



# Drivers of social interaction: Exploring the effect of modality styles on face-to-face contacts

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## Research Questions

- To what extent and in what form is multimodality observed in Beijing, China?
- What are the effects of monomodal use of car, active travel or public transport and multimodal travel on social interaction?
- How do effects of modality styles differ between commute days and non-commute days?

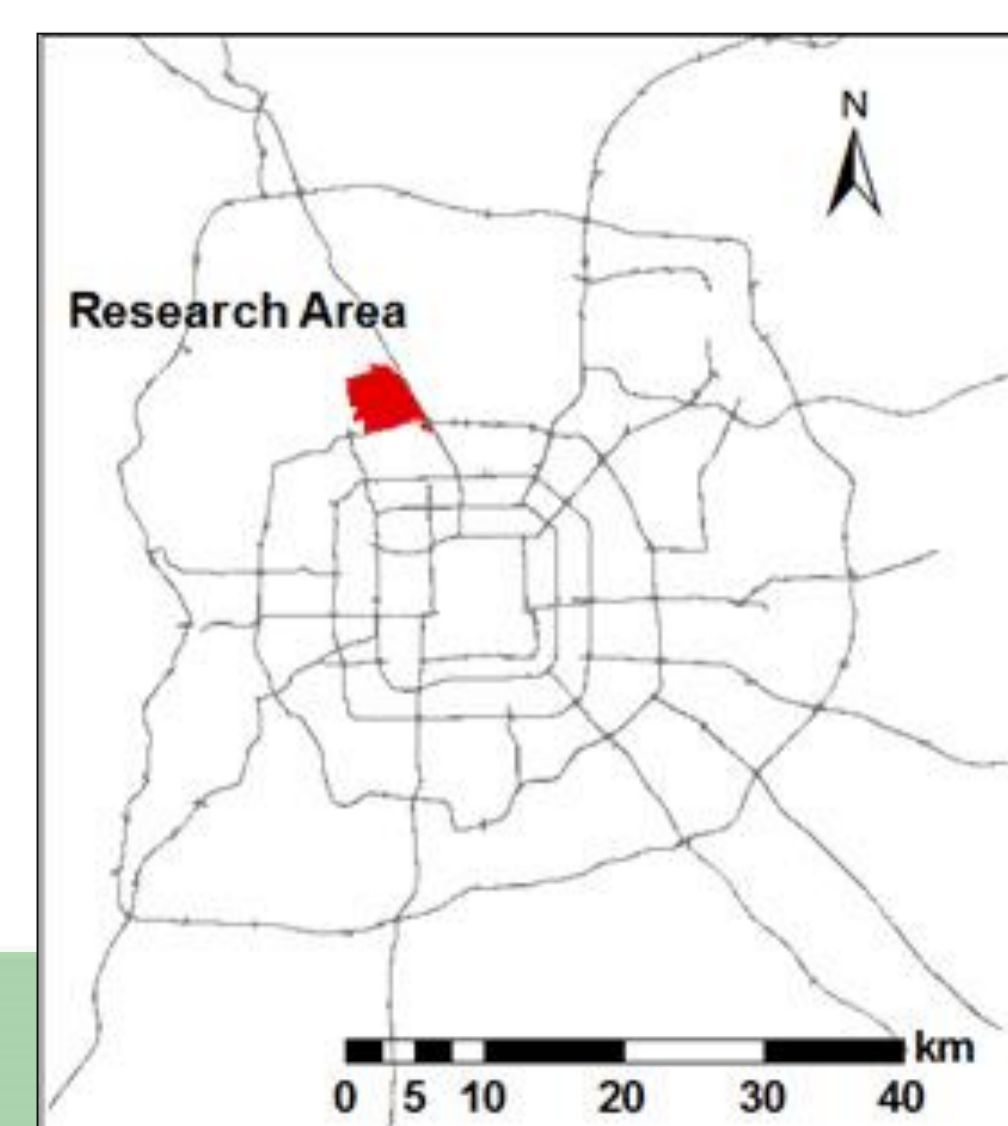
## Theory

Travel plays an inevitable role in facilitating social interaction and maintaining social ties, and a lack of access to travel options may lead to social exclusion. The effect of car use on social interaction has been well investigated. While most studies suggest that car use enables participation in social activities, there are also studies that associate car dependency with a-social lifestyles. A relatively new phenomenon in transportation is multimodality, defined as the use of multiple travel modes over a given period of time (often a week). The effects of multimodality on social interaction have not yet been investigated. Two hypotheses will be tested with respect to its effect on social interaction:

- Multimodality offers extra travel options, and therefore leads to more social interaction.
- Multimodality is adopted because of limited access to car, and is therefore associated with less social interactions

## Data

Data was collected from October to December 2012 in the Shangdi-Qinghe area of Beijing. The survey first collected the socio-demographic characteristics of the respondents and then activity diaries filled out by the respondents for one week and GPS data from GPS loggers carried by the respondents. The dataset for the current analysis includes 410 commuters, with 2870 days and 2064 out-of-base non-work activity episodes. For each episode the type of company (if any) was recorded.



## Multimodal and monomodal travel behaviour

Travel patterns are termed monomodal if more than 90% of the trips in a one week period are made by one travel mode. 60% of the sample displays multimodal behaviour, usually with public transport being the most frequent mode. 40% is monomodal, with public transport accounting for the largest share.

Modality styles		Weekly level measured			
		No.	Pct.	No.	Pct.
Mono modal	Mono Car	51	12.44%	163	39.76%
	Mono PT	81	19.76%		
	Mono Act	31	7.56%		
Multi modal	Multi Car	61	14.88%	247	60.24%
	Multi PT	115	28.05%		
	Multi Act	71	17.32%		

Figure 1: Multimodal and monomodal travel behaviour

## Social Interaction and out-of-home leisure activities

Non-Zero obs. of days		Commute days (2020 days)	Non- Commute Days (850 days)	All days (2870 days)
alone	No.	342	158	500
	Pct.	16.93%	18.59%	17.42%
	Avg. Dur. (min)	74.44	156.46	100.36
family members	Obs.	183	227	410
	Pct.	9.06%	26.71%	14.29%
	Avg. Dur. (min)	89.25	203.00	152.23
friends	Obs.	132	91	223
	Pct.	6.53%	10.71%	7.77%
	Avg. Dur. (min)	123.11	215.96	161.00
colleagues	Obs.	315	53	368
	Pct.	15.59%	6.24%	12.82%
	Avg. Dur. (min)	84.78	255.32	109.34

Figure 2: Social Interaction and out-of-home leisure activities

## Results

- Reliance on public transport leads to less out-of-home interaction with family and friends on commute days
- Reliance on active travel (also combined with other modes) leads to less out-of-home interaction with family on commute days
- Multimodal travellers display more solo out-of-home time, and more time with family and friends on non-commute days

## Model results

Variables	Alone		Family members		Friends		Colleague	
	Coef.	Z-stat.	Coef.	Z-stat.	Coef.	Z-stat.	Coef.	Z-stat.
Cons.	-2.57	-0.07	-133.34	-2.55**	6.96	0.10	-82.95	-1.92
<b>Modality indicators (ref. = Mono Car)</b>								
Mono PT	6.45	0.25	-146.20***	-4.42	-161.00***	-3.29	11.67	0.36
Mono Act	-24.12	-0.80	-51.86	-1.38	-293.80***	-4.46	-50.28	-1.21
Multi Car	-4.31	-0.17	-38.10	-1.27	-34.60	-0.70	33.42	0.97
Multi PT	37.39	1.45	-51.71	-1.77	-70.34	-1.76	30.23	0.99
Multi Act	-15.37	-0.59	-116.86***	-3.65	-72.92	-1.65	14.70	0.44
<b>Work and daily attributes</b>								
Weekend	3.74	0.17	6.41	0.20	95.71**	2.46	-3.68	-0.13
Friday	17.93	1.41	37.70**	2.51	34.23	1.32	22.69**	1.97
Work duration	-0.31***	-5.42	-0.29***	-5.18	-0.40***	-4.93	-0.19***	-3.54
H-W distance	-1.74	-1.48	-0.65	-0.41	-3.63	-1.51	0.73	0.58
<b>Personal attributes</b>								
Male	11.23	0.88	-39.18**	-2.13	56.58**	2.13	30.19*	1.88
Married	-9.77	-0.62	114.45***	3.44	-146.85***	-4.62	-47.32***	-2.60
Middle and high income	-15.56	-1.04	12.20	0.58	-43.12	-1.51	-0.34	-0.02
Middle and high education	-12.17	-0.54	-14.18	-0.46	-70.68	-1.38	-57.01*	-1.63
Extended household	-21.16	-1.04	-37.40	-1.44	-87.95**	-2.06	-53.43*	-1.94
<b>Spatial facilities</b>								
Home_Retail stores	0.18	1.00	-0.34	-1.29	-0.57	-1.46	-0.16	-0.71
Home_Restaurants	-0.19	-0.85	0.50	1.91	0.43	1.21	0.25	1.10
Home_Public recreational	-4.95	-0.56	-16.69	-1.37	21.03	1.31	-11.00	-1.10
Work_Retail stores	-0.17	-0.94	0.35	1.60	-0.28	-0.73	-0.34	-1.44
Work_Restaurants	0.16	1.12	-0.09	-0.49	-0.10	-0.36	0.24	1.27
Work_Public recreational	7.79	1.22	7.77	0.88	19.69*	1.63	5.25	0.66
<b>Summary statistics</b>								
Sigma	151.62***	11.27	166.21***	14.94	233.49***	15.33	159.88***	13.96
Rho Correlation	--	--	--	--	--	--	--	--
Family members	0.01	0.16	--	--	--	--	--	--
Friends	0.04	0.44	0.25***	3.07	--	--	--	--
Colleague	0.00	0.03	0.08	1.34	0.16**	2.51	--	--
Wild Chi-squared (80)	406.83***							
LR test	19.49***							
Total Observations	2020 obs. 410 clusters							

Bold format \* 90% significant, \*\* 95% significant, \*\*\* 99% significant

Variables	Alone		Family members		Friends	
	Coef.	Z-stat.	Coef.	Z-stat.	Coef.	Z-stat.
Cons.	-186.77***	-2.59	-474.99***	-6.45	-481.57***	-4.18
<b>Modality indicators</b>						
Mono PT	28.62	0.41	-134.26**	-2.22	27.95	0.31
Mono Act	-45.67	-0.57	-20.91	-0.29	-81.43	-0.55
Multi Car	77.69	1.11	126.46**	2.51	77.22	0.79
Multi PT	127.82**	2.10	33.37	0.69	103.07	1.29
Multi Act	151.97***	2.64	34.60	0.63	255.69***	2.68
<b>Work and daily attributes</b>						
Weekend	-124.22***	-2.98	70.78	1.67	-45.48	-0.56
Sunday	-13.95	-0.49	-27.87	-1.06	-108.55**	-2.38
Work duration	-0.62**	-1.96	-0.55**	-2.15	-1.42**	-2.28
H-W distance	-2.65	-0.87	2.63	1.14	3.40	0.77
<b>Personal attributes</b>						
Male	31.58	0.96	-10.21	-0.35	105.07**	2.17
Married	-53.31	-1.37	272.20***	5.64	-239.84***	-4.40
Middle and high income	27.31	0.76	69.45**	2.13	-16.99	-0.34
Middle and high education	13.28	0.23	-52.54	-0.98	-105.43	-1.06
Extended household	-1.64	-0.04	-59.27	-1.58	-49.77	-0.61
<b>Spatial facilities</b>						
Home_Retail stores	-0.15	-0.33	-0.15	-0.41	0.73	1.05
Home_Restaurants	-0.20	-0.46	0.16	0.38	1.24*	1.93
Home_Public recreational	6.20	0.27	-21.35	-0.98	-46.76	-1.60
<b>Summary statistics</b>						
Sigma	292.57*	11.55	283.88*	19.52	383.54*	16.19
Rho Correlation	--	--	--	--	--	--
Family members	0.10	1.47	--	--	--	--
Friends	0.08	1.06	0.08	1.08	--	--
Wild Chi-squared (51)	253.44***					
LR test	4.18					
Total Observations	850 obs. 402 clusters					

Bold format \* 90% significant, \*\* 95% significant, \*\*\* 99% significant

Figure 3:

Seemingly unrelated Tobit model of time spent in out-of-home leisure activities by company

Commute days

Figure 4:

Seemingly unrelated Tobit model of time spent in out-of-home leisure activities by company

Non-commute days