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Influence of station characteristics, urban surroundings and perceived safety on satisfaction and public transport ridership

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Introduction and background

Public transport (PT) is an important travel mode in urban areas, serving a heterogeneous set of users and contributing to more sustainable transport and social equity in cities. While attracting new PT users requires a good understanding of predictors of PT ridership, ensuring existing users' satisfaction is crucial to retain their ridership (van Lierop et al., 2018). Both PT ridership and satisfaction are linked to the built environment (BE) attributes, including those of station environments and their surroundings (Iseki et al., 2007; Susilo & Cats, 2014; Taylor & Fink, 2013). In addition, perceived safety is a crucial factor in predicting both ridership and satisfaction with the overall trip and can be enhanced by improving the stations and their surroundings as well (Ingvardson & Nielsen, 2021; Iseki et al., 2007; Susilo & Cats, 2014). However, further research is necessary to investigate which of these BE attributes have the highest importance for satisfaction and ridership.

Satisfaction with PT is influenced by a high number of factors, among which on-board cleanliness, comfort and staff behaviour are the most common ones according to a recent review (van Lierop et al., 2018). While these are trip attributes, station attributes such as wayfinding (Nielsen et al., 2021), real-time information (Chowdhury & Ceder, 2013), maintenance and cleanliness (Eboli et al., 2018) also improve users' experience. There are, however, few studies on PT satisfaction which incorporate urban characteristics. Perceived safety is one of the most crucial needs which has to be fulfilled for a PT trip to take place, as otherwise, one might have to alter the time or mode of the trip, or cancel the trip completely (Loukaitou-Sideris et al., 2009; Lubitow et al., 2017). Focusing on lighting, maintenance, real-time information and staff presence can help achieve safe station environments which can encourage PT users (Cozens et al., 2003; Rahaman et al., 2016). That said, urban design around stations is at least as important as at the station. Providing trees (Basu et al., 2022), good lighting and human activity (Iseki et al., 2007) enhance perceived safety around stations while the presence of isolated areas or unused parking lots negatively affect it (Iseki et al., 2007).

This study analyzes the influence of station characteristics, urban surroundings and perceived safety on satisfaction as well as PT ridership, focusing on train travel in East Denmark. Using a tailor-made online survey incorporating a detailed list of built environment attributes, we estimate a comprehensive structural equation model (SEM). First, we examine which attributes of train stations and their surroundings improve perceived safety and satisfaction. We do this separately at the home and activity ends of the trip to consider explicitly potential differences in user perceptions. Second, we investigate whether overall trip satisfaction increases with higher levels of satisfaction with individual attributes at both trip ends. Lastly, we explore the relationship between trip satisfaction and PT ridership. The SEM framework allows for analysing these relationships in detail through both the direct and indirect effects. Our final data set comprises 1,004 train trips made by a large sample of PT users in East Denmark in June-July 2022.

Methodology

Survey design and data collection

We designed an online survey in Danish, with 35-40 questions in three parts: (i) travel patterns and preferences towards the attributes of stations and their surroundings, (ii) details of respondents' latest train trip, and (iii) background questions.

In the first part, we included station facilities (e.g. escalators, information screens, wayfinding), station surroundings (e.g. human activity, large parking lots), environment at/around stations (noise, air quality, lighting, maintenance, cleanliness), and access paths to stations (e.g. tunnels, pedestrian streets). We measured the importance of the selected attributes on a 5-point Likert scale (1: Very unimportant, 5: Very important). In the second part, we collected which of these attributes were present on the specific trip, and measured respondents' perceived safety level. To provide a concrete scenario, we asked the respondents to rank how safe they would feel after dark at/around their stations on a 5-point Likert scale. We also measured satisfaction with: (a) station, (b) station surroundings, (c) access to/from the station, and (d) the entire trip, all measured on a 5-point Likert scale. Items (a) to (c) were repeated for start and end stations. In the third part, we asked about gender, age, education, and access to transport resources.

We distributed the online survey through a panel of PT users from the Danish consumer watchdog for public transport (Passenger Pulse). We targeted PT users over 18-years old who reside in East Denmark, an area which includes the city of Copenhagen and has more than 2 million residents. Collecting data in June-July 2022, we reached 1,314 complete responses in the final data set.

Analysis method

In this study, we followed a structural equation modelling (SEM) approach, which is a statistical analysis method allowing to explore the influence of multiple independent variables on multiple dependent variables simultaneously. Figure 1 shows our framework which covers the relationship between perceived safety, satisfaction variables and frequency of PT use, while also exploring the effects of station characteristics and urban surroundings. Socio-demographic variables are included to account for different user groups' needs and experiences. As we expected a difference in individuals' preferences at home and activity ends of the trip, we created latent variables and estimated separate models for both trip ends in the same SEM model.

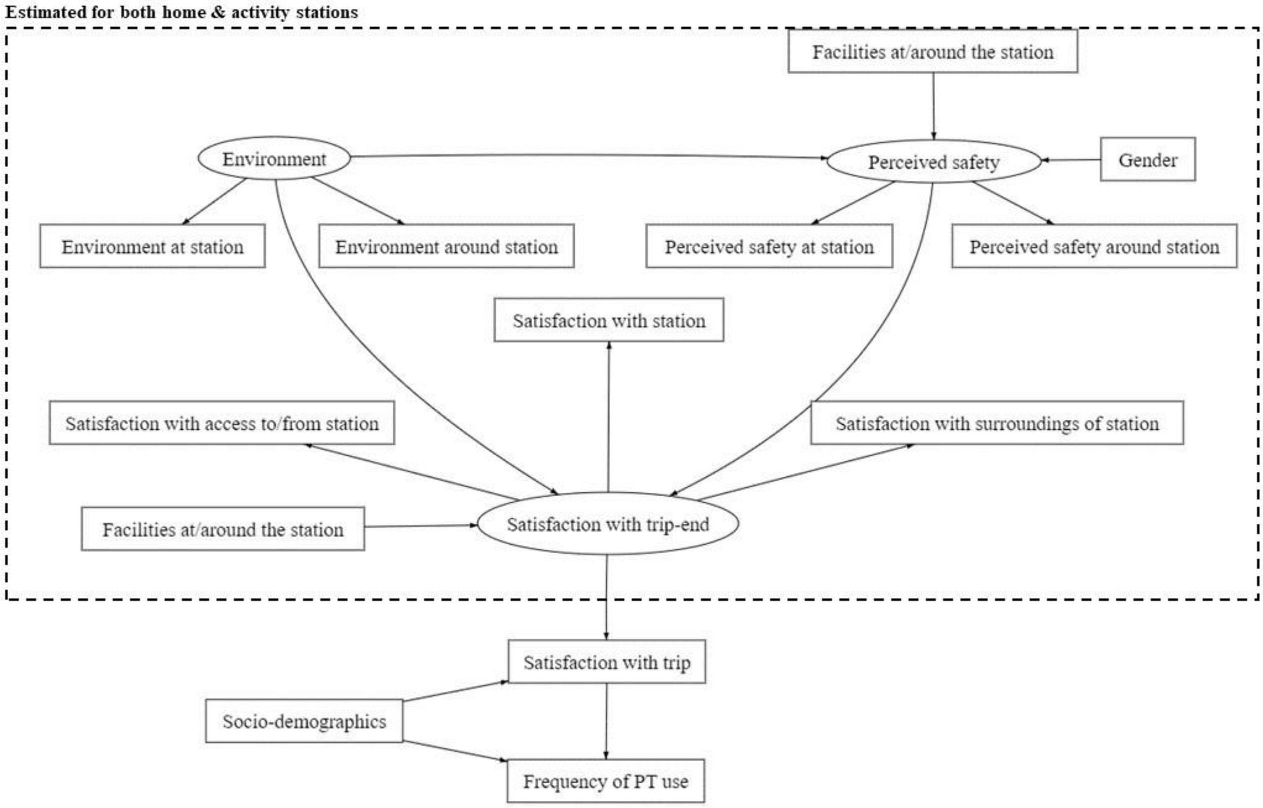

Figure 1 Structural equation modelling framework where circles represent latent variables.

In the SEM model, we introduced variables in 5-point scales as continuous variables in the model, and employed dummy variables for the yes/no questions or categorical variables (e.g. age, education).

In the measurement part of the SEM model, we applied confirmatory factor analysis (CFA) to create latent variables from items which were measured both at and around the stations. The five environment variables and perceived safety underwent this procedure separately at home and activity ends. We also loaded the three satisfaction items (i.e. satisfaction with access conditions, satisfaction with station surroundings, satisfaction with the station) into a single latent variable at each trip end.

In the structural part, we estimated models explaining these latent variables at both trip ends as well as satisfaction with the trip and frequency of PT use to test several hypotheses. First, we expected that maintenance and lighting, along with BE attributes and gender, significantly affected perceived safety at both trip ends. Second, we expected a positive significant relationship between perceived safety and satisfaction with trip ends, in addition to the significant effect of attributes such as wayfinding and crowdedness. Third, we hypothesised that satisfaction with trip ends would significantly contribute to the satisfaction with the overall trip and that there would be significant differences based on socio-demographics. Lastly, we expected a significant positive effect of satisfaction with the overall trip on frequency of PT use, in addition to socio-demographics.

Sample statistics

To test whether respondents have different preferences at home and activity ends of their trips, we converted start & end stations into home-end & activity-end stations depending on whether the trip started or ended at home. After removing trips with missing values, our modelling data set includes 1,004 trips. These 1,004 trips cover 180 stations out of the 297 in the region, and the largest transport hubs are represented. The remainder of the stations are mostly smaller local train stations with few daily users.

Table 1 describes the full sample (N= 1,314), and the sample used in the SEM model (N=1,004). In addition, we show the sample of PT users in the Danish National Travel Survey (Transportvaneundersøgelsen) between 2018-2022 for comparison, as this survey is representative for Denmark (Christiansen & Skougaard, 2015). In all three samples, women are slightly overrepresented. Given their low percentage, we merged "nonbinary" and "other" categories with women in the rest of the analysis. Both of our samples stand out with their age distribution from the TU sample, with a higher share of individuals over 50-years-old. This is a result of the age bias in the Passenger Pulse panel, which has an average age of 61. Furthermore, our sample is more educated and has higher income levels than the TU sample. In terms of access to transport resources, the samples resemble each other.

Table 1 Sample description, compared to the description of PT users in the Danish NTS

Variable / Category	Full sample	SEM sample	Danish NTS PT users
Gender Female	55.1%	54.7%	53.5%
Male	43.8%	45.0%	46.5%
Nonbinary	0.1%	0.1%	-
Prefer not to say	1.1%	-	-
Other	0.2%	0.2%	-
Age 18-29	2.4%	2.6%	39.7%
30-39	5.0%	4.8%	19.9%
40-49	9.8%	10.0%	12.5%
50-59	21.9%	21.6%	12.2%
60-69	29.3%	29.6%	7.9%
70-79	26.7%	26.7%	5.9%
>80	4.9%	4.8%	1.9%
Education Primary school	2.7%	3.2%	14.7%
High school	4.6%	4.8%	17.6%
Vocational	13.4%	13.8%	9.8%
Short-term higher education (1.5-2 years)	7.2%	6.8%	4.6%
Medium-tem higher education (2-5 years)	36.2%	36.6%	27.1%
Long-term higher education (5+ years)	35.8%	34.9%	26.2%
Income 0-99.999 DKK	1.9%	1.8%	9.2%
100.000-199.999 DKK	7.3%	7.5%	9.8%
200.000-299.999 DKK	16.8%	17.6%	9.3%
300.000-399.999 DKK	18.3%	18.9%	12.9%
400.000-499.999 DKK	15.4%	15.4%	8.9%
More than 500.000 DKK	25.0%	25.4%	11.7%
NA	15.2%	13.3%	38.2%
Car availability Yes	55.7%	56.0%	47.7%
No	44.3%	44.0%	52.3%
Bicycle availability Yes	73.8%	84.8%	76.4%
No	26.2%	15.2%	23.6%
Driving licence Yes	84.3%	74.6%	70.8%
No	15.7%	25.4%	29.2%
No. of obs	1314	1004	1850

The SEM sample consists mostly of frequent PT users as 55.6% travels with PT more than 3 times a week. Contrarily, 45.6% of the sample never drives a car. The perceived safety levels at and around stations at both trip ends are high with more than 50% of the respondents stating that they feel safe or very safe. The same applies for satisfaction where 60-70% of the respondents are satisfied with the characteristics of both trip ends. Lastly, 73.9% is satisfied with their trip.

Results and discussion

To test our hypotheses, we estimated a SEM model. As most of the attributes were highly correlated at and around station, we decided to create latent variables. For example, two variables measuring perceived safety at/around the home stations had a statistically significant correlation coefficient of 0.86. This was also the case for the three satisfaction variables (at, around, access) and environment variables. Maintenance and cleanliness variables were also highly correlated in all cases (>0.70). Therefore, we defined residual covariances between these variables in the SEM model. The fit indices show acceptable model fit with RMSEA and SRMR both below 0.08. However, CFI (0.86) is slightly below the required level of 0.90.

We present the measurement part of our SEM model in Table 2, and the structural part in tables 3-5. In these tables, the values in the "Estimate" column are the unstandardised coefficients showing how the dependent variable changes with a one-unit change in the independent variable. The values in the "Std. coef" column are the standardised coefficients showing how the dependent variable changes with a one-standard deviation change in the independent variable. These standardised coefficients can be used to compare the importance of different independent variables. Lastly, the variables with p-values less than 0.05 are considered as having a statistically significant influence on the dependent variable.

Table 2 shows that all indicators in the CFA have loaded into their corresponding latent variables with acceptable loading, and the Cronbach's alpha values were all above 0.70 thus suggesting good internal consistency (Miller, 1995). We introduced these variables as explanatory, and in some cases, also dependent variables in the structural part.

Table 2 Measurement model (N=1,004)

Latent variable (Cronbach's alpha)	Indicator	Estimate	Std.Error	Std. Coef.	P-value	Sig.
Satisfaction_home (0.84)	Satisfaction with the home station	1.000	1.000		0.834	
	Satisfaction with access to/from the home station	0.807	0.040	0.720	0.000	***
	Satisfaction with surroundings of home station	0.877	0.039	0.746	0.000	***
Noise_home (0.80)	Noise at home	1.000	1.000		0.636	
	Noise around home	1.215	0.055	0.869	0.000	***
Air_home (0.85)	Air quality at home	1.000	1.000		0.738	
	Air quality around home	1.046	0.035	0.883	0.000	***
Lighthing_home (0.82)	Lighting at home	1.000	1.000		0.693	
	Lighting around home	0.920	0.036	0.811	0.000	***
Maintenance_home (0.80)	Maintenance at home	1.000	1.000		0.793	
	Maintenance around home	0.854	0.034	0.792	0.000	***
Cleanliness_home (0.83)	Cleanliness at home	1.000	1.000		0.815	
	Cleanliness around home	0.850	0.032	0.808	0.000	***
Safety_home (0.93)	Perceived safety at home station	1.000	1.000		0.988	

	Perceived safety around home station	0.912	0.029	0.889	0.000	***
Satisfaction_activity (0.83)	Satisfaction with the activity station	1.000	1.000		0.750	
	Satisfaction with access to/from the activity station	0.789	0.038	0.668	0.000	***
	Satisfaction with surroundings of activity station	0.803	0.039	0.667	0.000	***
Noise_activity (0.84)	Noise at activity	1.000	1.000		0.758	
	Noise around activity	1.074	0.038	0.877	0.000	***
Air_activity (0.86)	Air quality at activity	1.000	1.000		0.767	
	Air quality around activity	0.981	0.030	0.868	0.000	***
Lighthing_activity (0.78)	Lighting at activity	1.000	1.000		0.652	
	Lighting around activity	0.878	0.036	0.772	0.000	***
Maintenance_activity (0.83)	Maintenance at activity	1.000	1.000		0.761	
	Maintenance around activity	0.909	0.031	0.827	0.000	***
Cleanliness_activity (0.84)	Cleanliness at activity	1.000	1.000		0.778	
	Cleanliness around activity	0.964	0.033	0.855	0.000	***
Safety_activity (0.92)	Perceived safety at activity station	1.000	1.000		0.853	
	Perceived safety around activity station	0.968	0.040	0.911	0.000	***

***: p <=0.001, **: 0.001<p <=0.01, *: 0.01<p <=0.05, . : 0.05 <p <= 0.1

The models explaining the latent perceived safety variables at home and activity ends identify isolated areas around stations, lighting conditions and gender as common significant predictors in both cases (Table 3). While increasing levels of isolation reduce perceived safety, good lighting conditions improve the experience. Men feel significantly safer than non-male respondents. At home-end, urban life and trees also have positive and significant parameter estimates.

Table 3 Structural model - perceived safety (N=1,004)

Dependent variable	Explanatory variable	Estimate	Std.Error	Std. Coef.	P-value	Sig.
Safety_home	Shops around home station	0.054	0.061	0.027	0.381	
	Urban life around home station	0.130	0.064	0.065	0.042	*
	Large parking lots around home station	-0.064	0.060	-0.030	0.287	
	Closed facades around home station	-0.064	0.071	-0.025	0.370	
	Isolated areas around home station	-0.262	0.071	-0.112	0.000	***
	Trees around home station	0.108	0.056	0.055	0.054	.
	Lighting_home	0.662	0.074	0.464	0.000	***
	Maintenance_home	0.064	0.063	0.051	0.310	
	Male (Ref: Female and other)	0.272	0.055	0.137	0.000	***
Safety_activity	Shops around activity station	0.070	0.054	0.041	0.197	
	Urban life around activity station	0.058	0.058	0.034	0.321	
	Large parking lots around activity station	-0.077	0.068	-0.035	0.257	
	Closed facades around activity station	-0.022	0.072	-0.009	0.760	
	Isolated areas around activity station	-0.306	0.079	-0.127	0.000	***

	Trees around activity station	0.040	0.058	0.021	0.487	
	Lighting_activity	0.395	0.093	0.302	0.000	***
	Maintenance_activity	0.118	0.078	0.105	0.132	
	Male (Ref: Female and other)	0.230	0.052	0.134	0.000	***

***: p <=0.001, **: 0.001<p <=0.01, *: 0.01<p <=0.05 , . : 0.05 <p <= 0.1

For satisfaction with trip ends, maintenance, perceived safety, wayfinding and problems with seeing screens are significant at both ends (Table 4). Except for problems with seeing information screens, these common predictors significantly increase satisfaction with trip ends. Satisfaction with the home station significantly reduces if the respondent has used escalators or stairs. This could imply a dispreference towards level changes or an unpleasant experience due to dirty elevators or long stairs.

Table 4 Structural model cont'd - satisfaction with stations (N=1,004)

Dependent variable	Explanatory variable	Estimate	Std.Error	Std. Coef.	P-value	Sig.
Satisfaction_home	Noise_home	-0.005	0.068	-0.004	0.944	
	Air_home	0.006	0.064	0.005	0.927	
	Lighthing_home	0.025	0.066	0.021	0.705	
	Maintenance_home	0.552	0.090	0.525	0.000	***
	Cleanliness_home	0.044	0.070	0.043	0.528	
	Safety_home	0.201	0.026	0.238	0.000	***
	Access via pedestrian street	0.130	0.050	0.075	0.010	**
	Access via tunnel	0.033	0.054	0.018	0.541	
	Access via bridge	0.004	0.066	0.002	0.952	
	Access via bike path	0.199	0.052	0.109	0.000	***
	Wayfinding_home	0.148	0.026	0.148	0.000	***
	Problems seeing information screens	-0.269	0.063	-0.110	0.000	***
	Used escalator	-0.151	0.074	-0.056	0.042	*
	Used stairs	-0.141	0.056	-0.079	0.012	*
	Used elevator	0.042	0.065	0.019	0.517	
	Crowedness	-0.015	0.019	-0.020	0.426	
Satisfaction_activity	Noise_activity	-0.066	0.069	-0.067	0.340	
	Air_activity	0.033	0.078	0.034	0.671	
	Lighthing_activity	0.071	0.085	0.062	0.400	
	Maintenance_activity	0.536	0.114	0.544	0.000	***
	Cleanliness_activity	0.030	0.087	0.031	0.734	
	Safety_activity	0.126	0.027	0.143	0.000	***
	Access via pedestrian street	0.194	0.050	0.128	0.000	***
	Access via tunnel	0.035	0.053	0.020	0.517	
	Access via bridge	0.065	0.063	0.029	0.304	
	Access via bike path	0.084	0.056	0.046	0.133	
	Wayfinding_home	0.119	0.024	0.143	0.000	***

	Problems seeing information screens	-0.203	0.062	-0.092	0.001	***
	Used escalator	0.103	0.058	0.057	0.078	.
	Used stairs	-0.013	0.057	-0.008	0.816	
	Used elevator	0.054	0.068	0.026	0.426	
	Crowedness	0.024	0.017	0.038	0.162	

***: p <=0.001, **: 0.001<p <=0.01, *: 0.01<p <=0.05 , . : 0.05 <p <= 0.1

As

Table 5 shows, satisfaction with the station conditions in both trip ends has a significant positive relationship with trip satisfaction. There is also a slight gender effect where men are less satisfied than non-male respondents. Respondents without a car are also slightly more likely to be satisfied with their trip. Education, which was added as a proxy for income, does not show a strong effect. Lastly, all age categories are less satisfied than respondents over 70-years-old, however only one of these categories is significant. Unlike our expectation, satisfaction with the trip does not significantly influence frequency of PT use. However, age and not owning a car have strong effects.

Table 5 Structural model cont'd - trip satisfaction and frequency of PT use (N=1,004)

Dependent variable	Explanatory variable	Estimate	Std.Error	Std. Coef.	P-value	Sig.
Satisfaction with the trip	Satisfaction_home	0.296	0.045	0.280	0.000	***
	Satisfaction_activity	0.372	0.049	0.317	0.000	***
	Male (Ref: Female and other)	-0.095	0.050	-0.054	0.058	.
	No cars (Ref: Car owner)	0.094	0.052	0.053	0.068	.
	Education - Primary school (Ref: 2+ year higher ed.)	-0.137	0.142	-0.027	0.337	
	Education - Highschool (Ref: 2+ year higher ed.)	0.193	0.120	0.047	0.107	
	Education - Vocational (Ref: 2+ year higher ed.)	0.180	0.073	0.071	0.013	*
	Education - Shrt higher education (Ref: 2+ year higher ed.)	-0.055	0.099	-0.016	0.577	
	Age - 18-29 (Ref: 70+)	-0.338	0.162	-0.061	0.038	*
	Age - 30-39 (Ref: 70+)	-0.231	0.121	-0.056	0.057	.
	Age - 40-49 (Ref: 70+)	-0.139	0.090	-0.047	0.122	
	Age - 50-59 (Ref: 70+)	-0.124	0.070	-0.058	0.075	.
	Age - 60-69 (Ref: 70+)	-0.145	0.063	-0.075	0.022	*
Frequency of PT use	Satisfaction with the trip Male (Ref: Female and other)	-0.028	0.044	-0.020	0.519	
	No cars (Ref: Car owner)	0.005	0.077	0.002	0.953	***
	Education - Primary school (Ref: 2+ year higher ed.)	0.496	0.080	0.197	0.000	
	Education - Highschool (Ref: 2+ year higher ed.)	-0.300	0.220	-0.042	0.172	*
	Education - Vocational (Ref: 2+ year higher ed.)	0.441	0.185	0.075	0.017	
	Education - Shrt higher education (Ref: 2+ year higher ed.)	0.121	0.112	0.033	0.282	
	Age - 18-29 (Ref: 70+)	0.107	0.153	0.021	0.486	
	Age - 30-39 (Ref: 70+)	0.072	0.251	0.009	0.774	**
	Age - 40-49 (Ref: 70+)	0.536	0.187	0.091	0.004	***
	Age - 50-59 (Ref: 70+)	0.457	0.139	0.109	0.001	***

	Age - 60-69 (Ref: 70+)	0.645	0.108	0.212	0.000	***

***: p <=0.001, **: 0.001<p <=0.01, *: 0.01<p <=0.05 , . : 0.05 <p <= 0.1

Discussion

This study found a high correlation between attributes measured at and around the stations. The experience on the way to a station might have a lasting influence on the experience at the station and vice versa, resulting in similar measurements. This should encourage planners to have a more holistic approach when designing stations and urban environments. Respondents might also have had difficulty differentiating between stations and their surroundings. However, as we explicitly mentioned the difference in each question, we believe this to be less likely.

The perceived safety analyses confirm gender effects in line with the literature. Among the hypothesised attributes, the presence of isolated areas and lighting were significant as expected while it is interesting that maintenance, for example, does not influence perceived safety.

It is initially unexpected that trip satisfaction does not significantly affect the frequency of PT use as, for example, Ingvardson & Nielsen (2019) found a positive significant relationship. One key difference between the two studies is that our sample consists heavily of captive PT users who never drive. Therefore, they might have to use PT even though they are dissatisfied as van Lierop et al. (2018) also highlight in their review. Susilo & Cats (2014) also state that choice users are often more satisfied than captive users.

As our structural model shows, home and activity ends have many significant parameters in common, although more factors are significant at the former. That said, many of the attributes at both ends, such as perceived safety, were correlated and this might have influenced model findings. One reason for this correlation can be the representation of the same stations with high passenger volumes in both ends. Another reason can be respondents' strong personal preferences. This will be considered explicitly in future work.

While the SEM results provide interesting insights, the model can and will be further developed. First, the SEM model lacks some important predictors of PT use such as service headway and trip duration in comparison to other alternatives. We will include such variables to get a clearer outcome and potentially improve model fit.

Second, the results are based on a relatively large sample of PT users, acting as a valuable source to understand actual users' needs and preferences. However, the age bias in the sample might have influenced the findings as younger individuals' preferences were under-represented. In March 2023, we will send the survey to a subset of respondents from the Danish NTS between 2018-2022 to achieve a larger and more representative sample. This way, we can also include more attributes such as bicycle parking which were left out due to having too many missing values. By including less frequent PT users in the data set, we can also test whether the relationship between satisfaction and ridership holds among different, and more representative, user groups.

Conclusions

This study analyzed the influence of station characteristics, urban surroundings, and perceived safety on satisfaction as well as PT ridership, in East Denmark. Using 1,004 observations from our tailor-made survey, we employed a Structural Equation Model (SEM) and first, we created latent variables from environment attributes which are highly correlated at and around stations as well as perceived safety and satisfaction variables. Second, we showed a significant relationship between (i) perceived safety and satisfaction with trip-ends, and (ii) satisfaction with trip-ends and overall trip satisfaction. While doing so, we identified which BE attributes should be present at stations and surroundings. Lastly, we could not demonstrate a significant effect of trip satisfaction on frequency of PT use. However, we expect that to be due to our sample's high share of captive PT users. As part of our future work, we will collect more data to achieve a more representative sample and incorporate more trip-related attributes to our SEM model to further investigate the relationship between the satisfaction constructs and PT ridership.

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References

Basu, N., Oviedo-Trespalacios, O., King, M., Kamruzzaman, M., & Mazharul Haque, M. (2022). The influence of the built environment on pedestrians' perceptions of attractiveness, safety and security. *Transportation Research Part F: Psychology and Behaviour*, *87*, 203–218. Retrieved 2022-05-02, from https://doi.org/10.1016/j.trf.2022.03.006 doi: 10.1016/j.trf.2022.03 .006

Chowdhury, S., & Ceder, A. (2013). The Effect of Interchange Attributes on Public-Transport Users'Intention to Use Routes Involving Transfers. *Psychology and Behavioral Sciences*, *2*(1), 5–13. Retrieved 2022-04-28, from http://www.sciencepublishinggroup.com/j/pbs (Publisher: Science Publishing Group ISBN: 20130201.12) doi: 10.11648/J.PBS.20130201.12

Christiansen, H., & Skougaard, B. Z. (2015). *Documentation of the Danish National Travel Survey* (Tech. Rep.). Technical University of Denmark Department of Transport. (ISBN: 978-87-7327288-6 ISSN: 1601-9458)

Cozens, P., Neale, R., Whitaker, J., & Hillier, D. (2003). Managing crime and the fear of crime at railway stations-A case study in South Wales (UK). *International Journal of Transport Management*, *1*, 121–132. (Publisher: Elsevier Ltd) doi: 10.1016/J.IJTM.2003.10.001

Eboli, L., Forciniti, C., & Mazzulla, G. (2018). Spatial variation of the perceived transit service quality at rail stations. Retrieved 2022-04-28, from https://doi.org/10.1016/j.tra.2018.01 .032 doi: 10.1016/j.tra.2018.01.032

Ingvardson, J. B., & Nielsen, O. A. (2019, August). The relationship between norms, satisfaction and public transport use: A comparison across six European cities using structural equation modelling. *Transportation Research Part A: Policy and Practice*, *126*, 37–57. Retrieved 2023-03-02, from https://www.sciencedirect.com/science/article/pii/S0965856417313046 doi: 10.1016/j.tra.2019.05.016

Ingvardson, J. B., & Nielsen, O. A. (2021). The influence of vicinity to stations, station characteristics and perceived safety on public transport mode choice: a case study from Copenhagen. *Public Transport*, 1–22. Retrieved from https://doi.org/10.1007/s12469-021-00285-x doi: 10.1007/s12469-021-00285-x

Iseki, H., Ringler, A., Taylor, B. D., Miller, M., & Smart, M. (2007). *Evaluating Transit Stops and Stations from the Perspective of Transit Users* (Tech. Rep.). California Department of Transportation.

Loukaitou-Sideris, A., Bornstein, A., Fink, C., Samuels, L., & Gerami, S. (2009). *How To Ease Women's Fear of Transportation Environments: Case Studies and Best Practices* (Tech. Rep.). Mineta Transportation Institute.

Lubitow, A., Rainer, J., & Bassett, S. (2017). Exclusion and vulnerability on public transit: experiences of transit dependent riders in Portland, Oregon. *Mobilities*. doi: 10.1080/17450101 .2016.1253816

Miller, M. B. (1995). Coefficient Alpha: A Basic Introduction From the Perspectives of Classical Test Theory and Structural Equation Modeling. *Structural Equation Modeling-a Multidisciplinary Journal*, *2*(3), 255–273. Retrieved 2023-03-02, from https://www.tandfonline.com/ doi/abs/10.1080/10705519509540013 (Place: Abingdon Publisher: Routledge Journals, Taylor & Francis Ltd WOS:000208062100005) doi: 10.1080/10705519509540013

Nielsen, O. A., Eltved, M., Anderson, M. K., & Prato, C. G. (2021). Relevance of detailed transfer attributes in large-scale multimodal route choice models for metropolitan public transport passengers. *Transportation Research Part A: Policy and Practice*, *147*(February), 76–92. Retrieved from https://doi.org/10.1016/j.tra.2021.02.010 (Publisher: Elsevier Ltd) doi: 10.1016/j.tra.2021.02.010

Rahaman, M., Currie, G., & Muir, C. (2016, January). Development and Application of a Scale to Measure Station Design Quality for Personal Safety:. *Transportation Research Record: Journal of the Transportation Research Board*, *2540*, 1–12. Retrieved 2021-08-11, from https://journals .sagepub.com/doi/10.3141/2540-01 (Publisher: SAGE PublicationsSage CA: Los Angeles, CA) doi: 10.3141/2540-01

Susilo, Y. O., & Cats, O. (2014, September). Exploring key determinants of travel satisfaction for multi-modal trips by different traveler groups. *Transportation Research Part A: Policy and Practice*, *67*, 366–380. Retrieved 2023-01-09, from https://linkinghub.elsevier.com/ retrieve/pii/S0965856414001827 doi: 10.1016/j.tra.2014.08.002

Taylor, B. D., & Fink, C. N. (2013). Explaining transit ridership: What has the evidence shown? *Transportation Letters*, *5*(1), 15–26. Retrieved 2021-11-13, from https://www.tandfonline .com/doi/abs/10.1179/1942786712Z.0000000003 (Publisher: Taylor & Francis) doi: 10 .1179/1942786712Z.0000000003

van Lierop, D., Badami, M. G., & El-Geneidy, A. M. (2018, January). What influences satisfaction and loyalty in public transport? A review of the literature. *Transport Reviews*, *38*(1), 52–72. Retrieved 2023-01-04, from https://doi.org/10.1080/01441647.2017.1298683 (Publisher: Routledge _eprint: https://doi.org/10.1080/01441647.2017.1298683) doi: 10.1080/01441647 .2017.1298683