Effects of a mixed-mode design in the German Mobility Panel

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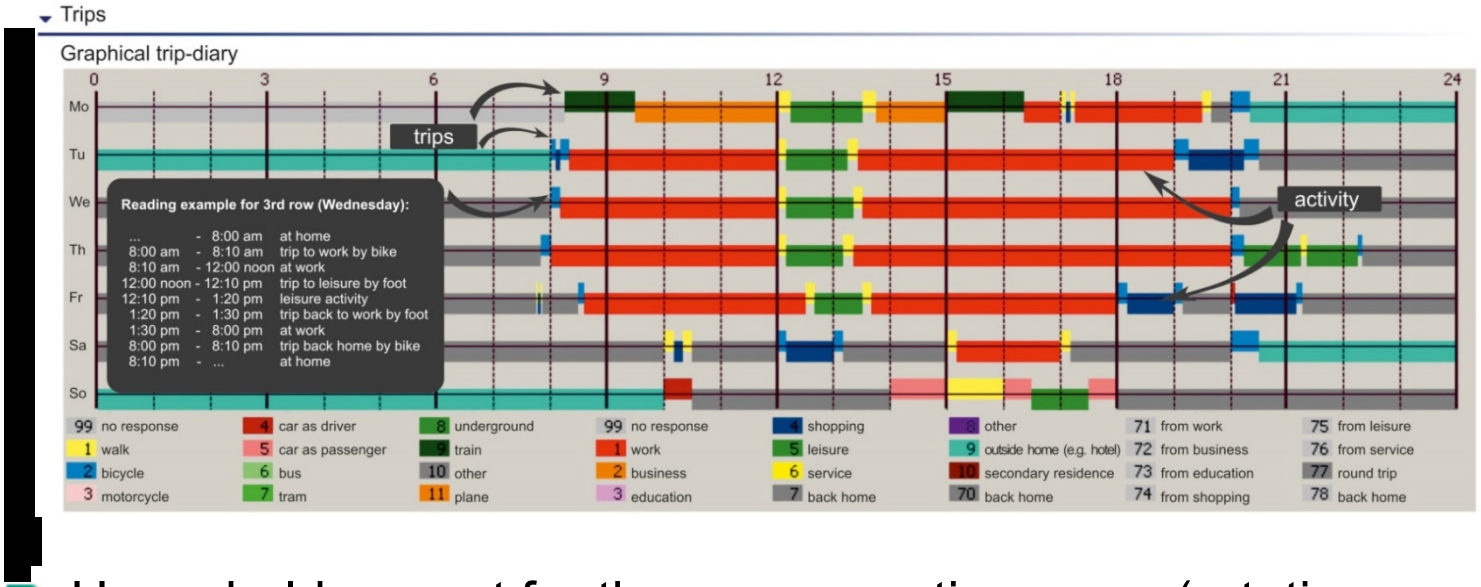
Motivation and research question

The German Mobility Panel (MOP)

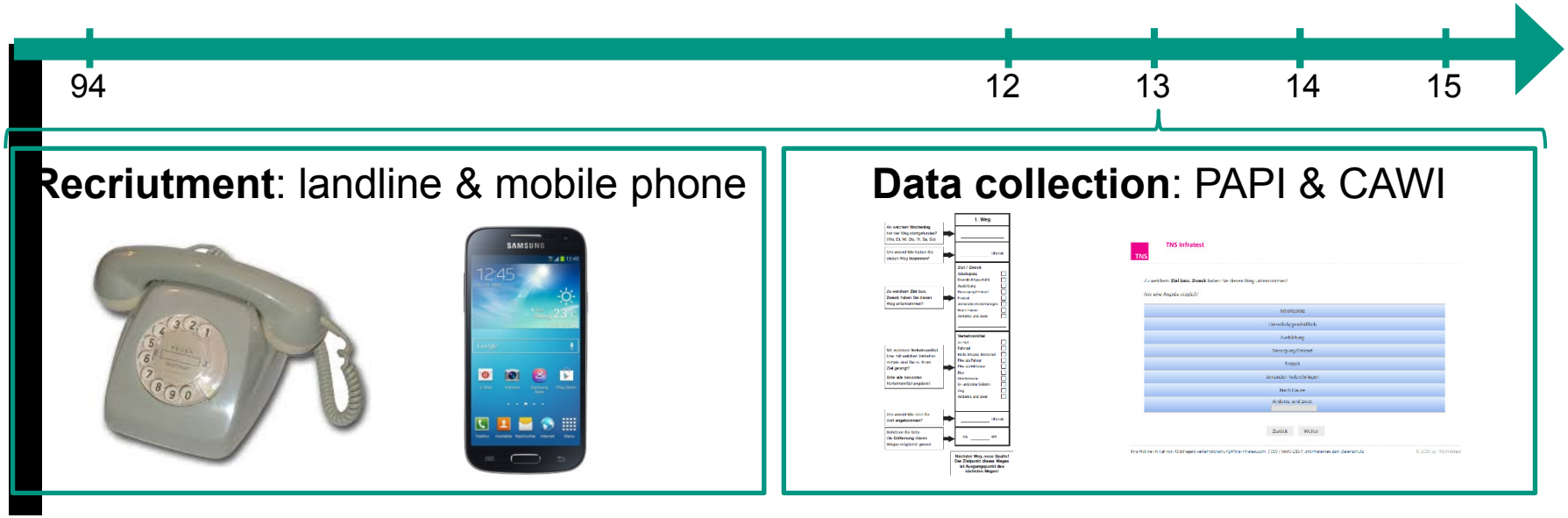
- Annual survey on travel demand in German households since 1994
- 1,000 -1,500 households; persons aged 10 years and older
- Trip diary for a whole week (multiday) in autumn



- Households report for three consecutive years (rotating panel)
- Funded by the German Federal Ministry of Transport and Digital Infrastructure (TNS Infratest: field work; KIT: design & scientific supervision)

Motivation and research question
Survey design adaptations

- **Important:** time series data on travel behaviour
- **But:** declining participation rates amongst particularly young adults



- Does the mixed-mode design affect survey results? If so, why?
  - **Selection effect (SE)**: different population groups participate
  - **Measurement effects (ME)**: trip diary is filled in differently solely because of the survey mode

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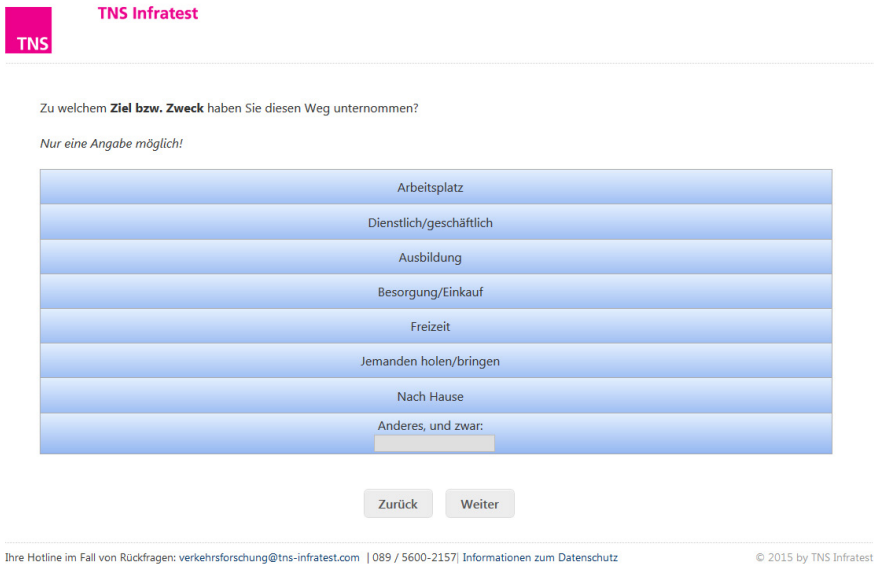
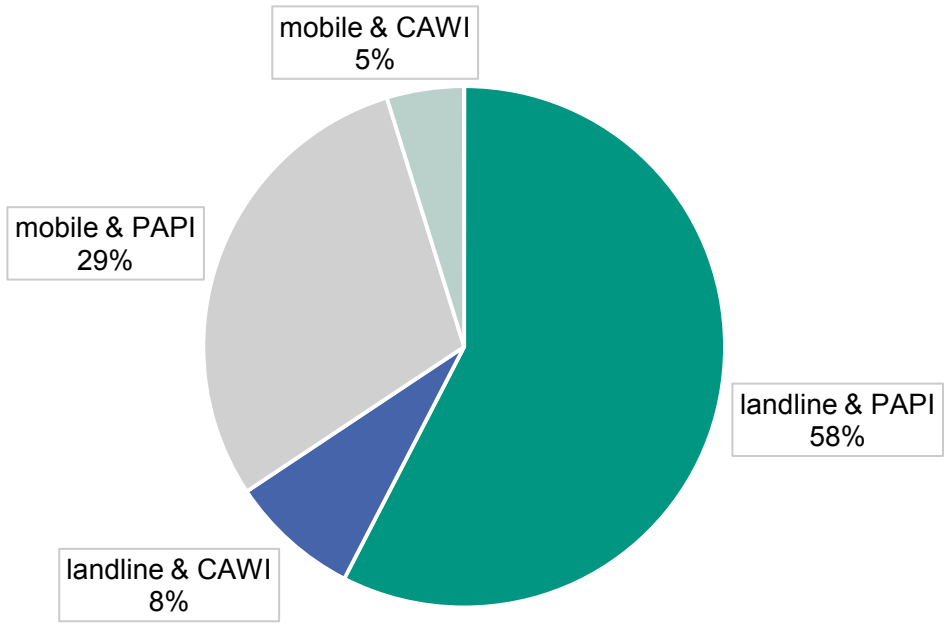
The online survey

- Accessible via IP address or QR code
- No App but optimized for mobile devices
  - One question per screen
  - Trip diary completion might require more time
- The same questions and response options than in PAPI



Sample of investigation
The German Mobility Panel (MOP)

- First year reporters of the surveys 2013, 2014 and 2015
  (N: 3,566 Persons)
- Unweighted analyses
- Distribution of the sample to the survey modes:



Descriptive results
Travel behaviour

Quantities per week	Recruitment: landline		Recruitment: mobile	
	PAPI diary	CAWI diary	PAPI diary	CAWI diary
Trips made [#]	23.7	24.9	24.0	26.4
Distance travelled [km]	281.8	368.0	332.1	398.5
Time spent in the transportation system [min]	581.3	598.7	617.4	654.6
Days with any trip-making	6.4	6.3	6.5	6.6

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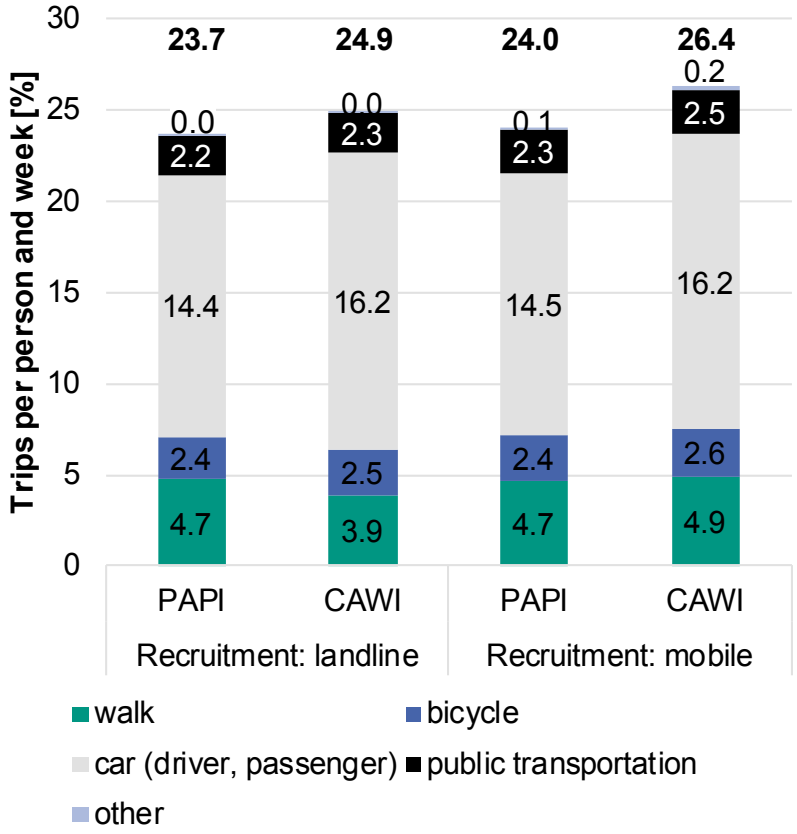
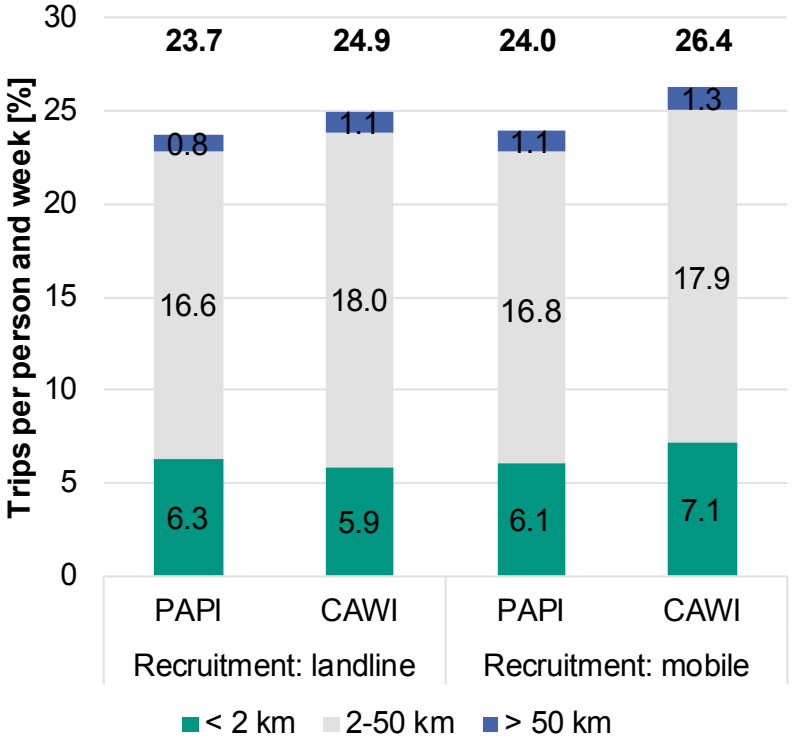
Descriptive results

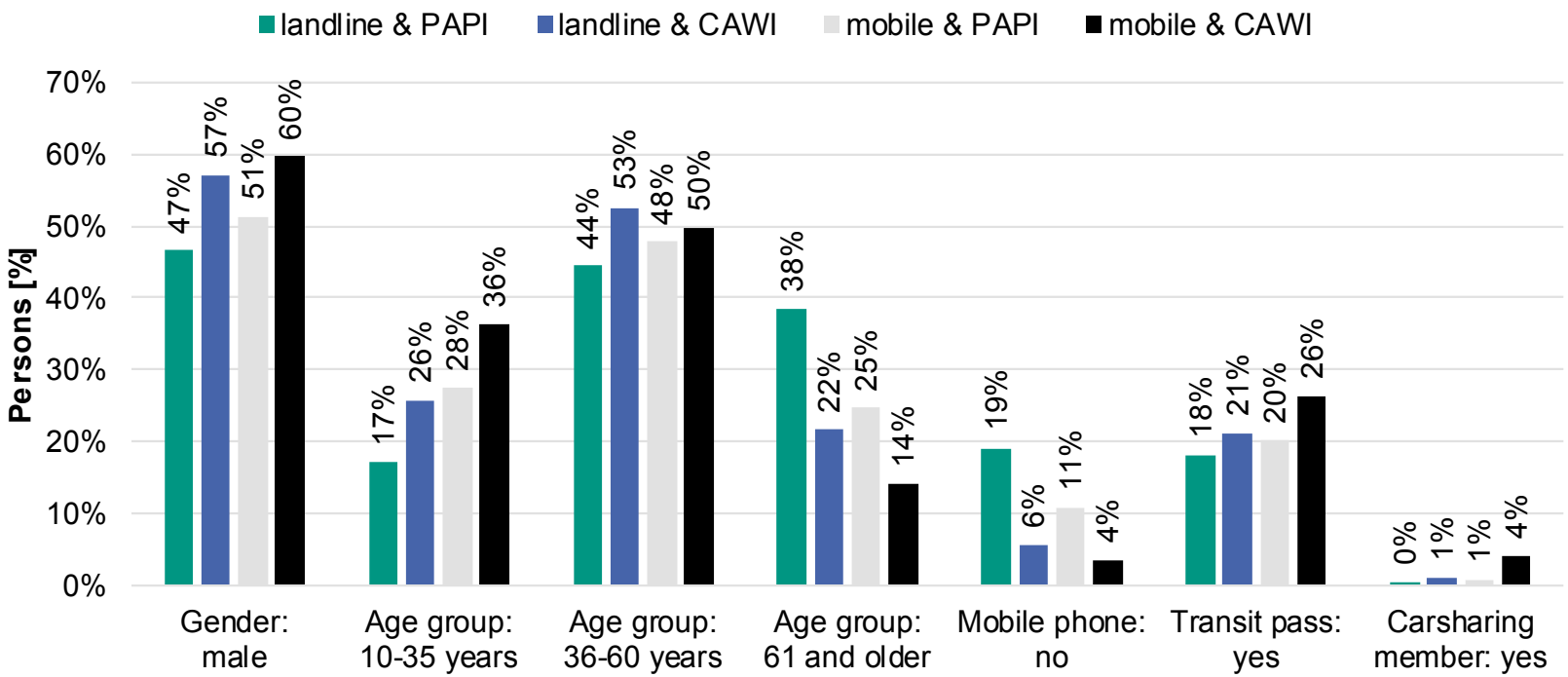
Trips made within the survey week





- Travel behaviour differs between the four survey mode groups…

Descriptive results
Sociodemographics



- …and the sociodemographics differ as well!

Propensity score weighting
Theoretical framework I

Propensity score weighting
Theoretical framework II

Propensity score weighting
Survey mode effects

	Recruitment: landline					Recruitment: mobile				
	TE	SE	ME	PAPI Mean	CAWI Mean	TE	SE	ME	PAPI Mean	CAWI Mean
Distance travelled per week [km]	86.18	42.43	43.75	281.83	368.01	66.43	56.88	9.55	332.09	398.51
Time spent in transport per week [min]	17.37	19.58	-2.21	581.29	598.66	37.17	42.23	-5.06	617.45	654.61
Trips made per week [#]	1.25	1.26	-0.01	23.68	24.93	2.40	1.54	0.86	23.95	26.35
Trips made per week grouped by modes of transportation [#]										
Walk	-0.83	-0.11	-0.72	4.73	3.90	0.25	0.32	-0.07	4.69	4.94
Bicycle	0.12	0.01	0.11	2.37	2.49	0.11	0.17	-0.06	2.45	2.56
Car (driver / passenger)	1.87	1.36	0.51	14.38	16.25	1.71	0.82	0.89	14.45	16.16
Public transportation	0.10	-0.01	0.11	2.15	2.25	0.19	0.21	-0.02	2.30	2.49
Trips made per week grouped by trip distance [#]										
< 2 km	-0.42	0.20	-0.62	6.29	5.87	1.05	0.41	0.64	6.08	7.13
2-50 km	1.40	0.86	0.54	16.57	17.98	1.14	0.92	0.22	16.75	17.88
>50 km	0.27	0.19	0.08	0.82	1.09	0.21	0.22	-0.01	1.12	1.33

Propensity score weighting
Survey mode effects

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	PAPI Mean	CAWI Mean	PAPI Mean	CAWI Mean
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Trips made per week groupe	*n [#]*			
Walk	4.73	3.90	4.69	4.94
Bicycle	2.37	2.49	2.45	2.56
Car (driver / passenger)	14.38	16.25	14.45	16.16
Public transportation	2.15	2.25	2.30	2.49
Trips made per week groupe				
< 2 km	6.29	5.87	6.08	7.13
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Propensity score weighting
Survey mode effects

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- Most TEs of overall travel quantities are explained by SEs
- Distance travelled: overestimation of distances because CAWI diaries are not filled in regularly?

Propensity score weighting
Survey mode effects

- Underreporting of walking and cycling trips and short trips
- Small MEs only for trips longer than 2 km
- Disparities due to MEs occur more often amongst landline recruits

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Summary and outlook

- Propensity score weighing is suitable to analyse the effects of a mixed-mode design in the MOP to the survey results
- Our findings can be utilized to adapt focal modes (i. e. CAWI) of a survey further, e. g.
  - App for CAWI with automatic regular reminders to fill in the diary.
  - Frequently visited places /activities
- Broad discussion in social science literature: which methods are most suitable to analyse mixed-mode surveys? (others: propensity score matching, double robust regressions, multiple imputation)
- Socio-demographic information only are not sufficient to estimate the probability of a participant to choose a survey mode. Better questions, e.g. the availability of smartphones and tablets, usage of mobility apps
- Survey mode effects need to be taken into consideration when comparing travel survey outcomes, since they influence the outcome

Thank you!
Questions?

Logit

Parameter	Recruitment: landline		Recruitment: mobile	
	Estimate	P > |t|	Estimate	P > |t|
Intercept	3.374	.000	-2.287	.000
Gender: male	0.462	.001	0.352	.044
Age group: 10-25 years	-	-	0.764	.078
Age group: 26-35 years	1.251	.000	0.833	.001
Age group: 36-50 years	0.954	.000	0.603	.006
Age group: 51-60 years	0.414	.067	-	-
Age group: 71 years and older	-0.822	.002	-1.797	.015
Employment status: employed	-0.703	.000	-	-
Employment status: in education	-	-	-0.913	.037
Level of education: secondary school (Hauptschule)	-0.340	.083	-0.508	.056
Level of education: university-entrance diploma (Abitur)	-0.278	.163	-	-
Monthly household income: 1.500€ and less	-	-	-1.547	.000
Monthly household income: 3.000€ and more	0.473	.001	-	-
Place of residence: newly-formed Germany states	-	-	-0.398	.061
Further survey participants in the household: no	0.252	.094	0.389	.034
Mobile phone: available	1.054	.000	-	-
Public transit pass ownership: yes	-	-	0.365	.097
Carsharing member	-	-	1.280	.023
Health related restrictions of mobility: yes	-	-	0.642	.047
Number of observations		*2,341*		*1,225*
Log likelihood at convergence		*1,623*		*902*
McFadden index		*0.07*		*0.09*