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Which policy measures can motivate active mobility in rural and semi-rural areas?

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ABSTRACT

This study investigates which policy measures are able to motivate citizens in rural and semi-rural areas of Lower Austria to use active transport modes for everyday trips. A representative sample was asked to evaluate six walking- and eight cycling-oriented policy measures. We find that the revitalization of village/town centers and infrastructural measures are considered most motivating, and soft measures (such as information provision) least motivating. The respondents' answers are found to depend on their current and intended mobility behavior, but only to a limited extent on their socio-demographic characteristics. Individuals who believe that active mobility is associated with time savings, freedom, ecological benefits, and health tend to feel significantly more motivated by most policy measures. Finally, we observe that respondents regard all policy measures as more motivating to others than to themselves. We discuss strategic answering and behavioral biases as potential explanations.

1. Introduction

Active transport modes can be regarded as advantageous from various perspectives (Steg and Gifford, 2005; Raser et al., 2018; Koszowski et al., 2019; Brand et al., 2021). They are more space-efficient than other transport modes, do not generate emissions or noise, and lead to better health outcomes (e.g. Roe and Aspinall, 2011; Cleland et al., 2008). Moreover, they increase mobility for those population groups who do not have access to a car, such as the youth, and those who do not own a car for reasons of cost. Much of the literature on how to shift mode choice behavior towards active modes in daily travel has so far focused on urban areas. A likely reason is that negative externalities of motorized transport, including congestion, air pollution, accidents, noise, and the use of public space are more salient in urban areas. With the increasing urgency of climate change and the modal split of motorized vehicles still increasing in rural and semi-rural areas, it has, however, been increasingly recognized that also in (semi-)rural areas, mode shifts away from motorized modes towards active modes are necessary (e.g. Carlson et al., 2018; ITF, 2021; Kirchengast et al., 2019).[1]

Achieving such mode shifts in (semi-)rural areas tends to be more challenging than in urban areas. A main reason is that the scope of providing good-quality infrastructure for alternative transport modes at a reasonable cost is much more limited in rural

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[1] Many existing studies on modal shifts in rural areas are focused on poverty or lack of access for persons who cannot afford cars, see for instance Velaga et al. (2012). These problems are not at the forefront of our case study, as most parts of Lower Austria are fairly affluent, and car ownership and usage rates are high (BMVIT, 2016).

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than in urban areas. The resulting lack of adequate alternatives to private car usage goes hand in hand with a car-oriented lifestyle (often involving multiple cars per household) leading to the car being the main transport mode even for short trips[2] (Mattioli et al., 2020). This has implications also for the availability of shops and other facilities in town and village centers, as car owners tend to prefer them to be located outside the centers such that they are easily accessible by car and offer ample parking facilities. Due to the resulting lack of demand, shops and other facilities disappear from town and village centers, decreasing the potential for short everyday trips that can reasonably be made by foot or bicycle. Another consequence of these dynamics is that the implementation of policies aimed at achieving mode shifts away from the private car becomes more difficult, as such policies enjoy little support in the (car-oriented) population. These specific challenges evident in many (semi-)rural areas render it unlikely that policy recommendations for urban areas can directly be transferred to (semi-)rural areas.

In this paper, we investigate which policy measures might motivate residents of (semi-)rural Lower Austria to switch some of their short everyday trips towards cycling and walking. Lower Austria surrounds Austria's capital city Vienna and is characterized mostly by rural and suburban spatial structures. We distinguish between six walking-oriented, and eight cycling-oriented policy measures, including infrastructure investments, financial incentives, regulatory, as well as informational measures and measures targeted at awareness raising. These policy measures have been developed based on existing evidence, expert and citizen interviews, and finally a joint workshop with local policymakers and experts. We focus on short everyday trips, undertaken for utilitarian purposes (commuting, educational, shopping), as they represent the majority of the undertaken trips and tend to have an over-proportionally high modal split for car (BMVIT, 2016). The distinction between trips for utilitarian and non-utilitarian purposes is especially important in the context of active modes, as individuals relatively often engage in walking and cycling for leisure purposes (i.e., without having/wanting to reach a certain destination). In this paper, we will use the expressions "everyday trips" and "trips undertaken for utilitarian purposes" interchangeably.

Our findings are based on a large-scale representative survey among 1026 Lower Austrians conducted in March 2020 (around the onset of the COVID-19 pandemic in Western Europe). Unlike related papers, we do not only investigate whether participants think that a specific policy measure will motivate them to walk/cycle more, but also to what extent they think the policy measures will be able to motivate fellow citizens to engage in more active mobility. To the best of our knowledge, it has not yet been investigated to which extent differences may occur between these two evaluations. A main reason why this is of interest is that citizens have been found to be more likely to evaluate a policy measure as acceptable when they think also others will change their behavior following the policy measure (Eriksson et al., 2006). Thus, the current study also allows us to draw conclusions on which policies are most likely to be supported by citizens.

Besides providing a rich set of descriptive statistics, we focus on explaining the respondents' evaluation of the policies using several types of explanatory variables: socioeconomic variables, variables reflecting current mobility behavior, the (perceived) quality of the pedestrian and cycling infrastructure, as well as psychological variables that are based on the theory of planned behavior (TPB).

This paper is structured as follows. Section 2 contains a review of the relevant literature, while Section 3 provides information on the context of the study, as well as the materials and methods employed. Section 4 presents an in-depth descriptive analysis of the data, and Section 5 the results of the ordered logistic regression models. Section 6 contains a discussion of our findings, while Section 7 concludes by discussing policy implications, limitations, as well as future research.

2. Literature background

Only few papers concerning active mobility have so far explicitly focused on rural areas. One of them is a recent policy report by Kircher et al. (2022), which provides an insightful overview of safety-related obstacles to cycling in rural areas. Research in the U.S. context suggests that access to infrastructure can increase walking in rural areas (Brownson et al., 2000), whereas the impact of various (non-infrastructural) interventions on walking in rural areas was rather low (Brownson et al., 2005). Stewart et al. (2016) find that small-town residents walk more for leisure purposes, but less for utilitarian purposes compared to individuals living in urban areas.

Existing research on intended or actual use of active mobility has often focused on one type of explanatory variables. Some studies (e.g. Krizek and Johnson, 2006; Hackl et al., 2019) emphasize the role of the built environment, typically concluding that the (perceived) access to (high-quality) cycling and walking infrastructure is associated with high usage rates. A larger number of studies has focused on psychological variables (e.g. García et al., 2019; Willis et al., 2015; Muñoz et al., 2016; Félix et al., 2019; Fernández-Heredia et al., 2014; Neto et al., 2020; Ton et al., 2019), usually concluding that these variables play an important role in determining whether someone uses or intends to use active modes.

Those studies emphasizing the role of psychological variables on the intention to use active mobility are often associated with the theory of planned behavior (TPB), as introduced by Ajzen (1991). The TPB is one of the most prominent models to study behavior, and is based on the idea that behavior is influenced by intentions, which in turn are influenced by social norms, attitudes, and perceived behavioral control. It has been frequently employed for predicting travel behavior (Lanzini and Khan, 2017), including active mobility. Specifically, de Bruijn et al. (2009), Dill et al. (2014), and Bird et al. (2018) found support for the theory of planned behavior in explaining walking and cycling. Other examples include Neto et al. (2020) for walking, Liu et al. (2017) for switching

[2] In Austria, 52% of trips are below 5 km; for car trips, the corresponding percentage amounts to 40% (BMVIT, 2016).

away from the car, Muñoz et al. (2016), Félix et al. (2019) for urban biking, and Fernández-Heredia et al. (2014) for biking in general.

Also the analysis conducted in this paper is inspired in at least two ways by the TPB. First, in line with the TPB, we study intentions. Specifically, we study how specific policy measures affect the intended use of active mobility rather than the actual use (studying the actual impact of the policy measures on behavior would not have been feasible in our study area, as the policy measures have not yet been implemented). Second, we account for variables based on the TPB, including perceived behavioral control and social norms in our analysis. However, our analysis also deviates in various ways from typical applications of the TPB. First, we account for socioeconomic variables, variables that represent current mobility behavior, and perceived infrastructure quality separately from the TPB-based variables. That way, we can test the relative importance of the different variables explaining active mobility. Second, unlike in typical TPB applications, we do not study a general intention (to walk/cycle more; see for instance Willis et al., 2015). Instead, our aim is to analyze whether specific policy measures would motivate respondents to cycle/walk more for everyday journeys, as well as whether they believe that these measures would motivate other citizens.

Our study adds to the body of literature that investigates the potential of specific measures to boost active mobility (see for instance Noland and Kunreuther (1995) and Yang et al. (2010)). The present study exceeds the scope of most existing studies, which mostly look at a limited number of policy measures, or only a specific type of policy measures. For instance, soft policy measures to foster mode switches away from car usage are investigated by Richter et al. (2011), and information interventions to promote active mobility in Austria have been studied by Markvica et al. (2020). Finally, the present study also (indirectly) allows for conclusions on the public support for specific policies, as we find that the stated intentions regarding the use of active travel modes are likely to be influenced by a (dis-)like for specific policies. Determinants of the support for environmental policies have for instance been summarized by Drews and Van den Bergh (2016) and, more recently, by Ejelöv and Nilsson (2020). In general, citizens tend to prefer "soft" measures over pricing and regulatory measures (e.g. Attari et al., 2009).

3. Context, material and methods

3.1. Context of the study

The study took place in Lower Austria, which is located in the Northeast of Austria, and has a population of about 1.7 million inhabitants and a population density of 88.2 persons/km^2 (while the Austrian average is 106.5) (Statista, 2021b). The yearly median income per inhabitant of EUR 24,900 (in 2019) is the highest among the nine Austrian provinces, with the Austrian average amounting to EUR 23,700 (Statistik Austria, 2020). Unlike in other countries where rural areas often have few public facilities, in Lower Austria (similar as in other Austrian regions) small municipalities tend to have relatively high-quality public facilities such as primary schools (on average, primary schools in Lower Austria have only around 100 pupils (BMBWF, 2019)). Nevertheless, most of the working population commutes, with less than 10% working in the municipality in which they live (Statistik Austria, 2021).

88% of the Lower Austrian land area is either used for agriculture (48%) or forestry (40%) (Hemetsberger, 2019). Its capital city is St. Pölten with about 56,000 inhabitants, which is followed by Wiener Neustadt (46,000 inhabitants), and Klosterneuburg (27,000 inhabitants). These towns tend to be embedded in rural areas or situated at the outskirts of the urban agglomeration of Vienna (the capital city of Austria which has a population of about 1.9 million), which Lower Austria surrounds (see Fig. 1 for a map). Those parts of Lower Austria that are close to Vienna tend to have a higher population density, better public transport connectivity, and mostly exhibit substantial population growth rates. Most of the peripheral areas, in contrast, have been losing population over the past decades (Hemetsberger, 2019). Our study hence covers different degrees of rurality, ranging from small villages with few hundred inhabitants to mid-sized towns of around 50,000 inhabitants. Due to the number of inhabitants and associated facilities and infrastructure, the latter cannot be considered exclusively rural. Instead, we refer to these agglomerations as semi-rural, which reflects a mix between rural and urban characteristics.

Car dependency is high in Lower Austria, and the car ownership rate is still increasing: while the number of cars per 1,000 inhabitants of Lower Austria was just above 600 in 2011, it amounted to 659 at the end of 2020 (compared to 570 in all of Austria, and 374 in Vienna) (Statista, 2021a; Hemetsberger, 2019). According to the most recent official mobility survey in Austria (conducted in 2013/13) (BMVIT, 2016), the modal split in Lower Austria is as follows: walking: 14%, cycling: 8%, car driver: 51%, car passenger: 13%, public transport: 13% (for Austria (Vienna) the corresponding percentages are: walking: 18% (25%), cycling: 7% (4%), car driver: 47% (25%), car passenger: 12% (8%), public transport: 17% (38%)).[3] Also the daily distance covered during workdays is over-proportionally high in Lower Austria and amounts to 44 km/day (the Austrian average amounts to 36 km/day). One reason is that about a quarter of the working population commutes to Vienna for work (Statistik Austria, 2021).

[3] Relatively low usage rates of actives modes in rural areas have also been found for other countries (e.g. Van Cauwenberg et al., 2012; Sjolie and Thuen, 2002).

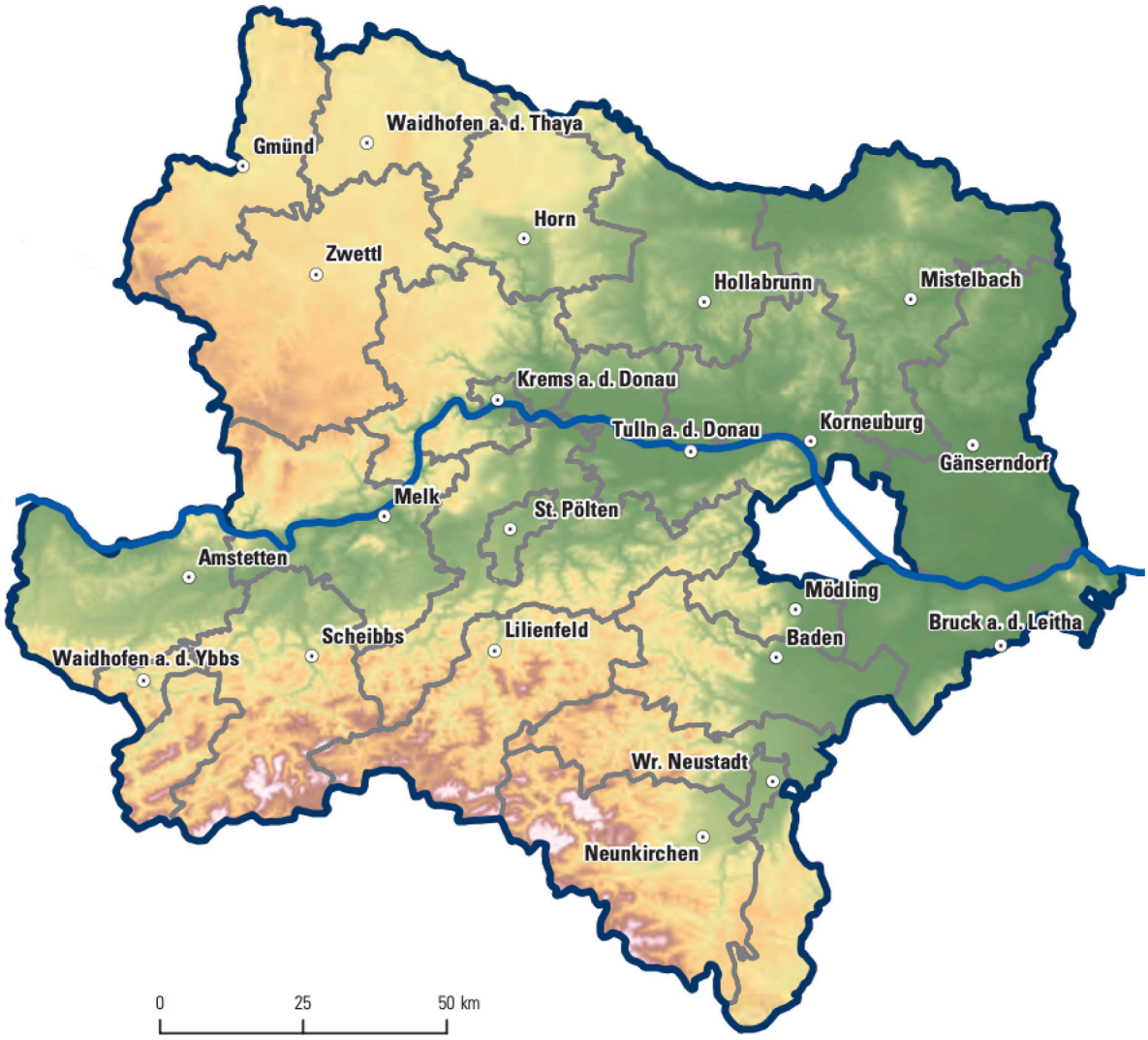

Fig. 1. Map of Lower Austria , with the white area in the middle corresponding to Vienna.
Source: Taken from Hemetsberger, 2019.

3.2. Survey

The analysis presented in this paper is based on a survey that was conducted between 10 and 23 March 2020.[4] We made use of a market research company to collect a sample that is representative of the Lower Austrian population with respect to gender, age, residential district, and education. The market research company administered the survey online (80%) and via telephone (20%) and collected 1026 responses, fulfilling the requirement of a representative sample along the aforementioned characteristics. Due to the use of the market research company, the underlying response rate is unknown.

The questionnaire consisted of four parts.[5] In the first part, detailed information on socioeconomic variables was collected. The second part contained questions on current and planned mobility-related behavior. In the third (and main) part, respondents were

[4] This time span coincides with the first Austrian-wide lock-down due to COVID-19, which began on March 16. As the pandemic had just started at this point, and it was not clear how long it would last, we expect that the answers provided by the respondents have not been significantly affected by COVID-19. Unlike in later phases of the pandemic, it is likely that people were less focused on the effects of COVID-19 on mobility and their choice of transport mode (especially with respect to longer-run adaptations) but rather on the immediate health impacts.

[5] The questionnaire and the collected data are available from the authors upon request.

asked to evaluate to which extent specific cycling and walking-oriented policies would motivate them to make more of their short everyday journeys by bicycle or on foot, as well as the extent to which they believe that these policies would on average motivate other Lower Austrians to make more of their short everyday journeys by bicycle or on foot. Finally, the fourth part included questions on various variables based on the theory of planned behavior. Respondents took on average 15 min to answer the survey questions.

3.3. Policy measures

The central part of the questionnaire concerned the evaluation of cycling- and walking-oriented policies. To determine which policies to present in the survey, we designed a participatory, trans-disciplinary process to ensure that the interests and assessments of all stakeholders as well as already existing knowledge are incorporated.

We started with a comprehensive literature research to collect scientific evidence as well as best-practice examples on motivators and barriers for cycling and walking. Also, evidence on existing national and international policies on how to promote walking or cycling in rural and semi-rural areas was examined. Moreover, we conducted interviews with five leading Austrian experts in the field of mobility as well as 50 in-depth interviews with Lower Austrian citizens. The purpose of these citizen interviews was to collect evidence what factors are motivating and/or holding back Lower Austrians with respect to active modes of transport, and to find out what measures could motivate them to cycle or walk more often. The interviews lasted on average 45 min and were conducted by psychologically trained interviewers.

Based on these inputs (literature, best practice, expert and citizen interviews), we prepared a list of proposed measures deemed adequate to motivate Lower Austrian citizens to cycle or walk more frequently. Subsequently, we organized a workshop where we presented the measures to policymakers responsible for mobility and transport policy in Lower Austria as well as scientific experts in the field. Workshop participants discussed the proposed measures regarding their potential effectiveness and practical feasibility, and could suggest additional or modified measures. At the end, the participants could vote for a set of five walking and five cycling measures that they considered most promising and realistic. These votes as well as further in-depth discussions on each of the measures served as a basis for the definition of the final proposed measures listed below (the brackets contain the abbreviated titles of the measures that are used in the results tables in the remainder of the paper).

Walking-oriented policy measures (to foster walking for everyday trips for distances up to 5 km):

1. **Revitalization of town and village centers [Revitalization].** More stores and local suppliers in town and village centers, such that shopping can be done more easily on foot or by bike; improvements of the public space through more seating possibilities, plants, and fountains, especially around bus stops, schools and stores.
2. **New footpaths [Footpaths].** New footpaths that are structurally separated from the road are built around schools, train stations, and local centers (with benches, lighting, and information).
3. **Parental responsibility [Parent resp.]** Information and motivational activities for parents and their children that educate about the health benefits of walking and provide tips on how to motivate children to be more active in everyday life in a fun way.
4. **Speed limit of 30 km/h [30 km/h].** Introduction of speed limits of 30 km/h or "shared spaces"[6] in town and village centers to make walking and cycling safer.
5. **Personalized mobility app on the cell phone [App].** A route planner that records routes and paths, suggests alternatives and allows a comparison between cycling, walking and car usage in terms of health, CO2 and costs. It also enables participation in competitions.
6. **Mobility advice center [Advice center].** Establishment of a central advice center on mobility related topics in Lower Austria with the aim to provide advice to citizens, schools, companies, and municipalities.

Cycling-oriented policy measures (to foster cycling for everyday trips for distances up to 10 km):

1. **Revitalization of town and village centers [Revitalization].** See description above.
2. **Safe bike storage [Storage].** Due to the expansion of theft-proof bicycle parking facilities at train stations, bicycles can be easily and safely parked at train stations. Combining biking and public transport thus becomes more convenient.
3. **Fast bike lanes [Bike lanes].** By 2030, 200 km of fast cycling connections (cycle paths structurally separated from the road) are built in those areas of Lower Austria that have the largest potential for commuting by bicycle.
4. **Rewards for cycling [Rewards].** Gifts and special discounts from stores, businesses, and employers for traveling by bike rather than the car.
5. **Information and Awareness [Info & awaren.].** Provide information about the health and climate benefits of cycling in newspapers, radio, and television to improve the image of cycling.
6. **Personalized mobility app on the cell phone [App].** See description above.
7. **Speed limit of 30 km/h [30 km/h].** See description above.
8. **Mobility advice center [Advice center].** See description above.

[6] "Shared spaces" is a concept where pedestrians, cyclists, car drivers and other road users share a common space. Elements that traditionally separate them (e.g., sidewalks) are removed. The aim is for car drivers to reduce their speed due to the (potential) presence of pedestrians and cyclists on the road.

Table 1
Overview TPB-based variables.

Compound variable	*"To switch from car to bike or walking for short everyday journeys ..."*	Mean	sd.	Cronbach's α
Ecological beliefs	...is important to me because it allows me to reduce climate change	3.68	1.20	0.88
	...is important to me because I respect nature	4.03	0.99	
	...is important to me because I want to live in unity with nature	3.71	1.08	
	...is important to me because I want to protect climate and nature	3.79	1.15	
Health beliefs	...implies more sports and is good for my health	4.24	0.93	0.86
	...leads to more exercise and increases my resilience against illnesses	4.23	0.90	
	...improves my physical and psychological well-being	4.08	1.00	
	...is an outdoor activity, which is good for my fitness	4.33	0.85	
Social norms	...is something that most of my friends do	2.96	1.15	0.81
	...is something most of the people I know try to accomplish	3.31	1.12	
	...is important to most people I know	3.32	1.14	
Lack of perceived behav. control	...is unfortunately not possible for me	2.76	1.41	0.77
	...is very difficult for me	2.87	1.31	
	...is something that is out of my control	2.70	1.38	
	...is impossible because of time constraints; I am always in a hurry.	2.86	1.31	
Time savings	...implies time savings	2.43	1.29	–
Freedom	...means freedom and independence	3.53	1.26	–
Observations	1026			

Note: The answers to the question items were recorded along a Likert scale, and hence are of ordinal nature. However, since only the endpoints of the scale were verbally described (*"completely agree"* vs. *"completely disagree"*), we believe that the distance between the 5 points is not subjective, and hence interpreting the answers along a continuous scale is warranted.

3.4. Measuring intentions

In the survey, the policy measures outlined in the previous section and their corresponding descriptions were shown in random order for each respondent. After each policy presentation, survey participants were asked two questions: (1) *"Is this measure able to motivate **Lower Austrians** to cycle/walk more often for short everyday journeys?"* (2) *"Is this measure able to motivate **you** to cycle/walk more often for short everyday journeys?"*. Respondents stated their answers using a 5-point Likert scale with labeled endpoints (1 = motivates Lower Austrians/me a lot, 5 = does not motivate Lower Austrians/me at all). Finally, respondents were asked to state which of the proposed measures would *motivate them the most to cycle/walk more for short everyday journeys?* (instead of selecting one specific policy measure, they could also opt for "all" or "none"). Please note that respondents were told to consider everyday trips for commuting, educational, and shopping purposes (but not for leisure purposes), hence the type of trips we here refer to as utilitarian.

3.5. Variables based on the theory of planned behavior

This section provides some background on the six variables used in our analyses that are based on the theory of planned behavior (TPB) (see Section 2). All six variables were measured with statements that start with *"To switch from car to bike or walking for short everyday journeys..."*. Respondents evaluated each statement on a five-point Likert scale with labeled endpoints: 1 = I fully agree, 5 = I fully disagree. Some of the variables are defined as compound variables based on multiple of these statements. In such instances, all items have the same weight. An overview of the statements and the corresponding (compound) variables can be found in Table 1. The table also shows the Cronbach's alpha test statistic for the compound variables, indicating that all of them have sufficient internal consistency.[7]

Four out of the six variables refer to attitudes, which in turn are based on a set of beliefs regarding the outcomes of a specific behavior. Here, we measure behavioral beliefs to assess the respondents' attitudes to ecological factors (four items; see Stern et al., 1999; De Groot and Steg, 2007), health (four items; see Silberstein et al., 1988), time savings, and freedom consequences. Ecological beliefs reflect the extent to which respondents believe that cycling and walking have positive effects on the nature and the climate. Health beliefs reflect the extent to which respondents believe that engaging in active mobility improves their health outcomes. Beliefs concerning time savings imply whether and to which extent respondents believe that engaging in active mobility will shorten their travel times. Finally, freedom beliefs reflect to which extent respondents believe that walking and cycling are associated with freedom and independence.

Moreover, the TPB proposes that the intention to engage in a specific behavior is influenced by social norms. Social norms reflect the extent to which others approve of a specific behavior, i.e., in our context, the use of active mobility for everyday trips. The stronger the corresponding social norms are, the stronger one would expect the intention to adopt active mobility to be. Here, social norms were measured with three items (see Noblet et al., 2014).

[7] It is advised that the test statistic should exceed 0.7 (Kline, 2015); in our case all 4 compound variables have a test statistic above or close to 0.8, with 0.77 for perceived lack of control being the lowest.

Table 2
Correlations between the TPB-based variables.

	Ecological	Health	Social norms	Per. behav. control	Time savings	Freedom
Ecological	1.00					
Health	0.67***	1.00				
Social norms	0.52***	0.38***	1.00			
Per. behav. control	0.19***	0.29***	−0.03	1.00		
Time savings	0.36***	0.20***	0.49***	0.04	1.00	
Freedom	0.54***	0.48***	0.49***	0.24***	0.43***	1.00

Note: Significance levels: * 5%, ** 1%, *** 0.1%.

The final variable concerns perceived behavioral control, which refers to the extent to which individuals feel they are able to use active transport modes. The stronger perceived behavioral control, the stronger one would expect the intention to use active transport modes to be. The corresponding variable is here defined in terms of the perceived *lack* of behavioral control, and is measured with four items shown in Table 1 (see Noblet et al., 2014; Ertz et al., 2016). In the descriptive and regression analyses, we will reverse the definition in order to obtain an indicator for perceived behavioral control.

Table 1 shows that the average agreement among respondents is particularly strong for the health-related statements, followed by the ecological statements, and the statement on freedom and independence. It is also interesting to note that almost all the TPB-based variables tend to be significantly positively correlated (see Table 2).

4. Descriptive analysis

In this section we provide an overview of the descriptive statistics in terms of socioeconomic characteristics, past and planned travel behavior, as well as the TPB-based variables and perceived infrastructure quality. We present the statistics for the total sample and in addition, for different municipality sizes (as proxy for the extent of rurality), and for three relevant population segments that differ in terms of their affinity for active mobility. We then proceed with presenting descriptive statistics regarding the respondents' perception of the motivating effect of the proposed policy measures on themselves and others.

4.1. Descriptive analysis: total sample

Our sample is representative of the Lower Austrian population in its main socioeconomic characteristics (age, education, and district of residence). Its characteristics are summarized in Table 3. We find that a quarter of respondents live in villages with less than 2,000 inhabitants and hence in places that can be considered very rural; half of respondents live in smaller agglomerations with 2,000 to 10,000 inhabitants, and the remaining quarter in somewhat more urban places with more than 10000 inhabitants. Around half of the sample consider the pedestrian and cycling infrastructure at their place of residence very good or good, while around 20% consider it very bad or bad. In terms of their overall mobility-related behavior, 90% indicate that they regularly drive a car. 80% of respondents state that they walk for leisure purposes, and 60% cycle for leisure purposes. For utilitarian purposes, the corresponding percentages are substantially lower: 40% walk for utilitarian trip purposes, while only 19% cycle for utilitarian trip purposes. According to the behavioral intentions reported in the survey, a large majority of respondents (71%) intends to walk more for utilitarian purposes in the future. For cycling, the corresponding percentage is somewhat lower (58%), but still substantial.

4.2. Descriptive analysis: municipality size

Table A.10 (see appendix) shows how the mobility-related variables differ across the four different municipality sizes distinguished in the questionnaire. In line with defining the study area as rural or semi-rural, we find that even in the larger towns (more than 10000 inhabitants), almost 90% drive a car, and less than 60% use public transport, which is not significantly different from the corresponding values for smaller municipalities.[8] In line with existing evidence (e.g. BMVIT, 2016), we find that cycling for leisure and for utilitarian purposes is more common in the larger municipalities, possibly also due to the better local availability of shops and other types of amenities. This finding goes hand in hand with both pedestrian and cycling infrastructure being evaluated more positively in the larger municipalities, as well as perceived behavioral control with respect to active mobility, and the attitude that the use of active mobility is associated with time savings being more predominant there. Additionally, we can observe that the extent to which respondents feel motivated to use active modes more is quite independent of the municipality size. An exception is revitalization, which is deemed more motivating for cycling as well as walking by respondents living in larger municipalities. This might be due to a higher perceived potential for revitalization. Additionally, also bicycle storage, and the speed limit are found to be perceived as more motivating for cycling in larger municipalities.

[8] For comparison, a recent research project (https://www.appraise-mobility.at/) showed (in a survey conducted among a representative sample of Viennese) that in Vienna the opposite is true: almost 90% use public transport, while only 62% drive a car.

Table 3
Descriptive statistics: total sample and segments.

Variable	All	Walking affinity			Cycling affinity		
		High	Medium	Low	High	Medium	Low
Socioeconomic variables [share]							
Gender: female	0.50	0.48	0.52	0.45	0.43	0.51	0.54
Age: 16–29	0.19	0.21	0.18	0.19	0.19	0.20	0.15
Age: 30–49	0.33	0.32	0.35	0.16	0.32	0.37	0.22
Age: ≥50	0.48	0.47	0.47	0.65	0.49	0.43	0.63
Education: high-school or higher	0.29	0.37	0.25	0.19	0.32	0.32	0.18
Household net income: ≤1649 Euro	0.14	0.15	0.14	0.13	0.21	0.13	0.14
Household net income: 1650–2999 Euro	0.35	0.36	0.35	0.37	0.32	0.36	0.36
Household net income: ≥3000 Euro	0.31	0.31	0.31	0.31	0.24	0.33	0.30
Household net income: unknown	0.20	0.19	0.20	0.19	0.24	0.18	0.20
Children (y/n)	0.22	0.20	0.24	0.10	0.24	0.24	0.15
Inhabitants: ≤2000	0.25	0.18	0.29	0.18	0.13	0.26	0.29
Inhabitants: 2001–5000	0.29	0.30	0.29	0.26	0.24	0.31	0.28
Inhabitants: 5001–10000	0.21	0.22	0.19	0.24	0.26	0.20	0.20
Inhabitants: >10000	0.26	0.30	0.22	0.32	0.38	0.23	0.24
Current mobility-related variables [share]							
Drives a car	0.90	0.83	0.94	0.92	0.79	0.94	0.88
Uses public transport	0.52	0.69	0.45	0.29	0.73	0.54	0.35
Commutes	0.56	0.57	0.58	0.37	0.45	0.63	0.45
Owns a bike	0.71	0.77	0.72	0.37	0.97	0.83	0.23
Walks for leisure purposes	0.80	0.72	0.92	0.00	0.84	0.82	0.71
Cycles for leisure purposes	0.60	0.67	0.59	0.26	0.73	0.79	0.00
Walks for util. purposes: Daily	0.17	0.49	0.00	0.00	0.29	0.15	0.14
Walks for util. purposes: Multiple times/week	0.17	0.51	0.00	0.00	0.27	0.18	0.10
Walks for util. purposes: Multiple times/month	0.06	0.00	0.08	0.15	0.04	0.06	0.07
Walks for util. purposes: Rarely/never	0.60	0.00	0.92	0.85	0.40	0.61	0.70
Cycles for util. purposes: daily	0.05	0.08	0.03	0.05	0.32	0.00	0.00
Cycles for util. purposes: Multiple times/week	0.10	0.17	0.07	0.05	0.68	0.00	0.00
Cycles for util. purposes: Multiple times/month	0.04	0.06	0.03	0.02	0.00	0.06	0.01
Cycles for util. purposes: Rarely/never	0.81	0.70	0.87	0.89	0.00	0.94	0.99
Perceived infrastructure quality [share]							
Pedestrian infrastructure: (very) good	0.52	0.64	0.48	0.29	0.64	0.53	0.43
Pedestrian infrastructure: average	0.28	0.26	0.29	0.31	0.28	0.29	0.28
Pedestrian infrastructure: (very) bad	0.19	0.09	0.23	0.40	0.08	0.19	0.28
Cycling infrastructure: (very) good	0.51	0.53	0.52	0.32	0.61	0.55	0.36
Cycling infrastructure: average	0.30	0.32	0.28	0.34	0.30	0.28	0.35
Cycling infrastructure: (very) bad	0.19	0.14	0.20	0.34	0.09	0.17	0.29
Intentions [share]							
Walk more: yes	0.19	0.32	0.14	0.00	0.22	0.21	0.12
Walk more: rather yes	0.52	0.48	0.60	0.00	0.58	0.55	0.40
Walk more: rather no	0.22	0.17	0.22	0.58	0.17	0.18	0.35
Walk more: no	0.06	0.03	0.05	0.42	0.03	0.05	0.13
Cycle more: yes	0.15	0.19	0.14	0.03	0.43	0.15	0.00
Cycle more: rather yes	0.43	0.51	0.42	0.15	0.48	0.58	0.00
Cycle more: rather no	0.24	0.16	0.28	0.35	0.04	0.22	0.42
Cycle more: no	0.17	0.13	0.16	0.47	0.05	0.05	0.58
TPB-based variables [5-point scale (1–5)]							
Ecological	3.80	4.07	3.73	3.06	4.27	3.86	3.34
Health	4.22	4.41	4.19	3.45	4.56	4.30	3.80
Social	3.20	3.41	3.14	2.56	3.56	3.22	2.91
Perceived behavioral control	3.20	3.52	3.06	2.81	3.80	3.20	2.84
Time savings	2.43	2.81	2.28	1.79	3.25	2.38	2.06
Freedom	3.53	3.91	3.40	2.58	4.22	3.56	2.98
Number of respondents	1026	349	615	62	152	634	240
Percentage	100	34.0%	60.0%	6.0%	14.8%	61.8%	23.4%

Note: We find significant differences (p-value < 0.05) across the three affinity segments for almost all variables shown in the table. The only exceptions are "gender", "children", and "income". Moreover, differences in "age" are only significant for cycling, but not for walking.

4.3. Descriptive analysis: three segments

As we observed substantial heterogeneity with respect to current and intended future use of active modes, we define three segments separately for cycling and walking[9]:

- **High cycling/walking affinity**: respondents who already cycle (walk) regularly (multiple times per week) for utilitarian purposes.
- **Medium cycling/walking affinity**: respondents who do not cycle (walk) regularly for utilitarian purposes (multiple times per month or less), but have the intention to do so in the future, or already cycle (walk) regularly for leisure purposes.
- **Low cycling/walking affinity**: respondents who do not cycle (walk) regularly (rarely/never) for utilitarians purposes and leisure purposes, and have no intention to do so in the future.

Table 3 shows that only a minor share of the respondents has low walking affinity (6%), whereas almost a quarter of them can be assigned to the low-affinity segment for cycling. Similarly, about a third of the respondents has high walking affinity, whereas only 15% have high cycling affinity.

Table 3 shows that the older population group (above 50 years) is over-represented in segments with low and medium cycling/walking affinity. This is not surprising as the use of active modes generally tends to be higher among younger population groups (e.g. Brainard et al., 2019). Individuals with a high-school degree are over-represented in segments with high cycling/walking affinity. We also find that the share of individuals who drive a car is substantially lower than average in segments with high cycling and walking affinity. Interestingly, those with high and medium cycling affinity have a much more positive perception of infrastructure quality for the corresponding transport mode (biking/walking) compared to those with low biking/walking affinity, probably because the higher (perceived) quality leads to more active mobility. However, it could also be an attempt to reduce internal dissonance (see for instance Kroesen et al., 2017): those who do not engage in active mobility might evaluate the corresponding infrastructure negatively in order to (consciously or subconsciously) justify their mode choice behavior.

Regarding the difference in attitudes across segments, we find that all TPB-based variables have the highest scores in segments with high cycling/walking affinity, followed by segments with medium cycling/walking affinity and then by segments with low medium cycling/walking affinity. But especially for health and ecological beliefs even for those with low cycling/walking affinity reach fairly high average scores.

4.4. Descriptive analysis: walking-oriented policy measures

When asked about which of the six presented policy measures would motivate the respondents the most to shift their everyday mobility towards walking (see first two columns in Table 4: "all"), the revitalization of town and village centers is considered most motivating by 38% of respondents, followed by improved footpaths (20%). The measures selected least often are the information-related measures (i.e., mobility app (6%) and mobility advice center (2%)). It is striking, yet not unexpected, that the share of respondents answering that none of the policies would make them walk more for utilitarian purposes goes from 6% in the high affinity segment, to 11% in the medium affinity segment, and finally to 39% in the low affinity segment.

As expected, the evaluations of the individual measures correspond quite closely to the ranking elicited in the above-described question (see again Table 4), which is also true for the rankings obtained for the three segments according to walking affinity. We observe for all measures that those with high walking affinity assign the highest scores for how motivated they feel by a specific policy measure, followed by those with medium affinity, which in turn are followed by those with low affinity.

Similarly, when respondents were asked to evaluate each measure (again on a 5-point-scale) in terms of its potential to motivate *other* citizens of Lower Austria to make more everyday journeys by foot, we again find a similar ranking of the policy measures. Interestingly, on average respondents perceive all the measure as more motivating to others than to themselves. The corresponding gap is on average 0.25 on the 5 point scale, and is significantly different from 0 for all policy measures. Among the three segments, only those with high walking affinity assume that Lower Austrians feel as motivated by the measures as they are themselves.

4.5. Descriptive analysis: cycling-oriented policy measures

For the cycling measures, which are presented in Table 5, the results are qualitatively similar to those obtained for the walking measures. Revitalization of town and village centers is the measure chosen the most as being capable of shifting their everyday mobility towards cycling, followed by rewards for cycling, and high-speed cycling paths. Again, the measures related to information and awareness rank lowest. Within the three segments according to cycling affinity, a similar pattern emerges, with the main difference being that among those with high cycling affinity, investments in high-speed cycling paths are chosen most frequently. Moreover, in the segments with high and medium cycling affinity, also rewards are chosen relatively often as most motivating.

[9] An alternative to forming the segments according to the observed variables would be to perform a latent class analysis, where the classes emerge from the data rather than being imposed by the researcher, as in our approach. In the context of our study, the latent class approach would have the drawback that the emergent classes will be different for each measures and we would hence have different class structures for each of the 14 regressions. Due to the sheer number of classes, it would be nearly impossible to provide a concise overview of the results.

Table 4
Descriptives: walking-oriented policies.

	(1)		(2)		(3)		(4)	
	All		High affinity		Medium affinity		Low affinity	
	Mean	sd	Mean	sd	Mean	sd	Mean	sd
Which measure would motivate you the most?								
Revitalization	0.38		0.38		0.39		0.24	
Footpaths	0.20		0.24		0.18		0.13	
Parent resp.	0.09		0.08		0.09		0.08	
30 km/h	0.07		0.07		0.07		0.06	
App	0.06		0.05		0.06		0.02	
Advice center	0.02		0.02		0.02		0.05	
None	0.11		0.06		0.11		0.39	
All	0.08		0.09		0.08		0.03	
Is this measure able to motivate you? (1–5)								
Revitalization	3.94	1.16	4.19	1.05	3.90	1.13	2.95	1.42
Footpaths	3.79	1.20	4.06	1.12	3.74	1.14	2.77	1.51
Parent resp.	3.29	1.29	3.51	1.32	3.26	1.23	2.31	1.30
30 km/h	3.01	1.46	3.35	1.47	2.90	1.42	2.18	1.34
App	2.91	1.40	3.09	1.44	2.92	1.35	1.84	1.15
Advice center	2.73	1.29	2.88	1.36	2.72	1.24	2.05	1.17
Is this measure able to motivate others? (1–5)								
Revitalization	4.09	0.96	4.24	0.91	4.06	0.95	3.63	1.15
Footpaths	3.96	0.98	4.06	0.96	3.94	0.98	3.60	1.03
Parent resp.	3.64	1.06	3.80	1.01	3.57	1.08	3.45	1.02
30 km/h	3.27	1.32	3.47	1.28	3.17	1.33	3.08	1.26
App	3.18	1.22	3.33	1.25	3.16	1.21	2.66	1.10
Advice center	3.04	1.14	3.15	1.16	3.02	1.13	2.61	1.06
Observations	1026		349		615		62	

Note: Note that the answers to the question items "*Is this measure able to motivate you?*" and "*Is this measure able to motivate others?*" have been measured along a 5-point Likert scale. However, since only the endpoints of the scale were verbally described (*"motivates me/Lower Austrians very much"* vs. *"does not motivate me/Lower Austrians at all"*), we believe that the distance between the 5 points is not subjective, and hence interpreting the answers along a continuous scale is warranted. We find that the difference between these two question items is statistically significant (p-value < 0.1) for all measures and affinity groups, except for some associated with the high affinity segment (revitalization, footpaths, speed limit).

When we take a closer look at how each cycling-oriented measure is evaluated (on a scale of 1–5) (see Table 5), town revitalization has again the highest score, followed by the two infrastructural measures: bike storage and high-speed cycling paths. It is striking that in the segment with high cycling affinity, four policy measures obtain a score above 4, indicating that even though the respondents assigned to this group already exhibit high cycling affinity, they see large potential to cycle even more in the future. When asked to which extent the eight cycling-oriented policy measures are able to motivate other citizens of Lower Austria, we again observe that respondents expect others to be more motivated than they are themselves. This is especially true for members of the low and medium cycling affinity segments. The gap is on average 0.29 on the 5-point-scale, and is statistically different from 0 for all eight measures.

5. Explaining the motivating power of the policy measures

In this section, we present the estimation results of models that try to explain to which extent respondents state that a specific policy measure can motivate them as well as others to make more of their everyday trips by foot or bicycle. For this purpose, we use ordered logistic regression models, and a subset of those variables shown in Table 3 as explanatory variables. In the model specifications presented here, we have excluded those variables that exhibited coefficient estimates not significantly different from zero in a large majority of the 14 (policy-specific) models. Moreover, we excluded some that may be endogenous, including the intention to walk/cycle more in the future and bike ownership. The remaining explanatory variables include:

- Standard socio-economic variables including *age, education, and (household) income*
- *Number of inhabitants*: municipality size serves as a proxy for the extent of rurality
- Variables reflecting current mobility behavior: whether the respondent *drives a car*, and whether he/she *walks/cycles for utilitarian purposes*
- The *perceived quality of pedestrian/cycling infrastructure*: serves as a proxy for infrastructure quality
- Six TPB-based variables as introduced in Section 3.5, namely the respondents' *ecological, health, time savings, and freedom* beliefs. Moreover, *social norms* and *perceived behavioral control* are considered.
- When explaining the extent to which respondents believe that a specific policy measure motivates *fellow citizens* to use active modes, we additionally include their answer on *how motivated they feel by that measure themselves* as explanatory variable. This is to test whether their own motivation influences their perception of others' motivation.

Table 5
Descriptives: cycling-oriented policies.

	(1)		(2)		(3)		(4)	
	All		High affinity		Medium affinity		Low affinity	
	Mean	sd	Mean	sd	Mean	sd	Mean	sd
Which measure would motivate you the most?								
Revitalization	0.23		0.16		0.24		0.24	
Storage	0.08		0.11		0.09		0.05	
Bike lanes	0.17		0.24		0.19		0.06	
Rewards	0.17		0.22		0.18		0.11	
Info & awaren.	0.04		0.04		0.04		0.03	
App	0.05		0.03		0.06		0.03	
30 km/h	0.05		0.11		0.04		0.04	
Advice center	0.01		0.00		0.01		0.02	
None	0.14		0.02		0.08		0.35	
All	0.07		0.07		0.07		0.05	
Is this measure able to motivate you? (1–5)								
Revitalization	3.80	1.22	4.27	0.91	3.92	1.08	3.17	1.47
Storage	3.60	1.34	4.31	0.96	3.74	1.23	2.78	1.46
Bike lanes	3.52	1.34	4.30	0.88	3.71	1.21	2.55	1.36
Rewards	3.32	1.40	4.03	1.11	3.50	1.28	2.40	1.42
Info & awaren.	3.12	1.27	3.66	1.23	3.23	1.19	2.48	1.25
App	3.06	1.42	3.63	1.38	3.21	1.34	2.27	1.32
30 km/h	2.94	1.46	3.57	1.48	2.98	1.38	2.43	1.49
Advice center	2.77	1.30	3.20	1.34	2.84	1.25	2.30	1.25
Is this measure able to motivate others? (1–5)								
Revitalization	4.02	1.03	4.19	0.96	4.06	0.98	3.83	1.14
Storage	3.96	1.03	4.29	0.90	3.98	1.00	3.71	1.10
Bike lanes	3.87	1.04	4.20	0.93	3.94	0.99	3.48	1.13
Rewards	3.69	1.18	4.13	0.93	3.75	1.13	3.25	1.31
Info & awaren.	3.37	1.11	3.61	1.13	3.41	1.07	3.12	1.14
App	3.35	1.19	3.59	1.28	3.42	1.11	3.00	1.25
30 km/h	3.13	1.36	3.47	1.40	3.10	1.33	2.99	1.38
Advice center	3.10	1.14	3.32	1.21	3.12	1.10	2.90	1.16
Observations	1026		152		634		240	

Note: Note that the answers to the question items "*Is this measure able to motivate you?*" and "*Is this measure able to motivate others?*" have been measured along a 5-point Likert scale. However, since only the endpoints of the scale were verbally described ("*motivates me/Lower Austrians very much*" vs. "*does not motivate me/Lower Austrians at all*"), we believe that the distance between the 5 points is not subjective, and hence interpreting the answers along a continuous scale is warranted. We find that the difference between these two question items is statistically significant (p-value < 0.1) for all measures in the low and medium affinity segment, but not for the high affinity segment.

We first discuss the results for the walking-oriented policy measures (Section 5.1), and then for the cycling-oriented policy measures (Section 5.2). In all regressions, we use the entire sample (and hence do not distinguish between the three segments in terms of walking/cycling affinity). One reason is that some of the segments are rather small. Moreover, we are able to include the variables that have been used to define the segments (in particular, current walking/cycling behavior) as explanatory variables, hence controlling for differences in walking/cycling affinity.

5.1. Regressions: walking-oriented policies

5.1.1. The motivating effect of walking-oriented measures on respondents

We first regress the evaluations of each of the six walking-oriented policy measures in terms of how motivating they are perceived to be by the survey respondents (see Table 6). The resulting Pseudo R-squared is relatively similar across models, ranging from 0.08 (town revitalization) to 0.12 (speed limit), providing an indication that the included explanatory variables can only capture a relatively small share of the heterogeneity in the answers provided.

We find that socioeconomic variables as well as municipality size have little explanatory power for how motivated respondents are by the proposed policy measures to make more of their everyday trips by foot. An exception is age, where age groups above 30 years tend to perceive footpaths and the app as less motivating, and the 30 km/h speed limit in town centers as more motivating compared to those below 30. Compared to lower educated respondents, higher educated ones intend to walk more for everyday trips when town and village centers are revitalized, but are relatively less motivated by the app and the advice center. Compared to respondents with a lower income, higher income individuals state that they are motivated to walk more if footpaths are improved, potentially due to a stronger preference for safety and comfort.

Those who drive a car state that they feel relatively less motivated by the 30 km/h speed limit and footpath improvements, whereas those who use public transport state that they feel relatively more motivated by the speed limit. We also find that those who perceive the walking infrastructure as average or (very) bad state that the information and awareness-related measures have little impact on their motivation to walk more.

Table 6
Results of ordered logistic regressions with the dependent variable definition corresponding to: *"Is this measure able to motivate you to walk more for short everyday journeys"*?

	(1) Revitalization	(2) Footpaths	(3) Parent resp.	(4) 30 km/h	(5) App	(6) Advice center
Age: 30–49	−0.185	−0.608***	0.204	0.495**	−0.675***	−0.489**
	(−1.06)	(−3.47)	(1.21)	(2.95)	(−4.02)	(−2.91)
Age: ≥50	−0.211	−0.567***	0.184	0.421**	−0.947***	−0.336*
	(−1.27)	(−3.38)	(1.14)	(2.61)	(−5.82)	(−2.08)
Education: high-school or higher	0.408**	−0.0194	−0.204	0.223	−0.292*	−0.267*
	(2.98)	(−0.15)	(−1.55)	(1.73)	(−2.25)	(−2.03)
Household net income: 1650–2999 Euro	0.229	0.455*	0.243	0.160	0.0982	0.0412
	(1.19)	(2.41)	(1.32)	(0.86)	(0.53)	(0.22)
Household net income: ≥3000 Euro	0.257	0.567**	0.225	0.0702	0.320	−0.0199
	(1.27)	(2.85)	(1.17)	(0.36)	(1.66)	(−0.10)
Household net income: Unknown	0.253	0.614**	−0.0283	0.124	−0.0905	0.0108
	(1.19)	(2.91)	(−0.14)	(0.60)	(−0.44)	(0.05)
Inhabitants: ≤2000	−0.113	−0.0424	0.245*	−0.105	0.186	0.0937
	(−0.94)	(−0.35)	(2.10)	(−0.89)	(1.58)	(0.80)
Drives a car	−0.0628	−0.459*	0.314	−0.613**	0.263	0.197
	(−0.28)	(−2.04)	(1.52)	(−2.89)	(1.25)	(0.94)
Walks for util. purp.: multiple times/week	−0.246	0.0584	0.208	0.147	0.0119	0.116
	(−1.16)	(0.28)	(1.03)	(0.72)	(0.06)	(0.58)
Walks for util. purp.: multiple times/mth	−0.504	−0.719*	0.0277	0.00593	0.343	0.00814
	(−1.77)	(−2.51)	(0.10)	(0.02)	(1.18)	(0.03)
Walks for util. purp.: rarely/never	−0.295	−0.118	−0.0158	−0.0258	0.219	0.243
	(−1.65)	(−0.67)	(−0.09)	(−0.15)	(1.26)	(1.44)
Pedestrian infrastructure: average	0.116	0.377**	−0.135	0.467***	−0.102	−0.0810
	(0.82)	(2.70)	(−1.00)	(3.41)	(−0.76)	(−0.60)
Pedestrian infrastructure: (very) bad	0.00658	0.0834	−0.496**	0.272	−0.642***	−0.493**
	(0.04)	(0.49)	(−2.97)	(1.60)	(−3.76)	(−2.91)
Ecological	0.233*	0.374***	0.303**	0.522***	0.417***	0.403***
	(2.40)	(3.96)	(3.19)	(5.51)	(4.32)	(4.15)
Health	0.520***	0.537***	0.362***	0.241*	0.272*	−0.0413
	(4.77)	(5.08)	(3.45)	(2.24)	(2.51)	(−0.38)
Social	0.204*	0.332***	0.000807	0.296***	0.0410	0.250**
	(2.37)	(3.90)	(0.01)	(3.59)	(0.48)	(3.06)
Perceived behavioral control	0.239***	0.207**	−0.112	0.0820	0.0300	−0.0926
	(3.67)	(3.16)	(−1.78)	(1.29)	(0.49)	(−1.47)
Time savings	0.0728	0.194***	0.384***	0.490***	0.308***	0.370***
	(1.25)	(3.37)	(6.70)	(8.43)	(5.51)	(6.53)
Freedom	0.0831	−0.0747	0.219***	−0.0270	0.191**	0.229***
	(1.29)	(−1.19)	(3.56)	(−0.44)	(3.08)	(3.69)
Observations	1025	1025	1025	1025	1025	1025
Pseudo R^2	0.083	0.103	0.094	0.121	0.093	0.099
AIC	2600.0	2682.0	2939.2	2915.3	3012.2	2926.8
BIC	2713.5	2795.4	3052.7	3028.7	3125.7	3040.3

Note: Significance levels: * 5%, ** 1%, *** 0.1%.

For almost all policy measures, we find that ecological and health beliefs as well as the belief that active mobility is associated with time savings are positively related to how motivating a policy measure is perceived to be. The same is true for social norms. Interestingly, perceived behavioral control is only (positively) significant for revitalization and footpaths, while stronger beliefs that active mobility implies freedom and independence are associated with feeling more motivated to walk only for information and awareness-raising policies.

5.1.2. The motivating effect of walking-oriented measures on others

Next, we explain the extent to which walking-oriented policy measures are perceived as being able to motivate others (i.e., fellow Lower Austrians) to walk more for everyday trips. As already evident from the descriptive analysis (see Section 4.4), there is a positive correlation between that indicator and the respondents' evaluation to which extent a policy measure motivates them to walk more. This is reflected in the strong significance of the explanatory variables indicating how motivated a respondent feels by the specific policy measure (see Table 7) and as a consequence in a Pseudo R-squared that is substantially higher (ranging from 0.17 to 0.27) than for the estimations concerning the respondents' own motivation. Socioeconomic or mobility-behavior related variables have little explanatory power. An exception is that persons residing in small villages are fairly pessimistic about the motivating effect of footpaths on others.

The TPB-based variables are again of high importance. Especially stronger perceived social norms are associated with a higher level of optimism that fellow citizens will be motivated by the proposed measures. For perceived behavioral control, we find the opposite pattern. Respondents with a stronger perception that active mobility is possible for them are more pessimistic about the

Table 7
Results of ordered logistic regressions with the dependent variable definition corresponding to: *"Is this measure able to motivate others to walk more short everyday journeys"*?

	(1) Revitalization	(2) Footpaths	(3) Parent resp.	(4) 30 km/h	(5) App	(6) Advice center
Age: 30–49	−0.306	−0.00525	−0.236	0.0821	−0.382*	−0.236
	(−1.60)	(−0.03)	(−1.35)	(0.47)	(−2.16)	(−1.36)
Age: ≥50	−0.266	0.0397	−0.129	0.151	0.117	0.118
	(−1.45)	(0.23)	(−0.77)	(0.90)	(0.69)	(0.71)
Education: high-school or higher	−0.0339	−0.0814	0.0312	0.153	−0.0378	−0.267*
	(−0.23)	(−0.57)	(0.23)	(1.12)	(−0.28)	(−1.97)
Household net income: 1650–2999 Euro	0.210	0.0299	−0.193	−0.0174	−0.147	−0.157
	(1.02)	(0.15)	(−1.00)	(−0.09)	(−0.76)	(−0.82)
Household net income: ≥3000 Euro	0.204	0.0300	0.182	−0.0412	−0.203	−0.173
	(0.95)	(0.14)	(0.90)	(−0.20)	(−1.01)	(−0.86)
Household net income: unknown	0.400	0.193	0.222	0.131	−0.00284	−0.0105
	(1.74)	(0.88)	(1.04)	(0.62)	(−0.01)	(−0.05)
Inhabitants: ≤2000	−0.170	−0.430***	−0.111	−0.160	−0.0394	−0.0406
	(−1.30)	(−3.38)	(−0.91)	(−1.31)	(−0.32)	(−0.34)
Drives a car	−0.294	0.0575	−0.288	−0.520*	−0.477*	−0.123
	(−1.24)	(0.24)	(−1.30)	(−2.24)	(−2.17)	(−0.57)
Walks for util. purp.: multiple times/w	0.205	0.0519	−0.279	−0.0159	0.256	−0.0514
	(0.90)	(0.24)	(−1.35)	(−0.08)	(1.22)	(−0.25)
Walks for util. purp.: multiple times/mth	−0.228	0.0795	−0.697*	−0.174	−0.0705	0.00923
	(−0.73)	(0.27)	(−2.39)	(−0.59)	(−0.25)	(0.03)
Walks for util. purp.: rarely/never	−0.120	0.109	−0.202	−0.0247	0.0929	−0.109
	(−0.63)	(0.60)	(−1.14)	(−0.14)	(0.52)	(−0.62)
Pedestrian infrastructure: average	−0.0690	0.0214	0.0861	0.154	−0.265	−0.149
	(−0.46)	(0.14)	(0.61)	(1.08)	(−1.86)	(−1.06)
Pedestrian infrastructure: (very) bad	0.418*	0.293	0.225	0.138	−0.331	−0.171
	(2.23)	(1.63)	(1.30)	(0.80)	(−1.89)	(−0.98)
Ecological	0.0139	−0.00836	0.289**	−0.107	−0.0217	0.0650
	(0.13)	(−0.08)	(2.97)	(−1.06)	(−0.22)	(0.67)
Health	0.245*	0.109	0.181	0.148	0.138	0.0969
	(2.06)	(0.95)	(1.67)	(1.32)	(1.25)	(0.89)
Social	0.320***	0.252**	0.390***	0.271**	0.125	0.221**
	(3.49)	(2.80)	(4.50)	(3.11)	(1.48)	(2.61)
Perceived behavioral control	−0.250***	−0.209**	−0.141*	−0.202**	−0.310***	−0.276***
	(−3.50)	(−3.02)	(−2.13)	(−3.06)	(−4.74)	(−4.26)
Time savings	−0.144*	0.00180	0.0257	−0.154*	0.00114	0.0616
	(−2.28)	(0.03)	(0.43)	(−2.55)	(0.02)	(1.05)
Freedom	−0.201**	−0.0893	−0.234***	−0.0879	0.0907	−0.00224
	(−2.82)	(−1.30)	(−3.58)	(−1.35)	(1.41)	(−0.03)
Revitalization (own motivation)	1.667***					
	(19.77)					
Footpaths (own motivation)		1.470***				
		(18.87)				
Parent resp. (own motivation)			0.988***			
			(15.67)			
30 km/h (own motivation)				1.507***		
				(21.97)		
App (own motivation)					1.387***	
					(20.99)	
Advice center (own motivation)						1.365***
						(19.55)
Observations	1025	1025	1025	1025	1025	1025
Pseudo R^2	0.265	0.230	0.172	0.266	0.251	0.238
AIC	1920.2	2097.8	2450.4	2404.5	2414.9	2402.9
BIC	2038.5	2216.2	2568.8	2522.8	2533.3	2521.3

Note: Significance levels: * 5%, ** 1%, *** 0.1%.

proposed measures being motivating to others (and vice versa). A plausible explanation is that such respondents (correctly) infer that their own conditions are very favorable towards walking, whereas these conditions might be less favorable to others.

5.2. Regressions: cycling-oriented policies

5.2.1. The motivating effect of cycling-oriented measures on respondents

Similarly, as for the walking-oriented policy measures, we also try to explain how motivating each cycling-oriented measure is perceived (see results in Table 8). The resulting Pseudo R-squared ranges from 0.06 (revitalization) to 0.11 (bike lanes), and is

Table 8
Results of ordered logistic regressions with the dependent variable definition corresponding to: *"Is this measure able to motivate you to cycle more for short everyday journeys"*?

	(1) Revitalization	(2) Storage	(3) Bike lanes	(4) Rewards	(5) Info & awaren.	(6) App	(7) 30 km/h	(8) Advice center
Age: 30–49	−0.238	−0.398*	−0.502**	−0.834***	−0.343*	−0.759***	0.460**	−0.235
	(−1.41)	(−2.32)	(−2.94)	(−4.84)	(−2.05)	(−4.51)	(2.77)	(−1.40)
Age: ≥50	−0.418**	−0.919***	−0.820***	−1.396***	−0.509**	−1.126***	0.332*	−0.225
	(−2.59)	(−5.53)	(−5.01)	(−8.33)	(−3.18)	(−6.87)	(2.09)	(−1.41)
Education: high-school or higher	0.171	0.361**	0.277*	−0.156	−0.0566	−0.243	0.0924	−0.159
	(1.30)	(2.72)	(2.11)	(−1.21)	(−0.44)	(−1.87)	(0.71)	(−1.24)
Household net income: 1650–2999 Euro	0.299	0.202	0.247	−0.0644	−0.0221	0.122	0.168	−0.134
	(1.62)	(1.09)	(1.30)	(−0.34)	(−0.12)	(0.65)	(0.90)	(−0.73)
Household net income: ≥3000 Euro	0.409*	0.587**	0.262	0.133	−0.0336	0.419*	0.136	−0.133
	(2.09)	(2.98)	(1.31)	(0.67)	(−0.17)	(2.13)	(0.69)	(−0.69)
Household net income: Unknown	0.395	0.436*	−0.0227	−0.0520	−0.0441	−0.103	0.344	−0.261
	(1.93)	(2.12)	(−0.11)	(−0.25)	(−0.22)	(−0.50)	(1.68)	(−1.30)
Inhabitants: ≤2000	0.0161	−0.185	−0.0266	0.127	0.172	0.146	−0.0708	0.186
	(0.14)	(−1.56)	(−0.22)	(1.07)	(1.46)	(1.24)	(−0.60)	(1.59)
Drives a car	−0.0580	0.0127	0.307	0.414	0.199	0.654**	−0.750***	0.104
	(−0.28)	(0.06)	(1.45)	(1.94)	(0.94)	(3.09)	(−3.58)	(0.51)
Walks for util. purp.: multiple times/w	−0.544	−0.00385	−0.954*	0.347	0.666*	0.554	−0.612	0.0952
	(−1.54)	(−0.01)	(−2.53)	(1.04)	(1.98)	(1.64)	(−1.77)	(0.29)
Walks for util. purp.: multiple times/mth	−0.712	−0.850*	−1.423**	−0.00222	0.345	−0.0680	−0.730	−0.0153
	(−1.71)	(−2.07)	(−3.21)	(−0.01)	(0.87)	(−0.17)	(−1.82)	(−0.04)
Walks for util. purp.: rarely/never	−0.695*	−0.688*	−1.364***	−0.366	0.258	0.00478	−0.664*	−0.107
	(−2.18)	(−2.19)	(−3.94)	(−1.25)	(0.87)	(0.02)	(−2.17)	(−0.36)
Cycling infrastructure: average	−0.141	−0.155	0.0526	−0.395**	−0.359**	−0.555***	−0.0479	−0.353**
	(−1.05)	(−1.15)	(0.39)	(−2.97)	(−2.69)	(−4.16)	(−0.36)	(−2.68)
Cycling infrastructure: (very) bad	−0.0946	−0.173	−0.0747	−0.734***	−0.638***	−0.638***	0.103	−0.439**
	(−0.58)	(−1.06)	(−0.45)	(−4.52)	(−3.98)	(−3.96)	(0.63)	(−2.72)
Ecological	0.251**	0.181	0.355***	0.152	0.512***	0.240*	0.465***	0.275**
	(2.74)	(1.94)	(3.84)	(1.64)	(5.33)	(2.57)	(4.98)	(2.96)
Health	0.369***	0.428***	0.565***	0.509***	0.120	0.432***	0.286**	0.00551
	(3.54)	(4.00)	(5.21)	(4.76)	(1.13)	(4.01)	(2.66)	(0.05)
Social	−0.00289	0.158	0.0752	−0.0806	0.0517	−0.155	0.292***	0.179*
	(−0.04)	(1.90)	(0.90)	(−0.99)	(0.64)	(−1.87)	(3.60)	(2.23)
Perceived behavioral control	0.170**	0.243***	0.183**	0.113	0.101	0.0297	0.109	−0.0306
	(2.71)	(3.85)	(2.85)	(1.79)	(1.61)	(0.47)	(1.73)	(−0.49)
Time savings	0.180**	0.205***	0.223***	0.286***	0.421***	0.415***	0.449***	0.343***
	(3.22)	(3.55)	(3.84)	(5.02)	(7.41)	(7.23)	(7.81)	(6.19)
Freedom	0.0856	−0.0551	0.117	0.150*	0.166**	0.251***	−0.126*	0.168**
	(1.39)	(−0.90)	(1.84)	(2.43)	(2.71)	(3.98)	(−2.06)	(2.72)
Observations	1026	1026	1026	1026	1026	1026	1026	1026
Pseudo R^2	0.058	0.084	0.115	0.101	0.111	0.108	0.107	0.073
AIC	2804.0	2855.9	2815.1	2930.1	2897.1	2958.4	2957.3	3019.9
BIC	2917.5	2969.4	2928.6	3043.5	3010.6	3071.9	3070.8	3133.4

hence similar in size as for the walking policies. Also for the cycling-oriented measures, we find that socioeconomic variables and municipality size have only limited explanatory power. Respondents above the age of 30 tend to agree less with the effectiveness of most measures (exceptions being the speed limit and the advice center). Persons who drive a car feel relatively less motivated by a 30 km/h speed limit measure. And we also find that those who already use the bicycle daily for their everyday trips perceive fast bike lanes more effective in increasing their cycling than those who do not cycle regularly. Also the finding that those who perceive the infrastructure as low-quality feel significantly less motivated by rewards and the information-related measures underlines the importance of adequate infrastructure as a prerequisite for considering cycling. In line with the descriptive results presented in Section 4.2, we find that those living in small municipalities perceive improved footpaths as significantly less motivating to others than those living in larger municipalities.

As for walking, we find that the TPB-based variables have a relatively high explanatory power. The belief that cycling implies time savings is significantly positively correlated with the perceived effectiveness for all measures. Also ecological and health beliefs tend to be associated with higher motivation to cycle for most measures. If one believes that active mobility is associated with freedom and independence, the person is more likely to be motivated by the information- and awareness-related measures as well as the rewards. Finally, a higher perceived behavioral control only goes hand in hand with higher motivation to cycle for the infrastructural measures and the revitalization of town and village centers.

5.2.2. The motivating effect of cycling-oriented measures on others

Next, we investigate, what determines how respondents evaluate each of the proposed measures in terms of the extent to which it is able to motivate others (i.e., fellow Lower Austrians) to use the bicycle more for everyday trips. We find – similarly as for

the walking-oriented measures – that the respondents' evaluations with respect to how motivated they themselves feel by a specific measure matter substantially, yielding a relatively high Pseudo R-squared (ranging from 0.18 to 0.21).

Socioeconomic and travel-related variables have only a small explanatory power for most policy measures (see Table 8 for the results). This is in contrast to the substantial explanatory power associated with the TPB-based variables. In particular, respondents with strong ecological and health beliefs as well as strong perceived social norms are significantly more optimistic about the motivational power of most policy measures. In contrast, higher perceived behavioral control is associated with being more pessimistic with respect to the motivational power to others. This is plausible as these respondents seem to be aware of the relatively high level of control they have on their mobility-related behavior, inferring that this is likely not the case for others. Probably for similar reasons, also the belief that active mobility is associated with time savings as well as freedom and independence is found to have a negative coefficient for some of the policy measures.

6. Discussion

In this section, we summarize our findings by discussing two main aspects of our findings in more depth. First, we discuss possible interpretations of the respondents' evaluations of how specific measure makes them (and others) walk/cycle more for everyday trips. Second, we elaborate on the observed gap in terms of the motivational power of the policy measures to respondents vs. fellow citizens.

6.1. Interpreting the evaluations of how motivating a measure is to respondents and to others

In line with many other studies in the tradition of the theory of planned behavior, we do not study actual behavior, but focus on behavioral intentions. Studying actual behavior was not feasible here, as the proposed policy measures have not yet been implemented in the study area. While the behavioral intentions serve as a proxy for actual behavior, we cannot assume that they translate one-to-one into actual behavior. Although we are not able to formally test for such a gap between intentions and behavior (which can be interpreted as a form of hypothetical bias), we will discuss some evidence that hints at its existence.

One piece of evidence for a possible intention-behavior gap is that for some measures a like or dislike that is unrelated to the intended use of walking/cycling seems to have influenced the respondents' answers. For instance, our regression results indicate that car users state that they feel relatively less motivated to walk/cycle more by the speed limit of 30 km/h compared to respondents who do not drive a car (see Tables 6 and 8). We speculate that this is due to the speed limit affecting them in ways that are unrelated to the use of active mobility, namely by potentially slowing down their car trips, which is something they likely evaluate negatively. Another example is the high scores assigned to town revitalization, even among those who rarely ever walk/bike, and have no intention to do so more often in the future. Here, the answers are probably influenced by (perceived) positive co-benefits of town revitalization (e.g., the imagination of beautiful central squares with cafes and shops), which do again not necessarily have a relation with engaging in active mobility. Provided that such a like/dislike exists for specific measures, we can assume that it might have induced strategic answering. As respondents were likely aware of the policy-relevance of the questionnaire (and the survey was funded by the Government of Lower Austria), they might have actively tried to influence which measures are being implemented.

Furthermore, also other factors might play a role. For instance, the high level of support for the notion that town revitalization and infrastructural measures are most motivating might at least partially be attributable to them being more salient: most respondents can be expected to be fairly familiar with walking and biking infrastructure, as well as bike storage solutions, even if not used actively. As a result, respondents might be inclined to evaluate these measures more positively in terms of their potential to motivate them and others, as they can better imagine themselves and others walking/cycling more due to improved infrastructure. In contrast, they might perceive the policy measures targeted at awareness raising/information provision as relatively vague and hence underestimate their potential to influence their own as well as others' behavior. Similarly, the respondents' answers might be overly optimistic about infrastructural and spatial planning policy measures, as indirect implications (e.g., fewer parking lots in the case of town revitalization) are disregarded. Such indirect effects are less likely to exist for information/awareness-oriented policy measures.

6.2. The gap between the evaluations of how motivating a measure is to respondents and to others

Our finding that respondents believe that the policy measures are more motivating to others than to themselves is striking. Similar findings have to our best knowledge not been established in the literature so far. Various potential explanations can be brought forward.

First, also here strategic motives may play a role: respondents who do not feel very motivated by the policy measures themselves (hence, in particular those with medium and low affinity) may answer truthfully when asked about their own motivation. But when the question concerns others, they might be overly optimistic, trying to express their support for the implementation of the measures, without having to "admit" that they do not feel motivated by them themselves. Similarly, respondents' beliefs about answers deemed desirable by society or by the researchers conducting the survey might play a role (e.g., Carlsson et al., 2018). While this may lead to respondents generally overstating how motivated they feel to switch towards active transport modes (if they believe that society and/or the involved researchers find mode switches towards active mobility desirable), we speculate that this effect may be even stronger if the answers concern another person or groups of persons. This is because the inclination to answer truthfully might decrease in the latter case.

Table 9
Results of ordered logistic regressions with the dependent variable definition corresponding to: *"Is this measure able to motivate others to cycle more for short everyday journeys"*?

	(1) Revitalization	(2) Storage	(3) Bike lanes	(4) Rewards	(5) Info & awaren.	(6) App	(7) 30 km/h	(8) Advice center
Age: 30–49	−0.158	−0.0241	−0.614***	−0.437*	−0.315	−0.495**	−0.0802	−0.470**
	(−0.88)	(−0.13)	(−3.40)	(−2.46)	(−1.83)	(−2.84)	(−0.47)	(−2.73)
Age: ≥50	0.0265	0.111	−0.260	−0.415*	0.0616	−0.238	0.179	−0.121
	(0.15)	(0.64)	(−1.50)	(−2.40)	(0.37)	(−1.41)	(1.08)	(−0.74)
Education: high-school or higher	0.0743	0.0293	0.0493	0.0442	−0.0412	−0.0568	0.147	−0.191
	(0.53)	(0.21)	(0.36)	(0.33)	(−0.31)	(−0.43)	(1.11)	(−1.44)
Household net income: 1650–2999 Euro	−0.0232	0.270	−0.0724	−0.165	−0.188	−0.370	0.0411	−0.293
	(−0.12)	(1.39)	(−0.37)	(−0.85)	(−0.99)	(−1.90)	(0.21)	(−1.53)
Household net income: ≥3000 Euro	−0.0384	0.219	−0.0671	−0.0647	−0.0861	−0.298	0.0921	−0.260
	(−0.18)	(1.05)	(−0.33)	(−0.32)	(−0.44)	(−1.46)	(0.45)	(−1.30)
Household net income: unknown	−0.0612	0.170	−0.117	−0.347	0.134	−0.505*	0.0734	−0.00766
	(−0.28)	(0.78)	(−0.54)	(−1.62)	(0.64)	(−2.38)	(0.34)	(−0.04)
Inhabitants: ≤2000	−0.00288	−0.000434	−0.0916	−0.116	−0.245*	−0.00275	−0.162	−0.154
	(−0.02)	(−0.00)	(−0.73)	(−0.95)	(−2.04)	(−0.02)	(−1.33)	(−1.28)
Drives a car	−0.259	−0.303	−0.0559	0.0110	−0.163	0.00466	−0.523*	−0.0838
	(−1.13)	(−1.34)	(−0.25)	(0.05)	(−0.77)	(0.02)	(−2.34)	(−0.40)
Cycles for util. purp.: multiple times/w	−0.349	−0.472	−0.362	−0.229	−0.144	0.403	−0.660	−0.0802
	(−0.96)	(−1.30)	(−1.02)	(−0.67)	(−0.42)	(1.20)	(−1.80)	(−0.24)
Cycles for util. purp.: multiple times/mth	−0.674	−0.634	−0.290	−0.0410	0.249	0.281	−0.350	−0.0970
	(−1.57)	(−1.46)	(−0.68)	(−0.10)	(0.60)	(0.70)	(−0.80)	(−0.24)
Cycles for util. purp.: rarely/never	−0.109	−0.582	−0.0592	−0.287	0.126	0.533	−0.520	0.0239
	(−0.33)	(−1.79)	(−0.19)	(−0.95)	(0.41)	(1.80)	(−1.56)	(0.08)
Cycling infrastructure: average	−0.164	−0.0129	−0.0598	−0.368**	−0.116	−0.0933	0.103	−0.102
	(−1.16)	(−0.09)	(−0.42)	(−2.67)	(−0.85)	(−0.68)	(0.75)	(−0.75)
Cycling infrastructure:: (very) bad	0.186	−0.413*	0.0365	−0.414*	−0.256	−0.366*	0.301	−0.148
	(1.06)	(−2.41)	(0.22)	(−2.44)	(−1.53)	(−2.18)	(1.79)	(−0.88)
Ecological	0.0812	−0.0353	0.227*	0.105	0.392***	0.247**	−0.0942	0.00240
	(0.82)	(−0.35)	(2.31)	(1.09)	(4.07)	(2.58)	(−0.99)	(0.02)
Health	0.198	0.469***	0.410***	0.377***	0.0609	0.210	0.192	0.157
	(1.76)	(4.12)	(3.65)	(3.43)	(0.56)	(1.93)	(1.77)	(1.44)
Social	0.391***	0.223*	0.188*	0.0129	0.258**	−0.0307	0.344***	0.290***
	(4.42)	(2.55)	(2.17)	(0.15)	(3.11)	(−0.37)	(4.10)	(3.50)
Perceived behavioral control	−0.0724	−0.274***	−0.139*	−0.165*	−0.189**	−0.211**	−0.249***	−0.187**
	(−1.08)	(−4.01)	(−2.06)	(−2.54)	(−2.92)	(−3.28)	(−3.84)	(−2.89)
Time savings	−0.136*	−0.201**	−0.0338	−0.0747	0.0305	0.0704	−0.0470	−0.00363
	(−2.22)	(−3.25)	(−0.55)	(−1.28)	(0.51)	(1.18)	(−0.77)	(−0.06)
Freedom	−0.174*	−0.134*	−0.104	−0.0450	−0.158*	0.101	−0.0450	0.0284
	(−2.56)	(−1.99)	(−1.56)	(−0.70)	(−2.46)	(1.58)	(−0.70)	(0.44)
Revitalization (own motivation)	1.223***							
	(18.04)							
Storage (own motivation)		1.123***						
		(17.71)						
Bike lanes (own motivation)			1.049***					
			(16.08)					
Rewards (own motivation)				1.025***				
				(17.03)				
Info & awaren. (own motivation)					1.025***			
					(15.65)			
App (own motivation)						1.079***		
						(17.92)		
30 km/h (own motivation)							1.237***	
							(20.20)	
Advice center (own motivation)								1.244***
								(18.82)
Observations	1026	1026	1026	1026	1026	1026	1026	1026
Pseudo R^2	0.190	0.197	0.198	0.184	0.176	0.208	0.226	0.209
AIC	2205.8	2217.0	2274.4	2469.3	2532.7	2507.0	2567.3	2489.7
BIC	2324.2	2335.4	2392.8	2587.7	2651.1	2625.5	2685.7	2608.1

Note: Significance levels: * 5%, ** 1%, *** 0.1%.

Second, the gap might also constitute a type of egocentric bias, reflecting that humans have a tendency to rely to a large extent on their own perspective, including their evaluation of others' behavior (e.g., Epley et al., 2004). An indication of that is the high correlation between the respondents' evaluation of their own motivation level and their evaluation of others' motivation level, as shown in the results presented in Tables 7 and 9. In line with that, they might believe that their own constraints are more binding and relevant than others', or that they are less strongly influenced by external factors, such as policy measures, than they actually

are (Nolan et al., 2008). Therefore, individuals might think that others can more easily adopt active transport modes than they themselves. An indication consistent with this explanation is our finding that for almost all policy measures a perceived lack of behavioral control corresponds to a higher evaluation assigned to how motivating a measure is to others.

Third, the difference between the own and other expected motivation might also reflect the optimistic hope that others will adopt their behaviors towards sustainable options. Based on that, oneself does not need to change behavior and can free-ride on the efforts of the others.

7. Conclusions and policy implications

7.1. Summary

This paper examines the potential of 14 different policy measures to motivate walking and cycling for everyday utilitarian trips in a rural/semi-rural province of Austria. Results show that the revitalization of town and village centers as well as a better walking and cycling infrastructure are regarded as motivating by a large share of respondents (for themselves as well as for other citizens). In contrast, measures aiming at information provision are considered the least motivating. Also most research on urban areas suggests that infrastructural measures (Krizek and Johnson, 2006) are effective in promoting behavioral change towards active mobility, while informational strategies are unlikely to change behavior much (Osbaldiston and Schott, 2012; Brownson et al., 2005). However, studies conducted in urban areas tend to place less emphasis on revitalization, likely because urban centers tend to have a diverse cultural and commercial offering, while in more rural areas such offerings are scarce and therefore the overall benefits of revitalization are potentially large. Also speed limits receive less attention in urban studies while they are a major topic in rural studies, particularly when it comes to cycling safety (e.g. Kircher et al., 2022), probably because average speeds are much higher outside urban areas.

In line with previous research (e.g. García et al., 2019), we find that TPB-based variables have a substantial influence on whether respondents perceive specific measures as motivating or not. In contrast, socio-demographic variables seem to have little influence (in particular, if current mobility behavior is considered as a control variable), while the degree of rurality matters in some aspects. Also these findings are widely in line with those derived in urban settings. One difference relates to the role of time savings, which generally are known to be among the most important mode choice determinants (see for the case of Austria: Schmid et al., 2019). Even though we find the belief that active mobility yields time savings to be positively correlated with active mobility usage and with being motivated by the proposed measures, the belief itself is rather weak on average, most likely because travel time savings due to using active mobility accrue only in rather specific cases in rural and semi-rural areas. In urban studies, in contrast, travel time savings play a much larger role, as often active modes (especially the bicycle) are indeed the fastest (e.g. Peer, 2019).

Finally, another interesting finding was that respondents indicated that others will be more motivated by the policy measures than they themselves (Section 6 has elaborated on potential reasons for this novel finding).

7.2. Policy implications

In terms of policy implications, our results have multiple ramifications. First, there seems to be only a small segment of the population who currently does not walk/cycle for utilitarian purposes and has no intention to do so in the future (6% for walking, and 23% for cycling). In contrast, the largest segment (about 60% of the sample) is not yet walking/cycling but intends to do so in the future. These respondents also report fairly high motivational potential to all measures and thereby signal that in general there is a large potential for increasing the use of active mobility in rural areas.

Second, the variables based on the theory of planned behavior are found to significantly influence mode choice behavior. Thus, strengthening beliefs that active mobility is associated with time savings and greater freedom (e.g., in the context of short trips by e-bike without the need to search for parking) could help increase the use of active modes in rural and semi-rural areas. Similarly, emphasizing the health and ecological benefits of active mobility or emphasizing that well-known role models use active modes could increase the extent to which people travel by bike or foot.

Third, a generic like/dislike for a policy measure (see Section 6) might impact the reported active mobility motivation. In particular, the reported high motivational potential of local town and village centers might be related to high co-benefits (such as improved shopping and cultural opportunities) also for citizens who do not want do engage in more active mobility. Actively communicating such co-benefits might be helpful to gain the political support of the wider (mostly car-driving) population for such measures.

Fourth, our results underline the essential role of accessibility. The modal split of short trips undertaken for utilitarian reasons is unlikely to shift in favor of active travel modes if potential destinations for such trips (workplaces, educational facilities, shops, etc.) are absent. The high motivational capacity assigned to the revitalization of town and village centers illustrates that (our finding that respondents living in smaller villages perceive revitalization as less motivating is likely to indicate that they see less potential for creating more lively centers in their place of residence). In addition to the availability of destinations for everyday trips, also the relevant infrastructure for active modes is essential. This is underlined by our finding that those who evaluate the

existing infrastructure as poor report that town revitalization and infrastructural measures have a higher potential to motivate active mobility. Overall, we can conclude that investing in policy measures directly aimed at motivating citizens to walk or cycle more (e.g., through monetary incentives, information provision, or awareness raising) are rather futile if the accessibility of destinations by foot and bike is not given.

7.3. Further research

As we were able to explain only a fairly small part of the variation in whether respondents feel motivated by a specific policy measure, one valuable direction would be to collect more detailed data on additional explanatory variables. In particular, additional psychological variables seem promising, as those that we accounted for carried substantial explanatory power (despite the limited number of question items some of them were based on). The theory of planned behavior mainly focuses on the costs and benefits of behavior. Theories such as the norm activation model that focus on normative factors influencing behavior could additionally explain the use of active mobility, for instance when active mobility is seen as doing the right thing for the environment (Schwartz, 1977). Future research may compare the predictive power of the theory of planned behavior and the norm activation model.

Another methodological alternative would be to employ stated preference methods, where respondents are asked to decide on their preferred mode of transport while trading off mode-specific travel times and costs, among others. This would overcome a main drawback of the approach applied in this paper, namely that the information provided on the policy measures was rather generic, potentially causing measurement errors. However, stated preference methods would not easily lend themselves for analyzing measures that involve limited trade-offs, as is typically the case for information-related measures.

Another fairly concrete extension would be to differentiate between traditional bicycles and e-bikes, as the latter are particularly attractive for somewhat longer distances compared to regular bicycles and might thus lend themselves especially well for utilitarian trip purposes, for which the exercise aspect is probably not the primary concern (unlike for many leisure trips).

Our conclusion that the stated motivational capacity of the policy measures is likely to be influenced by a like/dislike for measures is probably not an issue that is confined to the context of this study. Yet, existing studies that apply similar methods (often explicitly based on the Theory of Planned Behavior) have largely remained silent on the potential influence of hypothetical biases and strategic answering. In the face of the results obtained here, we believe that this is a major shortcoming of this literature, and should be covered in more depth in future research.

We have brought forwards some potential explanations for the novel finding that respondents on average indicated that others will be more motivated by the policy measures than they are being motivated themselves (see Section 6). Further research should be conducted to see which of these explanations is most realistic, whether this gap occurs also in other contexts, and whether it can be leveraged as a tool to increase policy acceptance (Eriksson et al., 2006).

Finally, our results are obtained in the specific context of a (semi-)rural area in a developed central European country. While it seems reasonable to assume that our results generalize to similar regions in other European countries, caution is advised for regions that differ significantly in terms of population structure, structural environment and generally cultural factors related to mobility. This is particularly true for developing countries, but potentially also for other European or Western countries — both representing promising alleys for future research in order to see whether our results can be replicated in such regions.

CRediT authorship contribution statement

Stefanie Peer: Conceptualization, Methodology, Formal analysis, Writing – original draft. **Katharina Gangl:** Conceptualization, Methodology, Funding acquisition, Writing – review & editing. **Florian Spitzer:** Conceptualization, Funding acquisition, Writing – review & editing. **Ellen van der Werff:** Methodology, Writing – review & editing.

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Appendix. Degrees of rurality

See Table A.10.

Table A.10
Descriptive statistics according to municipality size.

Variable	Number of inhabitants at residential location				Sig
	<=2000	2001–5000	5001–10000	>10000	
Current mobility-related variables [share]					
Drives a car	0.93	0.89	0.90	0.89	
Uses public transport	0.46	0.54	0.49	0.58	
Commutes	0.59	0.63	0.56	0.46	**
Owns a bike	0.71	0.70	0.68	0.74	
Walks for leisure purposes	0.82	0.81	0.79	0.78	
Cycles for leisure purposes	0.59	0.58	0.59	0.63	**
Walks for util. purposes: Daily	0.15	0.17	0.18	0.18	*
Walks for util. purposes: Multiple times/week	0.10	0.18	0.19	0.22	
Walks for util. purposes: Multiple times/month	0.06	0.04	0.05	0.08	
Walks for util. purposes: Rarely/never	0.70	0.61	0.58	0.5	
Cycles for util. purposes: daily	0.02	0.02	0.07	0.09	*
Cycles for util. purposes: Multiple times/week	0.06	0.10	0.12	0.13	
Cycles for util. purposes: Multiple times/month	0.05	0.05	0.02	0.03	
Cycles for util. purposes: Rarely/never	0.88	0.83	0.79	0.74	
Perceived infrastructure quality [share]					
Pedestrian infrastructure: (very) good	0.41	0.55	0.56	0.58	***
Pedestrian infrastructure: average	0.30	0.26	0.28	0.30	
Pedestrian infrastructure: (very) bad	0.30	0.19	0.16	0.12	
Cycling infrastructure: (very) good	0.43	0.50	0.50	0.62	***
Cycling infrastructure: average	0.30	0.32	0.33	0.24	
Cycling infrastructure: (very) bad	0.28	0.18	0.16	0.14	
Is this measure able to motivate you? (1–5)					
Walking: Revitalization	3.74	4.01	3.95	4.06	**
Walking: Footpaths	3.65	3.84	3.81	3.87	
Walking: 30 km/h	2.83	3.01	3.02	3.17	
Walking: Parent resp.	3.31	3.34	3.21	3.28	
Walking: App	2.96	2.91	2.90	2.89	
Walking: Advice center	2.71	2.74	2.64	2.82	
Cycling: Revitalization	3.62	3.91	3.83	3.81	*
Cycling: Bike lanes	3.35	3.54	3.56	3.65	
Cycling: Storage	3.32	3.63	3.76	3.71	**
Cycling: Rewards	3.22	3.39	3.34	3.35	
Cycling: 30 km/h	2.74	2.97	2.89	3.13	*
Cycling: Info & awaren.	3.04	3.17	3.12	3.12	
Cycling: App	3.01	3.09	3.10	3.03	
Cycling: Advice center	2.75	2.81	2.75	2.75	
Psychological variables [5-point scale (1–5)]					
Ecological	3.82	3.77	3.77	3.85	
Health	4.21	4.16	4.28	4.26	
Social	3.15	3.16	3.16	3.32	
Perceived Behavioral Control	2.98	3.27	3.30	3.26	**
Time savings	2.22	2.47	2.35	2.67	***
Freedom	3.60	3.51	3.48	3.52	
Number of respondents	254	298	212	262	
Percentage	24.76%	29.04%	20.66%	25.54%	

Note: Significance levels: * 5%, ** 1%, *** 0.1%.

References

Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50 (2), 179–211.

Attari, S.Z., Schoen, M., Davidson, C.I., DeKay, M.L., de Bruin, W.B., Dawes, R., Small, M.J., 2009. Preferences for change: Do individuals prefer voluntary actions, soft regulations, or hard regulations to decrease fossil fuel consumption? Ecol. Econom. 68 (6), 1701–1710.

Bird, E.L., Panter, J., Baker, G., Jones, T., Ogilvie, D., 2018. Predicting walking and cycling behaviour change using an extended Theory of Planned Behaviour. J. Transp. Health 10, 11–27.

BMBWF, 2019. Schulen, Klassen und Schüler/innen - Niederösterreich 2018/19. Website of the Austrian Federal Ministry of Education, Science and Research, URL: https://www.bmbwf.gv.at/Themen/schule/schulsystem/gd/schulstat_noe.html.

BMVIT, 2016. Österreich unterwegs 2013/2014: Ergebnisbericht zur österreichweiten Mobilitätserhebung "Österreich unterwegs 2013/2014".

Brainard, J., Cooke, R., Lane, K., Salter, C., 2019. Age, sex and other correlates with active travel walking and cycling in England: analysis of responses to the Active Lives Survey 2016/17. Prev. Med. 123, 225–231.

Brand, C., Dons, E., Anaya-Boig, E., Avila-Palencia, I., Clark, A., de Nazelle, A., Gascon, M., Gaupp-Berghausen, M., Gerike, R., Götschi, T., et al., 2021. The climate change mitigation effects of daily active travel in cities. Transp. Res. D 93, 102764.

Brownson, R.C., Hagood, L., Lovegreen, S.L., Britton, B., Caito, N.M., Elliott, M.B., Emery, J., Haire-Joshu, D., Hicks, D., Johnson, B., et al., 2005. A multilevel ecological approach to promoting walking in rural communities. Prev. Med. 41 (5–6), 837–842.

Brownson, R.C., Housemann, R.A., Brown, D.R., Jackson-Thompson, J., King, A.C., Malone, B.R., Sallis, J.F., 2000. Promoting physical activity in rural communities: walking trail access, use, and effects. Am. J. Prev. Med. 18 (3), 235–241.
Carlson, S.A., Whitfield, G.P., Peterson, E.L., Ussery, E.N., Watson, K.B., Berrigan, D., Fulton, J.E., 2018. Geographic and urban–rural differences in walking for leisure and transportation. Am. J. Prev. Med. 55 (6), 887–895.
Carlsson, F., Kataria, M., Lampi, E., 2018. Demand effects in stated preference surveys. J. Environ. Econ. Manag. 90, 294–302.
Cleland, V.J., Timperio, A., Crawford, D., 2008. Are perceptions of the physical and social environment associated with mothers' walking for leisure and for transport? A longitudinal study. Prev. Med. 47 (2), 188–193.
de Bruijn, G.J., Kremers, S.P., Singh, A., Van den Putte, B., Van Mechelen, W., 2009. Adult active transportation: adding habit strength to the theory of planned behavior. Am. J. Prev. Med. 36 (3), 189–194.
De Groot, J.I., Steg, L., 2007. Value orientations and environmental beliefs in five countries: Validity of an instrument to measure egoistic, altruistic and biospheric value orientations. J. Cross-Cult. Psychol. 38 (3), 318–332.
Dill, J., Mohr, C., Ma, L., 2014. How can psychological theory help cities increase walking and bicycling? J. Am. Plan. Assoc. 80 (1), 36–51.
Drews, S., Van den Bergh, J.C., 2016. What explains public support for climate policies? A review of empirical and experimental studies. Clim. Policy 16 (7), 855–876.
Ejelöv, E., Nilsson, A., 2020. Individual factors influencing acceptability for environmental policies: a review and research agenda. Sustainability 12 (6), 2404.
Epley, N., Keysar, B., Van Boven, L., Gilovich, T., 2004. Perspective taking as egocentric anchoring and adjustment. J. Personal. Soc. Psychol. 87 (3), 327.
Eriksson, L., Garvill, J., Nordlund, A.M., 2006. Acceptability of travel demand management measures: The importance of problem awareness, personal norm, freedom, and fairness. J. Environ. Psychol. 26 (1), 15–26.
Ertz, M., Karakas, F., Sarigöllü, E., 2016. Exploring pro-environmental behaviors of consumers: An analysis of contextual factors, attitude, and behaviors. J. Bus. Res. 69 (10), 3971–3980.
Félix, R., Moura, F., Clifton, K.J., 2019. Maturing urban cycling: comparing barriers and motivators to bicycle of cyclists and non-cyclists in Lisbon, Portugal. J. Transp. Health 15, 100628.
Fernández-Heredia, Á., Monzón, A., Jara-Díaz, S., 2014. Understanding cyclists' perceptions, keys for a successful bicycle promotion. Transp. Res. A 63, 1–11.
García, J., Arroyo, R., Mars, L., Ruiz, T., 2019. The influence of attitudes towards cycling and walking on travel intentions and actual behavior. Sustainability 11 (9), 2554.
Hackl, R., Raffler, C., Friesenecker, M., Kramar, H., Kalasek, R., Soteropoulos, A., Wolf-Eberl, S., Posch, P., Tomschy, R., 2019. Promoting active mobility: Evidence-based decision-making using statistical models. J. Transp. Geogr. 80, 102541.
Hemetsberger, M., 2019. Statistisches Handbuch des Landes Niederösterreich, 44. Jahrgang, 2020. Amt der Niederösterreichischen Landesregierung, Abteilung Raumordnung und Gesamtverkehrsangelegenheiten - Statistik.
ITF, 2021. Innovations for Better Rural Mobility. ITF Research Reports, OECD Publishing, Paris, URL: https://www.itf-oecd.org/sites/default/files/docs/innovation-rural-mobility.pdf.
Kirchengast, G., Kromp-Kolb, H., Steininger, K., Stagl, S., Kirchner, M., Ambach, C., Grohs, J., Gutsohn, A., Peisker, J., Strunk, B., 2019. Referenzplan als Grundlage für einen wissenschaftlich fundierten und mit den Pariser Klimazielen in Einklang stehenden Nationalen Energie-und Klimaplan für Österreich (Ref-NEKP). CCCA Report, URL: https://ccca.ac.at/wissenstransfer/uninetz-sdg-13/referenz-nationaler-klima-und-energieplan-ref-nekp.
Kircher, K., Forward, S., Wallén Warner, H., 2022. Cycling in Rural Areas: an Overview of National and International Literature. Working Paper, Statens väg-och transportforskningsinstitut.
Kline, R.B., 2015. Principles and Practice of Structural Equation Modeling. Guilford publications.
Koszowski, C., Gerike, R., Hubrich, S., Götschi, T., Pohle, M., Wittwer, R., 2019. Active mobility: bringing together transport planning, urban planning, and public health. In: Towards User-Centric Transport in Europe. Springer, pp. 149–171.
Krizek, K.J., Johnson, P.J., 2006. Proximity to trails and retail: Effects on urban cycling and walking. J. Am. Plan. Assoc. 72 (1), 33–42.
Kroesen, M., Handy, S., Chorus, C., 2017. Do attitudes cause behavior or vice versa? An alternative conceptualization of the attitude-behavior relationship in travel behavior modeling. Transp. Res. A 101, 190–202.
Lanzini, P., Khan, S.A., 2017. Shedding light on the psychological and behavioral determinants of travel mode choice: a meta-analysis. Transp. Res. F 48, 13–27.
Liu, Y., Sheng, H., Mundorf, N., Redding, C., Ye, Y., 2017. Integrating norm activation model and theory of planned behavior to understand sustainable transport behavior: Evidence from China. Int. J. Environ. Res. Public Health 14 (12), 1593.
Markvica, K., Millonig, A., Haufe, N., Leodolter, M., 2020. Promoting active mobility behavior by addressing information target groups: the case of Austria. J. Transp. Geogr. 83, 102664.
Mattioli, G., Roberts, C., Steinberger, J.K., Brown, A., 2020. The political economy of car dependence: A systems of provision approach. Energy Res. Soc. Sci. 66, 101486.
Muñoz, B., Monzon, A., López, E., 2016. Transition to a cyclable city: Latent variables affecting bicycle commuting. Transp. Res. A 84, 4–17.
Neto, I.L., Matsunaga, L.H., Machado, C.C., Günther, H., Hillesheim, D., Pimentel, C.E., Vargas, J.C., d'Orsi, E., 2020. Psychological determinants of walking in a Brazilian sample: An application of the theory of planned behavior. Transp. Res. F 73, 391–398.
Noblet, C.L., Thøgersen, J., Teisl, M.F., 2014. Who attempts to drive less in New England? Transp. Res. F 23, 69–80.
Nolan, J.M., Schultz, P.W., Cialdini, R.B., Goldstein, N.J., Griskevicius, V., 2008. Normative social influence is underdetected. Pers. Soc. Psychol. Bull. 34 (7), 913–923.
Noland, R.B., Kunreuther, H., 1995. Short-run and long-run policies for increasing bicycle transportation for daily commuter trips. Transp. Policy 2 (1), 67–79.
Osbaldiston, R., Schott, J.P., 2012. Environmental sustainability and behavioral science: Meta-analysis of proenvironmental behavior experiments. Environ. Behav. 44 (2), 257–299.
Peer, S., 2019. To bike or not to bike?–Evidence from a university relocation. Transp. Res. D 70, 49–69.
Raser, E., Gaupp-Berghausen, M., Dons, E., Anaya-Boig, E., Avila-Palencia, I., Brand, C., Castro, A., Clark, A., Eriksson, U., Götschi, T., et al., 2018. European cyclists' travel behavior: differences and similarities between seven European (PASTA) cities. J. Transp. Health 9, 244–252.
Richter, J., Friman, M., Gärling, T., 2011. Soft transport policy measures: Gaps in knowledge. Int. J. Sustain. Transp. 5 (4), 199–215.
Roe, J., Aspinall, P., 2011. The restorative benefits of walking in urban and rural settings in adults with good and poor mental health. Health Place 17 (1), 103–113.
Schmid, B., Jokubauskaite, S., Aschauer, F., Peer, S., Hössinger, R., Gerike, R., Jara-Diaz, S.R., Axhausen, K.W., 2019. A pooled RP/SP mode, route and destination choice model to investigate mode and user-type effects in the value of travel time savings. Transp. Res. A 124, 262–294.
Schwartz, S.H., 1977. Normative influences on altruism. In: Advances in Experimental Social Psychology, Vol. 10. Elsevier, pp. 221–279.
Silberstein, L.R., Striegel-Moore, R.H., Timko, C., Rodin, J., 1988. Behavioral and psychological implications of body dissatisfaction: Do men and women differ? Sex Roles 19 (3), 219–232.
Sjolie, A.N., Thuen, F., 2002. School journeys and leisure activities in rural and urban adolescents in Norway. Health Promot. Int. 17 (1), 21–30.
Statista, 2021a. Anzahl der Personenkraftwagen je 1.000 Einwohner in Österreich nach Bundesländern im Jahr 2020. URL: https://de.statista.com/statistik/daten/studie/288168/umfrage/pkw-dichte-in-oesterreich/.
Statista, 2021b. Bevölkerungsdichte in Österreich nach Bundesländern 2021. URL: https://de.statista.com/statistik/daten/studie/687135/umfrage/bevoelkerungsdichte-in-oesterreich-nach-bundeslaendern/.

Statistik Austria, 2020. Allgemeiner Einkommensbericht. URL: https://www.statistik.at/statistiken/volkswirtschaft-und-oeffentliche-finanzen/volkswirtschaftliche-gesamtrechnungen/regionale-gesamtrechnungen.
Statistik Austria, 2021. Arbeitsort und Pendeln. URL: https://www.statistik.at/statistiken/arbeitsmarkt/erwerbstaetigkeit/arbeitsort-und-pendeln.
Steg, L., Gifford, R., 2005. Sustainable transportation and quality of life. J. Transp. Geogr. 13 (1), 59–69.
Stern, P.C., Dietz, T., Abel, T., Guagnano, G.A., Kalof, L., 1999. A value-belief-norm theory of support for social movements: The case of environmentalism. Hum. Ecol. Rev. 81–97.
Stewart, O.T., Vernez Moudon, A., Saelens, B.E., Lee, C., Kang, B., Doescher, M.P., 2016. Comparing associations between the built environment and walking in rural small towns and a large metropolitan area. Environ. Behav. 48 (1), 13–36.
Ton, D., Zomer, L.B., Schneider, F., Hoogendoorn-Lanser, S., Duives, D., Cats, O., Hoogendoorn, S., 2019. Latent classes of daily mobility patterns: the relationship with attitudes towards modes. Transportation 1–24.
Van Cauwenberg, J., Clarys, P., De Bourdeaudhuij, I., Van Holle, V., Verté, D., De Witte, N., De Donder, L., Buffel, T., Dury, S., Deforche, B., 2012. Physical environmental factors related to walking and cycling in older adults: the belgian aging studies. BMC Public Health 12 (1), 1–13.
Velaga, N.R., Beecroft, M., Nelson, J.D., Corsar, D., Edwards, P., 2012. Transport poverty meets the digital divide: accessibility and connectivity in rural communities. J. Transp. Geogr. 21, 102–112.
Willis, D.P., Manaugh, K., El-Geneidy, A., 2015. Cycling under influence: summarizing the influence of perceptions, attitudes, habits, and social environments on cycling for transportation. Int. J. Sustain. Transp. 9 (8), 565–579.
Yang, L., Sahlqvist, S., McMinn, A., Griffin, S.J., Ogilvie, D., 2010. Interventions to promote cycling: systematic review. BMJ 341.