence—as revealed in a British study (Lorenc et al., 2008). Thus, perceptions of cycling, access to a driver’s license and a desire for independence all impact, in differing ways, the mobility choices and habits of young people. We will further discuss this in Section 2.2, through the notion of mobility biographies.

Secondly, gender also plays an important role in cycling practices among the youth. Boys usually cycle more than girls, especially in countries without a cycling culture (McDonald et al., 2021), a trend that is similar among adults. This gap may first be explained by safety issues (Bonham & Wilson, 2012; Emond et al., 2009). Girls abandon cycling more often, and more quickly, than boys, due to their perception of road safety and a lower stated level of confidence in traffic (Dill, 2017). The lack of (perceived) safety also depends on parents, who tend to exercise greater control over girls than boys (Brown et al., 2008; McDonald et al., 2021). A second explanation may be found in the differences between boys and girls in terms of their reasons for and frequency of use of the bike (appropriation). Boys tend to be more enthusiastic about cycling and quicker to become independent in their mobility (Brown et al., 2008; Fyhri & Hjorthol, 2009), while girls, on the other hand, are more likely to give up cycling if it is perceived negatively among their group of friends (Brown et al., 2008; Cavill & Watkins, 2007; Dill, 2017; Underwood et al., 2014).

Thirdly, educational orientation has an influence on the transport needs of young people and on their access to mobility. To our knowledge, level of education has not yet

been considered in the literature on young people's cycling practices. However, an analysis of the mobility practices of young people in Switzerland indicates a correlation between level of education and cycling habits: young people with a high-school education that leads to university studies cycle more than young people engaged in vocational education (Sauter & Wyss, 2014). This may be in part because those in vocational training earn a salary and are therefore more likely to have access to a car (Haldimann & Rérat, 2020).

2.1.2. Socialization

According to Hanson (2010), in questioning daily mobility, the individual must be considered as “embedded in, and interacting with, the household, family, community and larger society” (p.8). This embeddedness is particularly true of children and young people, for whom access to and learning about daily mobility are strongly influenced by the household in which they live, its social position, and the means of transport available to them, as shown by studies in the US, the UK, and France (Mitra, 2013; Panter et al., 2010; Vincent-Geslin & Authier, 2016).

Those influences can be observed through the concept of ‘socialization’, which is a set of processes that make the individual who they are (Darmon, 2016). Two types can be identified: primary socialization, i.e. within the family, and secondary socialization, through friends and the school system. Within the field of mobility, the theory of socialization has been extended under the term “travel socialization studies” (Baslington, 2008), an approach that aims to understand the mechanisms of social influence around modal practices.

The mobility practices of children and young people are strongly influenced by the mobility practices of their parents (Susilo & Liu, 2016; Thigpen & Handy, 2018). Emond and Handy (2012) observe that parental cycling plays an important role in the cycling behavior of young people, who “are apparently influenced by the encouragement and behavior of their parents” (p. 78). Although peers also influence modal practices, and in particular the appropriation of modes of transport, the influence of parents is observed continuously throughout childhood and youth. “Parents continue to have a strong influence on the choices of their children, both through their encouragement (or not) of bicycling and their willingness (or not) to drive their children” (Emond & Handy, 2012, p. 72).

Mobility practices vary greatly according to the parents' socio-economic status: the higher the income, the greater the motility (Kaufmann & Widmer, 2005), and the greater the use of active modes of travel (Van Goeverden & de Boer, 2013). Some studies have found that parents with a lower income tend to be more concerned about their children's safety and therefore less open to them using active modes (Aarts et al., 2013; van den Berg et al., 2020). Higher-income households are likely to own more cars than lower-income households, which can lead to a more car-dependent and less active mobility for children and young people (Johansson, 2006; Van Goeverden & de Boer, 2013).

Finally, the family's country of origin also plays a role in cycling. Immigrants cycle less than native-born people in

European countries with a strong cycling culture, such as the Netherlands and Denmark (Haustein et al., 2020; Van der Kloof, 2015). These trends are even more pronounced among women and young people with a non-Western migration background (Haustein et al., 2020). In Holland, which has a strong local cycling culture, Dutch adolescents are three times more likely to cycle than their immigrant counterparts (de Bruijn et al., 2005).

2.1.3. The hosting potential of the spatial context

The hosting potential of a spatial context for cycling—or its bikeability—refers to three dimensions: the spatial structure (distance, density, traffic, topography, etc.), facilities and infrastructures (such as cycle lanes and tracks, which determine the extent to which cyclists can use the road alongside other road users), and non-material elements such as rules and social norms (Rérat, 2021a; Rérat et al., 2022).

In turn, bikeability influences access to, skills for, and appropriation of cycling (McDonald, 2012). This impact is even greater if the bikeability of the context is not child friendly, as this makes parents less likely to encourage their children to cycle—particularly in the case of girls (De Vries et al., 2010; Osborne, 2005), as we saw in the previous sections.

Distance, topography, and existing facilities all play a role in the decision to (re)start cycling, a decision which is, like other mobility choices, often the result of a complex set of processes that take place consciously or unconsciously and may be constrained by objective and subjective circumstances (De Witte et al., 2013). These processes occur throughout the life course (Chatterjee et al., 2013), and so while an individual may decide at one point in time not to cycle, this may change over time in response to other changes. For example, as young people grow up, they are likely to change school, whose location may have an influence on their decision to start or stop cycling to school. Thus, home–school distance is a decisional factor for the modal choice to travel to school, as is bicycle infrastructure, which provides additional safety for cyclists (Emond & Handy, 2012; Fitch et al., 2016; Mitra & Buliung, 2012).

Bikeability also revolves around the social norms and rules in place in a given context (Rérat, 2021a). Norms play an important role for young people and reveal a gendered dimension: “[...] if bicycling is not socially normalized or seen as “cool” in a community, teenagers are less likely to accept it. This is especially true for girls [...]” (Underwood et al., 2014, p. 22). Thus, consideration of both social and spatial contexts in which young people evolve is important for understanding their mobility practices (Mitra & Manaugh, 2020).

2.2. Trends in cycling over young people's life course

As we have seen, individual cycling potential and the bikeability of a context reflect a specific meaning among children and young people. Indeed, their modal choices include more constraints than those of adults: limited access to

certain modes of transport, parental control and supervision, and lack of financial autonomy (Kaufmann & Widmer, 2005; Mitra & Manaugh, 2020).

However, while cycling depends on individual and contextual components at a given moment, these evolve over the life course. The mobility biographies approach offers an interesting way of analyzing this evolution. During their life, people go through various events that impact their daily lives and thus their daily mobility practices. Several authors have developed the notion of ‘key events’, which can be defined as “major event[s] in a personal life that trigger a process of reconsidering current behavior” (van der Waerden et al., 2003, in: Müggenburg et al., 2015). Since their influence on mobility is variable, two categories of events are distinguished in the literature: on the one hand, mobility-related events, also called mobility milestones, and on the other hand, all other key events not directly related to mobility (Rau & Manton, 2016). These events vary over the life course and depend on the age of the individual. For young people, the first category may refer to cycling (e.g. learning how to ride a bike, getting a bike to meet new needs) as well as to other modes (e.g. getting a moped or car driving license). The second category of event refers to life course changes, such as a new place of residence (Janke & Handy, 2019; Lanzendorf, 2010; Rau & Manton, 2016) or a new school (Chatterjee et al., 2013; Rau & Manton, 2016). Changing school may also decrease free time (due to more homework) and thus impact leisure activities such as cycling (or activities that young people would travel to by bike).

3. Research design

3.1. Variables used in this study

Based on our literature review, we selected seven explanatory factors to analyze the changes in cycling among young people. We used three individual factors: gender, age, and education; and three variables related to socialization: home language (to identify the migratory pathway of young people), parents’ level of education (to identify the socio-economic profile of young people) and parents’ cycling practices (i.e. the frequency with which both parents’ cycle to work and/or engage in sport/leisure cycling). Finally, the place of residence is used as a variable to reflect the physical environment, i.e. whether young people live in the city (neighborhoods of various morphologies but within a limited radius of 1.5 km), in municipalities of the urban region (sub- or peri-urban municipalities, predominantly residential, within the catchment area of Yverdon between 2 to 5 km) or in another remoter municipality (either rural or in another region). More specific features of the physical environment, such as cycling facilities, are not considered here.

3.2. Case study

Cycling in Switzerland represents about 7% of the modal share. While this is higher than in Latin and Anglo-American countries, it is much lower than in some northern

European countries, such as the Netherlands and Denmark (Buehler, 2018; Rérat, 2019).

Cycling among young people in Switzerland is characterized by three major trends: (1) a decline in cycling is observed over recent decades—for both recreational and utility reasons; (2) cycling decreases during youth, and (3) cycling practices differ between linguistic regions. The decline in cycling during youth is such that the modal share of cycling among 13- to 15-year-olds decreased from 32% in 1994 to 19% in 2015, and from 18% to 6%¹ for 16- to 20-year-olds (Sauter, 2019). The trend seen across linguistic regions is that cycling is more popular in the German-speaking region (26% of all trips of 13- to 15-year-olds) than in the French-speaking (4%) and Italian-speaking (5%) regions; this may be explained by the fact that the German-speaking regions are more cycling friendly, with more 20 and 30 km/h zones and cycling infrastructures.

This study aims to understand how cycling among young people differs according to age. To do so, we selected the medium-sized city of Yverdon (30,000 inhabitants), given its relatively flat topography and the presence of a variety of types of schools that can accommodate young people aged 12 to 20². The modal share of cycling in the city of Yverdon is estimated at 7%, which is equivalent to the national average, but higher than most other cities in French-speaking Switzerland. In the urban region surrounding Yverdon³, the modal share of cycling is only 4% (OFS & ARE, 2017).

Cycling facilities, cycle lanes and tracks are present in several places in Yverdon, but in a somewhat haphazard manner: cycle lanes are not continuous, and while the city has a bike-sharing scheme, a secure bicycle station, and several maintenance stations (inflation, repair tools), there are parts of the city that don’t have any of these. Nevertheless, the urban region of Yverdon is crossed by three cycle tourism routes. Thus, although the modal share of cycling remains modest, the city of Yverdon has an interesting potential for cycling, particularly because of its flat topography and small size.

3.3. Methodology

This study was based on a quantitative survey and group interviews with young people from four different state schools. Schools were contacted because this was the easiest way to get in touch with young people. Our study covers nearly all young people aged up to 16 years old living in Yverdon (as well as some who live in the adjacent municipalities that don’t have their own school). For young people aged 16 and over, we contacted all students and apprentices attending a school in Yverdon through the school authorities. This includes a significant percentage of the young people living in Yverdon, as well as many living in the urban region or even beyond.

¹These are the most recent figures available.

²The choice of this age range was determined by the Swiss school system. Participants were mainly aged 13 to 19. Some children aged 12 and some aged 20 are included and added to the youngest and oldest age groups. This is due to the age of schooling of the young people and their date of birth.

³An urban region is defined by a core city and its suburbs (suburban and peri-urban municipalities).

The four schools contacted included two lower secondary schools (ISCED 2⁴), an academic high school (ISCED 34) that prepares students for university studies, and a vocational school (ISCED 35) for young people doing an apprenticeship. These four schools are in very different urban contexts. One lower secondary school and the vocational school are in a residential area, the other lower secondary school is in a former industrial zone near the city center, and the high school is in a suburb, outside the city of Yverdon, and is located on a hill, which does not favor bicycle use for school trips.

This paper focuses on the initial results analyzed from the quantitative survey conducted among the students in the four selected schools. We propose here a cross-sectional study and assume that 18- to 20-year-olds had, a few years earlier, similar practices to 12- to 14-year-olds.

A link to an online survey was sent by e-mail to the four schools, who then emailed it to their own students. In some lower secondary classes, teachers asked students to fill in the questionnaire in class. The questionnaire was divided into five parts: profile; travel habits; motivations and barriers to cycling; parents' mobility practices; and plans to increase cycling. It contained a total of 35 questions, including an open section for comments. Participation in the survey was completely voluntary, and no inducement was given to the students on our part. In this paper, we focus on cycling skills, access (vehicle ownership), and practices (reason for use).

The participation rate for the questionnaire was 27% (1,358 responses). Only the vocational school had very low participation in the questionnaire (9.5% of all the students, compared to 61.2% and 37.9% for the two secondary schools and 39.6% for the high school). It seems that students at the vocational school were less able to fill in the questionnaire or less interested in doing so. Several explanatory factors can be put forward: firstly, most students are away from school for one or two days a week; secondly, being the only school in the canton to offer certain courses, its recruitment area extends beyond the borders of the urban area, meaning that students may live too far away to cycle to school; thirdly, most of them receive a salary and have a higher average age, they are thus able to take other modes of transport, like to drive their own car. The latter point is confirmed by Haldimann and Rérat (2020), who find that apprentices are more likely to have a driving license than high-school students. Those three aspects can explain that many students may have felt that a questionnaire about cycling in Yverdon was irrelevant to them. The analysis methods that we chose (binary and multinomial logistic regressions—see Section 3.4) allow these factors to be investigated further.

3.4. Profile of the respondents

The profile of the respondents is detailed in Table 1. Young people who completed the survey are mostly girls (60.6%) and live in the city of Yverdon (54.5%), and their language spoken at home is mostly French (53.1%). Among the

participants, the secondary schools (45.4%) and the upper secondary schools (37.7%) are overrepresented compared to the vocational school (16.9%). Most mothers (76.1%) and fathers (78.9%) have continued education beyond compulsory school. Fathers are more likely to own a bicycle than mothers (75.1% vs 62.2%), although the utilitarian practice of cycling⁵ is equal in both genders among parents (around 42%). Fathers, however, are more likely to ride for recreational or sport reasons (79.0% vs 69.8% for mothers).

3.5. Methods of analysis

The responses were processed with SPSS. In addition to descriptive statistics, we ran two binary logistic regressions. The first one aimed to distinguish young people who cycle from those who do not ($N = 1,339$), while the second looked at bicycle ownership, and in particular its evolution among non-cyclists ($N = 1,355$). Logistic regressions were used to analyze the propensity to cycle and to own a bicycle; to do this, we used a stepwise model, where the variables were first treated individually. This allowed us to measure the specific effects of a range of explanatory variables (age, gender, school, place of residence, language spoken at home, parents' cycling practice, and parents' level of education) in terms of odds ratios. If the odds ratios are bigger (or smaller) than 1, the modality increases (or decreases) the likelihood among young people of cycling or owning a bicycle compared to the reference modality.

We then developed a typology of young people who cycle ($n = 971$) using cluster analysis. This analysis is based on the reasons for cycling (travelling to school or activities, doing sports, recreational bike rides) and the frequency (often, occasionally, never)⁶. Three groups are identified and compared to each other using multinomial logistic regression. Young people who have not learned to ride a bike or who do not have a functional bicycle are not considered, nor are young people who state that they never ride a bicycle for any reason. We applied Ward's method, which minimizes the variance within a group while maximizing the variance between groups. The degree of relatedness between the statistical units (in this case, young people) is identified according to a series of successive nests represented graphically by a dendrogram, which was used as a basis for determining the number of classes (or types of cyclists).

4. Results

4.1. Cycling practices

To observe young people's cycling habits, we first distinguished between young people who cycle and those who

⁵By the utilitarian practice of the parents, we mean regular use (often or sometimes) of the bicycle to go to work or to travel for purchases, activities or to visit relatives.

⁶As cycling practice varies a lot during the year (school and holiday weeks, weekdays or weekends, Summer or Winter), we tried to find a scale that would be understandable for young people aged from 12 onwards, while having a gradual increase in frequency. The frequencies 'often', 'occasionally' and 'never' are therefore used without further clarification, but provide a useful indicator to distinguish a regular, occasional or inexistant practice.

⁴The International Standard Classification of Education (UNESCO) is the international reference classification for the organization of educational programs.

Table 1. Profile of young respondents.

Variable		%	Variable		%			
Gender	Female	60.6%	Age	12–13 years old	11.9%			
	Male	39.4%		14 years old	17.7%			
Educational orientation	General orientation (ISCED 2)	25%	15 years old	14.0%				
	Educational orientation (ISCED 2)	20.4%	16 years old	15.6%				
	General culture and business school (ISCED 34)	12.9%	17 years old	14.0%				
	Vocational School (ISCED 35)	16.9%	18 years old	15.1%				
	Maturity high school (ISCED 34)	24.8%	19–29 years old	11.7%				
Place of residence	Yverdon	54.5%	Language spoken at home	French	53.1%			
	Urban area (outside Yverdon)	7.5%		French and another language	35.8%			
	Other	38.1%		Mainly another language	11.1%			
Parents' level of education	Mother	Father	Parents' level of cycling	Mother	Father			
		Compulsory		23.9%	21.1%	Owns a bicycle	62.2%	75.1%
		Vocational or general secondary		44.2%	45.9%	Cycle to work often or occasionally	42.2%	42.4%
Tertiary	31.9%	33.0%	Cycle often or occasion. for sport or leisure	69.8%	79.0%			

Table 2. Bicycle use by type of cyclist.

		Recreational cyclists (<i>N</i> = 309; 31.8%)	Occasional cyclists (<i>N</i> = 366; 37.7%)	Utilitarian cyclists (<i>N</i> = 296; 30.5%)
Cycle to school	Never	100%	95.1%	0.0%
	Sometimes	0.0%	4.9%	45.6%
	Often	0.0%	0.0%	54.4%
Cycle to activities	Never	38.2%	42.6%	4.7%
	Sometimes	43.0%	42.3%	39.5%
	Often	18.8%	15.0%	55.7%
Cycle for sport	Never	9.0%	97.8%	36.4%
	Sometimes	75.7%	1.9%	41.0%
	Often	24.3%	0.3%	21.6%
Cycle for recreational bike rides	Never	6.1%	10.7%	8.8%
	Sometimes	58.6%	73.0%	47.6%
	Often	35.3%	16.4%	43.6%

do not. Of the total sample ($N=1,339$), 33.2% ($N=345$) do not cycle. Who are these non-cyclists? The reason for not riding a bike is not a lack of skills, as 97.6% of young people have learned to ride a bike—this childhood rite of passage is still very common—but rather a lack of bike ownership. Among young people who learned how to ride a bike, 17.3% do not own a bicycle, and another 8.3% do not have a functioning bicycle.

We then looked more closely at young people who cycle. The typology identifies three main groups according to their use of cycling (Table 2): recreational, occasional, and utilitarian. The occasional users ($N=366$; 37.7%) are the least frequent cyclists. Very few of them use a bicycle to go to school (95.1%) or as a sporting activity (97.8%). If they use their bike, it is to go for an occasional ride (89.3%) or to travel to other activities (31.1%).

The recreational cyclists ($N=309$; 31.8%) use a bicycle mainly for leisure (58.6% sometimes, 35.3% often) and sport (75.7% sometimes, 24.3% often). If they use it for a utilitarian purpose, it is to go to certain activities (43.0% sometimes, 18.8% often), but never to get to school.

The utilitarian cyclists ($N=296$; 30.5%) all go to school by bike (45.6% sometimes, 54.5% often). They also use their bicycle as a means of transport to other activities (39.5% sometimes, 55.7% often). Recreational and sports use is lower than in the recreational category but higher than in the occasional category. This is the category with the most diversified and regular use of a bicycle.

4.2. Evolution of cycling during youth

We analyzed the responses according to the age of the respondents to identify continuities and breaks in cycling during youth (Figure 1).

Firstly, the proportion of young people who do not cycle increases with age. 26.8% of 12- to 13-year-olds do not cycle, compared to 49.0% aged 19–20. Among these non-cyclists, very few have not learned to ride a bicycle (between 1 and 4%, depending on age). Even though it is not possible to carry out further analyses due to the small size of this group ($N=32$), we can suggest some trends. Young people who did not learn to ride a bike are slightly more likely to be girls (19 girls vs. 13 boys) and to be from households where the first language is not French (19 vs. 13). In addition, most of their mothers and almost half of their fathers do not own a bicycle.

Almost all young people who have learned to ride a bike learned with their parents or a family member (95.5%). Only 1.5% of them learned to cycle through a course. Some differences appear concerning the language spoken at home: young people with a home language other than French are more likely than their French-speaking counterparts to have learned to ride a bike with the help of their friends (15% vs. 5%) and less likely to have learned with their parents or family (88% vs. 98%). We observe here the first hint of a socialization effect, whether through the family (primary socialization) or peers (secondary socialization).

The next two variables in Figure 1 refer to access to a bicycle. Ownership also increases with age: while 10% of

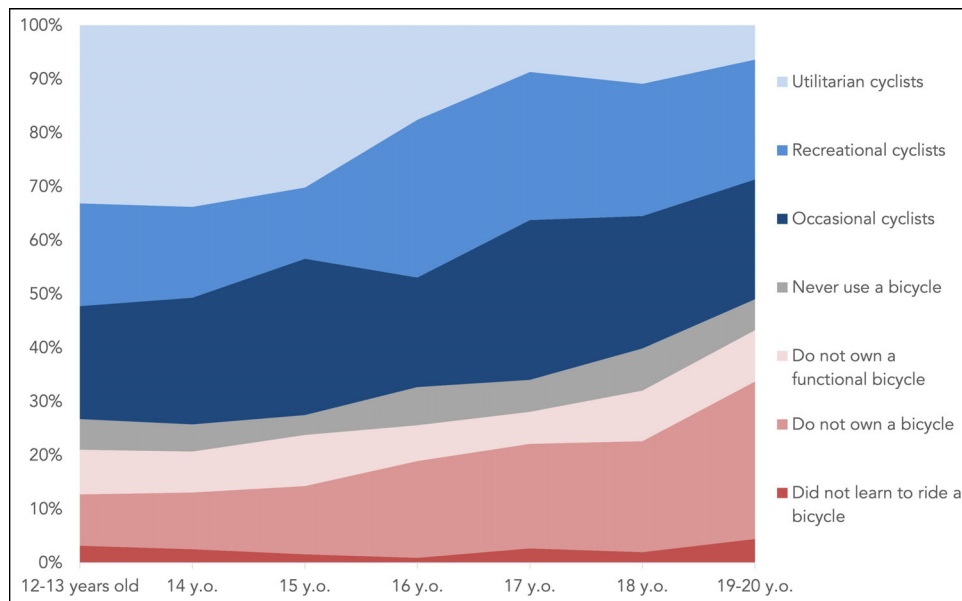


Figure 1. Typology of young people in relation to their cycling practice by age ($N = 1.339$).

participants do not own a bicycle at the age of 12-13, they are almost 30% at the age of 19-20. A further 10% of young people own a bicycle that is not working (in need of repair, wrong size, etc.). This share does not change over time.

An in-between category of young people is then identified. These are young people who have a functional bicycle but never use it. This category represents between 3.7 and 7.9% of the sample, depending on age.

Finally, there are the three types of cyclists. The percentage of occasional cyclists differs the least across the ages (between 20.2% and 29.7%), while recreational cyclists show an initial increase around the age of 16 (13.2% at 15 years vs. 29.4% at 16 years), at the expense of utility cyclists, who represent the type with the greatest variation. Utility cycling declines with age; two key events can be observed that may explain this. The first occurs around the age of 15-16 and corresponds to the start of upper secondary school, an increase in distances both to school and for various extracurricular activities, growing autonomy, the ability to take public transport alone, and access to motorized two-wheelers (4.5% of young people in secondary school travel to school on a motorized two-wheeler vs. 11.1% of the older ones). The second decrease in the use of bicycles for utilitarian purposes is observed around the age of 18, which could correspond to access to a driving license.

4.3. Determinants of young people's cycling practices

We conducted two binary logistic regressions to explain variations in cycling practices among the youth. The first one explains the practice of cycling and the second one is about bicycle ownership.

4.3.1. Young people's cycling practices

The first binary logistic regression compares the profiles of young people who cycle for any reason with those who do

not. All else equal, we observe the strong influence of parents: a young person is much more likely to cycle if his or her parents also cycle (Table 3, columns 3 and 4). A significant socialization effect within families can therefore be observed.

Because of its very high significance, this variable hides other effects. A second analysis, which does not include parents' cycling habits, reveals an education effect (Table 2, columns 7 and 8): young people in upper secondary education are more likely to be non-cyclists. This can be explained by the catchment area of the two upper secondary institutions in this study, which is larger than for the lower secondary schools, meaning that students may live further away from these schools (too far, perhaps, to cycle). The location of the high school, on a hill, is also a consideration here, as the hilly topography is likely to discourage students from cycling to school.

Furthermore, as already discussed, for young people doing apprenticeships at the vocational school, an income effect may also be involved, as these students receive a salary, giving them a higher purchasing power and potentially enabling them to buy a car or scooter for their daily commute.

The place of residence also explains whether young people cycle or not, with young people from the sub- and peri-urban municipalities of the urban region being more likely to be non-cyclists than those living in the city. Finally, gender is also significant, with girls being more likely to be found among non-cyclists. No age effect is evident here, as it is considered in the school variable (location and orientation) and the place of residence (the older the students get, the greater the distance to school tends to be).

4.3.2. Young people's propensity to own a functional bicycle

A second binary logistic regression measures young people's likelihood of owning a functional bicycle, considering the

Table 3. Young people's likelihood of owning a functional bicycle and cycling – extract from the logistical regressions.

		Cycling habits								
		With the variable "parents' cycling habits"			Without the variable "parents' cycling habits"			Owning a functional bicycle		
		Exp (B)	Sig.	Stand. error	Exp (B)	Sig.	Stand. error	Exp (B)	Sig.	Stand. error
School and school orientation	General orientation (ISCED 2)	0.977	ns	0.525	0.673	ns	0.285	3.358	ns	1.072
	Educational orientation (ISCED 2)	1.373	ns	0.536	1.252	ns	0.317	2.853	ns	0.998
	General culture and business school (ISCED 34)	0.612	ns	0.362	0.558	**	0.216	0.515	ns	0.707
	Vocational School (ISCED 35)	0.851	ns	0.372	0.566	**	0.208	0.931	ns	0.718
Age	Maturity high school (ISCED 34) (ref)									
	13–15 (ref)									
	16–17	0.864	ns	0.463	0.882	ns	0.256	2.248	ns	0.896
Gender	18–20	0.602	ns	0.524	0.682	ns	0.293	1.841	ns	0.977
	Female	0.625	ns	0.243	0.714	*	0.138	1.871	ns	0.464
Place of residence	Male (ref)									
	Elsewhere	1.458	ns	0.314	0.855	ns	0.175	1.212	ns	0.639
	Sub- and periurban municipalities in the urban region of Yverdon	0.732	ns	0.436	0.548	*	0.251	0.247	*	0.658
Language spoken at home	City of Yverdon (ref)									
	Mainly another language	1.724	ns	0.495	0.824	ns	0.228	3.531	ns	1.179
	French and another language	1.514	ns	0.288	0.814	ns	0.155	1.539	ns	0.568
Parental education	French (ref)									
	Tertiary	1.897	ns	0.378	1.606	*	0.2	5.262	*	0.665
	Vocational or general secondary	1.642	ns	0.372	1.317	ns	0.189	4.721	*	0.689
Parents' cycling practices	Compulsory (ref)									
	Utility: often	7.833	***	0.377	–	–	–	6.456	**	0.604
	Utility: occasionally	9.691	***	0.408	–	–	–	16.397	**	0.862
	Recreational: often	10.972	***	0.546	–	–	–	6.927	*	0.903
	Recreational: occasionally	5.855	***	0.39	–	–	–	6.38	**	0.663
	Do not own a bike (ref)									

Note: ns = non-significant; * = $p < .05$; ** = $p < .01$; *** = $p < .001$; Model fit indicator (Nagelkerke R Square): 0.161; 0.079; 0.177.

seven variables as presented above (age, gender, school orientation, home language, place of residence, parents' level of education, and parents' cycling habits).

All else equal, parents have a clear influence on bicycle ownership (Table 3, columns 9 and 10). Firstly, parents' cycling habits have a very strong effect: if mothers and fathers cycle for recreational or utilitarian reasons, their children are generally equipped with a bicycle. Secondly, parents' level of education has an effect: a young person is more likely to have a functional bicycle if one of his or her parents has completed education beyond compulsory schooling (apprenticeship or higher education). This may point to an issue of income or to the importance given to learning to ride a bicycle—among the more qualified, it may be considered as necessary or normal to own a bike; alternatively, it may indicate inadequate parking conditions at home for families with lower incomes, such as inaccessible or insecure facilities.

Finally, bicycle ownership is also explained by the place of residence: young people living in the wider urban region are less likely to own a bicycle than those living in the city. This could indicate that a greater distance from home to school and other activities may lead to an earlier abandonment of cycling than young people living in the city, or at

least an earlier switch. There were no differences according to school orientation, age, gender, and language(s) spoken at home.

4.4. Characteristics of cyclist types

Following the typology of cyclists we created, we analyzed their profile with a multinomial logistical regression (Table 4). This approach makes it possible to identify the specificities of recreational and utilitarian cyclists compared to occasional cyclists.

Compared to occasional cyclists, recreational cyclists are more often male, which shows the gendered dimension of cycling, particularly as a sport⁷. They are also more likely to live outside of the urban region of Yverdon. The remoteness of their place of residence makes commuting by bicycle more difficult for them. Most recreational cyclists live in rural villages, which explains why, despite recreational use of the bicycle, they use it less for utility purposes, since distances from home to school/activities tend to be greater.

⁷While occasional cycling is stable among boys, it varies more strongly among girls (36% at 15 compared to 22% at 16). Recreational use also decreases among girls from the age of 16, whereas it remains stable among boys.

Table 4. Multinomial logistic regression model explaining the propensity to use a bicycle for utility, recreational or occasional use.

		Characteristics of recreational cycling vs occasional cyclists			Characteristics of utilitarian cyclists vs occasional cyclists		
		Exp (B)	Sig.	Standard error	Exp (B)	Sig.	Standard error
School and school orientation	General orientation (ISCED 2)	0.87	ns	0.514	1.306	ns	0.565
	Educational orientation (ISCED 2)	1.227	ns	0.506	1.63	ns	0.557
	General culture and business school (ISCED 34)	1.772	ns	0.375	0.309	ns	0.635
	Vocational School (ISCED 35) Maturity high school (ISCED 34) (ref)	0.887	ns	0.367	0.586	ns	0.466
Age	13–15 (ref)						
	16–17	1.277	ns	0.448	0.946	ns	0.508
	18–20	0.795	ns	0.512	1.177	ns	0.61
Gender	Female	0.425	**	0.246	0.21	***	0.257
	Male (ref)						
Place of residence	Elsewhere	2.123	*	0.3	0.395	*	0.362
	Agglomeration of Yverdon Yverdon (ref)	1.085	ns	0.507	1.396	ns	0.482
Language spoken at home	Mainly another language	0.47	ns	0.512	0.901	ns	0.473
	French and another language French (ref)	0.807	ns	0.275	1.009	ns	0.29
Highest level of parental education	Tertiary	1.055	ns	0.4	2.399	*	0.422
	Vocational or general secondary Compulsory (ref)	0.523	ns	0.399	1.182	ns	0.414
Parents' cycling practices	Utility: often	1.28	ns	0.53	7.001	**	0.717
	Utility: occasionally	1.773	ns	0.539	6.387	*	0.731
	Recreational: often	2.105	ns	0.594	1.712	ns	0.884
	Recreational: occasionally Do not own a bike (ref)	1.352	ns	0.541	3.042	ns	0.747

Note: ns = non-significant; * = $p < .05$; ** = $p < .01$; *** = $p < .001$; Model fit indicator (Nagelkerke R Square): 0.346.

The young people in this group have, to a much greater extent than the occasional users, at least one parent who uses a bicycle, with an even more marked difference when one parent has a frequent sporting or leisure activity. This result shows the existence of a socialization process. However, there were no links with education, age, language(s) spoken at home, or the parents' level of education.

Compared to occasional cyclists, utilitarian cyclists are more likely to be students at the general upper secondary school. The effect of education observed here may be explained by ecological values that are more present among young people preparing for academic studies. The utilitarian cyclists are more likely than occasional users to be male, which shows a gender effect for utility cycling, as well as for recreational use as identified above⁸. These young people are less likely to live outside the urban region, suggesting that living in the city or a nearby municipality reinforces the attractiveness of cycling as a means of transport, both to school and to activities.

As with recreational cyclists, there is no difference according to the language(s) spoken at home or the parents' level of education. However, a young person is much more likely to fall into the category of utilitarian cyclist if at least one of his or her parents often uses a bicycle as a means of transport. A socialization process is also observed here, this time for the specifically utilitarian practice. It is interesting

to note that there are no significant differences between households where the parents do not own a bicycle and those where at least one parent uses a bicycle for leisure purposes, as utilitarian cycling among young people is highly dependent on their parents' *utilitarian* cycling, rather than on their parent's bicycle ownership or use for non-utilitarian purposes.

5. Discussion & conclusion

This study addresses the evolution of cycling during youth. It looks beyond the cyclist/non-cyclist dichotomy by focusing on the potential for cycling mobility among young people (skills, access, and uses). An analysis of the determinants of cycling practices was carried out on a group of young people aged 12 to 20 through an online survey in Yverdon, Switzerland. This study highlights levers to promote cycling among young generations and thus anchor sustainable behaviors for the years to come.

This analysis of cycling among young people confirms the trends observed in the literature: cycling declines as young people grow up. Learning to ride a bicycle is “an important milestone for children” (McDonald, 2012, p. 235) and almost all young people in our case study went through this rite of passage and used the bike as a toy when they were children. However, an important minority of teenagers and young adults stop cycling, and those who continue to do so have a more occasional and recreational practice. The main determinants explaining cycling practices among the youth refer to socialization (parents' own cycling practices,

⁸Girls' utilitarian cycling often decreases during youth, and almost disappears by the age of 19–20. For boys, utilitarian cycling falls sharply between the ages of 14 and 17 (from 52% to 13%) but then stabilizes at between 14 and 18%.

their level of education, and income), gender, and the spaces of everyday life (place of residence and school).

Firstly, cycling among young people is highly gendered (Dill, 2017; Emond et al., 2009). Girls are more likely to be occasional cyclists or non-cyclists, a gender difference that is generally found in contexts where the modal share of cycling is low (Buehler & Pucher, 2021; McDonald, 2012) and means that girls are more likely to reduce or even stop cycling during adolescence.

Secondly, parents' cycling habits have a strong influence on cycling among young people (Emond & Handy, 2012; Thigpen & Handy, 2018). Within the family context, people most often learn to ride a bicycle. This socialization effect is reflected in practice: young cyclists are more likely to have a parent who regularly cycles, and this is even more pronounced among young utilitarian cyclists. Parents' cycling habits can therefore explain why some young people do not pursue the recreational cycling common among young children as a leisure activity or mode of transport when they get older. Parents' cycling habits and education level also impact access to a functional bicycle. Their influence decreases as young people get older: the proportion of those who do not own a functional bike increases from 18.8% at age 13 to 39.7% at age 20.

Thirdly, cycling is closely dependent on the context's bikeability, from both a physical and social point of view. This can be observed in the practice of cyclists, where recreational cyclists are more likely to live outside the urban region, while utilitarian cyclists are more likely to live in the city where short distances facilitate cycling to everyday activities. In addition, non-cyclists are more likely to live in the sub- and peri-urban areas.

Non-cyclists are also more likely to be in upper secondary education (older than 16). A change in the rhythm of life and an ever-increasing home-school distance throughout youth may both contribute to a lack of interest in or purpose for cycling (Osborne, 2005). As the home-school distance increases with age, there is competition between means of transport to the detriment of cycling (Emond & Handy, 2012), particularly in Switzerland, where public transport is highly developed and where the transport of bicycles on board is paid for. The use of means of transport that offer greater spatial range and reduced effort becomes even more pronounced when the context is deficient in cycling facilities and infrastructure such as safe and direct cycle routes and parking. Two key events can be identified here: the first around the age of 15–16 and the second around the age of 18–20. Both correspond to a change in place of education (or starting work) and thus a change in distances between home and school or work, or a lifestyle change (e.g. access to a driver's license), which are not easily compatible with cycling.

The analyses of bicycle use, ownership, and the different types of cyclists do not directly highlight an age effect on cycling. Although cycling changes significantly with age, this variable is explained through changes in the home-school distance and the rhythm of life during youth (Chatterjee

et al., 2013). Cycling is also more fragile over time among girls and young people from non-cycling families.

This study has highlighted some mechanisms that influence cycling among young people. It is thus possible to propose some recommendations to promote this practice, not only in Switzerland but also in all countries with similarities to the trends exposed in this research. These recommendations concern both public policies and school administration, and focus on measures related to skills, access, appropriation, and improvements to the built environment. We first present recommendations for increasing the individual's cycling potential and then develop recommendations for improving the hosting potential of the spatial context. This order refers to the conceptual framework used in this article and does not reflect the importance given to these recommendations.

Firstly, to help young people gain cycling skills, we recommend that cycling lessons be offered in school, and suggest public cycling courses in cities. Secondly, to improve access among young people to functional bicycles, we recommend subsidies to help with the purchase of a bicycle, the establishment of repair workshops (both static and mobile) by and for young people, bike-sharing schemes, and bicycle markets. Thirdly, to help increase take-up of cycling among young people, there is need of campaigns that raise awareness of the needs and expectations of young people and that work to change negative preconceived notions about cycling, such as the time or effort involved. We also recommend opportunities and initiatives to encourage young people to try utility cycling, such as participation in the "bike to school" initiative. Finally, in order to improve bikeability, there need to be safe and direct cycle routes, secure parking facilities, and permission to board bicycles on public transport. We also suggest road closures around schools during rush hours.

This study has shown the major influence of socialization processes on the choice to cycle, notably parents' mobility practices and education level, both of which play an important role in cycling among young people. The perception of the bicycle as a means of transport is a key step in increasing this sustainable practice. But it is not enough without an improved infrastructure that is accessible to all ages and genders. In this respect, the needs of young people must be considered. Further work could be done from both a qualitative and quantitative perspective, including focus groups, biographical interviews, or panels, in a variety of spatial contexts with different cycling cultures. These methods would also help to identify and clarify the key events related to giving up cycling during youth—and thus to find measures to encourage young people to continue cycling.

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References

- Aarts, M.-J., Mathijssen, J. J. P., van Oers, J. A. M., & Schuit, A. J. (2013). Associations between environmental characteristics and active commuting to school among children: A cross-sectional study. *International Journal of Behavioral Medicine*, 20(4), 538–555. <https://doi.org/10.1007/s12529-012-9271-0>
- Baslington, H. (2008). Travel socialization: A social theory of travel mode behavior. *International Journal of Sustainable Transportation*, 2(2), 91–114. <https://doi.org/10.1080/15568310601187193>
- Bonham, J., & Wilson, A. (2012). Bicycling and the life course: The start-stop-start experiences of women cycling. *International Journal of Sustainable Transportation*, 6(4), 195–213. <https://doi.org/10.1080/15568318.2011.585219>
- Brown, B., Mackett, R., Gong, Y., Kitazawa, K., & Paskins, J. (2008). Gender differences in children's pathways to independent mobility. *Children's Geographies*, 6(4), 385–401. <https://doi.org/10.1080/14733280802338080>
- Buehler, R., & Pucher, J. (Eds.) (2021). *Cycling for sustainable cities*. The MIT Press.
- Buehler, R. (2018). Bicycling levels and trends in Western Europe and the USA. *La Renaissance Du Vélo/Die Renaissance Des Velos*, 1, 10–13.
- Buehler, R., Pucher, J., & Bauman, A. (2020). Physical activity from walking and cycling for daily travel in the United States, 2001–2017: Demographic, socioeconomic, and geographic variation. *Journal of Transport & Health*, 16, 100811. <https://doi.org/10.1016/j.jth.2019.100811>
- Cardon, G. M., Maes, L. R. D., Haerens, L. L., & Bourdeaudhuij, I. M. M. D. (2012). Bicycling to school during the transition from childhood into adolescence: A six-year longitudinal study. *Pediatric Exercise Science*, 24(3), 369–383. <https://doi.org/10.1123/pes.24.3.369>
- Cavill, N., & Watkins, F. (2007). Cycling and health: An exploratory study of views about cycling in an area of North Liverpool, UK. *Health Education*, 107(5), 404–420. <https://doi.org/10.1108/09654280710778556>
- Central Statistics Office. (2017). *Census of population 2016: Student travel patterns*. CSO. <https://www.cso.ie/en/releasesandpublications/ep/p-cp6ci/p6cii/p6stp/>
- Chatterjee, K., Sherwin, H., & Jain, J. (2013). Triggers for changes in cycling: The role of life events and modifications to the external environment. *Journal of Transport Geography*, 30, 183–193. <https://doi.org/10.1016/j.jtrangeo.2013.02.007>
- Christiansen, H., & Baescu, O. (2021). The Danish national travel survey: Annual Statistical Report 2020 TU0620v1. In *The Danish National Travel Survey* [Report]. <https://doi.org/10.11581/dtu:00000034>
- Cox, P. (2019). *Cycling: A sociology of vélo-mobility*. Routledge. <https://doi.org/10.4324/9781315533698>
- Darmon, M. (2016). *La socialisation* (3e éd.). Armand Colin.
- de Bruijn, G.-J., Kremers, S. P. J., Schaalma, H., van Mechelen, W., & Brug, J. (2005). Determinants of adolescent bicycle use for transportation and snacking behavior. *Preventive Medicine*, 40(6), 658–667. <https://doi.org/10.1016/j.ypmed.2004.09.003>
- De Vries, S. I., Hopman-Rock, M., Bakker, I., Hirasing, R. A., & Van Mechelen, W. (2010). Built environmental correlates of walking and cycling in Dutch urban children: Results from the SPACE Study. *International Journal of Environmental Research and Public Health*, 7(5), 2309–2324. <https://doi.org/10.3390/ijerph7052309>
- De Witte, A., Hollevoet, J., Dobruszkes, F., Hubert, M., & Macharis, C. (2013). Linking modal choice to motility: A comprehensive review. *Transportation Research Part A: Policy and Practice*, 49, 329–341. <https://doi.org/10.1016/j.tra.2013.01.009>
- Delmelle, E. M., & Delmelle, E. C. (2012). Exploring spatio-temporal commuting patterns in a university environment. *Transport Policy*, 21, 1–9. <https://doi.org/10.1016/j.tranpol.2011.12.007>
- Department of Transport. (2021). *Mode of travel. Average number of trips (trip rates) by age, gender and main mode: England*. <https://www.gov.uk/government/statistical-data-sets/nts03-modal-comparisons>
- Dill, J. (2017). *Why do girls' attitudes about bicycling decline as they get older?* <https://jenniferdill.net/2017/03/26/why-do-girls-attitudes-about-bicycling-decline-as-they-get-older/>
- Emond, C. R., & Handy, S. L. (2012). Factors associated with bicycling to high school: Insights from Davis, CA. *Journal of Transport Geography*, 20(1), 71–79. <https://doi.org/10.1016/j.jtrangeo.2011.07.008>
- Emond, C. R., Tang, W., & Handy, S. L. (2009). Explaining gender difference in bicycling behavior. *Transportation Research Record: Journal of the Transportation Research Board*, 2125(1), 16–25. <https://doi.org/10.3141/2125-03>
- Fitch, D. T., Thigpen, C. G., & Handy, S. L. (2016). Traffic stress and bicycling to elementary and junior high school: Evidence from Davis, California. *Journal of Transport & Health*, 3(4), 457–466. <https://doi.org/10.1016/j.jth.2016.01.007>
- Fyhri, A., & Hjorthol, R. (2009). Children's independent mobility to school, friends and leisure activities. *Journal of Transport Geography*, 17(5), 377–384. <https://doi.org/10.1016/j.jtrangeo.2008.10.010>
- Givoni, M., & Banister, D. (2013). *Moving towards low carbon mobility*. Edward Elgar.
- Haldimann, L., & Rérat, P. (2020). Young people and driving licences: Who hasn't got one (yet) and why? *Flux*, 119120(1), 5–24.
- Hanson, S. (2010). Gender and mobility: New approaches for informing sustainability. *Gender, Place & Culture*, 17(1), 5–23. <https://doi.org/10.1080/09663690903498225>
- Haustein, S., Kroesen, M., & Mulalic, I. (2020). Cycling culture and socialisation: Modelling the effect of immigrant origin on cycling in Denmark and the Netherlands. *Transportation*, 47(4), 1689–1709. <https://doi.org/10.1007/s11116-019-09978-6>
- Hume, C., Timperio, A., Salmon, J., Carver, A., Giles-Corti, B., & Crawford, D. (2009). Walking and cycling to school: Predictors of increases among children and adolescents. *American Journal of Preventive Medicine*, 36(3), 195–200. <https://doi.org/10.1016/j.amepre.2008.10.011>
- Janke, J., & Handy, S. (2019). How life course events trigger changes in bicycling attitudes and behavior: Insights into causality. *Travel Behaviour and Society*, 16, 31–41. <https://doi.org/10.1016/j.tbs.2019.03.004>
- Johansson, M. (2006). Environment and parental factors as determinants of mode for children's leisure travel. *Journal of Environmental Psychology*, 26(2), 156–169. <https://doi.org/10.1016/j.jenvp.2006.05.005>
- Kaufmann, V. (2017). *Rethinking the city* (1er éd.). Routledge.
- Kaufmann, V., & Widmer, É. D. (2005). L'acquisition de la motilité au sein des familles. *Espaces et Sociétés*, n° 120-121(1), 199–217. <https://doi.org/10.3917/esp.120.0199>
- Kontou, E., McDonald, N. C., Brookshire, K., Pullen-Seufert, N. C., & LaJeunesse, S. (2020). U.S. active school travel in 2017: Prevalence and correlates. *Preventive Medicine Reports*, 17, 101024. <https://doi.org/10.1016/j.pmedr.2019.101024>
- Lanzendorf, M. (2010). Key events and their effect on mobility biographies: The case of childbirth. *International Journal of Sustainable Transportation*, 4(5), 272–292. <https://doi.org/10.1080/15568310903145188>
- Lorenc, T., Brunton, G., Oliver, S., Oliver, K., & Oakley, A. (2008). Attitudes to walking and cycling among children, young people and parents: A systematic review. *Journal of Epidemiology and Community Health*, 62(10), 852–857. <https://doi.org/10.1136/jech.2007.070250>
- McDonald, N. (2012). Children and cycling. In J. Pucher & R. Buehler (Eds.), *City cycling* (Vol. 487, pp. 211–234). MIT Press.
- McDonald, N., Kontou, E., & Handy, S. (2021). Children and cycling. In R. Buehler & J. Pucher (Eds.), *Cycling for sustainable cities*. MIT Press.

- <https://direct.mit.edu/books/book/5000/chapter/2654057/Children-and-Cycling>
- Mitra, R. (2013). Independent mobility and mode choice for school transportation: A review and framework for future research. *Transport Reviews*, 33(1), 21–43. <https://doi.org/10.1080/01441647.2012.743490>
- Mitra, R., & Buliung, R. N. (2012). Built environment correlates of active school transportation: Neighborhood and the modifiable areal unit problem. *Journal of Transport Geography*, 20(1), 51–61. <https://doi.org/10.1016/j.jtrangeo.2011.07.009>
- Mitra, R., & Manaugh, K. (2020). A social-ecological conceptualization of children's mobility. In E. O. D. Waygood, M. Friman, L. E. Olsson, & R. Mitra (Eds.), *Transport and children's wellbeing* (pp. 81–100). Elsevier. <https://doi.org/10.1016/B978-0-12-814694-1.00005-1>
- Müggenburg, H., Busch-Geertsema, A., & Lanzendorf, M. (2015). Mobility biographies: A review of achievements and challenges of the mobility biographies approach and a framework for further research. *Journal of Transport Geography*, 46, 151–163. <https://doi.org/10.1016/j.jtrangeo.2015.06.004>
- OFS & ARE. (2017). *Comportement de la population en matière de transports. Résultats du microrecensement mobilité et transports 2015*. <https://www.bfs.admin.ch/bfs/fr/home/statistiques/mobilite-transport/transport-personnes/comportements-transport.assetdetail.1840478.html>
- Osborne, P. (2005). Safe routes for children: What they want and what works. *Children, Youth and Environments*, 15(1), 234–239. <https://doi.org/10.1353/cye.2005.0077>
- Panter, J. R., Jones, A. P., van Sluijs, E. M., & Griffin, S. J. (2010). Attitudes, social support and environmental perceptions as predictors of active commuting behaviour in school children. *Journal of Epidemiology and Community Health*, 64(1), 41–48. <https://doi.org/10.1136/jech.2009.086918>
- Rau, H., & Manton, R. (2016). Life events and mobility milestones: Advances in mobility biography theory and research. *Journal of Transport Geography*, 52, 51–60. <https://doi.org/10.1016/j.jtrangeo.2016.02.010>
- Rérat, P. (2019). Cycling to work: Meanings and experiences of a sustainable practice. *Transportation Research Part A: Policy and Practice*, 123, 91–104. <https://doi.org/10.1016/j.tra.2018.10.017>
- Rérat, P. (2021a). *Cycling to work: An analysis of the practice of utility cycling* (Springer). Springer International Publishing. https://doi.org/10.1007/978-3-030-62256-5_6
- Rérat, P. (2021b). The rise of the e-bike: Towards an extension of the practice of cycling? *Mobilities*, 16(3), 423–439. <https://doi.org/10.1080/17450101.2021.1897236>
- Rérat, P., Haldimann, L., & Widmer, H. (2022). Cycling in the era of Covid-19: The effects of the pandemic and pop-up cycle lanes on cycling practices. *Transportation Research Interdisciplinary Perspectives*, 15, 100677. <https://doi.org/10.1016/j.trip.2022.100677>
- Richer, C., & Rabaud, M. (2019). L'évolution des mobilités actives dans la Métropole Européenne de Lille depuis dix ans: Changement de modèle ou prolongement de tendance ? *Belgeo*, 4(4), 21–64. <https://doi.org/10.4000/belgeo.35298>
- Rothman, L., Fridman, L., Cloutier, M.-S., Manaugh, K., & Howard, A. (2020). Chapter Six - Impact of road traffic and speed on children: Injuries, social inequities, and active transport. In E. O. D. Waygood, M. Friman, L. E. Olsson, & R. Mitra (Eds.), *Transport and children's wellbeing* (pp. 103–117). Elsevier. <https://doi.org/10.1016/B978-0-12-814694-1.00006-3>
- Sallis, J., Prochaska, J., & Taylor, W. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise*, 32(5), 963–975. <https://doi.org/10.1097/00005768-200005000-00014>
- Sauter, D. (2019). *Mobilität von Kindern und Jugendlichen. Veränderungen zwischen 1994 und 2015. Analyse basierend auf den Mikrozensus "Mobilität und Verkehr. (No. 141; Materialien Langsamverkehr)*. Bundesamt für Strassen ASTRA, Bereich Langsamverkehr.
- Sauter, D., & Wyss, K. (2014). Pilotstudie: Velonutzung von Jugendlichen im Kanton Basel-Stadt. Bau- und Verkehrsdepartement des Kantons Basel-Stadt.
- Susilo, Y. O., & Liu, C. (2016). The influence of parents' travel patterns, perceptions and residential self-selectivity to their children travel mode shares. *Transportation*, 43(2), 357–378. <https://doi.org/10.1007/s11116-015-9579-0>
- Thigpen, C. G., & Handy, S. L. (2018). Effects of building a stock of bicycling experience in youth. *Transportation Research Record: Journal of the Transportation Research Board*, 2672(36), 12–23. <https://doi.org/10.1177/0361198118796001>
- Underwood, S. K., Handy, S. L., Paterniti, D. A., & Lee, A. E. (2014). Why do teens abandon bicycling? A retrospective look at attitudes and behaviors. *Journal of Transport & Health*, 1(1), 17–24. <https://doi.org/10.1016/j.jth.2013.12.002>
- van den Berg, P., Waygood, E. O. D., van de Craats, I., & Kemperman, A. (2020). Factors affecting parental safety perception, satisfaction with school travel and mood in primary school children in the Netherlands. *Journal of Transport & Health*, 16, 100837. <https://doi.org/10.1016/j.jth.2020.100837>
- Van der Kloof, A. (2015). Lessons learned through training immigrant women in the Netherlands to cycle. In P. Cox (Ed.), *Cycling cultures* (pp. 78–105). Chester University Press.
- van der Waerden, P., Timmermans, H., & Borgers, A. (2003). *The influence of key events and critical incidents on transport mode choice switching behaviour: A descriptive analysis* [Paper presentation]. Paper Presented at the 10th International Conference on Travel Behaviour Research, Lucerne, 10th–15th August.
- Van Goeverden, C. D., & de Boer, E. (2013). School travel behaviour in the Netherlands and Flanders. *Transport Policy*, 26, 73–84. <https://doi.org/10.1016/j.tranpol.2013.01.004>
- Vincent-Geslin, S., & Authier, J.-Y. (2016). Les mobilités quotidiennes comme objet sociologique. *Cahiers de Recherche Sociologique*, 59–60, 79–97. <https://doi.org/10.7202/1036787ar>