The Impact of the Built Environment on Active Travel Mode Choices among Students in NSW, Australia

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WHAT

The primary factor influencing children's likelihood to walk to school is the distance to their educational institution. However, the strength of this influence varies depending on the specific variables that are controlled for. This study is centred on investigating **how the '6Ds' (Design, Density, Diversity, Distance, Destination accessibility, and Demand) affect the magnitude of the impact of distance to school on students' walking propensity.**

WHY

Excluding essential variables like the '6Ds' from the model can lead to policy conclusions that are incomplete or even misleading. *Misleading policy outcomes* can promote inequalities in school transport. Some communities may benefit from policies that are incorrectly tailored to their needs, while others are left at a disadvantage. Ensuring accurate models can help address these disparities.

HOW

Data
- ✓ SPANS "School Physical Activity and Nutrition Survey"
- ✓ ABS
- ✓ TfNSW Open Data Hub
- ✓ OSM Geofabrik
- ✓ GTFS

Nested Logit Tree

Mode choice → Motorised / Active
Motorised → Car, Public transit
Active → Active
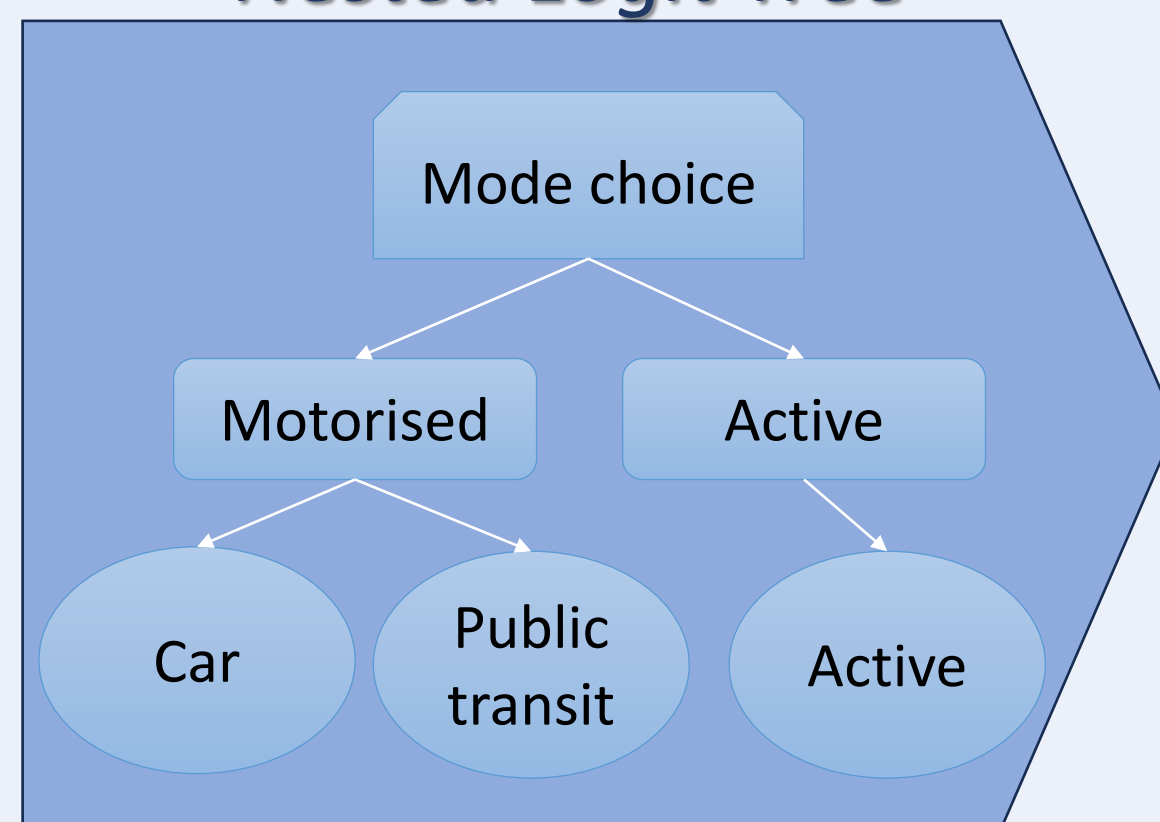
Competing Models

Base
socio-economic + demographic + travel distance

BEM
Base model + 6Ds

Results

Base vs. BEM
Changes in the role of 'distance' in active school travel mode choice
→ coefficients, elasticity

MODELS

Categories	Variables	Base	BEM
	Constant	30.63	-16.02
Socio-economic and demographic	Age	4.54***	2.87***
	SES	32.90	33.79*
	Female	-9.92***	-7.42***
	English	-14.47***	-7.43***
	Rural	14.41***	13.83***
Travel distance	Government	6.27	12.37***
	Distance with ceiling 1km	-93.85***	-56.41***
	Distance over 1km with ceiling 2km	-58.91***	-33.38***
	Distance over 3km with ceiling 2km	-17.73***	-10.42***
	Distance over 5km	-3.92	-2.45
Design	Bike lane length density (km/km²)	-	2.99**
	Footpath length density (km/km²)	-	0.20
	Road length density (km/km²)	-	-1.55
	Crossing density (count/km²)	-	-0.10
	Stop sign density (count/km²)	-	2.89***
	Cul-de-sac density (count/km²)	-	0.02
Density	Population density (1000 people / km²)	-	1.66***
	Employment density (1000 jobs / km²)	-	-0.71
Diversity	Land-use mix	-	30.37**
	Job/housing balance	-	-22.49
	Retail density (count/km²)	-	-0.89
Distance (to transit)	Distance to nearest bus stop (km)	-	5.03
Destination	Number of all parks	-	-1.26**
	Number of local parks	-	0.97
Demand	Car parking density (count/km²)	-	-0.15
Mu	Motorised	0.03***	0.05***
	Active	1	1
Model General Information	Number of Observations	6561	6561
	Rho square	0.421	0.444
	Log-Likelihood	-4171.1	-4007.7
	Null Log-Likelihood	-7208.0	-7208.0
	Likelihood ratio test statistic	-	340.8
	Akaike Information Criterion	8388.2	8121.4
	Bayesian Information Criterion	8544.4	8481.2

6Ds correlation with base variables

6Ds	age	SES	Female	English	Rural	Government	Distance with ceiling 1km	Distance over 1km with ceiling 2km	Distance over 3km with ceiling 2km	Distance over 5km
Bike lane length density	4%	2%	2%	-9%	-32%	-8%	0%	-2%	1%	2%
Footpath length density	-4%	7%	-3%	5%	-12%	5%	-5%	-5%	-1%	1%
Road length density	-2%	7%	2%	-13%	-46%	-25%	-3%	-3%	1%	4%
Crossing density	0%	0%	1%	-2%	-15%	2%	-5%	-6%	-1%	2%
Stop sign density	0%	13%	9%	1%	-17%	-15%	-4%	-6%	-1%	4%
Cul-de-sac density	1%	-33%	-3%	-24%	-32%	4%	1%	-1%	-5%	-4%
Population density	-1%	2%	7%	-21%	-45%	-27%	0%	-1%	2%	4%
Employment density	-1%	1%	7%	-21%	-48%	-20%	-2%	-4%	-2%	2%
Land-use mix	0%	-2%	0%	12%	31%	6%	0%	1%	1%	-4%
Job/housing balance	13%	-19%	2%	3%	44%	-20%	5%	11%	15%	11%
Retail density	7%	4%	-2%	0%	10%	-8%	1%	5%	8%	6%
Distance to nearest bus stop	-1%	-16%	0%	7%	39%	7%	1%	4%	4%	5%
Number of all parks	0%	18%	1%	-9%	-36%	13%	-4%	-9%	-12%	-11%
Number of local parks	4%	13%	1%	-12%	-39%	10%	-3%	-8%	-11%	-9%
Car parking density	-2%	18%	2%	3%	9%	17%	-6%	-6%	-2%	-3%

Elasticities

Average elasticities (%)

Distance Variables	Base	BEM
Distance with ceiling 1km	-94.7	-44.0
Distance over 1km with ceiling 2km	-102.4	-44.8
Distance over 3km with ceiling 2km	-20.9	-9.6
Distance over 5km	-7.6	-3.7

Elasticities at different buffers (%)

Distance Variables	Base				BEM			
	<=1km	1-2km	2-3km	>3km	<=1km	1-2km	2-3km	>3km
Distance with ceiling 1km	-0.4	0	0	0	-0.8	0	0	0
Distance over 1km with ceiling 2km	-82.1	-18.7	0	0	-36.6	-7.6	0	0
Distance over 3km with ceiling 2km	-115.5	-118.2	0	0	-53.7	-51.7	0	0
Distance over 5km	-115.5	-145.1	-39.3	-14.3	-53.9	-63.6	-18.0	-7.0

SO WHAT?

- ✓ From a practical perspective, the exclusion of the '6Ds' cuts the estimated impact of distance on walking to school nearly in half. This omission can lead to a significant overestimation of the role distance plays in shaping this choice.

- ✓ On a theoretical level, overlooking these explanatory variables, especially when they have correlations with existing ones in the base model, introduces bias and inconsistency into our coefficient estimates.

- ✓ Ultimately, the '6Ds' emerge as powerful players in policy assessments, even when policies don't explicitly target them. By recognising their significance and incorporating them into our models, we pave the way for more accurate, fair, and effective decision-making, ensuring that our policies truly meet the diverse needs of our communities.