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TRANSPORT FINDINGS

Bike Attitudes Predict Behaviour Change, more than Vice Versa: A Norwegian Quasi-replication of Kroesen and Colleagues (2017)

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Findings

Existing research from the Netherlands suggests that bicycle attitudes and behaviour affect each other, but bicycle behaviour affects attitude more than vice versa (Kroesen et al., 2017). We conducted a quasi-replication study using existing datasets (n=972) with slightly different operationalisations and timeframes in a Norwegian context. Using two variations of a structural equation model, we confirm this bidirectional effect, though our findings show a considerably stronger influence of attitudes on behaviour than the reverse.

1. Questions

Kroesen, Handy, and Chorus (2017) investigated the relationship between travel attitudes and behaviours, focusing on whether attitudes influence behaviour or vice versa. Using a two-wave survey conducted one year apart, they assessed how first-year attitudes and behaviours predicted their counterparts in the second year. Their findings revealed a reciprocal relationship between cycling attitudes and behaviour, with each influencing the other. Notably, they found that first-year behaviour was a stronger predictor of second-year attitudes than first-year attitudes were of second-year behaviour. Specifically, behaviour predicted attitudes with twice the strength that attitudes predicted behaviour, as measured by standardised effect sizes.

While their research provided valuable insights into the causality between attitude and behaviour, it was limited to the Netherlands, a country with an exceptionally high cycling modal share compared to other European countries (Goel et al. 2022; Schepers et al. 2015). Replicating their findings with slightly different operationalisations and sample would reinforce that their results are not due to their specific methodology or limited to the Netherlands. Therefore, we conduct a quasi-replication of their findings using different samples and instruments.

2. Methods

We searched for existing datasets originally collected for other purposes where participants (1) responded to two or more surveys regarding cycling attitudes and behaviour and (2) were not subject to study manipulation (i.e., the control groups). Following these criteria, we had access to two datasets collected in Norway. The first dataset, collected in June 2013, investigated the effect of borrowing a free electric bike (reported in Fyhri and Fearnley 2015;

Table 1. Descriptive data of variables used in the analysis.

Cycling on my daily trips will involve for me...	Pre-survey	Post-survey
... mental relaxation	4.6 (SD=1.9)	4.7 (SD=1.7)
... great freedom	4.7 (SD=1.9)	5.1 (SD=1.7)
... time savings	3.8 (SD=2.2)	4.1 (SD=2.1)
... money savings	5.3 (SD=1.9)	5.4 (SD=1.8)
... improved fitness	6.2 (SD=1.2)	6.1 (SD=1.2)
... a correct image	4.4 (SD=1.8)	4.3 (SD=1.8)
Approximately how far did you cycle last week? That is, over the past 7 days.		
- Cycling to/from work, school, or other transport purposes, kilometres:	27.5 (SD=39.0)	31.9 (SD=50.2)

Table 2. Frequencies of distance travelled by bike.

Category	T1	T2
1 (= 0 km)	304	209
2 (0-10km)	101	102
3 (10-40km)	240	201
4 (<40km)	245	237

Fyhri et al. 2017; Fyhri and Sundfør 2014). The sample was from members of the Norwegian Automobile Federation. In total, 247 respondents in the control group responded to the follow-up survey. The second dataset was from another study using a similar survey with a sample from an insurance company. This survey was distributed in May 2014, investigating the effect of buying an electric bicycle. Here, A total of 725 participants in the control group responded to the first and second surveys (reported in Fyhri and Sundfør 2020; Sundfør and Fyhri 2017).

In both datasets, all participants answered items regarding cycling attitudes and behaviour. See Table 1 for details. For attitude, we found that a combination of 6 items created a reasonably reliable index on attitudes. Here, the Cronbach's alpha was .747 for the pre-data (T1), and .749 for the post-data (T2). Behaviour was measured by the distance biked in kilometres for transport. Although the data also included distance biked for exercise data, we argued that this was not as relevant for this study. The statistical script and output for this analysis and a minimized dataset is available as supplementary information.

For the structural equation modelling, our primary interest is to compare the effect of T1 attitudes on T2 behaviour, with the effect of T1 behaviour on T2 attitudes, staying as close as possible to the methods of Kroesen, Handy, and Chorus (2017). Therefore, like the original article, we also categorized the behavioural measures into 4 categories, created summated attitude scores, and fixed their error term to (1 - Cronbach's Alpha) * variance. See Table 2 for details. Additionally, all background variables affect all variables in the model, but insignificant effects were removed from the model through stepwise backwards elimination.

Table 3. Demographic information on the datasets. Numbers in parentheses represent standard deviations.

	Dataset 1 n = 247	Dataset 2 n = 725	Norway 2014
Age	45.6 (11.7)	46.4 (11.7)	48.0 (18.4)
Male	72%	65%	50%
Education			
Basic	2%	2%	25%
High School	19%	14%	43%
University, 4 years or less	41%	33%	23%
University, 5 years or more	37%	51%	9%

Our models differed in that we did not apply a probit model to the two behaviour measures. This was because our software, Stata 18, does not allow for covariance from the error terms of ordered probit variables. Thus, running the model with ordered probit models for the behavioural measure would cause the model to not control for the covariance between attitude and behaviour in T1 and T2, which would considerably change the model. Therefore, in the supplementary information, we present one model with and without ordered probit links side by side, showing that the only difference seems to be slightly higher effect sizes on bicycle use T2. For this purpose, this is not a problem, and we argue that they can be interpreted similarly.

In the supplementary information, we also present a similar model that differs more from the methods of Kroesen, Handy, and Chorus (2017) but better fits our data. Here, the behavioural measures are continuous instead of categorical, and construct the attitude measure as a latent variable derived from individual attitude items. This allows for results that are both true to the original methods, as well as best fit to the data.

The final dataset had 972 participants. The mean time between the first and second surveys was 94 days, with considerable variation (SD = 27, MIN = 34, MAX 147). Demographic information on the two datasets is listed in Table 3. Population characteristics for Norway are retrieved from Microdata.no and represent the population of Norway over the age of 18 in the relevant time period.

3. Findings

The results of the structural equation model are reported in Figure 1.

Similarly to Kroesen, Handy, and Chorus (2017) we find a statistically significant effect of both T1 bicycle use on T2 attitudes, and T1 attitudes on T2 bicycle use. Our findings differ in that in our model, the effect of T1 attitudes on T2 bicycle use is stronger than the effect of T1 bicycle use on T2 attitudes. Furthermore, in the alternative model, which deviates from a strict replication of their methods but better aligns with our data, we find no statistically significant effect of T1 bicycle use on T2 attitudes. Other than this, it is largely similar to the model presented above. In other words, we

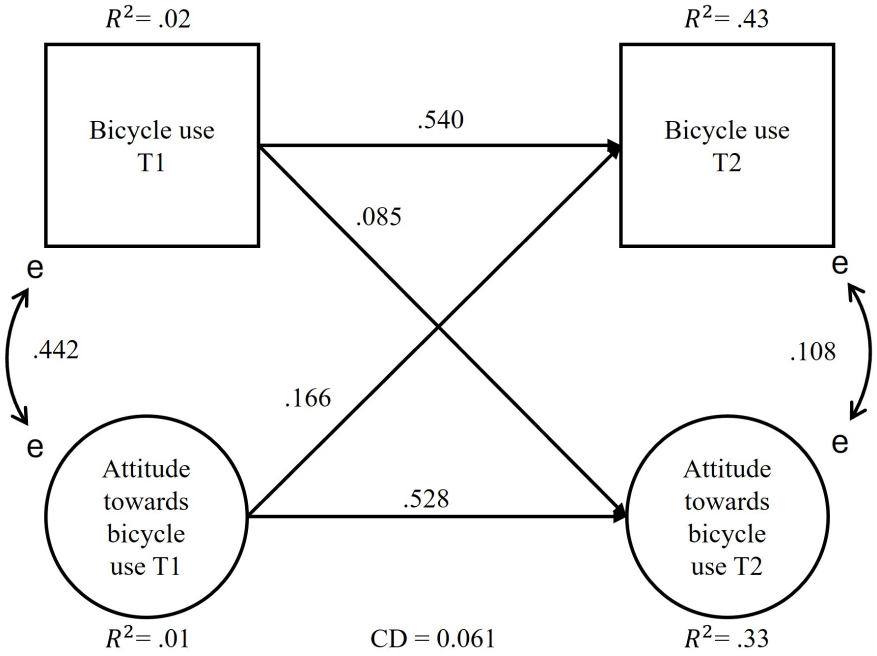

Figure 1. Structural equation model. Numbers indicate standardised coefficients. Full lines indicate statistically significant relationships at p<.05.

find a stronger link, relatively speaking, between T1 attitudes and behaviour than what Kroesen, Handy, and Chorus (2017) found. Additionally, we find a weaker link between T1 behaviour and T2 attitudes. Likely, the Norwegian context with a considerably lower bike modal share than the Netherlands, and a considerably shorter period (3 vs. 12 months) between T1 and T2 cause these differences.

Disclosure and conflicts of interest

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REFERENCES

Fyhri, A., and N. Fearnley. 2015. "Effects of E-Bikes on Bicycle Use and Mode Share." *Transportation Research. Part D, Transport and Environment* 36:45–52. https://doi.org/10.1016/j.trd.2015.02.005.

Fyhri, A., E. Heinen, N. Fearnley, and H. B. Sundfør. 2017. "A Push to Cycling—Exploring the e-Bike's Role in Overcoming Barriers to Bicycle Use with a Survey and an Intervention Study." *International Journal of Sustainable Transportation* 11 (9): 681–95. https://doi.org/10.1080/15568318.2017.1302526.

Fyhri, A., and H. B. Sundfør. 2014. "Elsykkel–hvem vil kjøpe dem, og hvilken effekt har de?" No. 1325. Transportøkonomisk Institutt.

———. 2020. "Do People Who Buy E-Bikes Cycle More?" *Transportation Research Part D: Transport and Environment* 86:102422. https://doi.org/10.1016/j.trd.2020.102422.

Goel, R., A. Goodman, R. Aldred, R. Nakamura, L. Tatah, L. M. T. Garcia, B. Zapata-Diomedi, et al. 2022. "Cycling Behaviour in 17 Countries across 6 Continents: Levels of Cycling, Who Cycles, for What Purpose, and How Far?" *Transport Reviews* 42 (1): 58–81. https://doi.org/10.1080/01441647.2021.1915898.

Kroesen, M., S. Handy, and C. Chorus. 2017. "Do Attitudes Cause Behavior or Vice Versa? An Alternative Conceptualization of the Attitude-Behavior Relationship in Travel Behavior Modeling." *Transportation Research. Part A, Policy and Practice* 101:190–202.

Schepers, P., N. Agerholm, E. Amoros, R. Benington, T. Bjørnskau, S. Dhondt, B. de Geus, C. Hagemeister, B. P. Y. Loo, and A. Niska. 2015. "An International Review of the Frequency of Single-Bicycle Crashes (SBCs) and Their Relation to Bicycle Modal Share." *Injury Prevention: Journal of the International Society for Child and Adolescent Injury Prevention* 21 (e1): e138-43.

Sundfør, H. B., and A. Fyhri. 2017. "A Push for Public Health: The Effect of e-Bikes on Physical Activity Levels." *BMC Public Health* 17 (1): 809. https://doi.org/10.1186/s12889-017-4817-3.

SUPPLEMENTARY MATERIALS

Supplementary information

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Statistical script

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Minimized dataset

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