

Preferred citation style for this presentation

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Human behaviour in large scale evacuation events

M. Kowald

J. Koot

C. Dobler

K.W. Axhausen

IVT

ETH

Zürich

June 2012

 Institut für Verkehrsplanung und Transportsysteme
Institute for Transport Planning and Systems

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Motivation

FOCP Switzerland needs information on time needed for large scale evacuations

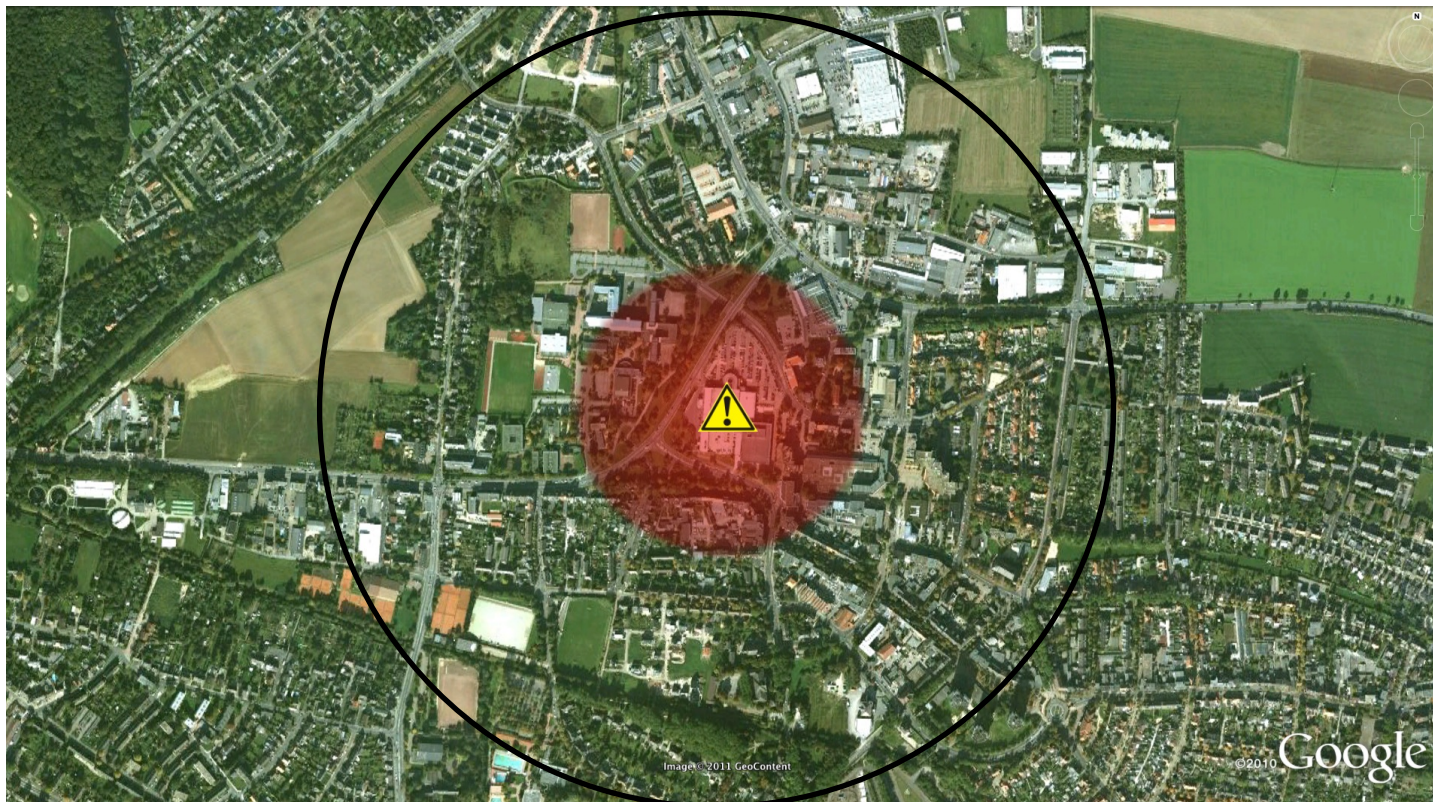
IVT simulates evacuation events in MATSim

Behavioural model in MATSim is Homo Economicus

→ Collect information on human behaviour in evacuations and estimate more realistic behavioural model

Definition: Large scale evacuation

- Areas of at least 3 km in diameter
- E.g. cities, towns, districts, villages, not single objects or households



Collecting data: Triangulated methodology

1. Literature research
2. Expert interviews
3. Survey study

Literature research: Results

Important issues are:

1. Socio-demographics
2. Characteristics of the situation
3. Ways of pro- and anti-social behaviour
4. Influences from evacuation planning and warning
5. People and institutions that need evacuation assistance
6. Behaviour of emergency forces

Expert interviews: Recruitment

Challenge: Who is considered as an expert?

→ Use institutions for emergency planning and management

Expertise of interview partner	No. of interviews
Administrative-organizational/ operational-practical background	
Staff activity (regional)	3
Incident command (local)	2
Theoretical-scientific background	
Evacuation planning	4
Evacuation research	3
Total	12

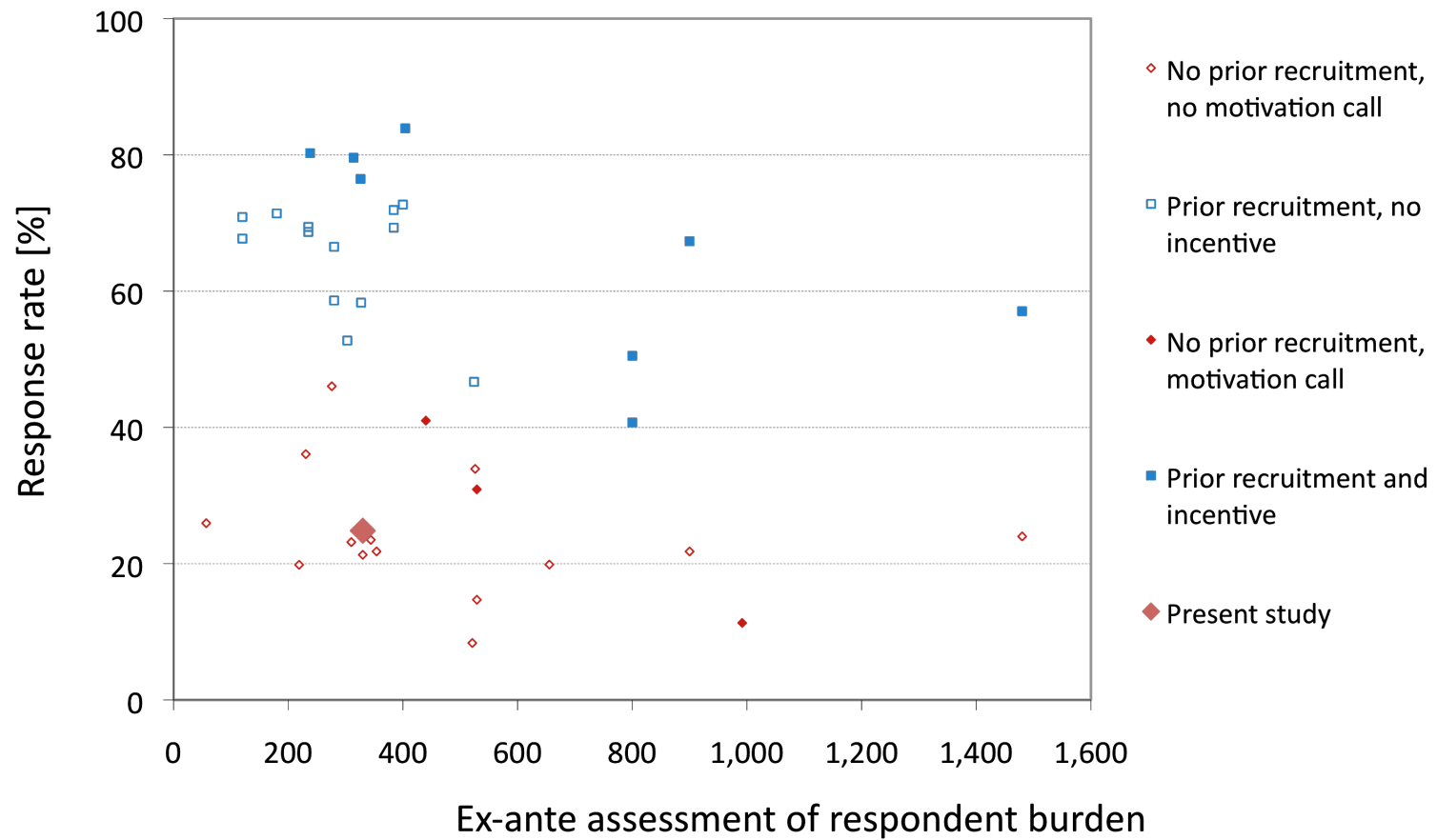
Expert interviews: Results

Hypotheses: Participation...	Influence
...increases for 'life-threatening' evacuation reasons	+++
...decreases for natural disasters	++
...decreases if time span is too large or too narrow	+
...increases with available information from reliable sources	++
...increases if people have to care for others	+++
...increases for people without emotional relations	++
...increases when family is united	+++
...decreases for old people and young adults	+++
...decreases for people from 'isolated' sub-groups	+++
...decreases for people with high value private property	+++
...decreases for males	+
...is likely for most people	+++
...is often done in own car	+++
...is done in a pro-social way of behaviour	+
...includes that most people find private accommodations	++
...depends on an interaction between reason and information	++

Survey study: Stated choice experiment

Attributes	Flood	Chemical accident	Nuclear accident	Fire, toxic gasses
Source of initial warning		1. Siren 2. Mass media (Radio & TV) 3. Social contacts		
Source of warning confirmation		1. Rescue teams (Police & fire fighters) 2. Mass media (Radio & TV) 3. Social contacts		
Status of household community		1. United 2. Divided		
Time for evacuation	1. Immediately 2. 8 hours 3. 16 hours	1. Immediately 2. 8 hours	1. Immediately 2. 8 hours 3. 16 hours	1. Immediately
Distance to evacuation source	1. 2 kilometers 2. 5 kilometers	1. 2 kilometers 2. 5 kilometers	1. 2 kilometers 2. 5 kilometers 3. 10 kilometers	1. 2 kilometers 2. 5 kilometers
Distance to evacuation border	1. 2 kilometers 2. 5 kilometers	1. 2 kilometers 2. 5 kilometers	1. 2 kilometers 2. 5 kilometers 3. 10 kilometers	1. 2 kilometers 2. 5 kilometers
Choice	1. Immediate evacuation; 2. Later evacuation; 3. No evacuation			

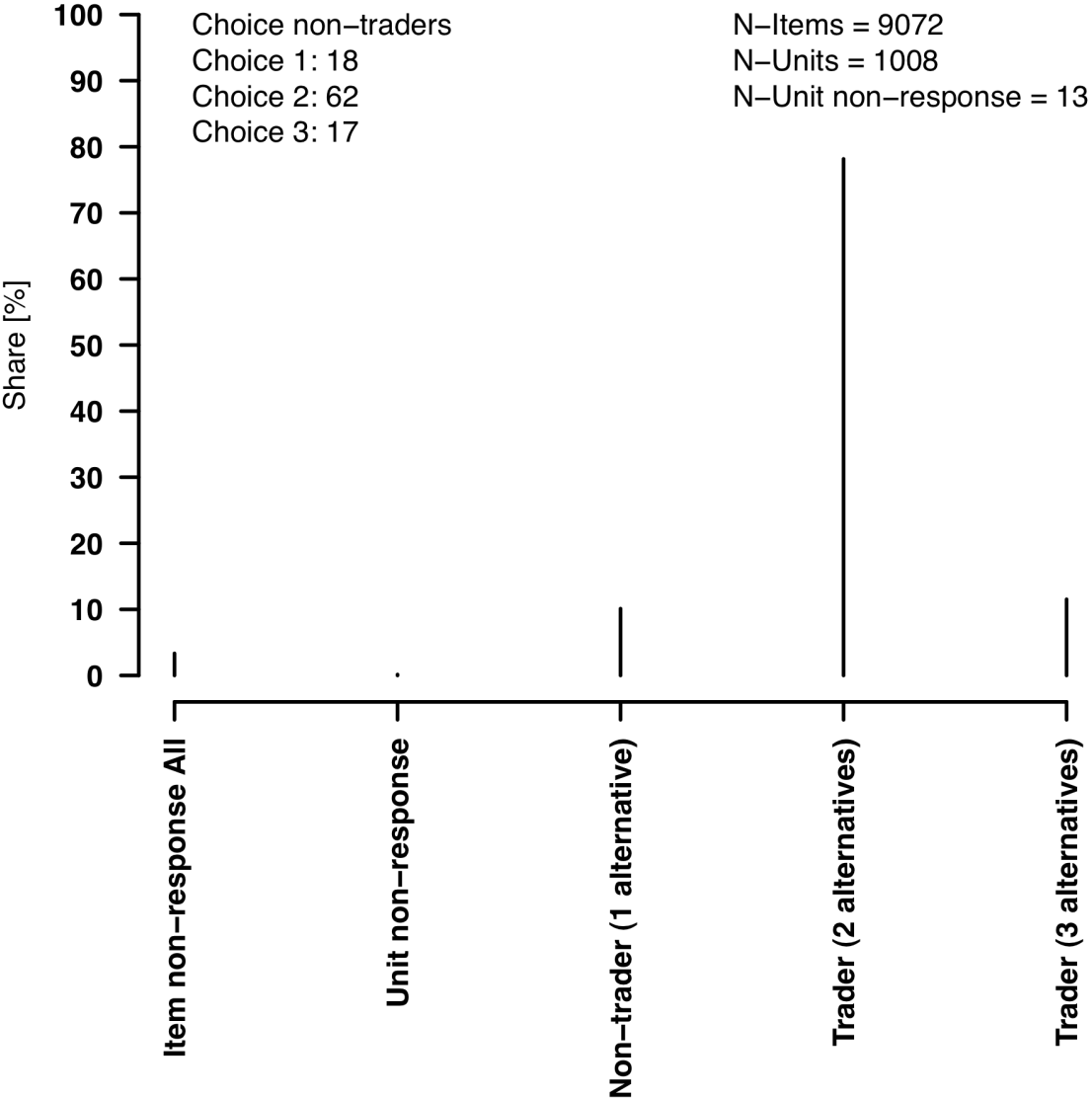
Survey study: Response rate



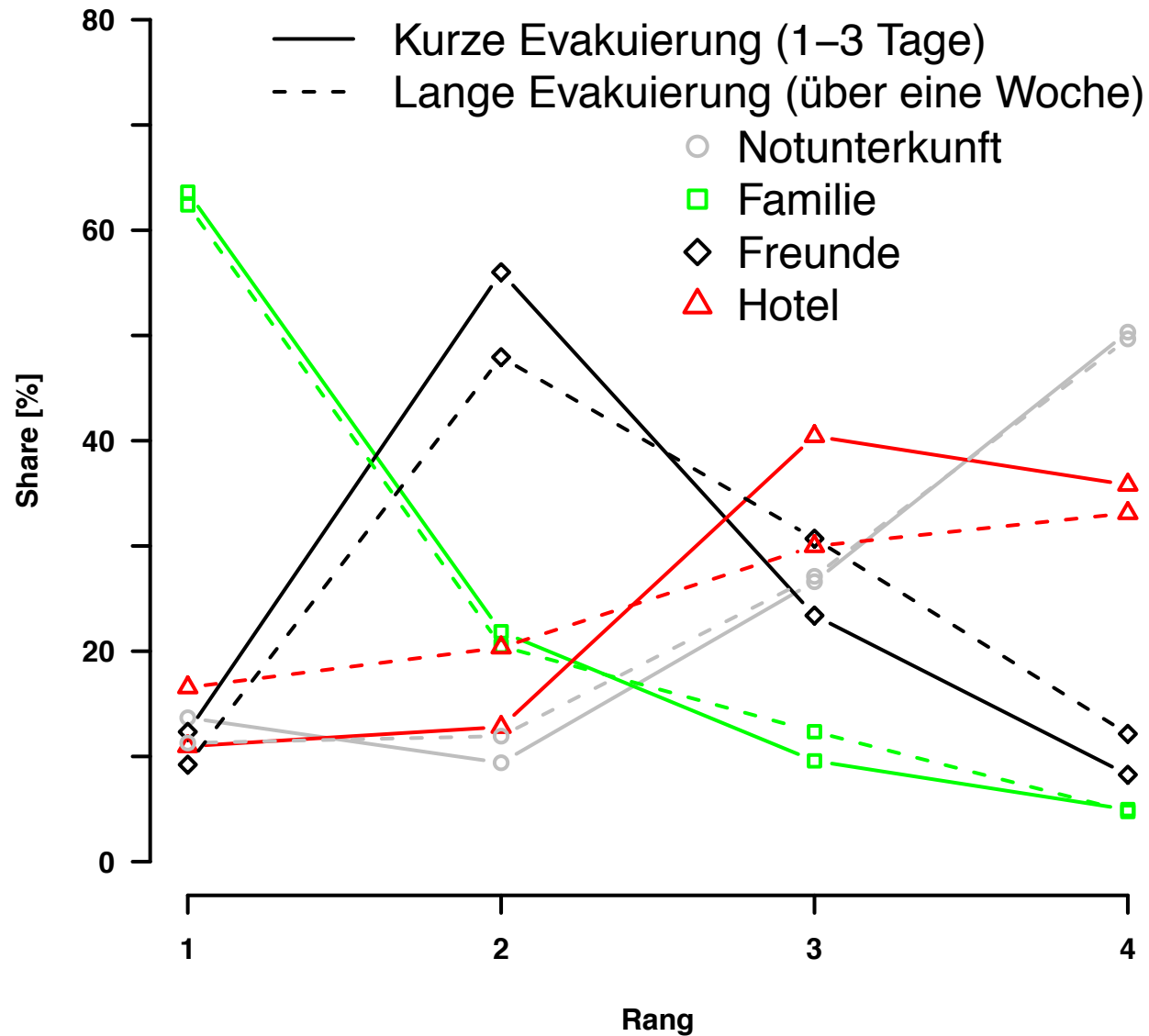
A comparison between survey data and Swiss population

	Attribute	Survey data	Microcensus (MZMV 2005)
Sex	Male	50.3	49.7
	Female	49.0	51.3
Civil status	Single	25.3	29.9
	Married	58.1	54.5
	Divorced	11.0	7.6
	Widowed	3.6	6.6
	Living separated	2.0	1.4
Household income	< 8'000	57.9	73.0
	8001 – 12'000	28.2	19.1
	>12'000	13.9	7.9
Drivers license	Available	91.8	80.7
	Not available	8.2	19.3

Survey study: Stated choice experiment

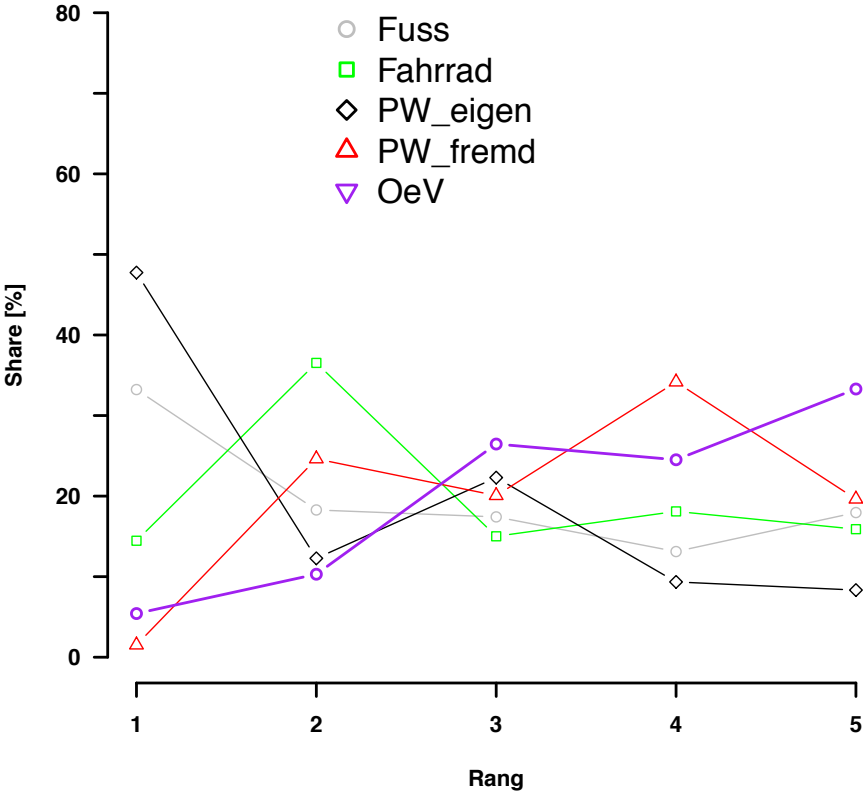


Finding accommodations in evacuations

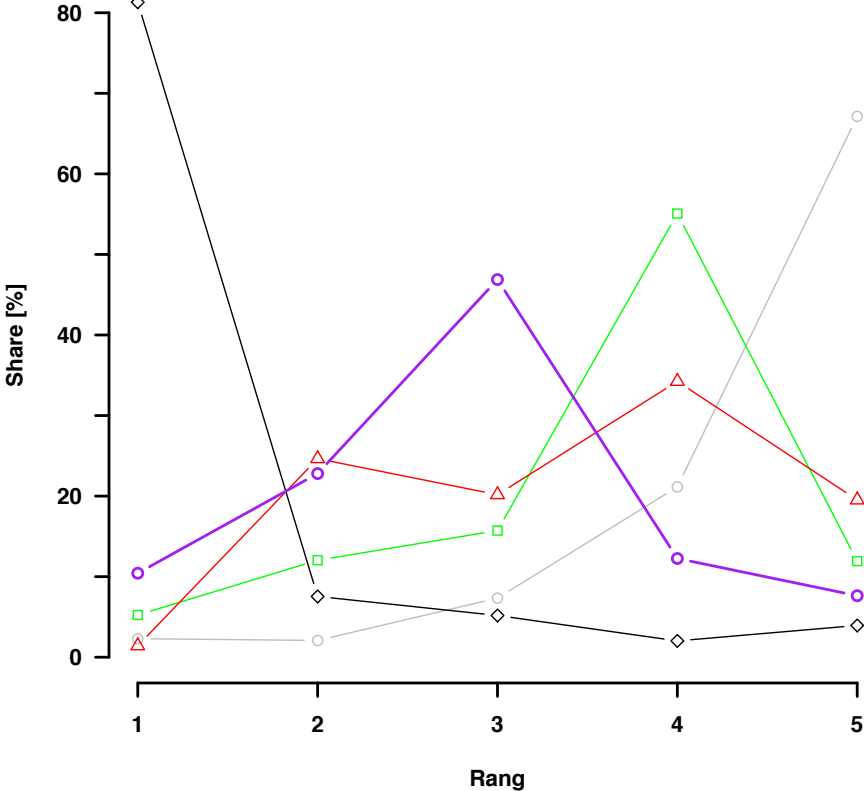


Preferred transport modes

Geringe Evakuierungsdistanz



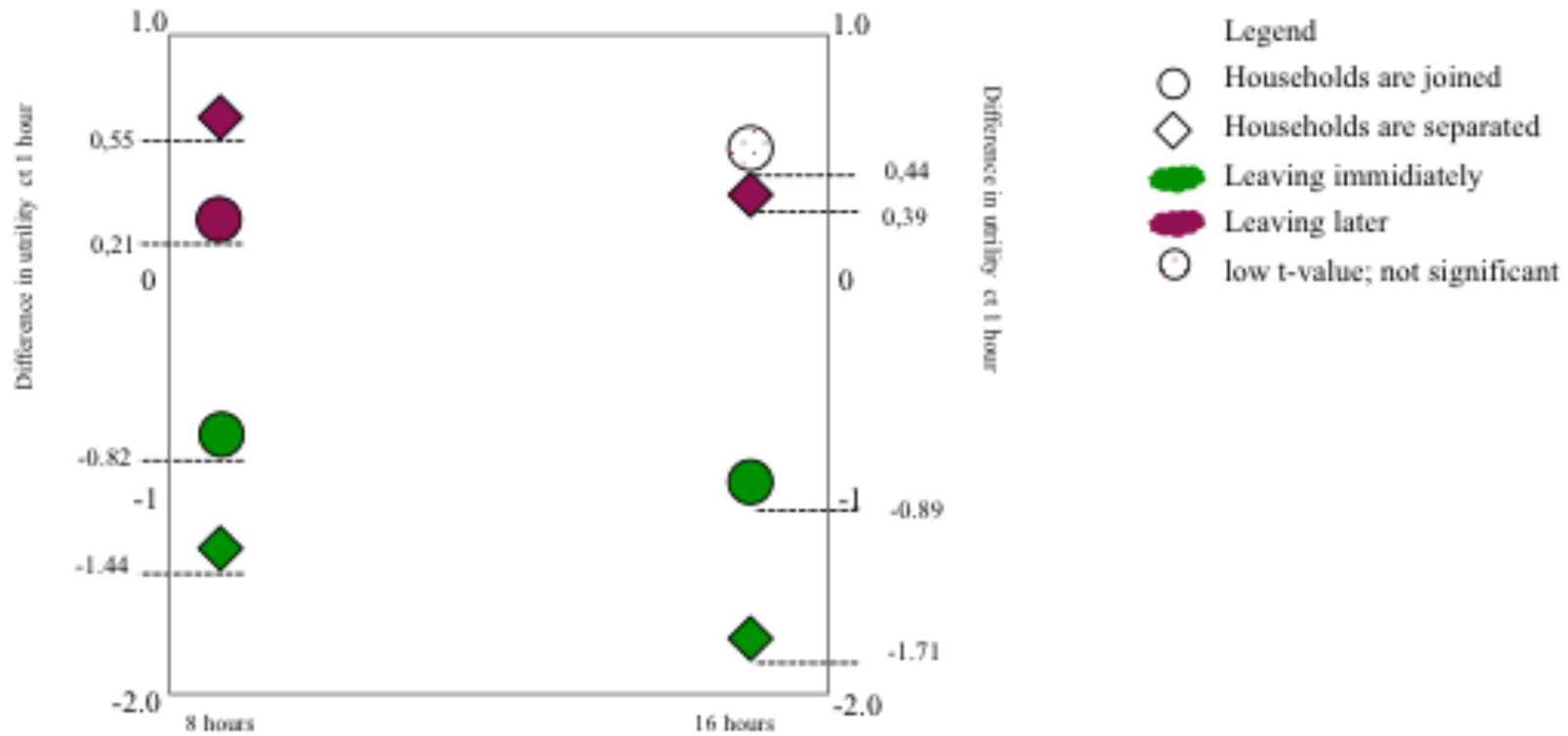
Ferne Evakuierungsdistanz



Survey study: Latent class MNL-model of stated choices

Coefficient	Alternative: Evacuate immediately		Alternative: Evacuate later	
	value	t-value	value	t-value
Constant	3.25	7.20	2.62	6.46
Chemical accident	1.44	4.44	0.88	2.74
Nuclear accident	1.82	8.25	0.57	2.78
Fire, toxic gases	0.55	1.72	0.20	0.62
Age 31 - 61	-0.60	-1.35	-0.29	-0.75
Age 62 - 71	-1.34	-2.84	-0.79	-1.85
Age > 72	-1.22	-1.95	-0.58	-1.02
Time 8 hours	-2.32	-6.32	0.40	0.26
Household united	-0.39	-8.27	-1.93	-5.62
Time 16 hours	-3.13	-7.00	0.20	0.26
Household united	-0.36	-5.92	-1.32	-4.81
Class 1	-0.87	-1.69		
Child in household	0.17	0.81		
Drivers license	0.86	2.40	Roh ²	0.397
Preferring joint evacuation	0.87	2.71	N	6854

Interaction between time and household status

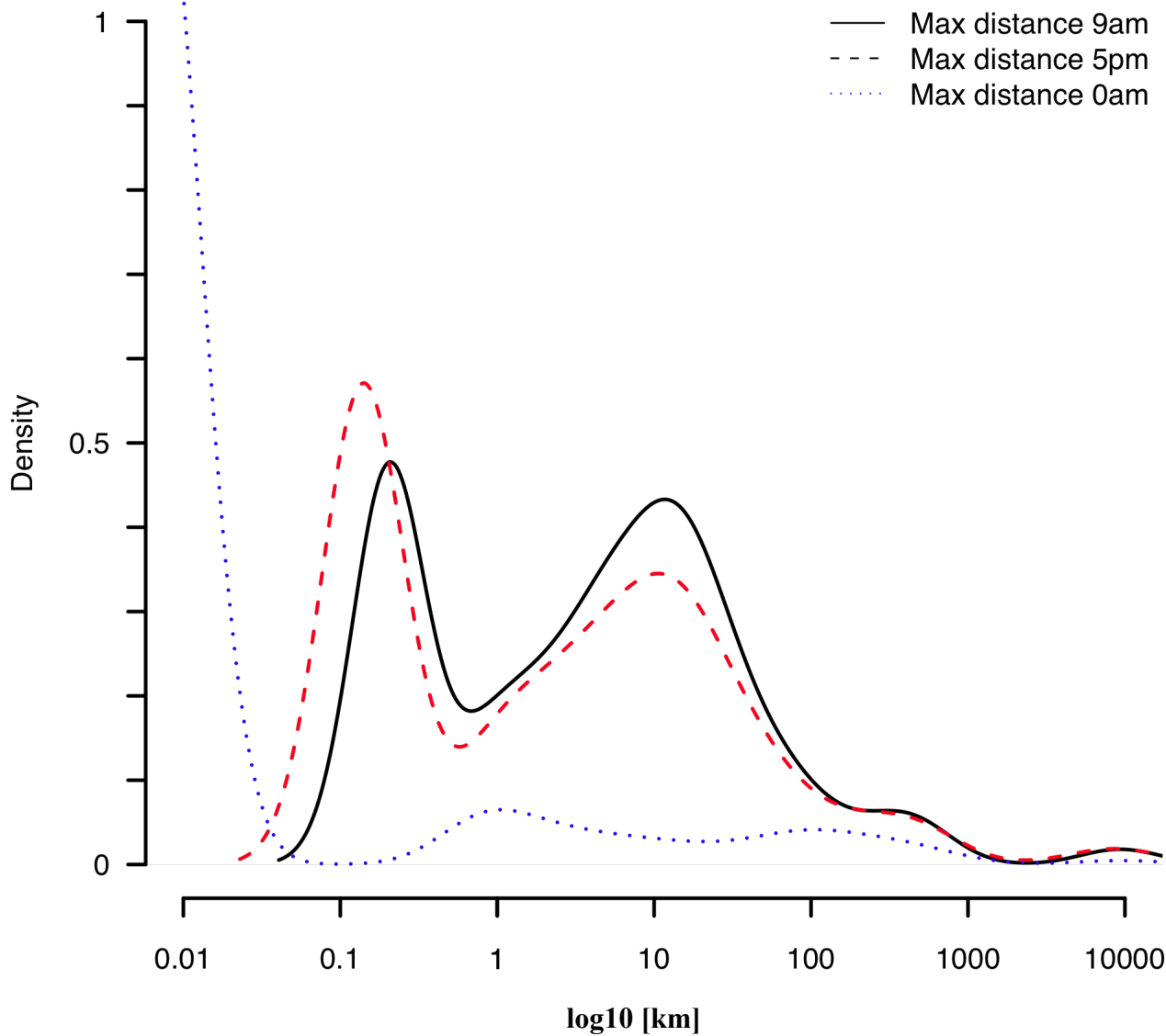


Survey study: MNL-model on solidaric behaviour

Coefficient	Alterative: Share car if space available		Alterative: Always share car	
	value	t-value	value	t-value
Constant	0.92	0.52	2.67	1.60
Age 31 - 61	-0.81	-0.96	-0.71	-0.85
Age 62 - 71	-0.76	-0.75	-0.71	-0.70
Age > 72	6.43	8.04	6.08	7.64
Child in household	1.57	1.46	1.66	1.54
Drivers license	3.00	2.52	1.54	1.53
Sex	-0.47	-0.76	-0.65	-1.06
			Roh ²	0.319
			N	664

Survey study: Distance between household members

Density estimate



Outlook

- Sensitivity analysis of relevant parameters in Matsim
- Re-run evacuation scenarios with estimated parameters
- Compare simulation results