Abandoning the Car to Embrace the Bicycle in Urban France: A Model of Modal Shift

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Article

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Abstract: The current climate context is prompting stakeholders in the ecological transition to reconsider our transportation modes. The bicycle, in particular, appears promising, offering numerous benefits such as reducing polluting emissions and CO2, limiting noise pollution, alleviating urban congestion, and improving both the physical and mental health of citizens. However, despite policies aimed at encouraging cycling and the measures implemented, how can we explain the difficulty of urban French citizens in adopting the bicycle? Rather than focusing on the barriers to cycling, we have chosen to center our study on citizens who have opted to reduce or even abandon car use in favor of cycling in urban areas. This study provides a detailed description of the modal shift process that leads 20 individuals to transition from car use to cycling. By adopting a fine-grained approach through semi-structured and biographical interviews, it is possible to highlight the mechanisms behind this modal shift. Key stages appear to emerge: predispositions, triggering factors, the exploration and trial phase, and, in the longer term, the phase of appropriation. The article also explores the situations that lead cyclists to return to using their cars for specific trips.

Keywords: bicycle; sustainable mobility; modal shift; transport; city; ergonomics; sustainable transition

1. Introduction

The current climate context requires the consideration of new more sustainable forms of mobility. This is why, at the European level, territorial policies, as well as urban planning and mobility professionals, are reflecting on how to reduce the presence of automobiles in public spaces [1–4]. These strategies primarily aim to alter individual automobile travel practices by expanding modal shift options, promoting more ecological services (shared transport, bike or scooter-sharing schemes, carpooling, etc.), or improving existing infrastructure (e.g., reducing lanes in favor of public transport or bike lanes) [5].

The bicycle, in particular, offers multiple benefits [6,7]. Less polluting than the car at every stage of its lifecycle—from manufacturing and circulation to recycling—it is especially praised for not producing carbon dioxide (CO2), which contributes to climate change, or toxic air particles [8]. Being silent, it also reduces noise pollution in cities [9]. It also takes up less public space for example, for parking or road infrastructure. [3]. Furthermore, the bicycle is less expensive than the car, both in terms of purchase price and maintenance costs [10,11]. It is also seen as beneficial for the local economy and tourism [12]. Finally, when used regularly, cycling is considered advantageous for one's health [13].

Despite these advantages, the car remains the primary mode of transport for daily trips in France, with 84.7% of domestic transport being carried out by private vehicles [14]. Cycling, on the other hand, remains marginal, and the French rank 19th out of 28 European countries in terms of

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cycling as the primary mode of transport, far behind countries like Hungary, Denmark, or the Netherlands, where 36% of the population commutes by bike [15,16].

How can we explain the difficulty for the French, despite the policies and measures implemented, to adopt cycling? Rather than focusing on the factors inhibiting cycling practices, we have chosen to center our study on citizens who have decided to limit or even abandon car use in favor of cycling in urban and suburban areas. How did they manage to adopt this mode of transport in their daily commutes, contrary to the general trend? What factors motivated or triggered this choice? What difficulties did they face, and what strategies did they employ to overcome them?

To answer these questions, we investigate the various aspects of the modal shift to cycling among 20 cyclists living in four French cities: Tours, Paris, Lille, and Nantes. This sample of 20 individuals allows for an in-depth exploration of their personal experiences, enriching our understanding of the motivations and challenges associated with adopting cycling. Each of the four selected cities presents distinct urban characteristics, varying mobility policies, and different cycling infrastructures, offering a wide range of experiences and contexts to explore.

After reviewing existing studies on automobile and cycling mobility practices in France and identifying gaps in the literature, we present our data and qualitative approach. Regarding the results, we focus on the stages of modal shift towards cycling. A second section explains why even cyclists from urban areas do not completely abandon the car. Finally, we discuss these findings before concluding the paper in the final section.

2. Related Works

2.1. Automobile Mobility Practices in France

The driving license, beyond being an administrative document, carries a significant symbolic dimension and represents, through access to automobilism, a rite of passage into adulthood [2,17]. Automobile mobility then becomes the predominant mode of transport for individuals, notably because it is perceived as a way to comply with dominant social norms [18,19]. The car is also associated with a range of widely shared positive aspects. For example, it offers great flexibility in terms of travel times, and thereby, greater autonomy compared to other modes of transport that are bound to specific schedules [20]. In terms of practicality, the car is also linked to the ability to juggle activities that intersect work and daily life (e.g., picking up children from school, driving them to extracurricular activities, sports, shopping, etc.) and thus facilitates daily household needs [21]. Parenthood, in particular, is one of the events most likely to lead to the purchase of a car [22–24].

Beyond social norms and the perceived advantages of car use, automobilism remains the dominant mode of transport today, as urban planning policies continue to structure cities – residential areas, jobs, and commercial offerings – around car usage [2,25,26]. As a result, the automobile system is part of a vast sociotechnical system in which infrastructures, regulations, and technologies lead the population to rely heavily on this mode of transport [5,27,28]. Kaufmann et al. [29] already showed in 2001 that the French population does not exclusively aspire to car use. It is more than ever being questioned by the population due to high costs, the occupation of urban space, and its ecological impact, [18,30,31].

Studies highlight certain factors that hinder the shift to active mobility modes such as cycling, and which include the lack of safe lanes for pedestrians and cyclists [32], the private vehicle use habits [33,34], even age and gender [35], or race [36]. These studies, based on large-scale surveys, provide an overview of the drivers and barriers to making a modal shift. Other works focus on the life conditions that prompt individuals to consider new modes of transport.

2.2. Modal Shift Studied Through Mobility Biographies

It has long been acknowledged that daily mobility corresponds to a sequence of activities and movements that are indivisible and constrain individuals to a “program of activities” [37]. Therefore, the choice of a specific mode of transport must be understood by considering the entirety of this sequence, as well as within the context of life events.

 doi:10.20944/preprints202411.1933.v1

Over the past thirty years, the concept of mobility biographies has developed with various empirical analyses using both qualitative and quantitative methods. Beige & Axhausen [38], for example, adopted a longitudinal perspective to understand mobility trajectories through personal and family history, places of residence, education, employment, and the possession of mobility tools (vehicle, transport cards, etc.). More recently, Jain et al. [39], using a stated-choice method, demonstrated how life events can radically alter household transport demand. They highlighted, for instance, how the birth of a child increases the likelihood of purchasing an additional car while reducing the likelihood of buying an electric bike or joining a car-sharing system. On the other hand, Rau & Matern [40] showed how sudden disruptions from significant life events and more gradual changes related to societal and environmental shifts led to changes in citizens' relationship with the car.

Within the framework of mobility biographies, many studies have focused more specifically on cycling. Over ten years ago, Bonham & Wilson [42] conducted a qualitative study on the cycling experiences of Australian women throughout their lives, focusing on the circumstances under which they began or abandoned cycling. Van Acker et al. [42], for their part, analyzed the influence of childhood experiences on cycling use in adulthood, thus calling for documentation of individuals' "mobility capital" [43].

In France, Cailly et al. [44] and Adam et al. [45] have explored the socialization processes that lead to the adoption of cycling as a daily mode of transport in urban contexts. Their work details the importance of primary socialization for later adoption of daily cycling practices, as well as the role of peer groups, which help develop additional sensory-motor and practical skills, such as orientation, dealing with motorized traffic, and dressing appropriately.

2.3. Research Gap

Although these studies provide valuable insights into life trajectories related to cycling, they lack a systematic model that could structure and equip the analysis of the process of appropriation of cycling practice. For example, the research conducted in France by Cailly et al. [44] and Adam et al. [45] highlights the importance of primary socialization and peer groups in the adoption of cycling. While these studies shed light on social and cultural influences, they do not sufficiently delve into the appropriation mechanisms that enable the transformation of cycling from a mode of transport to a daily, integrated practice. As a result, the absence of a unified theoretical framework hinders a deeper understanding of how these dynamics interact and evolve over time. This limits their ability to generate practical recommendations for public policies or local initiatives, which require an overarching view to be effective.

In the absence of a systematic model, it is difficult to identify the key stages of the appropriation process and the levers that could facilitate the adoption of cycling. Mobility policies may, therefore, remain superficial, merely encouraging cycling without addressing the structural and behavioral challenges that hinder its integration into citizens' daily lives.

The **instrumental approach**, conceptualized by Rabardel [46] and updated through numerous recent works across various fields [47–53], specifically addresses the process of appropriation of any technical device, through the concept of "instrumental genesis."

Instrumental genesis refers to the process by which an individual becomes familiar with a tool (whether material or symbolic), integrating it into their practices and adapting it to their specific needs. This concept allows us to explore how people build their skills and knowledge through interactions with material or conceptual tools. Two dimensions are highlighted in this process:

- **Instrumentalization**: This is the phase where the user appropriates the tool, meaning they learn how to use it according to their goals. It involves adapting the tool so that it meets the user's specific needs.
- **Instrumentation**: This refers to the evolution of the tool itself, which can be modified by the user over time to better align with their practices and contexts of use.

In summary, the concept "**instrumental genesis"** emphasizes the dynamic interaction between the individual and the tool, showing how each influences and transforms the other during use.

 doi:10.20944/preprints202411.1933.v1

The **object of activity** is also a central concept in the process of instrumental genesis. It refers to the goals the user seeks to achieve through interacting with an instrument or tool. It represents the intentions, motivations, and objectives that guide the user in their interactions with the instrument, influencing both its appropriation and transformation. This highlights the importance of understanding not only the tool but also the motivations and contexts of use that shape the user's experience.

The instrumental approach thus provides a developmental perspective by generating knowledge on the internal and external effects associated with the introduction of a new technical device into activity. This theoretical grounding seems particularly productive for analyzing modal shift, as it allows for the exploration of various dimensions of the appropriation of a new mode of transport, particularly from the perspective of instrumentalization (how does the individual adapt their cycling practice?) and the development of skills (how does cycling experience contribute to modal shift? What skills are developed through cycling?).

It seems interesting to focus our study on citizens who have chosen to limit or even abandon car use in favor of cycling in urban environments. *How did they manage to adopt this mode of transport in their daily commuting? What factors motivated or triggered this choice? What difficulties did they encounter, and what strategies did they use to overcome them? Finally, what conditions sustain cycling as a regular part of their daily commute?*

More broadly, we aim to characterize the different stages of the transition that leads an individual to switch from car use to cycling.

3. Materials and Method: A Qualitative Approach

3.1. Participants

Our analysis is based on a corpus of 20 semi-structured and biographical interviews, fully transcribed, conducted between March 2023 and June 2023. The interviews, each lasting between 1.5 and 2 hours, were carried out with 9 men and 11 women aged between 30 and 70 years. All of the individuals interviewed reside in urban areas within French metropolitan cities with populations of over 130,000: Lille, Paris, Tours, and Nantes. The four areas studied differ in terms of size, infrastructure, population, and density.

We recruited our 20 participants using a combined approach, through social media and posters placed in public spaces. This strategy allowed us to reach a broad audience. From the responses received, we selected 20 individuals to obtain diverse and representative perspectives in terms of profession, gender, and age (Table 1). All the first names have been changed.

Analyzing modal shift to cycling in a sample of 20 people in urban environments offers several advantages that make this approach both relevant and enriching. First, working with a smaller sample allows for in-depth, qualitative interviews. This facilitates a detailed exploration of the motivations, experiences, and challenges faced by each individual. Such a qualitative approach provides a nuanced understanding of the factors that influence cycling adoption, which could be lost in a large-scale quantitative study.

Furthermore, our sample of 20 individuals represents a range of backgrounds, ages, professions, and lifestyles. This diversity enables the capture of a wide spectrum of perspectives and strategies related to cycling adoption, enriching the analysis and making it more representative of urban realities.

We chose to focus on urban environments to study cycling adoption because these areas have a high population density, which leads to a variety of transport modes and mobility behaviors. This allows us to observe how cycling can integrate into a larger transportation system, interacting with other modes such as cars, public transport, and walking. Additionally, the four selected areas have well-developed cycling infrastructures, such as dedicated bike lanes and bike-sharing stations. This provides an interesting research context for evaluating the impact of these infrastructures on cycling adoption and user behaviors.

Table 1. Profile of the Participants in the Study.

 doi:10.20944/preprints202411.1933.v1

First Name	Age	Gender	Profession	City	Attitude Toward Cycling	Attitude Toward the Car	Occasional Modes of Transport
Fabien	30	M	Translator	Tours	Personal bike (daily commutes: errands, outings, leisure)	Personal car (family visits [monthly]; music rehearsals [weekly]; vacations [annually]; material transport [occasionally])	Walking [occasionally]
Victor	31	M	Unemployed	Nantes	Shared city bike service (daily commutes: errands, outings, leisure; work)	Parents' car (visiting friends when returning to hometown) [about 6 times/year]	Bus, train, walking [occasionally]
Lisa	31	F	Bank employee	Tours	Shared city bike service (daily commutes: errands, outings, leisure; work)	Partner's car (family visits [monthly]; occasional professional trips in the region [about 3 times/year]; vacations [annually]; material transport [occasionally])	
Marcia	31	F	Unemployed	Tours	Personal bike (daily commutes: errands, outings, leisure)	Borrowed car from friends (material transport [occasionally])	
Lucie	32	F	Engineer	Tours	Electric-assisted cargo bike (daily commutes: errands, outings, leisure; material transport; child transport [weekly])		Train (work [occasionally])
Mathéo	33	M	Stage manager	Tours	Personal bike (daily commutes: errands, outings, leisure)		Train (work [several weeks/year]); walking [occasionally]
Manon	33	F	Life and earth sciences teacher	Tours	Personal bike (daily commutes: errands, outings, leisure; work)	Carpooling with friends (family visits [monthly]; material transport [occasionally]; music rehearsals [weekly]; visits to friends [occasionally])	
Yannick	34	M	Social studies teacher	Tours	Electric-assisted cargo bike (daily commutes: errands, outings,	Personal car (family visits [monthly]; music rehearsals	Bus [occasionally]

 doi:10.20944/preprints202411.1933.v1

					leisure; work; material transport [occasionally]; child transport [daily]) Personal bike (daily commutes: errands, outings, leisure; work)	[weekly]; vacations [annually]; material transport [occasionally])	
Séverine	38	F	Unemployed	Tours	Electric-assisted cargo bike (daily commutes: errands, outings, leisure; work; material transport [occasionally]; child transport [daily])	Parents' car (material transport [occasionally]; vacations [annually])	
Garance	42	F	Social studies teacher	Paris	Electric-assisted cargo bike (daily commutes: errands, outings, leisure; work; material transport [occasionally])		Bus, RER, metro, train, walking [occasionally]
Maryse	62	F	Retired	Tours	Electric-bike (daily commutes: errands, outings, leisure; associative missions) Personal bike (daily commutes: errands, outings, leisure; work)	Personal bike (for short trips)	Borrowed car from friends (material transport [occasionally])
Patrick	66	M	Emergency doctor	Lille	Personal bike (daily commutes: errands, outings, leisure; work)	Personal car (daily commutes: errands, outings, leisure)	Metro [occasionally]
Heidi	66	F	Retired	Tours	Personal bike (daily commutes: errands, outings, leisure; work)	Personal car (material transport [occasionally]; visits to friends [occasionally])	
France	70	F	Retired	Tours	Personal bike (daily commutes: errands, outings, leisure; work)	Personal car (material transport [occasionally]; leisure, outings [occasionally])	
Alicia	54	F	Jewelry designer	Paris	Personal bike (daily commutes: errands, outings, leisure; work)		Metro (material transport [occasionally])
Yohann	48	M	Consultant	Lille	Personal bike (daily commutes: errands, outings, leisure; work)	Personal car (material transport [occasionally]; leisure, outings [occasionally])	

 doi:10.20944/preprints202411.1933.v1

Thomas	34	M	Teacher	Lille	Personal bike (daily commutes: errands, outings, leisure; work)	Personal car (material transport [occasionally]; leisure, outings [occasionally])	Bus [occasionally]
Marc	45	M	Unemployed	Paris	Electric-assisted cargo bike (daily commutes: errands, outings, leisure; work; material transport [occasionally]; child transport [daily])	Personal car (material transport [occasionally]; leisure, outings [occasionally])	
Philippe	52	M	Craftsman	Nantes	Shared city bike service (daily commutes: errands, outings, leisure; work)	Borrowed car from friends (material transport [occasionally]; leisure, outings [occasionally])	Bus [occasionally]
Chloé	28	F	Communication officer	Nantes	Electric-bike (daily commutes: errands, outings, leisure; work)	Personal car (family visits [monthly]; material transport [occasionally]; leisure, outings [occasionally])	Bus, walking [occasionally]

3.2. Research Methods: Between Semi-Structured Interviews and Biographical Interviews

The interview conducted with each participant consisted of two parts: 1) the first is based on a semi-structured interview and 2) the second is based on a biographical interview. Participants were informed that they could refuse to answer certain questions and that the analyses would be anonymized.

For the first part, we developed – based on our research questions – a set of questions aimed at systematically collecting themes to document: experiences, significant memories, and representations related to the car; experiences, significant memories, and representations related to the bike; the chronology and choice of modal shift towards cycling; difficulties, advantages, and surprises encountered; the objects of activity related to cycling practice; relationship to other modes of transport and to living space.

The modal shift towards cycling was mainly documented around the home-to-work commute, as this trip is quantitatively the primary reason for travel in France [20]. However, we also discussed other daily trips. The interview remained relatively open, allowing the participant to express their thoughts and perspective on the situation fairly freely, while the researchers occasionally prompted further responses based on those same comments.

For the second part of the interview, the biographical interview approach was used. The following instruction was given to participants: “Can you tell me your story with the bicycle, from the first time you used it until now?” This type of interview focused on the sequence of actions from the perspective of the subject who is telling the story. The subject describes the key and significant events that make the unfolding of their experience intelligible. Demazière [54] explains that the production of the narrative works by selecting events and episodes because the interview time is limited.

During this part of the interview, prompts encouraged participants to verbalize their actions, thoughts, and feelings [55], as well as to understand the logics and processes involved in specific mobility situations. Our goal was to identify phases of change, obstacles encountered, and the influence of peers.

 doi:10.20944/preprints202411.1933.v1

3.3. Analysis Methods

The collected material was subject to a multi-thematic coding process, involving a grid created from a variety of themes [56]. Multi-thematic coding aims to understand the material while engaging in a back-and-forth process with theory: it is through this movement that themes emerge. This coding technique involves reading the entire material without focusing on specific themes at first. By allowing for constant questioning of the initial theoretical concepts, it helps avoid the risk of circularity [57].

In practice, each interview was carefully read two to three times to identify emerging themes, such as territory or equipment. Meaning units, which could be a single expression, a sentence, or a series of sentences, were grouped under these themes. This multi-thematic coding analysis sits at the intersection of grounded theory [58] and theoretical coding [59]. At the crossroads of these two methods, it enables researchers to move beyond pre-established conceptual frameworks, allowing them to "cut through reality" and thus manage the density of data. This approach not only prevents researchers from becoming locked into a priori categories that might bias the reading of the data and prevent new insights, but also encourages thinking beyond these concepts and, more broadly, the theoretical frameworks themselves. For this reason, it seems to us the most suitable method for qualitative research.

4. Results

Analysis of the interviews first reveals the mechanisms leading to a modal shift towards cycling. Presenting the shift from one mode of transportation to another as a transition thus highlights the journey that individuals take in abandoning car use for cycling, taking into account a complex reality made up of multiple constraints, values, and desires. These mechanisms, some of which were also identified by Vincent [20], are as follows: *Predispositions to change, Triggers, Exploration/trials,* and *Instrumental Genesis.* They are presented successively in this section.

4.1. Stages of the Modal Shift to Cycling

4.1.1. Predispositions to Change

Predisposition to change can be understood as a person's prior ability to do something or act in a specific circumstance or domain. This ability is not innate; it results from a set of experiences that allow an individual to interpret a situation [60].

4.1.1.1. Questioning the Car

One of the first predispositions to choosing cycling as a mode of transport is the gradual rejection of the car. This rejection is spontaneously mentioned by all of the interviewees for various reasons, ranging from strong rejection to simple inconvenience. First, there is frustration, or even exhaustion, due to **the nuisances of road congestion**:

"The traffic, a part of me just wanted to avoid that."

Mathéo, 33, Stage manager, Tours

All participants mentioned a sense of weariness regarding traffic difficulties in cities like Nantes, Lille, Paris, and Tours, where many roads have been narrowed in recent years to provide more space for cyclists. The **feelings of stress, frustration, and even anger in bad traffic conditions**, especially during rush hour, are also mentioned by 8 participants. In this regard, cycling and walking are seen as less restrictive modes of transport that make it easier to move around the city center.

"It really ruins your life, spending so much time looking for a parking spot morning and night, honestly."

Chloé, 28, Communications Officer, Nantes

Parking issues are also cited as negative aspects of car use. Finding a parking spot can significantly extend commute time, creating a strong feeling of time lost among most participants.

Car commuting time, in fact, is often associated with wasted time that offers little opportunity for other activities, except for those who enjoy listening to the radio or podcasts. In contrast, public

 doi:10.20944/preprints202411.1933.v1

transportation is viewed as offering time savings, conducive to reading, watching videos, working, and even, for Alicia, to leisure.

For 6 participants, driving a car is also associated with feelings of stress or anxiety, related to a sense of road insecurity and fear of accidents.

"I'm convinced that the car is an object of death. I get knots in my stomach when I drive."

Garance, 42, Social Sciences Teacher, Paris

The cost of car use also contributes to the desire to limit its use. While maintenance and insurance costs seem inherent to car ownership and are relatively tolerated, it is primarily the costs of fuel and parking that participants seek to avoid:

"I used to park on the quays to avoid paying for parking, but there was never a spot, so I would park past the last spaces, far from the university, just to park for free."

Mathéo, 33, Stage manager, Tours

These costs are seen as unfair surcharges, especially as they have consistently increased in recent years in France.

4.1.1.2. Physical Health

Cycling, from the participants' perspective, requires optimal physical health, which means having a certain amount of muscle strength in the legs, balance, endurance, good vision, and breath. While all 20 cyclists interviewed affirmed that cycling helps them stay in shape, they all noted that it is also primarily because they are in good health that they practice cycling.

In this context, questioning car use is also linked, for 11 participants, to a **desire to counteract sedentary behavior**. Active modes of transport, such as walking and cycling, are seen as more conducive to maintaining good physical health:

> *"And if I start using a car again, I'll be sitting down, getting sluggish. But when you walk, when you run to catch the bus, you move. I didn't want to get sluggish and end up with a big butt."*

Alicia, 54, Jewelry Designer, Paris

4.1.1.3. Experience with Cycling and Its Representation

All of the participants interviewed have some **degree of experience** with cycling, either extensive or limited, starting in childhood and typically acquired within the family. During this period, they developed a set of motor and cognitive skills: accelerating, braking, coexisting with other road users, and navigating space.

Some, like Lisa (31, Bank Employee, Tours) or Mathéo (33, Stage manager, Tours), have only used cycling on rare occasions (such as visiting friends in their childhood town), while others, like Manon (33, Life and earth sciences teacher, Tours) or Patrick (66, Emergency Doctor, Lille), grew up cycling:

"[My sisters and I], we were lucky to live in a building with a big park around it, which gave us the opportunity to learn to ride a bike very quickly and safely."

Manon, 33, Life and earth sciences teacher, Tours

While our sample is too small to analyze the **link between childhood cycling experience and choosing this mode of transport in adulthood**, it is worth noting that participants who switched almost immediately from car to bike once the opportunity arose (retirement, reduced family responsibilities, relocation, etc.) shared the common experience of having had a very favorable opinion of cycling based on increased use in childhood or adolescence. On the other hand, those for whom the transition was more difficult had limited cycling experience and retained a relatively unfavorable view:

"Before, cycling was linked to constraints. I only used it when I didn't have the car. […] As a kid, I always had crappy bikes because of lack of money. So, I didn't find any enjoyment in it. […] In middle school, I walked because my mom's apartment was just nearby. It was convenient. I had a bike that I used a few

 doi:10.20944/preprints202411.1933.v1

times to go to my friends' houses. I went to my dad's place once a week, and he would take me by car. In high school, I took the bus, Line 12. Same for going to town. I also walked to my theater class on Friday evenings. Anyway, my bike got stolen, and I didn't get another one right away."

Mathéo, 33, Stage manager, Tours

The excerpt above clearly shows how Mathéo developed a negative view of cycling during his childhood (due to using "crappy bikes" and "no enjoyment"). As a result, he didn't buy another bike until he was 30, when he lost his driving license. A negative preconception of this mode of transport seems to limit the willingness to experiment with it, thus delaying the possibility of forming a more positive opinion. In contrast, the more someone masters a means of transportation, the more likely they are to explore it further and develop new skills related to it. Mathéo, for example, only returned to cycling when forced by the inability to drive, at which point he began to slowly reshape his view of cycling:

"Today, cycling is part of my transport choices; I think about it. There's the pleasure of walking and cycling."

Mathéo, 33, Stage manager, Tours

Additionally, 4 participants had used motorized two-wheelers (motorbikes and scooters) during their adolescence or early adulthood, a phase during which they abandoned cycling. These experiences may have also contributed to developing transferable skills for urban cycling. The comparison between the equipment used for cycling and motorcycling is noteworthy:

"For us, the cycling gear is really like motorbike gear. On two wheels, we are really vulnerable."

Séverine, 38, Unemployed, Tours

Another participant, Lisa (31, Bank Employee, Tours), used a scooter for six months to commute to work before switching to cycling. This phase served as a kind of transition to two-wheeled cycling, a mode she had rarely used during her childhood, adolescence, and early adulthood, making motorized two-wheelers a first step toward urban cycling mobility.

4.1.1.4. Ecological Concerns

While the analysis of our data shows that ecological values alone are not the driving force behind the modal shift to cycling, they remain a key predisposition in the process of changing practices. Ten participants reported that **the ecological benefits of cycling** contributed to instilling in them a desire for a change in mobility.

For some participants, ecological reasons challenge a well-established car habit, or even a strong preference for driving:

"I must say it's frustrating because I really like the car, and if I weren't aware of the harm it does to the planet, I'd use it much more often. In fact, I probably use it too much compared to others. But I always ask myself the question. In cold weather, I try to motivate myself to take the bike, even though it's hard."

Fabien, 30, Translator, Tours

Here, Fabien's testimony shows how the value system can shake up a deeply entrenched set of practices. Thus, like Fabien, 8 participants mention a sense of guilt when using the car, a feeling of making a harmful and morally questionable choice:

"It took me time to think about my mobility choices and mature them. Some realizations came later than I would have liked. I feel guilty. When I don't have to use the car, for example, to visit my mother. I often go to the [Atlantes Shopping Center] for groceries. The bags are very heavy, so I tend to take the car. I allow myself to use the car for shopping."

Mathéo, 33, Property Manager, Tours

This testimony reveals **the sense of responsibility and guilt** Mathéo **feels**. Thus, questioning mobility practices gradually pulls the car out of routine, incorporated use. Here, using the car for shopping is an "authorization" he grants himself, a deviation from his desire for more ecological mobility.

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4.1.1.5. The Influence of Close Ones

We also observe among several participants the influence of **people who can serve as role models for imitation**. A close person – a child, a partner, a neighbor, a colleague, or a teacher – using a bicycle can thus become a model to follow for individuals and facilitate the integration of the bicycle as a possible mode of transport. This is what Maryse (62, Retired, Tours) describes, who abandoned the use of her car to take up cycling, under the influence of her son. Social circles thus represent privileged spaces for initiating a change in practices.

4.1.1.6. The Territory

4.1.1.6.1. Terrain and Climate

The **terrain of the area** also plays a role in the projection of the bicycle as a possible mode of transport. Marcia (31, Unemployed, Tours) thus states that it took her a long time to consider cycling to a twin city of hers due to the steep slope that must be climbed to get there. Uphill routes can indeed require significant physical effort, which may discourage some people, even though they might actually be capable of it.

The **climate** also plays an important role. Rain, snow, wind, storms, cold, and to a lesser extent, extreme heat, are all reasons mentioned for not using a bicycle, especially by those who are trying today to cycle more in their daily commuting but whose practice is not yet fully ingrained in their habits. Yohann (48, Consultant, Lille) spontaneously states that rain has long been an obstacle to cycling. Thus, rain, cold, and even extreme heat influence bicycle use.

4.1.1.6.2. Infrastructure

Infrastructure specifically designed for cycling naturally encourages the shift towards using bicycles. Bicycle lanes, in particular, promote the adoption of cycling, especially because the feeling of insecurity associated with road traffic is reduced. Lucie shares how discovering new bike lanes upon her arrival in Tours led her to consider cycling as a viable mode of transportation. Yannick (34, Social Studies Teacher, Tours) describes how urban planning shapes the potential for cycling to become a viable transport option:

"When I was young, we lived in Mauritania. The streets were unpaved, and cycling wasn't practical, so we didn't have bikes. We moved to Paris in 9th grade, and that's when I started cycling to school. I've hardly stopped since."

Yannick, 34, Social Studies Teacher, Tours

4.1.2. Triggers

The predispositions outlined above, however, do not seem sufficient on their own to trigger a change in practices. In order for a break in routine to occur, these predispositions must combine with a specific, often unexpected event that disrupts mobility routines. Four types of events—or triggering elements—were identified among our participants: biographical events, temporary inability to drive, unavailability of public transport, and urban planning, social, and technical innovations.

4.1.2.1. Biographical Events

4.1.2.1.1. Moving and New Territories

Among our participants, 11 people reported starting to use a bicycle after **moving or changing jobs**. This kind of event seems to be a key trigger for a modal shift because it leads individuals to become familiar with new territories. Three main factors related to the characteristics of the territory then come into play: the discovery of new infrastructures, the distance, and the availability of transport options. For example, Lisa (31, Bank Employee, Tours) explains how her move to a new job location made her reconsider her transport options:

 doi:10.20944/preprints202411.1933.v1

"I knew it would be a hassle to get to my new job by bus. There were bus changes, and I hate that. […] On the bike, I was worried about being on the road. I need a lot of safety. But then I realized it wasn't so bad, and I got used to going by bike."

This passage shows how Lisa rethinks her daily commute after discovering that the bike route was safe and accessible.

Fabien (30, Translator, Tours) also embraced the bicycle more fully after moving closer to the center of Tours. Having lived in Essonne, where using a car seemed essential due to long distances and the lack of nearby public transport, his move allowed him to significantly reduce his car usage. The shorter distances to various amenities, like gyms, cafes, and stores, became a gateway for adopting cycling.

The distance between one's home and workplace heavily influences the choice of transport. For example, Yannick (34, Social Sciences Teacher, Tours) was forced to buy a car due to his work assignments further away from Tours. In 2021, he was stationed in Nogent-le-Rotrou, about 150 km from home:

"We moved to Tours in the summer of 2021, my wife continues to work in Paris by train. And I was assigned to Nogent-le-Rotrou, it's an hour and forty minutes by car, even two hours. There's no public transport. There's a train, but with transfers in Le Mans or Paris. Given my schedule, it wasn't feasible. With three kids already, I wanted to be home in the evening, so I knew I would have to buy a car."

In this case, the distance and **lack of public transport** led Yannick to opt for a car, but when he was later reassigned closer to Tours, he returned to using the bike.

4.1.2.1.2. Changes in Schedules

A change in one's schedule that provides more free time can also encourage individuals to adopt cycling as an alternative mode of transport. With less time pressure, they can enjoy their trips, take breaks, and explore more pleasant routes. For example, Maryse (62, Retired, Tours), France (70, Retired, Tours), and Heidi (66, Retired, Tours) all took up cycling after retiring. For example, for Heidi, former librarian at a high school in Tours, retirement provided the opportunity to reorganize her daily routine, and she describes how the time gained and flexibility in her schedule enabled her to switch to cycling:

"I thought that when I retired, I would at least use the car as a minimum. But the bike became my main mode of transport. I don't really like the bus because it restricts my schedule, and the bike, for me, has always meant freedom."

Similarly, Mathéo (33, Stage manager, Tours), who works intermittently in the film industry, reflects on how his more flexible work periods allowed him to rely on cycling:

"After my first shoot, I started to manage my intermittent work better and stopped accepting any and every job. I allowed myself longer breaks, which meant I was home more often and not always in Paris. During these break periods, I used the bike 100%... But during the hectic weekends of filming, when I barely have time to return, I drive to optimize time."

For Mathéo, the availability of time during his breaks enabled him to cycle, while during intense work periods, he optimized time by using the car.

4.1.2.1.3. Decrease in Family Responsibilities

Six participants mentioned abandoning daily cycling due to family responsibilities at certain points in their lives. As Heidi (66, Retired, Tours) explains:

"When I had my first child, it wasn't common to carry kids by bike. […] It was too rushed, the schedules were impossible, so I couldn't manage everything. I was starting to teach, and I had other things on my mind."

This excerpt illustrates the **link between parenthood and car dependency** (already discussed in sections 2.1 and 2.2). When children are young, especially infants, parents often have strict schedules, which can make cycling less feasible. As children grow and the burden of childcare decreases, particularly for mothers, cycling becomes a more viable mode of transport. The home-to-work trip often bridges the professional and personal spheres, connecting a series of activities: dropping

 doi:10.20944/preprints202411.1933.v1

children off in the morning, picking them up in the evening, doing grocery shopping, etc. This chain of activities often influences the choice of transport, with cars being preferred for the flexibility they offer.

4.1.2.2. Temporary Inability to Drive

As mentioned earlier, routines are disrupted when an unpredictable and restrictive event occurs. Two key events that may lead to a **temporary inability to drive are vehicle failure or the driver's incapacity**. For example, Séverine (38, Unemployed, Tours) describes how her car accident led her to reconsider her transport options:

"We've had the bike since January. We only had one vehicle. My partner had an accident, and we looked at the second-hand market, but the prices were very high, and there wasn't much choice. We were debating whether to buy another car or not. Eventually, we decided to buy a solid bike to fit our daughter's seat. The accident was the trigger."

In this case, the temporary unavailability of the family vehicle prompted them to consider alternative transport options.

The temporary inability to drive can also be due to a personal issue, such as an injury or illness. Mathéo, for instance, had to adapt when he lost his driving license due to a DUI:

"I lost my license too. I started taking the bus and train. That's when everything switched. I bought a bike. I got my license back, and the shoot ended, but I continued to move around by bike. I handled all my admin tasks on the bike. It was a turning point."

This personal constraint led Mathéo to integrate cycling into his life more fully.

Similarly, Thomas (34, Teacher, Lille) recounts how he temporarily relied on a bike after his car broke down:

"I had a car in the garage for two weeks, and I had no choice but to use the bike."

4.1.2.3. Unavailability of Public Transport

The unavailability of public transport—due to factors such **as limited schedules, strikes, construction, or new, poorly adapted routes**—can also trigger a shift towards cycling. The bicycle often becomes an accessible and flexible alternative. For example, during the COVID-19 crisis in 2019, Patrick (66, Emergency Doctor, Lille) began cycling the 16 kilometers to his hospital to avoid exposure to the virus in public transport.

The COVID-19 pandemic caused a significant rise in cycling in France [61], as many people sought alternative, safer ways to get around due to the restrictions on movement and fear of public transport. Additionally, government initiatives, such as the expansion of temporary bike lanes and financial incentives for buying bikes, contributed to this surge in cycling.

4.1.2.4. Introduction of New Possible Transport Modes

4.1.2.4.1. Shared Bikes

Our analysis suggests that **social innovations** impact mobility practices. Shared bikes, for example, enabled five of our participants to start cycling. Lisa (31, Bank Employee, Tours) and Victor (31, Unemployed, Nantes) use a bike-sharing service to commute to work each day. Séverine also tried a temporary, free electric bike-sharing service provided by her city, which encouraged her to eventually purchase her own.

Bike-sharing services address several challenges, such as the issue of maintenance and storage. Lisa, for instance, explains that when she first started working at 20, she could have biked to work but was discouraged by the inconvenience of carrying the bike in and out of her apartment. Shared bikes solve this issue, similar to public transport, by eliminating the need for **storage, maintenance, and ownership costs.**

4.1.2.4.2. The Rise of Electric Bikes

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The rise of electric bicycles can significantly contribute to the daily adoption of cycling as a mode of transportation, as it opens up more possibilities compared to traditional bikes. Thanks to the motor assistance, **climbing hills or covering longer distances becomes feasible**. Electric assistance thus facilitates the spatial extension of cycling practices. For example, Maryse, like the other five participants who use electric bikes, can now reach new destinations thanks to the electric assistance of her bike:

"At the start of my retirement, I resumed my activities at La Camusière, sports and activism. I went there up to four times a week. I couldn't climb the hill, so I used to take my car. But it consumed a lot, and I felt guilty. So, I thought either I get a car that consumes less, or I buy an electric bike. And so, I bought an electric bike and switched to a supplier that provides non-nuclear energy. It was just to go to Saint-Avertin [a town located at the top of a hill, where La Camusière is]. And I have my regular bike for the rest of the city. I also have an allotment garden, and I go there with the electric bike because it's far, and it's exhausting."

Maryse, 62, Retired nurse, Tours

Thus, trips that were previously made by car—trips she couldn't replace with a traditional bike due to the terrain or distance—are now being done on an electric bike.

Moreover, the electric bike allows for more comfortable uphill rides with less effort and therefore less sweat. This is an important point mentioned by several users of e-bikes: the electric assistance offers the advantage of **arriving at work in a presentable state** without needing to bring a change of clothes or anticipate the availability of special facilities (shower, changing rooms, etc.). Additionally, **transporting children or grocery bags** is easier, as the weight added to the bike is offset by the motor's power.

4.1.2.4.3. The Rise of Cargo Bikes

The growth of cycling practices, spurred by the arrival of electric bikes, is even more pronounced with the development of electric cargo bikes. Thus, our four participants who use electric cargo bikes, all of whom are parents of young children, rely on this type of bike for their daily commutes. Thanks to the space provided by the integrated cargo trailer, it becomes possible to combine activities such as leaving work, running errands, and dropping children off at extracurricular activities.

4.1.3. Exploration and Trials

Exploration and trials around cycling refer to the initial phase in which users test various equipment, configurations, and practices. It is an experimental process that allows individuals to discover the possibilities offered by cycling, evaluate the comfort, performance, and functionality of different gear and routes. This phase is often characterized by curiosity and a desire to adapt the practice based on individual needs and lived experiences.

It should be noted right away that **this phase is not linear and can involve multiple back-and-forth adjustments.** Cyclists may start by exploring different navigation apps, testing performance tracking devices, and checking various weather websites, while adjusting their choices based on their experiences. For instance, an app that seemed promising may not meet their needs in real-life conditions, prompting them to try another one. Similarly, incorporating new equipment may require numerous adjustments.

4.1.3.1. The Choice of the Bike

Among all participants, 10 had already owned a recreational bike before using it for daily commuting; 1 participant did not have a bike and bought one at the time; 9 participants already had a recreational bike but chose to purchase a second bike specifically adapted for daily commutes. Among these, 6 participants invested in an electric-assisted bike (including 4 cargo bikes); 3 participants purchased a new bike.

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Here, acquiring a bike can either involve buying a second-hand one or actively searching for new products on the market. In all cases, **individuals are looking for a bike that meets their own criteria** in terms of shape, handlebar height, saddle, and weight:

"It's important to have a bike that fits your body. For now, this one works fine. The handlebar height, the saddle, and the comfort with the pedals. I don't like bikes where you're hunched over like a racer. I prefer an upright position, like women's bikes. I don't feel safe on a hunched bike."

Heidi, 66, Retired, Tours

The phase of reflection and trials before purchasing becomes even more important when it comes to electric-assisted bikes, whose average price is around 2000 euros:

"When it came time to buy, it was mostly my wife who took care of it. I was dealing with the car. And she decided she was going to choose the cargo bike so that it would be suitable for her and her needs. The goal was to fit three seats, one for each child. She's quite small, so the seat needed to be low and the bike needed to be maneuverable because she's small and not very heavy. She did her research on the Internet, checked reviews, and then we tested bikes, looking on sites like Le Bon Coin. We tested bikes at the bike shop."

Yannick, 34, Social sciences Teacher, Tours

Finally, 5 participants used a bike-sharing service when they shifted to cycling. Among them, 2 were satisfied with the service and do not plan to purchase a bike; 1 invested in an electric-assisted bike after testing the service for several months.

Choosing this option allows individuals to avoid the material constraints (e.g., purchase, storage) while also testing the bike before deciding to invest in one, especially if it is an electric-assisted bike. This testing phase, however, can lead to dissatisfaction and abandonment of cycling altogether, as was the case for Patrick during his initial trials with bike-sharing in Lille:

"I had considered and experimented with biking—during times when I didn't have a car—by using Vélib'. I saw that the stations allowed me to move around and reach the stations. It wasn't as convenient; the bikes weren't always available, the weather was an issue, and it took a lot of time. The convenience of being in a car, being able to do my shopping on the way home, doing sports afterward, and putting my gym bag in the car—those were things I missed."

Patrick, 66, Emergency Doctor, Lille

This process of instrumentalization, as discussed in Section 2.3**, involves transformations to the artifact** (in this case, the bike), which can be local or global, temporary or more permanent. A wide range of equipment today offers the possibility to adapt one's bike. New functions are then assigned to the artifact by the user and "improve" what was originally conceived by the designers to meet the needs of cyclists based on their personal characteristics and situational needs. These additions can affect the entire bike: clip-on saddlebags for the rear rack, baskets on the handlebars, saddle cushions, mirrors to attach to the handlebars, vertical grips. Among our participants, most of these additions remain permanently on the bike, thus creating new functional properties that expand the possible activities. For instance, several participants explained that they added panniers to extend their bike use to grocery shopping.

4.1.3.2. The Choice of the Route

The new mode of transport is then put to the test on the road to explore the route to work. These trials may be conducted with a third party, especially if the individual hasn't ridden a bike in several years or has never ridden in an urban environment. Exploring the route allows individuals to scout future commutes and evaluate road safety conditions:

"I was with my friend Théa, and I suggested we try the route to my work, we were doing a lot of sports together at the time. On a bike, I'm afraid to be on the road next to cars. I need a lot of safety. And I realized it wasn't that bad, and I got into the habit of going by bike two or three times a week."

Lisa, 31, Bank Employee, Tours

 doi:10.20944/preprints202411.1933.v1

"I did a route survey by bike with my husband to see how to get there, because he navigates better than I do. Thanks to Covid-19, a lot of bike lanes opened up, so it's not bad. I've tried other options, but I ended up sticking with the original route, it was the best."

Garance, 42, Social Sciences Teacher, Paris

This last excerpt clearly illustrates **the trial-and-error process involved in route reconnaissance**. Individuals consider different options and select the best routes based on their own criteria: safety, speed, or even the beauty of the place. This last criterion, for example, is what leads Heidi (66, Retired, Tours) to choose the Loire river paths to reach downtown Tours.

4.1.3.3. The Choice of the Equipment

Participants also gradually try and introduce **a variety of equipment to maximize comfort, safety, and functionality**. Equipment refers to the clothing and accessories chosen for a specific activity. Perceived as an external element to the bike, it is mainly seen as a way to adapt cycling to one's needs and the different situations encountered. It first serves as a response to weather conditions:

"I bought enough gear for rain and cold, pants, to be really equipped. I have a big visor to protect myself, all that."

Maryse, 62, Retired, Tours

Equipment is also a way to address road safety issues:

"I've made adjustments by buying equipment to make it more practical and safe: a mirror, a yellow vest, a helmet, lighting... Because I'm very aware of the risks of cycling. I realize that bikes aren't always visible."

Patrick, 66, Emergency Doctor, Lille

Finally, equipment also provides a solution for managing situations where appearance matters, such as in jobs in retail or education:

"I would get dirty... and that annoyed me. So I had a spare shirt in my bag—shirt and pants, in case I needed them in the locker at the school. As a teacher, I need to dress fairly well and be presentable."

Yannick, 34, Social Sciences Teacher, Tours

For some participants, "equipment" means adapting their attire: for example, Maryse (62, Retired, Tours) chooses to wear shorts to let rain hit her bare legs, or Marcia (31, Unemployed, Tours) avoids wearing a long skirt to pedal more easily.

4.1.3.3. The Choice of the Technology (Navigation and Weather)

Cyclists also test various technological tools that **enrich their experience and improve their safety**. Among these tools, navigation apps allow cyclists to plan routes that are adapted to bike paths and traffic conditions. Additionally, performance-tracking devices, such as speed and distance counters, help cyclists measure their progress and can provide a fun aspect:

"I tested several weather websites, and the best one is the agricultural weather. That way, I know the exact moment I can go out and bike my route."

Marc, 45, Unemployed, Tours

As Marc explains above, testing different weather sites allows cyclists to choose the best time to ride, avoiding bad weather.

4.1.4. Instrumental Genesis: Towards a Cyclist Identity

This phase of exploration and experimentation, dynamic and iterative, leads to significant modifications of equipment and practices, gradually evolving into a sustainable cycling routine that allows each cyclist to find the configuration that best suits them.

Moreover, this cycling practice is accompanied by deeper transformations that gradually invite individuals to build a cyclist identity, particularly through the development of skills, the creation of

 doi:10.20944/preprints202411.1933.v1

social spaces, the expansion of cycling to other uses, and, finally, the strengthening of the objects involved in the activity.

4.1.4.1. Development of Skills

The process of appropriation of the equipment involves a dual movement in the activity of individuals, directed towards the bike, the equipment, and the route, but also towards the individual themselves. Depending on the situation, each person develops their own system of internal resources. We identify five specific areas of competence:

- Acquiring experience in traffic situations;
- Knowledge of the area being traveled;
- Physical abilities;
- Technical skills related to the bike;
- Self-confidence.

4.1.4.1.1. Acquisition of Experience in Traffic Situations

Cycling requires a number of skills related to the actual operation of the mode of transportation. The basics of cycling involve acquiring good balance and mastering the three primary actions of cycling: pedaling, turning, and braking. All of the participants learned to ride a bike as children, so none had to develop these basic skills at the time of the modal shift, as Garance:

"I know that at the beginning, I did quite a few scouting trips, especially with my partner, to get used to it and understand how it worked."

Garance, 42, Social Sciences Teacher, Paris

However, several of them had to learn how to navigate in urban environments, that is, in public spaces shared with other road users (drivers, cyclists, scooter riders, pedestrians, skateboarders...):

"When you're on a bike, there's a way to position yourself on the road so the person behind understands that you're going to turn left, for example."

Philippe, 52, Craftsman, Nantes

The main skills acquired in this context relate to the formal and informal rules of interaction with other vehicle drivers, such as signaling a turn by raising an arm.

4.1.4.1.2. Knowledge of the Territory

Another skill acquired, as revealed through the interviews, relates to knowledge of the area traveled. This competence develops through regular cycling trips, with routes being perfected over time. For example, Marcia (31, Unemployed, Tours), looking to save effort, prefers routes with gentler slopes, while Maryse **adapts her route** based on the bike lanes she has identified over time:

"I don't take the gentle slope through the village because the street is narrow and cars go really fast. I prefer Beaugaillard, there's a bike lane."

Maryse, 62, Retired, Tours

Knowledge of the territory also includes knowing how to navigate using maps and identifying the relevant resources for that purpose:

"I added a phone holder to guide me; it's a really strong magnet to attach it to the handlebars. I use the Geovélo® app. I had to get used to riding by following the route."

Garance, 42, Social sciences teacher, Paris

The duration of the commute is also a factor frequently considered by individuals when using a bike to travel within their territory. Most participants use a geolocation app to estimate the time it will take to cycle from point A to point B. However, they know that the duration also depends on factors such as their health, the equipment used, the condition of the road, the destination (and its parking facilities), the weather (wind, extreme heat...), the time of day, traffic conditions, and the purpose of the trip. For example, Yannick says he adapts his pace or even gets off the bike if necessary:

 doi:10.20944/preprints202411.1933.v1

"During periods of extreme heat, I would arrive early enough in the morning so that it wouldn't be a problem. It was a concern of mine, but it turned out not to be because I adjusted my pace, like walking up the hill if I had a meeting or something."

Yannick, 34, Social sciences teacher, Tours

These factors influence the average speed, but over time, cyclists become better at assessing the duration of their bike rides with greater precision. After regular trips, Marcia knows exactly how long it takes her to get to various points in the city center.

In addition, **parking in the city** can be a major barrier to cycling. Therefore, knowing where bike parking is located becomes a skill in itself. Cyclists must anticipate a place to park, whether it's a designated facility or urban fixtures like racks, poles, or barriers. However, such parking is not suitable for bulky cargo bikes. Several participants mention preferring places with dedicated bike parking spaces and ample room for bikes:

"Now, I go more to certain shops than others because I can park my cargo bike there more easily."

Séverine, 38, Unemployed, Tours

Similarly, Marcia (31, Unemployed, Tours) has developed a set of criteria for choosing where to park her bike: a secure, ground-fixed point, in areas with foot traffic, and often with two locks.

4.1.4.1.3. Physical Abilities

Cycling is also perceived by the participants as a mode of transport that helps develop physical skills related to endurance, instant power, that is, efficiency in generating speed, as well as lung capacity.

Endurance plays a crucial role: cycling long distances strengthens the cardiovascular system and improves the efficiency of the heart and lungs. Over time, participants notice an increased ability to sustain prolonged physical effort without getting tired, which benefits not just cycling but other physical activities as well:

"It's clear that since I started cycling, I feel in better overall shape. It's hard to explain, but I just feel better physically in general."

Marc, 45, Unemployed, Paris

Instantaneous power becomes key, too. The ability to quickly generate speed, for instance, in a sprint or when going uphill, requires well-developed musculature. Leg muscles, particularly the quadriceps, hamstrings, and calves, are strengthened and adapted to these demands. This power is also synonymous with efficiency, as the cyclist learns to optimize each pedal stroke to maximize speed with minimal effort.

Breathing is another fundamental skill that develops with regular cycling. Cyclists must learn how to manage their breathing, inhaling deeply to supply their muscles with oxygen and exhaling effectively to remove carbon dioxide. This breath control not only improves cycling performance but also helps with self-regulation in stressful situations or intense physical effort.

"Climbing the hill was hard the first two or three times, and after that, you get used to it, you don't think about it anymore."

Manon, 33, Life and earth sciences teacher, Tours

4.1.4.1.4. Technical Bike Skills

Cycling also allows individuals to develop **technical skills** related to bike maintenance and repair:

"I've been cycling for a long time, so I know how to fix small things, like a chain derailment or a flat tire. I'm not afraid of that. My wife gets frustrated, so I do it for her. I'm not a real handyman for bigger repairs, though. If it's something more complicated, like changing brake cables, I go to the bike shop. I'd like to learn to do everything on my bike, but I haven't seriously tried yet. Right now, I have a problem with the gears shifting poorly, and I don't know how to fix that system, but I'll have to learn one day. For now, I take it to the repair shop."

 doi:10.20944/preprints202411.1933.v1

Yannick, 34, Social sciences teacher, Tours

Yannick describes how his technical skills have developed over time through cycling. He mentions routine repairs like fixing a chain derailment or flat tire, which he now handles without fear. This indicates not only a familiarity with the bike but also a proactive approach to minor repairs. His attitude suggests that cycling is not just a physical activity for him but also an area where he has developed some technical expertise.

It's worth noting that, like Yannick, most participants prefer to delegate more complex repairs or a full bike overhaul (e.g., before a long bike trip) to professionals. However, all express a desire to improve their technical skills**, a positive attitude toward learning, and a wish to become more self-sufficient.**

4.1.4.1.5. Self-Confidence

It also became apparent that, over time, participants gained confidence and dared to venture beyond their usual routes, traveling farther and farther. They grew more **confident in their ability to navigate urban traffic** (including in very busy areas like central Paris) and in their physical abilities.

"Now, on my new route, it's much less safe. I wouldn't have taken it at the beginning. When I started, it was important for me to have bike lanes to feel comfortable."

Garance, 42, Social sciences Teacher, Paris

In conclusion, the various skills acquired, particularly the confidence gained through regular cycling, feed into an iterative cycle that strengthens the subjects' predispositions.

4.1.4.2. Development of Socialization Spaces

Finally, cycling can also have a social dimension, fostering encounters and exchanges. The creation of cycling groups or communities of enthusiasts encourages the sharing of experiences and ideas, sometimes even promoting collective innovation. These interactions can lead to initiatives aimed at promoting the use of bicycles in broader contexts, such as improved cycling infrastructure.

Participating in group bike rides or joining a cycling community strengthens **the sense of belonging, mutual support, and sharing**. For instance, Yannick (34, Social Sciences Teacher, Tours) and Séverine (38, Unemployed, Tours) both describe how cycling invites them to interact with other parents who transport their children by cargo bikes at school drop-off. Here, the group is formed around a **shared commitment to ecological values.**

In other contexts, socialization is built around a **shared interest in nature and botany, accessible through cycling trips**. This is what Heidi (66, Retired, Tours) describes, as she rides along the Loire river paths into the center of Tours. She encounters other cyclists and can exchange thoughts about the plants they see along the way. Thus, the socialization spaces that emerge go far beyond the issue of daily commuting.

Modal shift to cycling can also lead individuals to more concretely join an already-formed group focused on cycling practice:

"Cycling daily sparks other uses. I joined the 'Droit au Vélo' association. There is a community aspect to it."

Patrick, 66, Emergency Doctor, Lille

Patrick has thus become involved with the association Droit au Vélo, which works to promote cycling as the preferred mode of transportation in the Nord-Pas-de-Calais region.

4.1.4.3. Extension of Cycling to Other Uses

Finally, we observe that the modal shift to cycling for commuting leads participants **to adopt the bicycle for other forms of use in various aspects of daily life**. Thus, while recreational cycling experiences often facilitate the transition to using the bicycle for daily commuting, it is also important to highlight that cycling, initially focused exclusively on commuting, can also expand into leisure activities.

 doi:10.20944/preprints202411.1933.v1

For example, Garance (42, Social Sciences Teacher, Paris), who purchased an electric bike for commuting to work, gradually began using the bike for other types of trips, such as meeting friends in Paris, taking her children to school, and doing errands. Similarly, Lisa (31, Bank Employee, Tours) started using her bike for leisure activities once she had become accustomed to using it for commuting between her home and work.

4.1.4.4. Objects of Activity that Sustain Cycling Practice

Our study also reveals that **emerging objects of activity** (OA) play a crucial role in the sustainability of cycling practice. These motives, although initially secondary, strengthen over time through practice, thus broadening the scope of initial motivations. They contribute to firmly embedding cycling into the daily routines of users, transforming it into a long-term commitment, both personal and collective.

It is also important to emphasize that these OA are dynamic and overlapping. An individual may adopt one or more of these objects depending on the journey or specific context. Eight objects of activity (OA) were identified:

- Pragmatic OA (OAPra)
- Ecological OA (OAEco)
- Sportive OA (OASpo)
- Health-related OA (OASan)
- Hedonistic OA (OAHed)
- Safety-related OA (OASec)
- Financial OA (OAFin)
- Social OA (OASoc)

These will be presented following a summary table of the OAs relative to each participant (Table 2).

Table 2. Synthesis of OA for Each Participant.

First Name	Summary of Interview and Identified Activity Objects
Fabien	Since moving to Tours three years ago, Fabien uses the car much less, although he enjoys driving. He finds that cycling is as fast as driving into the city center (OAPra) and has the added advantage of being easy and free to park (OAFin). Currently, he tries to do most of his commuting by bike for ecological reasons (OAEco). He enjoys the sport it provides (OASpo) and has also taken up cycling tourism (OAHed).
Victor	Victor has lived in the center of Nantes for several years. He regularly uses the city's shared bike service and also commutes by bus and walking. It is cheaper than using the car (OAFin) and more practical (OAPra). He feels that it benefits his mental health, especially since he suffers from frequent anxiety attacks (OASan).
Lisa	After being a long-time car user, Lisa now uses a bike to get to work, except in bad weather. She finds it faster than public transport (OAPra). She also feels it benefits her physically (OASpo) and finds it more secure than other modes of transport (OASec), especially since she rides on dedicated bike lanes. The ecological aspect reinforces her choice (OAEco).
Marcia	Marcia uses the bike for most of her daily travel. Unemployed, she chose cycling to stay active (OASan/OASpo) and save money (OAFin). She cycles for shopping, visiting friends, and exploring the city, enjoying the freedom it provides (OAHed). Marcia participates in local events and organized bike rides (OASoc), allowing her to meet other cycling enthusiasts and build a social network. Her commitment to cycling aligns

 doi:10.20944/preprints202411.1933.v1

	with her desire to live more sustainably (OAEco). The bike is also a safer way to travel at night (OASec).
Lucie	Lucie lives in Tours with her husband and children but works in Paris. She commutes by train for work and uses the bike for her daily activities. She finds cycling more secure than driving (OASec) and, most importantly, more ecological (OAEco).
Mathéo	Mathéo, a freelance actor, lives in Tours but works mostly in Paris. He has been thinking about reducing his car use for ecological reasons (OAEco). It's also a financial gain, particularly compared to parking fees in his city, which have risen significantly (OAFin). It's also more practical since he no longer has to search for parking spaces (OAPra). He has bought a bike and started walking. He also frequently takes the bus. Cycling still presents some challenges for him (e.g., storing the bike in his building's basement). He still uses the car occasionally.
Manon	Manon, who lives in Tours, is a committed cyclist and enjoys cycling a lot (OAHed). She has used the bike for most of her daily commuting for several years, initially for ecological reasons (OAEco) – it pollutes less and takes up less space in public areas – and for sports (OASpo). However, she had to buy a car two years ago due to her transfer to a work site in the northern part of the city and specific schedules (e.g., parent-teacher meetings). Overall, she finds the bike to be the least expensive transport (OAFin) and the fastest for getting around the city (OAPra). She also feels that the bike is safer, especially when she is too tired to drive (OASec).
Yannick	Yannick, who has lived in Tours for several years (previously in Île-de-France), uses the bike extensively. He and his wife bought an electric-assisted cargo bike two years ago to drop their children off at school. It's easier to park (OAPra). His main motivation is ecological (OAEco), and he rarely uses the bike's battery to save energy. He also enjoys the physical workout the bike provides (OASpo). Yannick mentions that cycling has led to financial savings, though it's not his primary concern (OAFin). He discovered that cycling is a topic of conversation with other parents at school pick-up time, and he enjoys this (OASoc).
Séverine	After a car accident that resulted in material damage, Séverine and her partner decided not to replace their car. They bought an electric-assisted cargo bike instead, which was cheaper than repairing their car (OAFin). Séverine had already tried this type of bike through a city bike-sharing program and found it practical, especially for taking her daughter to school (OAPra). Séverine is very athletic, and cycling allows her to exercise daily, particularly since she is unemployed (OASpo). She also discovered that cycling is a topic of discussion with other parents at the school gates, which she enjoys (OASoc).
Garance	Garance hates driving. She has sometimes been forced to use the car for professional reasons. She also used public transport a lot, but didn't like it. Since acquiring an electric-assisted bike a year ago, she really enjoys this new mode of transport, finding it the safest (OASec). She also considers it helps her maintain good general physical fitness (OASan) and especially strengthens her back (OASpo). The bike is also a moment of relaxation for her (OAHed).
Maryse	Maryse, now retired, uses an electric-assisted bike for most of her daily travels. Her main motivation is ecological (OAEco), though some trips, such as to Saint-Avertin (a town bordering Tours), were previously

 doi:10.20944/preprints202411.1933.v1

	difficult due to steep roads. Since purchasing an electric bike, she finds it very practical for avoiding traffic (OAPra) and not having to search for parking in town. Maryse aims to maintain her physical fitness (OASpo) and enjoys being outdoors (OAHed). The bike is also a safer way to travel at night, such as when she goes to the cinema (OASec).
Patrick	Patrick, an emergency doctor at the Roubaix hospital, used to drive alone for years. For several years, he used a folding bike combined with public transport, mainly for ecological reasons (OAEco). Since the COVID-19 crisis in 2019, he now does the entire commute by bike. He is also involved in a cycling association (OASoc). He enjoys the sportiness of cycling (OASpo).
Heidi	Heidi lives in Rochecorbon, 7 kilometers from the center of Tours. Since retiring, she has made a greater effort to use the bike for her daily commuting. She loves cycling on paths where she can observe nature (OAHed). She feels that it benefits her mind and keeps her in good spirits (OASan). The ecological aspect of cycling is important to her (OAEco). She also considers that it provides financial savings (OAFin) and saves time compared to driving, as there is no need to wait in traffic or search for parking (OAPra).
France	France, a retired artist, uses the bike and bus for transportation. She still uses her car to transport art materials. She believes that cycling helps her stay active (OASan) while being practical (OAPra).
Alicia	Alicia has completely switched from driving to cycling to stay in good physical shape (OASan) and avoid traffic (OAPra). She feels less stressed (OASan). She occasionally uses the RER (a commuter train) and metro for professional trips but has switched to cycling now that bike lanes are more widespread in Paris. This transition has helped her save time (OAPra) and discover the city from a new perspective (OAHed).
Yohann	Yohann decided to reduce his car use in favor of cycling and public transport, which helps him avoid traffic jams (OAPra) and the stress associated with driving (OASan). Concerned about the environment (OAEco), he also wants to set an example for his child by adopting sustainable modes of transport. While he owns a car for family outings, he systematically prefers the bike and public transport for his daily commute.
Thomas	Thomas uses the bike for commuting and leisure. A cycling enthusiast since childhood (OAHed), he enjoys the flexibility the bike offers to navigate the city (OAPra). In addition to his daily commute, he regularly participates in bike outings with a cycling club (OASoc). For him, cycling is both a practical mode of transport and a way to socialize.
Marc	Marc uses an electric-assisted cargo bike for city trips. He enjoys the physical activity it provides (OASpo), while teaching his children the importance of sustainable transportation (OAEco). Although he owns a car for longer trips, he consciously makes an effort to use the bike whenever possible. He also uses the car to take his children to school, as it avoids parking difficulties (OAPra).
Philippe	Philippe uses the bike for all his personal commuting. Cycling allows him to avoid traffic (OAPra) and stay active (OASpo). As a craftsman, he still uses the car for work-related travel,
Chloé	Chloé uses the bike as her primary mode of transport for daily commutes. She appreciates the speed and efficiency of cycling in a city with frequent traffic jams (OAPra). Concerned about the environment

 doi:10.20944/preprints202411.1933.v1

(OAEco), she decided to reduce her carbon footprint by prioritizing cycling and participating in events that raise awareness about sustainable mobility (OASoc).

For participants, the bicycle primarily addresses a pragmatic goal (**OA Pragmatic**), meaning it is seen as a practical solution. It is perceived as efficient because it allows for relatively fast, easy, and unconstrained travel from point A to point B. Compared to a car, the bicycle is described as simpler, with fewer requirements; there is no need to find parking, wait for the car to warm up in the winter, deal with traffic jams, keep up with car documents, anticipate technical inspections, or maintain the vehicle. Ultimately, the bicycle provides a mode of transportation that compensates for the loss of flexibility and autonomy associated with other forms of soft mobility like carpooling or public transport. The bicycle is also mentioned in various interviews as a way to alleviate the stress associated with driving and to permanently dissipate the mental load related to owning a motorized vehicle.

Cycling also serves an ecological goal (**OA Ecological**) and can even be part of a broader citizen and ecological commitment, often expressed through involvement in associations. Several participants, whose ecological motivation predominates in their cycling practice, report being active in environmental organizations. As Vincent (2008) shows, these activist practices suggest that the environmental values emphasized by participants are not merely justifications for their cycling practices.

It should be noted, however, that while the rise of cycling in cities suggests an increase in environmental concerns, the ecological objective (OA Ecological) often takes a backseat to pragmatic, sports, health, or hedonistic goals. Thus, except for a minority of activists who are particularly informed about environmental issues, the primary motivation for cycling is practical, sporty, or for pleasure:

"If it really wasn't practical for me to take the bike—say, if the journey was longer—I would without hesitation take the bus, even though I find it really unpleasant. The secondary motivation is sport. The bike lets me do my exercise. And the last thing is ecology, even though that's a really important aspect for me."

Lisa, 31, Bank Employee, Tours

Sport motivation (**OA Sport**) is also a major factor in the desire to cycle. It even appears, in some cases, as an additional motivation that encourages participants to use the bike:

"Sometimes, I can really feel lazy. But just the thought that I'll get my exercise on the bike motivates me to take it. It's really a reason that pushes me."

Marcia, 31, Unemployed, Tours

This motivation is less pronounced among electric bike (E-Bike) users, but still exists. Yannick (34, Social Sciences Teacher, Tours), for example, removes the battery from his E-Bike for ecological reasons, but also to get some exercise. Garance, on her part, finds that using the E-Bike, even without heavy effort, helps to strengthen her back muscles:

"I think it's good to move regularly. Also, I have back problems, so I think it helps me to tone up a bit."

Garance, 42, SES Teacher, Paris

Health motivation (**OA Health**) is also mentioned but remains distinct from the sporting reason. Indeed, for some participants, cycling is much more than just a physical activity. It represents a true philosophy of life, centered on self-care and overall well-being. In this context, cycling becomes a tool for preventing various diseases, strengthening the immune system, and promoting longevity. The cyclist who integrates cycling into their daily routine often does so with the goal of preserving themselves, reducing stress, and feeling better overall. Cycling becomes a way to release endorphins, the "happiness hormones," which help combat stress and depression. Furthermore, the regular pedal rhythm, combined with the scenery, can have a meditative effect, helping individuals to refocus and clear their thoughts.

 doi:10.20944/preprints202411.1933.v1

We also note a hedonistic motivation (**OA Hedonistic**) in the use of the bicycle, in the sense of a practice linked to the search for pleasure and positive sensations. Cycling outdoors allows individuals to reconnect with nature, appreciate the surrounding landscape, take deep breaths, and enjoy the sunshine. For participants, simply changing the environment and leaving enclosed spaces contributes to improving mood and reducing anxiety:

"There's a moment of relaxation on the bike, something I didn't get even while reading. Sometimes, on public transport, I couldn't even take my book out because it was too crowded. The bike is more comfortable, it's a moment of breathing."

Garance, 42, Social sciences Teacher, Paris

Two female participants also mention safety motivation (**OA Safety**). The bicycle is then used, especially for evening outings, to face the risks of public space aggression. They emphasize the ability to escape quickly, unlike walking or using public transport, where one has to wait at a bus stop for several minutes.

"In the evening, I always take my bike, even though I'd like to walk around the city. But the bike is a defense tool for me. I'm less bothered, I can escape quickly. That's the main reason I use the bike in the evening."

Marcia, 31, Unemployed, Tours

In these extracts, the bike, beyond being just a mode of transport, is used as a defense tool, as it allows, through acceleration, to extricate oneself from uncomfortable (e.g., "being bothered") or even dangerous (e.g., "being followed") situations. Moreover, the bicycle can also be perceived as a safer mode of transport compared to the car. For at least two other participants, driving is seen as a dangerous activity (due to the risk of road accidents), with the bicycle providing a safer alternative. For example, Garance (42, Social Sciences Teacher, Paris) finds driving to be a source of suffering, stress, and fear. Discovering the bike, after years of putting up with bus rides she no longer tolerated, was a relief. For Manon (33, Life and earth sciences teacher, Tours), driving is associated with danger when drivers are tired. Therefore, she prefers the bike when she's not feeling physically well:

"For me, there's no safety in the evening. The headlights blind me. Driving at night is really tiring, and I find it very dangerous. It's never changed. Plus, I have a Twingo, so compared to an SUV... [laughs]... When I'm sick, I think it's stupid to take my car because I won't be as attentive."

Manon, 33, Life and earth sciences teacher, Tours

Finally, financial motivation (**OA Financial**) is mentioned, but always in relation to the costs incurred by car use in the city. Compared to the car, the bike does not require fuel costs or parking fees. This motivation is also mentioned in relation to public transport. For instance, Mathéo (33, Stage manager, Tours) chooses to use the bike or walk instead of paying for a bus ride.

Social motivation (**OA Social**) also plays a key role in sustaining the practice of cycling by facilitating meetings and interactions between individuals. This social dimension is particularly noticeable among parents who take their children to school by bike. For them, the trip becomes an opportunity for socialization, both with their children and with other parents or neighbors. This social aspect also extends to those who join cycling communities, whether in organized clubs or informal groups.

Despite the reasons that push individuals to adopt cycling as their primary mode of transport, our study reveals that cyclists rarely completely abandon their cars. This is addressed in the final section of results.

4.2. Cyclists Do Not Completely Abandon the Car

4.2.1. Several Situations of Using the Car

The modal shift to the bicycle does not completely eliminate the use of the car. In some cases, specific events may lead individuals to occasionally maintain car usage, or even adopt other complementary modes of transportation. The reasons include: *distance, work-life management, transportation of goods, climate, and safety.*

 doi:10.20944/preprints202411.1933.v1

4.2.1.1. Distance

It is first observed that for most long-distance trips between home and the destination, the use of the bicycle is limited. This is the case, for example, for the trips made by Lisa (31, Bank Employee, Tours), Yannick (34, Social Sciences Teacher, Tours), Manon (33, Life and earth sciences teacher, Tours), Marc (45, Unemployed, Tours), and Chloé (28, Communications Officer, Nantes), when they visit their parents living in another region. Similarly, trips related to travel are often long distances and take place outside the geographic area of daily life (other regions of France, abroad, to visit grandparents, friends, etc.). In this case, trains and cars are the preferred modes of transport (and airplanes for international trips) because they allow for covering large distances.

The car is therefore used to reach areas that are far from home and poorly served by public transport. Manon explains that she replaces her bike when visiting friends in areas far from Tours:

"And when it's not for work, most of the times I use the car is to visit friends in areas far from Touraine."

Manon, 33, Life and earth sciences teacher, Tours

Similarly, Heidi (66, Retired, Tours) – who practices ceramics – regularly travels to see a sculptor 57 kilometers away from her home. This trip – one of the last she makes by car – seems impossible to complete by bike (it would take an average of 6 hours for a round trip).

Outside of family visits, vacations, and access to poorly served areas, two participants (both teachers) who have been cycling for several years mention specific periods in their professional careers when they had to buy a car to reach rural areas, due to job relocations.

4.2.1.2. Managing Work Life

Other participants mention specific periods in their lives when using a mode of transport other than the car became difficult or even impossible due to time constraints. **Professions with fragmented hours and several hours of break time during the day** (such as teachers, for example) highlight the difficulty of using the bike when the trip has to be made multiple times in a single day.

4.2.1.3. Transporting Goods

On the other hand, it is observed that some leisure or work-related trips are still made by car for a number of participants: these trips often involve **transporting heavy or bulky goods** that are difficult to carry by bike. For example, in the case of Fabien (30, Translator, Tours) and Manon (33, Life and earth sciences teacher, Tours), transporting musical instruments for band rehearsals often requires using the car.

Manon, to get to the middle school where she works, sometimes abandons her bike; the car, with its cabin and trunk, allows her to transport equipment related to her teaching activity:

"This year, I'll go by bike except when I need to bring specific equipment, plants, or biology materials..."

Manon, 33, Life and earth sciences teacher, Tours

The purchase of heavy furniture, or even moving house, almost always justifies using the car, either by using one's own vehicle, renting a car, or borrowing one from a relative:

"At the time, for moving or buying heavy furniture, I would borrow my parents' Renault Espace. We moved in 2013, a year after I arrived. At that time, my wife didn't have a car."

Yannick, 34, Social Sciences Teacher, Tours

However, it should be noted that users of cargo bikes manage this constraint, as they can transport heavy and bulky goods on their bikes.

4.2.1.4. Climate

Adverse weather conditions for cycling are varied and can pose significant obstacles for cyclists, both in terms of **comfort and safety**. While 13 of our participants report being equipped to face bad weather, 7 state that they opt for another mode of transport when weather conditions deteriorate.

 doi:10.20944/preprints202411.1933.v1

"In cold weather, I try to motivate myself to ride my bike, even if it's tough. But in the rain, I'm not there yet, unless it's just a light drizzle."

Fabien, 30, Translator, Tours

Unfavorable weather conditions for cycling include extreme **heat, rain, cold, fog, and snow**. Heat makes cycling exhausting and risky, especially on long trips. High temperatures also cause cyclists to sweat, which can limit cycling, especially for the commute to work:

"If it's too hot, I can't take the bike. I can't show up at a client's place all sweaty, smelling strong [from sweat]."

Philippe, 52, craftsman, Nantes

Rain and snow make the roads slippery, increasing the risk of falls and reducing visibility. Cold weather can cause pain and frostbite, while fog also limits visibility, both for cyclists and motorists. In particular, cycling in heavy rain or snow is considered dangerous because the cyclist becomes difficult to see, increasing the risk of accidents.

4.2.1.5. Safety

Finally, several participants abandon cycling if the route they need to take seems too dangerous. **The fear of accidents** discourages cycling. As previously mentioned, this may be related to bad weather, but also to dense traffic on narrow roads. This is the case for Heidi, who says she avoids certain trips she perceives as too dangerous:

"There are some trips I avoid. I have a friend who lives in Ville-aux-Dames, and I drive to her house. I don't take the bike over the bridge to get there. Too risky."

Heidi, 66, Retired, Tours

The presence of specific infrastructure then has a direct influence on abandoning the bike and is considered a key factor by the majority of participants. Thus, congested, poorly designed, or poorly maintained bike lanes can lead to a modal shift back to the car.

4.2.2. Modal Shift or Systemic Reorganization of Different Transportation Options?

Ultimately, it appears that modal shift is not simply a matter of switching from one mode of transportation to another, but rather involves a systemic reorganization of the different mobility options available. This broader perspective acknowledges that individuals' transport choices are often interconnected and fall within a larger framework of mobility practices.

When a person decides to use a bike instead of a car for certain trips, it does not necessarily mean that they are permanently abandoning the car. On the contrary, it may indicate an intention to integrate the bike into a set of transportation solutions, depending on the specific needs of each situation. For example, a user may prefer the bike for daily trips in the city while still keeping the car for longer journeys or situations that require transporting heavy loads.

This reorganization of transport modes also involves an awareness of the advantages and disadvantages of each option. Users become more sensitive to environmental, economic, and health-related issues, prompting them to think about the optimal use of each mode of transport in their daily lives. Thus, modal shift becomes a process of adaptation and experimentation, where individuals constantly adjust their choices based on contexts, available infrastructure, and social dynamics.

5. Discussion and Implications

Our results corroborate previous work on this topic. For instance, regarding predispositions, we confirm studies on the socialization of travelers (travel socialization studies), such as those by Baslington [62] or Cacciari [63], which state **that early mobility experiences influence the transport modes chosen in adulthood.**

This perspective views mobility as a socialization process in its own right (similar to other cultural aspects) and considers that individuals who regularly used a bike during childhood are more likely to adopt this mode of transport in adulthood due to the skills acquired and the sense of

 doi:10.20944/preprints202411.1933.v1

capability that comes with it [45,64]. It seems that fostering confidence in one's ability to use this mode of transport from a young age, through training programs and encouragement to use bikes, could be an effective strategy. Rigal [2], for example, suggests introducing a bicycle driving license, similar to a car driving license, to establish the bike as a legitimate and fully recognized mode of transport.

Moreover, our work shows, like existing studies, that **the improvement of infrastructure encourages bike usage** [20,43,65]. Studies focus particularly on the creation of quality bike lanes to enhance safety, as well as, and more importantly, the perception of safety [6]. The development of bike parking facilities, showers, changing rooms, and lockers would also promote cycling to work [66,67], with the availability of parking being especially important [68].

It should also be noted that **social and technical innovations** could be key triggers to encourage the transition to cycling. Bike-sharing programs seem to be valuable tools that allow people to try biking without having to purchase or store a bike. Since the introduction of the first Vélib' bike-sharing program, urban cycling for daily commutes has increased, particularly in city centers with more than 100,000 inhabitants, where 60% of trips are under five kilometers [16].

Regarding these kinds of triggers, financial incentives could also play a role. Companies could make biking financially attractive by offering mileage allowances, subsidies for purchasing bikes, or providing company bikes [69].

The **rise of electric-assisted bicycles (e-bikes)** seems to open up new possibilities for cycling in areas that were previously considered inaccessible for example, hilly or more distant areas. E-bikes are particularly popular in regions where cycling rates have been historically low and mainly among older French citizens who had stopped biking, as well as women [16]. E-bikes also allow families with young children to travel by cargo bike.

These studies provide valuable insights into the life trajectories related to cycling. However, there is still a lack of a systematic model to guide the analysis of the process of adopting cycling and thus assist in the development of concrete strategies in rapidly changing urban contexts.

Our study aimed to provide a detailed description of the process of appropriation that leads individuals to switch from the car to the bike. By adopting a fine-grained approach through semi-structured and biographical interviews, we were able to highlight the key stages of modal shift (Figure 1): predispositions to change, triggering factors, the exploration and trial phase, and the instrumental genesis.

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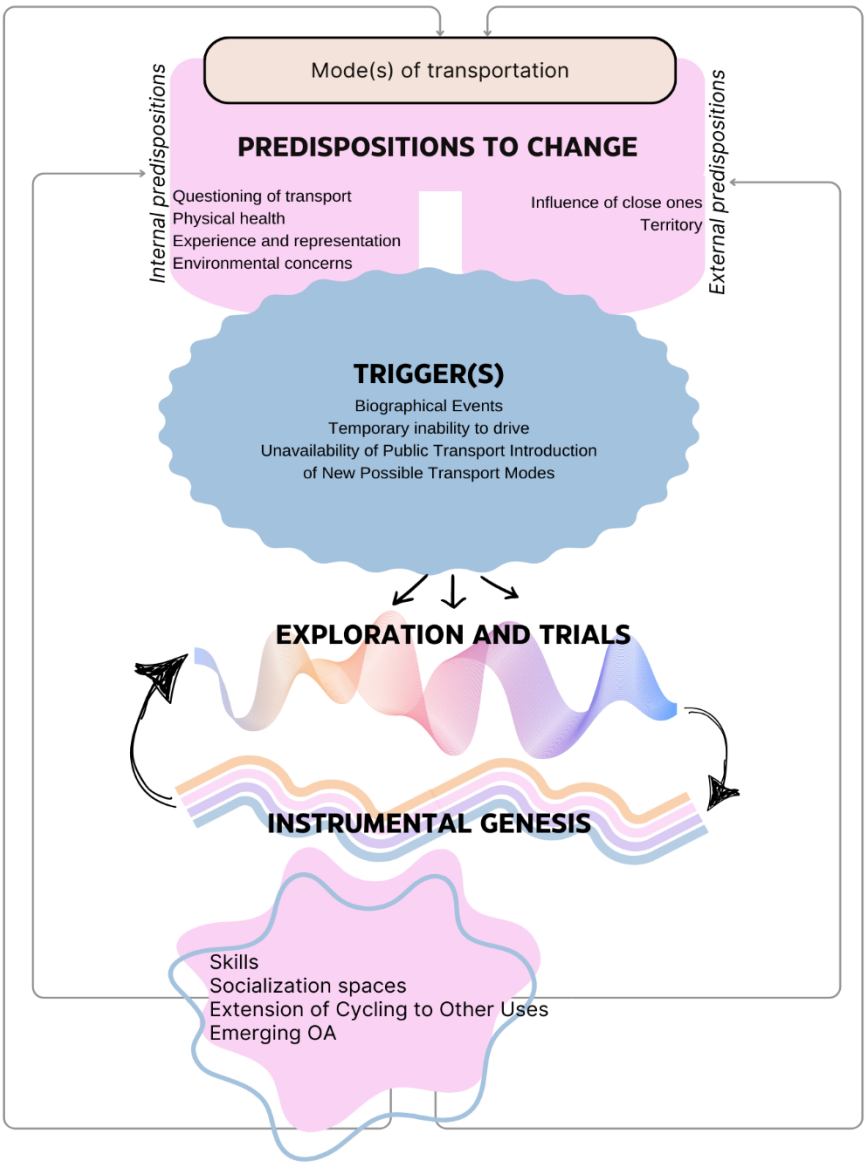

Figure 1. The Key Stages of Modal Shift.

The first two stages (predispositions to change, triggering factors) resonate with the work of Goodwin [70] and later with Vincent [20], which focus on the disruption of habits. Goodwin explains that a deeply ingrained habit can be broken if certain predispositions allow for a 'slow erosion of the attractiveness of the habit,' and if a 'particular, sudden or unexpected' event occurs. While these two stages are indeed the origin of the shift towards cycling, they do not alone explain the long-term adoption of cycling in daily transport practices. Our study thus proposes a model that extends from the initial situation (here, car use) to the integration of a new mode of transport into one's mobility practices (in this case, cycling).

The individual possesses internal predispositions (e.g., experience, physical health, etc.) and external predispositions (e.g., territory, etc.). The initial habit of a transport mode is disrupted by a triggering factor (e.g., moving house, temporary inability to drive, new bike-sharing station, etc.). The individual then begins to consider the bicycle as a possible mode of transport and explores the necessary conditions for making this mobility a reality (e.g., type of bike, equipment, route, etc.). This exploration phase corresponds to the moment when the individual tests various equipment, configurations, and practices. It is an experimental process that allows the discovery of the possibilities offered, evaluating the comfort, performance, and functionality of the different materials

 doi:10.20944/preprints202411.1933.v1

and routes. This phase is often characterized by curiosity and a desire to adapt the practice according to individual needs and lived experiences. This phase is not linear and may involve multiple back-and-forths.

This exploration and trial phase, dynamic and iterative, leads to significant modifications of equipment and practices and transforms into a sustainable cycling routine, allowing each cyclist to find the configuration that works best for them. Deeper transformations gradually encourage the individual to build a cycling identity, notably through the development of skills, the creation of socialization spaces, the extension of practice to other uses, and, finally, the reinforcement of activity objects.

These instrumental geneses will, in turn, feed back into the individual's predispositions, particularly by increasing their cycling experience. The practice of cycling can also influence external predispositions, as territorial policies may, for example, develop infrastructure to accommodate the growing number of cyclists [6].

This model ultimately allows us to understand mobility as a system subject to contingencies and variations. It further views the human not as a passive mobile individual, but as an actor in their own transition, capable of taking initiatives, adapting, and modifying their actions to successfully achieve the objectives of the activity they pursue.

6. Conclusions et Future Research

The study aimed to understand how and why urban residents in France chose to limit or even abandon the car in favor of cycling. The main findings revealed the favorable conditions for modal shift towards cycling, but also the difficulties encountered in certain situations.

From our perspective, another interesting result is that the modal shift is not merely a switch from one mode of transport to another, but rather involves a systemic reorganization of the different mobility options available. This expanded perspective acknowledges that people's transportation choices are often interconnected and fit within a larger framework of travel practices. In future research, it could be relevant to develop a framework to understand this modal shift at the systemic level, such as the concept of "instrument system" [71,72]. This would highlight the complexity of the relationships between citizens and transport modes, shedding light on the process of adaptation and evolution that characterizes the use of instruments in daily practices.

This study also presents several limitations. First, the research was conducted with a limited sample of 20 participants. Although this sample allowed for rich and varied testimonies, it remains relatively small for drawing generalizable conclusions about the entire urban population. Cyclists' behaviors and motivations can vary significantly depending on numerous factors such as age, socio-economic status, or geographic region. Therefore, some viewpoints or experiences may not have been sufficiently represented in the sample.

Furthermore, the diversity of the participants' profiles could also influence the results. While the sample includes individuals who chose to prioritize cycling for ecological, health, or economic reasons, perspectives from other groups might be lacking, such as those who continue to use the car for practical reasons or out of habit. This could introduce bias into the understanding of the motivations and challenges associated with modal transition. The marginalization of cycling practices based on gender, social, or ethnic origin is also clearly identified today and deserves further study in works related to cycling use [36,45,73].

Additionally, the urban context in which the study was conducted may limit the generalizability of the results. The dynamics of the transition to cycling can differ significantly between cities, depending on the availability of cycling infrastructure, local transport policies, and urban culture. Thus, the findings obtained in one city may not be applicable to other urban contexts or rural areas, where the factors influencing the decision to abandon the car may be radically different. For example, rural populations, especially those living in expansive areas with long distances, may face different challenges. In these areas, car use remains dominant, with four out of five trips being by car (Ministry of Ecological Transition and Territorial Cohesion, 2022). Cycling has also significantly declined in

rural areas and multi-polarized communes, where cycling was once the most common mode of transport 25 years ago (5.8% in 1994) [16].

In summary, while this study offers valuable insights into the modal transition towards cycling, its limitations highlight the need for future research with a larger and more diverse sample, as well as the exploration of different urban and rural contexts, in order to better understand the complex dynamics that underlie this phenomenon.

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