Title: Perceived Accessibility Scale adapted to cycling: What insights can it provide in the context of Stockholm?

Abstract
The study adapts the previously developed Perceived Accessibility Scale (PAC) to examine perceived cycling accessibility in Stockholm. Assessments of perceived cycling accessibility are particularly lacking. Using data from recent surveys in Stockholm and employing factor analysis, the study confirms the reliability of the scale in capturing perceived cycling accessibility. Hypothesis testing reveals that perceived cycling accessibility is positively associated with cycling frequency. Socio-demographic factors appear to play a less significant role, except for an indication that perceived accessibility differs by gender among frequent cyclists. Mobility characteristics, along with the social environment factor of peer influence, seem to show stronger associations with perceived accessibility compared to socio-demographics. While the adapted PAC seems to effectively measure perceptions, its ability to provide more details on what these perceptions consist of is limited. Further research should focus on examining unobserved factors and causal relations to gain deeper insights.

1 Background

Perceived accessibility was first conceptualized decades ago, together with the recognition that perceptions are a determinant of behaviour (Morris et al., 1979; Pot et al., 2021). However, there are still gaps in perceived accessibility assessments. This is particularly striking as significant differences have been found between perceived accessibility measurements and more conventionally used spatial measurements that exclude individual perceptions (e.g., Curl et al., 2015; El Murr et al., 2023; Jehle et al., 2024; Jehle et al., 2022; Lättman et al., 2018; Pot et al., 2023; Scheepers et al., 2016; van der Vlugt et al., 2019). This evidence highlights the limitations of using accessibility measures that exclude perceptions, as these may provide inaccurate insights into people's accessibility and potentially undermine policy aims (Dixit & Sivakumar, 2020; Pot et al., 2021). Measuring accessibility solely using spatial data, such as distances to destinations, travel times or route characteristics, may thus yield conclusions that differ substantially, especially for cyclists.

One reason why perceived accessibility is understudied compared to accessibility measured using spatial (objective) data is the usual data availability and deemed simplicity and ease of operationalization (Pot et al., 2023). The Perceived Accessibility Scale, developed by Lättman et al. (2016), aims to resemble these characteristics. The measure defines perceived accessibility in terms of how easy it is to live a satisfactory life with the help of the transport system. Typically comprising four survey statements, the scale is easy to administer, understand, and interpret. Thanks to these characteristics, it has been used to study perceived accessibility in multiple contexts, including rural car accessibility and public transit accessibility (Friman et al., 2020; Lukina et al., 2021; Lättman et al., 2020; Lättman et al., 2018; Pot et al., 2023; Ryan & Pereira, 2021; van der Vlugt et al., 2022).

Given current environmental and health challenges, improvements in cycling accessibility are important to encourage a modal shift away from motor vehicles to active mobility and thus to address some of these challenges (Cunha & Silva, 2023; Kilani & Bennaya, 2023; Logan et al., 2023). However, encouraging this shift requires more than purely improving physical conditions for cycling. It is equally important to improve people's perceptions of cycling, i.e., ensuring they view cycling as a feasible transport options, as perceptions, often linked to intentions, are key predictors of behaviour (Ajzen, 1991; Scheepers et al., 2016).

The adaptation of the Perceived Accessibility Scale for perceived cycling accessibility has been lacking, similarly as other research studying perceived cycling accessibility has been rather underdeveloped, with exceptions (Kellstedt et al., 2021; Ma & Cao, 2017; Ma & Dill, 2015; Rosas-Satizábal et al., 2020; Scheepers et al., 2016; Vafeiadis & Elldér, 2024). Developing perceived measures for cycling is important, because perceptions and attitudes are especially important for cycling behavior (Ma & Cao, 2017; Ryan & Pereira, 2021; Scheepers et al., 2016). While codeterminants of cycling have been largely studied, research has also shown that local context can play an important role in the association of individual characteristics with cycling behaviour (Aldred & Jungnickel, 2014; Haustein et al., 2019; Heinen et al., 2010). For example, in countries with high cycling frequencies, cycling seems to be more equal across genders, income groups, education, attitudes and other individual characteristics. However, the effects of individual characteristics on perceptions of accessibility remain less studied than their effects on behaviour. Further, Pot et al. (2023) note that the integration of relatively easy-to-obtain individual characteristics into spatial accessibility measurements could already significantly improve current practices of measuring accessibility. Understanding what factors are therefore important in shaping perceptions in certain contexts is important for advancing these efforts.

1.1 Objectives

This paper has two main objectives. First, to adapt the existing Perceived Accessibility scale by rephrasing the statements to make them suitable for assessing perceived cycling accessibility and to test the scale's performance. Second, to examine the factors that affect perceptions, as measured by the PAC, in Stockholm, a city with a relatively developed cycling culture.

As suggested by existing conceptual models of perceived accessibility, not focusing specifically on cycling (e.g., De Vos et al., 2022; Pot et al., 2023; Pot et al., 2021; van der Vlugt et al., 2019), socio-demographic characteristics, mobility resources, capabilities, attitudes and preferences matter for perceived accessibility. Previous mobility research has identified various factors influencing cycling behaviour (beyond environmental factors), which include socio-demographics (e.g., gender, age, income, education, family composition), car and bike ownership and availability, cycling skills, risk attitudes, travel attitudes, travel habits, and social support or attitudes towards cycling in the community (Blitz, 2021; Fernández-Heredia et al., 2014; Heinen et al., 2010; Jahanshahi et al., 2022; Muñoz, Monzon, & Daziano, 2016; Muñoz, Monzon, & López, 2016; Piatkowski & Marshall, 2015; Willis et al., 2014; Yuan et al., 2023). While for some variables, such as gender, age, cycling skills, car and bike availability, commute duration and peer influence, most studies agree on their effect on bicycling behaviour, other factors, such as income and education, show ambiguous effects.

2 Methods

2.1 Study setting and procedure

The study is based on data collected as part of the Bike2Green project in Stockholm, Sweden. Stockholm is a city with a medium level of cycling culture; it lacks a well-established cycling culture of the Netherlands or Denmark (Haustein et al., 2019), neither it is considered to be a starting cycling city, such as some Spanish cities (Muñoz, Monzon, & López, 2016). The project, conducted between 2023 and 2025, aims to promote cycling in Stockholm through gamification and incentivization, and is open to participants aged 13 years and older. Data used in this study were collected through two surveys – an online registration survey filled in by participants when they decided to join the project and a mid-term survey completed a few months later. The data analysed in this study were collected between March and December 2024. The surveys together collected data on respondents' socio-demographics, mobility behaviours and perceived cycling accessibility. After data cleaning, the dataset comprised responses from N = 491 participants. However, a subset of observations (N = 110) lacked complete information for certain variables (excluding statements related to perceptions, socio-demographics, and cycling frequency).

2.2 Perceived Accessibility

Perceived accessibility was measured using the previously validated Perceived Accessibility Scale (Lättman et al., 2016, 2018). In this study, the scale was adapted to specifically examine cycling perceived accessibility, in contrast to previous applications. The adaption was done by rephrasing the statements to explicitly refer to travelling by bicycle. The PAC used here constitutes of 4 statements capturing self-reported accessibility on a scale from 1 to 5 (from 1 = I strongly disagree to 5 = I strongly agree). In order to evaluate the effectiveness of the redesigned index for capturing perceived cycling accessibility, an exploratory factor analysis was conducted.

2.3 Hypotheses and Data analysis

In this paper, we hypothesize that the effect of socio-demographic, mobility and other variables is through the effect on perceptions, and, therefore, test the association of these variables with perceived accessibility. The tested hypotheses are summarized in Table 1. The null hypothesis corresponding to H1 to H5 is that "There is no significant difference in perceived bikeability depending on the mentioned characteristics". Attitudes and habits were excluded in this study due to the unavailability of data. Further, we want to test the association of the adapted perceived accessibility scale with cycling behaviour (H6). The corresponding null hypothesis is "There is no significant relationship between cycling frequency and perceptions of cycling accessibility".

Table 1. Summary of hypotheses. PCA = Perceived cycling accessibility

H1	Socio-demographic variables	• H1.a: There is a significant difference in PCA between genders. • H1.b: There is a significant difference in PCA between people in different age groups. • H1.c: There is a significant difference in PCA depending on the level of education. • H1.d: There is a significant difference in PCA for those living with children and those not living with children.
H2	Mobility variables	• H2.a: There is a significant difference in PCA for people who have a car and who do not have a car. • H2.b: There is a significant difference in PCA between those who do not have a car, who own a car and who have other access to a car. • H2.c: There is a significant difference in PCA between those who have an SL card and who do not have an SL card. • H2.d: There is a significant difference in PCA between those who have or do not have a driving license.
H3	Cycling confidence	• H3: There is a significant difference in PCA between people with different level of cycling confidence.
H4	Peers cycling	• H4: There is a significant difference in PB between people who know someone on their vicinity who cycles and who do not know anyone.
H5	Commute duration	• H5: There is a significant correlation between PCA and how long people commute.
H6	Cycling frequency	• H7: There is a difference in cycling frequency between people with different PCA.

The hypotheses are evaluated by the means of Man-Whitney U tests (for variables with two categories) and Kruskal-Wallis rank sum tests (for variables with more than more categories). These tests were chosen because the perception variable does not follow a normal distribution, as assumed by independent t-test or one-way ANOVA. To determine differences in perceived accessibility across multiple categories, the post-hoc Dunn test with Bonferroni correction was applied. Further examination included conditional Chi-square tests and cross-tabulations to assess differences in perceived accessibility levels for fixed levels of cycling frequency. For this purpose, perceived accessibility was categorised into two groups - below the mean and above the mean. In case where the number of observations in some categories was small, the Fisher exact test was used instead.

3 Results

3.1 Descriptive statistics

As can be seen in Table 2, the sample is skewed towards male participants, individuals with higher education levels, and frequent cyclists compared to Stockholm's average population. However, since the primary aim is not to necessarily derive results representative of the Stockholm's entire population, no weighting or other data adjustments were applied.

Table 2. Key sample statistics (N = 491), compared to population characteristics.

Variable	Category	Sample Mean(sd)/%	Study area[a] Mean(sd)/%
Gender	Male	66.2%	50.14%
	Female	33.8%	49.86%
Age (group)	Mean	38.4 (10.3)	40.2
	0-29	16.3%	34.86%
	30-59	79.8%	42.87%
	60+	3.9%	22.27%
Education	Lower than university	14.5%	63.62%
	University	85.5%	32.65%
Living with children	Yes	43.6%	28.23%
	No	56.4%	71.77%
Car ownership (in household)	1+	48.7%	
	0	51.3%	
Car access[b, c]	Yes, own	30.6%	60%
	Yes, other (shared, company, etc.)	33.2%	10%
	No	36.2%	30%
Driving license	Yes	88.0%	
	No	12.0%	
Public transport subscription[c]	Yes	14.3%	53%
	No	85.7%	47%
Cycling confidence	On separated bike paths	5.7%	
	In areas with low traffic, where there are no separated bike paths	26.4%	
	In areas with high traffic, where there are no separated bike paths	67.9%	
Daily commute duration[d]	Mean (in minutes one way)	31.7 (13.6)	35 (work), 39 (study)
	Less than 30 minutes (one way)	60.7%	
	More than 30 minutes (one way)	39.3%	
Having peers who also cycle	0	9.6%	
	1	29.2%	
	2	31.3%	
	3	18.2%	
	4	7.3%	
	5	4.4%	
Cycling frequency[b]	Low frequency[e]	12.8%	64%
	High frequency[f]	87.2%	36%

Variables besides socio-demographic information and cycling frequency have N = 381.
[a]Data source: Statistics Sweden (2023).
[b]Data for the study area is for Stockholm city, while the participants reside in all Stockholm region. However, almost 60% of participants live in Stockholm city. Data source: Stockholms stad (2020).
[c]Categories in the data from Stockholm are defined differently; category "Own" also includes leased or company car, while category "Other" includes only car pool or car borrowed from others.
[d] For sample mean: By the most frequently used transport mode. For study area: By cycling. Data source: Region Stockholm (2020).
[e]Low frequency = 2 times a week and less often.
[f]High frequency = at least 3 times a week.

3.2 Perceived accessibility scale for cycling

The results of the exploratory factor analysis indicate that the current adaption is suitable for capturing perceptions of cycling accessibility (Table 3.). The analysis demonstrated high overall factor adequacy (Kaiser-Meyer-Olkin) of 0.81. One factor was extracted with eigenvalue of 2.90, explaining 63% of the variance. Cronbach's alpha (α = 0.87) also showed satisfactory item correlation, in line with previous studies, and there is no increase after an item deletion. Cross-correlations show that items are also related. Perceived cycling accessibility was then calculated as a weighted average of responses to the four statements, with the factor loadings used as weights.

Table 3. Correlations, Means, Standard deviation, change in Cronbach's alpha, and factor loadings of the factor analysis. (N = 491)

Item (By travelling by bike, ...)	1	2	3	4	M	SD	Sk	Kur	α if item deleted	PAC factor loading
1. ...it is easy to do my activities.	-	-	-	-	4.24	0.89	-1.39	2.03	0.85	0.737
2. ...I am able to live my life as I want to.	0.63*	-	-	-	4.31	0.92	-1.45	1.88	0.84	0.784
3. ...I am able to do all activities I prefer.	0.62*	0.69*	-	-	3.92	1.03	-0.88	0.16	0.81	0.880
4. Access to my preferred activities is satisfactory ...	0.57*	0.57*	0.71*	-	4.07	0.94	-0.92	0.39	0.85	0.778
Eigenvalue										2.90
% of variance										63%

M = Mean, SD = Standard deviation, Sk = Skewness, Kur = Kurtosis, *p < 0.01, CFI = 0.982, TLI = 0.945, RMSEA = 0.135, SRMR = 0.024.

3.3 Hypotheses tests

Firstly, the associations of independent variables with perceived accessibility were tested, using the weighted average of perceived accessibility statements (Table 4). None of the socio-demographic variable showed significant differences in perceived accessibility. From the mobility characteristics, having at least one car in the household is significantly associated with lower perceived accessibility compared to not having a car in the household, even though the type of car access does not have a significant effect. People who have a public transport subscription card also have significantly lower perceptions of cycling accessibility. Same for those who commute to work or to school more than 30 minutes. The Dunn test revealed a significant difference in perceived accessibility between people who have one vs three peers who also commute by bicycle (p-value = 0.01). A possible but weakly significant difference was observed between participants' confidence to cycle in areas with low versus high traffic where no separated bicycle paths are available (p-value = 0.06).

Cycling frequency was found to have a significantly positive association with perceived accessibility, with frequent cyclists experiencing higher accessibility. Results from a binomial logistic regression of bike frequency on perceived accessibility show a 156% increase in odds of a higher biking frequency for a unit increase in perceived accessibility (odds ratio = 2.56; 95% confidence interval = [1.90, 3.52]; p-value < 0.00; McFadden's R^2 = 0.10). Further examinations of associations between perceived accessibility, cycling frequency and explanatory variables were performed using Chi-Squared and Fisher tests. Chi-square test for marginal independence between bike frequency and perceived accessibility, now categorized into Above and Below average, also indicated significant association (X^2 = 21.7, df = 1, p-value < 0.00).
Cramer's V (0.21) suggests a moderate association between the two variables.

Table 4. Overview of associations between perceived accessibility and individual characteristics

Variable	Category	Mean perceived accessibility	p-value
Gender	Male	4.098	0.326
	Female	4.182	
Age (group)	0-29	4.050	0.776
	30-59	4.125	
	60+	4.265	
Education	Lower than university	4.093	0.353
	University	4.133	
Living with children	Yes	4.165	0.519
	No	4.098	
Car ownership (in household)	1+	4.052	0.003***
	0	4.243	
Car access	Yes, own	4.095	0.318
	Yes, other (shared, company, etc.)	4.147	
	No	4.216	
Driving license	Yes	4.153	0.955
	No	4.126	
Public transport subscription	Yes	3.818	<0.000***
	No	4.205	
Cycling confidence	On separated bike paths	4.041	0.097*
	In areas with low traffic, where there are no separated bike paths	4.020	
	In areas with high traffic, where there are no separated bike paths	4.213	
Daily commute duration	Less than 30 minutes (one way)	4.253	0.002***
	More than 30 minutes (one way)	3.990	
Having peers who also cycle	0	3.936	0.017**
	1	3.986	
	2	4.207	
	3	4.338	
	4	4.255	
	5	4.333	
Having peers who cycle	Yes	4.172	0.137
	No	3.936	
Cycling frequency	Low frequency	3.495	<0.000***
	High frequency	4.220	

***p < 0.01, **p < 0.05, *p < 0.1.

Conditional correlations, given two fixed levels of bike frequency (either Low or High), revealed some significant differences (Table 5). Frequent male cyclists are less likely to report above average accessibility compared to female frequent cyclists. Individuals with a car are also less likely to report above average compared to those who do not have a car, given that they cycle frequently. Those who own a public transport subscription card are also less likely to have above average perceived accessibility, even though the confidence interval is weak. Frequent cyclists who are confident to cycle in areas with high traffic are more likely to report above average accessibility, compared to those frequent cyclists who only feel confident to cycle in areas with low traffic levels. Commuters commuting shorter distances are also more likely to experience better accessibility, given they are frequent cyclists. Knowing someone, specifically knowing one or three people, who also cycles seems to be positively associated with perceptions of accessibility, both among frequent and non-frequent cyclists.

Table 5. Conditional independence of perceived accessibility and explanatory variables, given bike frequency.

Variable	Low cycling frequency		High cycling frequency	
	Conditional independence (p-value)	Odds ratio	Conditional independence (p-value)	Odds ratio
Gender	0.7123		0.03715**	0.642 (Male/Female) CI: 0.419-0.975
Age (group)	1		0.8228	
Education	0.6673		0.2804	
Living with children	0.391		0.8744	
Car ownership (in household)	0.5845		0.001**	0.485 (Car/No car) CI: 0.311-0.752
Car access	0.6678		0.1345	
Driving license	0.3598		0.4417	
Public transport subscription	0.5505		0.05166*	0.506 (Yes/No) CI: 0.245-1.018
Cycling confidence[a]	1		0.08478*	0.585 (In Low/High traffic areas) CI: 0.349-0.982
Daily commute duration[b]	0.1864		0.02632**	0.601 (More/Less than 30 minutes) CI: 0.382-0.945
Having peers who commute (0 to 5 peers)[a]	0.02216**	0.137 (1 vs 3) CI: 0.019-0.748	0.09238*	0.557 (1 vs 2) CI: 0.315-0.978 0.444 (1 vs 3) CI: 0.223-0.864
Having peers who cycle (Yes/No)	0.2945		0.1642	

[a]Other pair-wise comparisons were not included in the table as their odds were not significantly different.
[b]By the most frequently used transport mode.
***p < 0.01, **p < 0.05, *p < 0.1.

4 Discussion and conclusion

The adapted Perceived Accessibility Scale seems to be suitable for studying cycling accessibility. The performance of the factor is similar to previous findings in Lättman et al. (2020); Lättman et al. (2018); Pot et al. (2023); van der Vlugt et al. (2019). The analysis revealed that there is a significant relationship between perceived accessibility, as measured by the averaged factor, and cycling frequency. However, the explanatory power of perceived accessibility on frequency remained low, suggesting there are other factors besides perceived accessibility that should be considered.

The socio-demographic variables generally seem to not matter much for reported accessibility, as rather expected based on findings from determinants of cycling behaviour in countries with highly or moderately developed cycling culture. An exception is the significance of gender within the frequent cyclists group. The fact that man are more likely to report below average accessibility than females in the high frequency cycling group is in contrast to the general expectation of women having lower perceived accessibility. However, given that these women are frequent cyclists, this may suggests that they already overcame the initial barriers of low perceptions and cycling. This, and other conditional differences suggest that people with low and high cycling frequencies may face different barriers to accessibility, and some distinction based on cycling experience may be important. Mobility variables (e.g., car ownership, commute duration, and cycling confidence) have expected associations with perceived accessibility. The significant result for peer influence suggests that such social environment effects are important for accessibility, even though they are rather rarely accounted for in perceived accessibility.

The studied sample is skewed towards males and frequent cyclists and positive responses towards the PAC statements, causing a limitation of this study. The oversampling of frequent cyclists also could have caused that the conditional comparison, given low frequent cyclists did not produce many significant results.

The insights of this study can be useful for further work on perceived cycling accessibility, for example hinting what factors can help pointing out people who are more or less likely to experience satisfactory level of perceived accessibility. However, PAC as is defined now does not provide more detailed insights into what causes low accessibility and does not provide indication of what concrete aspects should be improved to improve accessibility. Therefore, the measure could be adapted, while aiming to keep its simplicity, in order to provide further actionable insights. Future work may also include improved, more suitable analysis of the data to analysis to derive the unobserved factors underlying the observed indicators and examining causalities (van der Vlugt et al., 2022), and linking perceptions with spatial component (Lättman et al., 2020; Pot et al., 2023). Lastly, we tested the association of perceived accessibility with only a sample of other variables, excluding other potentially important factors such as health status, risk and travel attitudes, which, based on theory (Ajzen, 1991; De Vos et al., 2022), are likely to also affect perceptions.

References

Ajzen, I. (1991). The Theory of planned behavior. *Organizational Behavior and Human Decision Processes*.

Aldred, R., & Jungnickel, K. (2014). Why culture matters for transport policy: the case of cycling in the UK. *Journal of Transport Geography*, *34*, 78-87. https://doi.org/10.1016/j.jtrangeo.2013.11.004

Blitz, A. (2021). How does the individual perception of local conditions affect cycling? An analysis of the impact of built and non-built environment factors on cycling behaviour and attitudes in an urban setting. *Travel Behaviour and Society*, *25*, 27-40. https://doi.org/10.1016/j.tbs.2021.05.006

Cunha, I., & Silva, C. (2023). Assessing the equity impact of cycling infrastructure allocation: Implications for planning practice. *Transport Policy*, *133*, 15-26. https://doi.org/10.1016/j.tranpol.2022.12.021

Curl, A., Nelson, J. D., & Anable, J. (2015). Same question, different answer: A comparison of GIS-based journey time accessibility with self-reported measures from the National Travel Survey in England. *Computers, Environment and Urban Systems*, *49*, 86-97. https://doi.org/10.1016/j.compenvurbsys.2013.10.006

De Vos, J., Lättman, K., van der Vlugt, A.-L., Welsch, J., & Otsuka, N. (2022). Determinants and effects of perceived walkability: a literature review, conceptual model and research agenda. *Transport Reviews*, *43*(2), 303-324. https://doi.org/10.1080/01441647.2022.2101072

Dixit, M., & Sivakumar, A. (2020). Capturing the impact of individual characteristics on transport accessibility and equity analysis. *Transp Res D Transp Environ*, *87*, 102473. https://doi.org/10.1016/j.trd.2020.102473

El Murr, K., Boisjoly, G., & Waygood, E. O. D. (2023). Measuring accessibility to parks: Analyzing the relationship between self-reported and calculated measures. *Journal of Transport Geography*, *107*. https://doi.org/10.1016/j.jtrangeo.2023.103550

Fernández-Heredia, Á., Monzón, A., & Jara-Díaz, S. (2014). Understanding cyclists' perceptions, keys for a successful bicycle promotion. *Transportation Research Part A: Policy and Practice*, *63*, 1-11. https://doi.org/10.1016/j.tra.2014.02.013

Friman, M., Lättman, K., & Olsson, L. E. (2020). Public Transport Quality, Safety, and Perceived Accessibility. *Sustainability*, *12*(9). https://doi.org/10.3390/su12093563

Haustein, S., Koglin, T., Nielsen, T. A. S., & Svensson, Å. (2019). A comparison of cycling cultures in Stockholm and Copenhagen. *International Journal of Sustainable Transportation*, *14*(4), 280-293. https://doi.org/10.1080/15568318.2018.1547463
Heinen, E., van Wee, B., & Maat, K. (2010). Commuting by Bicycle: An Overview of the Literature. *Transport Reviews*, *30*(1), 59-96. https://doi.org/10.1080/01441640903187001
Jahanshahi, D., Costello, S. B., Dirks, K. N., Chowdhury, S., & Wee, B. v. (2022). Understanding Perceptions of Cycling Infrastructure Provision and its Role in Cycling Equity. *Transportation Research Record: Journal of the Transportation Research Board*, *2677*(3), 820-835. https://doi.org/10.1177/03611981221117821
Jehle, U., Baquero Larriva, M. T., BaghaiePoor, M., & Büttner, B. (2024). How does pedestrian accessibility vary for different people? Development of a Perceived user-specific Accessibility measure for Walking (PAW). *Transportation Research Part A: Policy and Practice*, *189*. https://doi.org/10.1016/j.tra.2024.104203
Jehle, U., Coetzee, C., Büttner, B., Pajares, E., & Wulfhorst, G. (2022). Connecting people and places: Analysis of perceived pedestrian accessibility to railway stations by Bavarian case studies. *Journal of Urban Mobility*, *2*. https://doi.org/10.1016/j.urbmob.2022.100025
Kellstedt, D. K., Spengler, J. O., & Maddock, J. E. (2021). Comparing Perceived and Objective Measures of Bikeability on a University Campus: A Case Study. *SAGE Open*, *11*(2). https://doi.org/10.1177/21582440211018685
Kilani, M., & Bennaya, S. (2023). Environmental impacts of bicycling in urban areas: A micro-simulation approach. *Transportation Research Part D: Transport and Environment*, *125*. https://doi.org/10.1016/j.trd.2023.103967
Logan, G., Somers, C., Baker, G., Connell, H., Gray, S., Kelly, P., McIntosh, E., Welsh, P., Gray, C. M., & Gill, J. M. R. (2023). Benefits, risks, barriers, and facilitators to cycling: a narrative review. *Front Sports Act Living*, *5*, 1168357. https://doi.org/10.3389/fspor.2023.1168357
Lukina, A. V., Sidorchuk, R. R., Mkhitaryan, S. V., Stukalova, A. A., & Skorobogatykh, I. I. (2021). Study of Perceived Accessibility in Daily Travel within the Metropolis. *Emerging Science Journal*, *5*(6), 868-883. https://doi.org/10.28991/esj-2021-01316
Lättman, K., Friman, M., & Olsson, L. E. (2020). Restricted car-use and perceived accessibility. *Transportation Research Part D: Transport and Environment*, *78*. https://doi.org/10.1016/j.trd.2019.102213
Lättman, K., Olsson, L. E., & Friman, M. (2016). Development and test of the Perceived Accessibility Scale (PAC) in public transport. *Journal of Transport Geography*, *54*, 257-263. https://doi.org/10.1016/j.jtrangeo.2016.06.015
Lättman, K., Olsson, L. E., & Friman, M. (2018). A new approach to accessibility – Examining perceived accessibility in contrast to objectively measured accessibility in daily travel. *Research in Transportation Economics*, *69*, 501-511. https://doi.org/10.1016/j.retrec.2018.06.002
Ma, L., & Cao, J. (2017). How perceptions mediate the effects of the built environment on travel behavior? *Transportation*, *46*(1), 175-197. https://doi.org/10.1007/s11116-017-9800-4
Ma, L., & Dill, J. (2015). Associations between the objective and perceived built environment and bicycling for transportation. *Journal of Transport & Health*, *2*(2), 248-255. https://doi.org/10.1016/j.jth.2015.03.002
Morris, J. M., Dumble, P. L., & Wigan, M. R. (1979). Accessibility indicators for transport planning. *Transportation Research Part A: General*, *13*(2), 91-109. https://doi.org/https://doi.org/10.1016/0191-2607(79)90012-8
Muñoz, B., Monzon, A., & Daziano, R. A. (2016). The Increasing Role of Latent Variables in Modelling Bicycle Mode Choice. *Transport Reviews*, *36*(6), 737-771. https://doi.org/10.1080/01441647.2016.1162874
Muñoz, B., Monzon, A., & López, E. (2016). Transition to a cyclable city: Latent variables affecting bicycle commuting. *Transportation Research Part A: Policy and Practice*, *84*, 4-17. https://doi.org/10.1016/j.tra.2015.10.006
Piatkowski, D. P., & Marshall, W. E. (2015). Not all prospective bicyclists are created equal: The role of attitudes, socio-demographics, and the built environment in bicycle commuting. *Travel Behaviour and Society*, *2*(3), 166-173. https://doi.org/10.1016/j.tbs.2015.02.001
Pot, F. J., Koster, S., & Tillema, T. (2023). Perceived accessibility in Dutch rural areas: Bridging the gap with accessibility based on spatial data. *Transport Policy*, *138*, 170-184. https://doi.org/10.1016/j.tranpol.2023.04.014
Pot, F. J., van Wee, B., & Tillema, T. (2021). Perceived accessibility: What it is and why it differs from calculated accessibility measures based on spatial data. *Journal of Transport Geography*, *94*. https://doi.org/10.1016/j.jtrangeo.2021.103090

Region Stockholm. (2020). *Resvaneundersökning 2019*. https://www.regionstockholm.se/4a272f/contentassets/d6c4da12e11843c0ab8249c297dfd8fe/resvaneundersokning-2019.pdf
Rosas-Satizábal, D., Guzman, L. A., & Oviedo, D. (2020). Cycling diversity, accessibility, and equality: An analysis of cycling commuting in Bogotá. *Transportation Research Part D: Transport and Environment*, *88*. https://doi.org/10.1016/j.trd.2020.102562
Ryan, J., & Pereira, R. H. M. (2021). What are we missing when we measure accessibility? Comparing calculated and self-reported accounts among older people. *Journal of Transport Geography*, *93*. https://doi.org/10.1016/j.jtrangeo.2021.103086
Scheepers, C. E., Wendel-Vos, G. C. W., van Kempen, E. E. M. M., de Hollander, E. L., van Wijnen, H. J., Maas, J., den Hertog, F. R. J., Staatsen, B. A. M., Stipdonk, H. L., Int Panis, L. L. R., van Wesemael, P. J. V., & Schuit, A. J. (2016). Perceived accessibility is an important factor in transport choice — Results from the AVENUE project. *Journal of Transport & Health*, *3*(1), 96-106. https://doi.org/10.1016/j.jth.2016.01.003
Statistics Sweden. (2023). https://www.scb.se/en/finding-statistics/
Stockholms stad. (2020). *Trafik och resvanor*. https://miljobarometern.stockholm.se/stockholmarna/trafik-och-resvanor/
Vafeiadis, E., & Elldér, E. (2024). When is Perceived Accessibility Over- or Underestimated by Accessibility Indicators? *Findings*. https://doi.org/10.32866/001c.94648
van der Vlugt, A.-L., Curl, A., & Scheiner, J. (2022). The influence of travel attitudes on perceived walking accessibility and walking behaviour. *Travel Behaviour and Society*, *27*, 47-56. https://doi.org/10.1016/j.tbs.2021.11.002
van der Vlugt, A.-L., Curl, A., & Wittowsky, D. (2019). What about the people? Developing measures of perceived accessibility from case studies in Germany and the UK. *Applied Mobilities*, *4*(2), 142-162. https://doi.org/10.1080/23800127.2019.1573450
Willis, D. P., Manaugh, K., & El-Geneidy, A. (2014). Cycling Under Influence: Summarizing the Influence of Perceptions, Attitudes, Habits, and Social Environments on Cycling for Transportation. *International Journal of Sustainable Transportation*, *9*(8), 565-579. https://doi.org/10.1080/15568318.2013.827285
Yuan, Y., Masud, M., Chan, H., Chan, W., & Brubacher, J. R. (2023). Intersectionality and urban mobility: A systematic review on gender differences in active transport uptake. *Journal of Transport & Health*, *29*. https://doi.org/10.1016/j.jth.2023.101572