

## Preferred citation style for this presentation

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# Human behaviour in large scale evacuation events

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# Motivation

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FOCP Switzerland needs information on time needed for large scale evacuations

IVT simulates evacuation events in MATSim

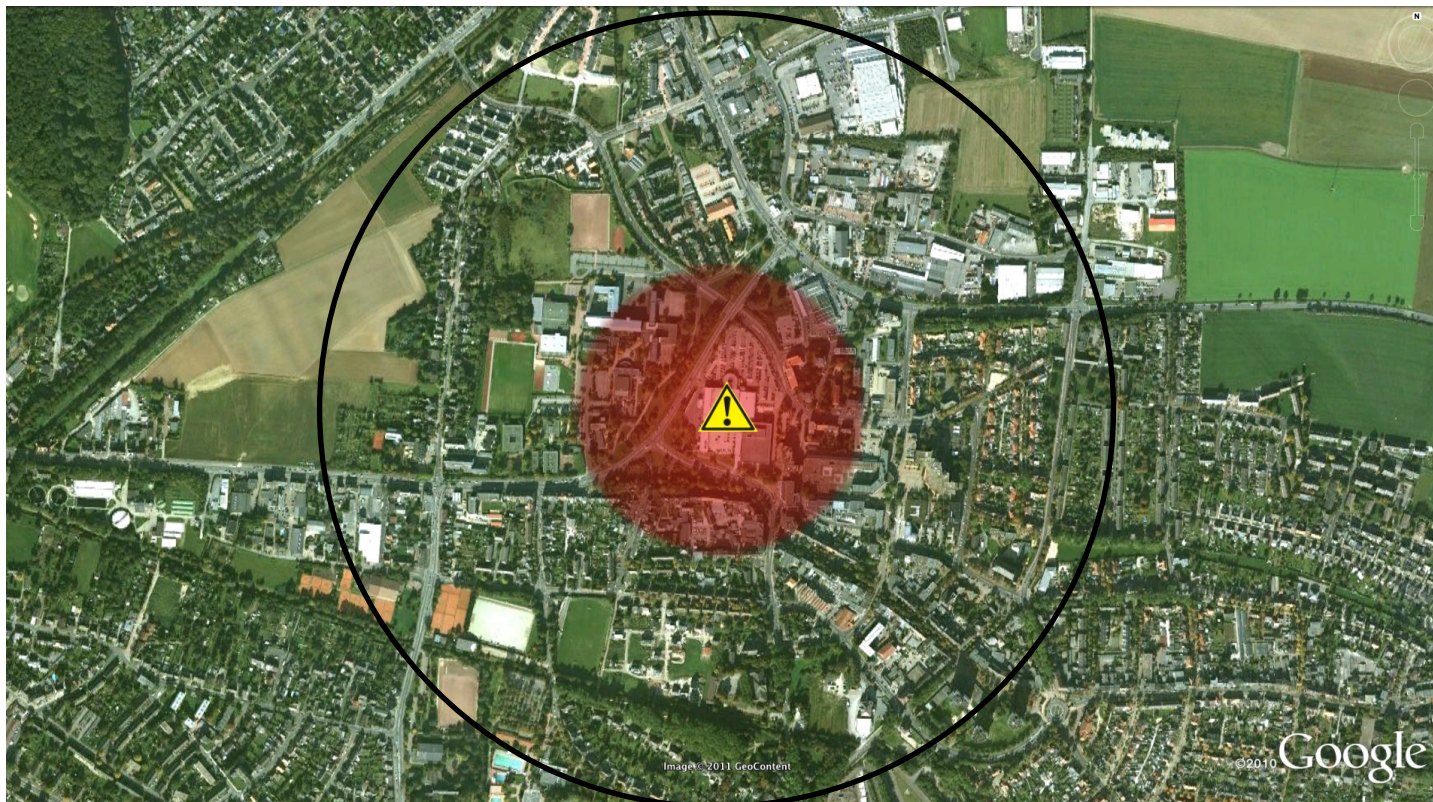
Behavioural model in MATSim is Homo Economicus

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

# Definition: Large scale evacuation

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



# Collecting data: Triangulated methodology

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

# Literature research: Results

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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

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Challenge: Who is considered as an expert?

→ Use institutions for emergency planning and management

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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

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# 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	+
...decreases 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	++

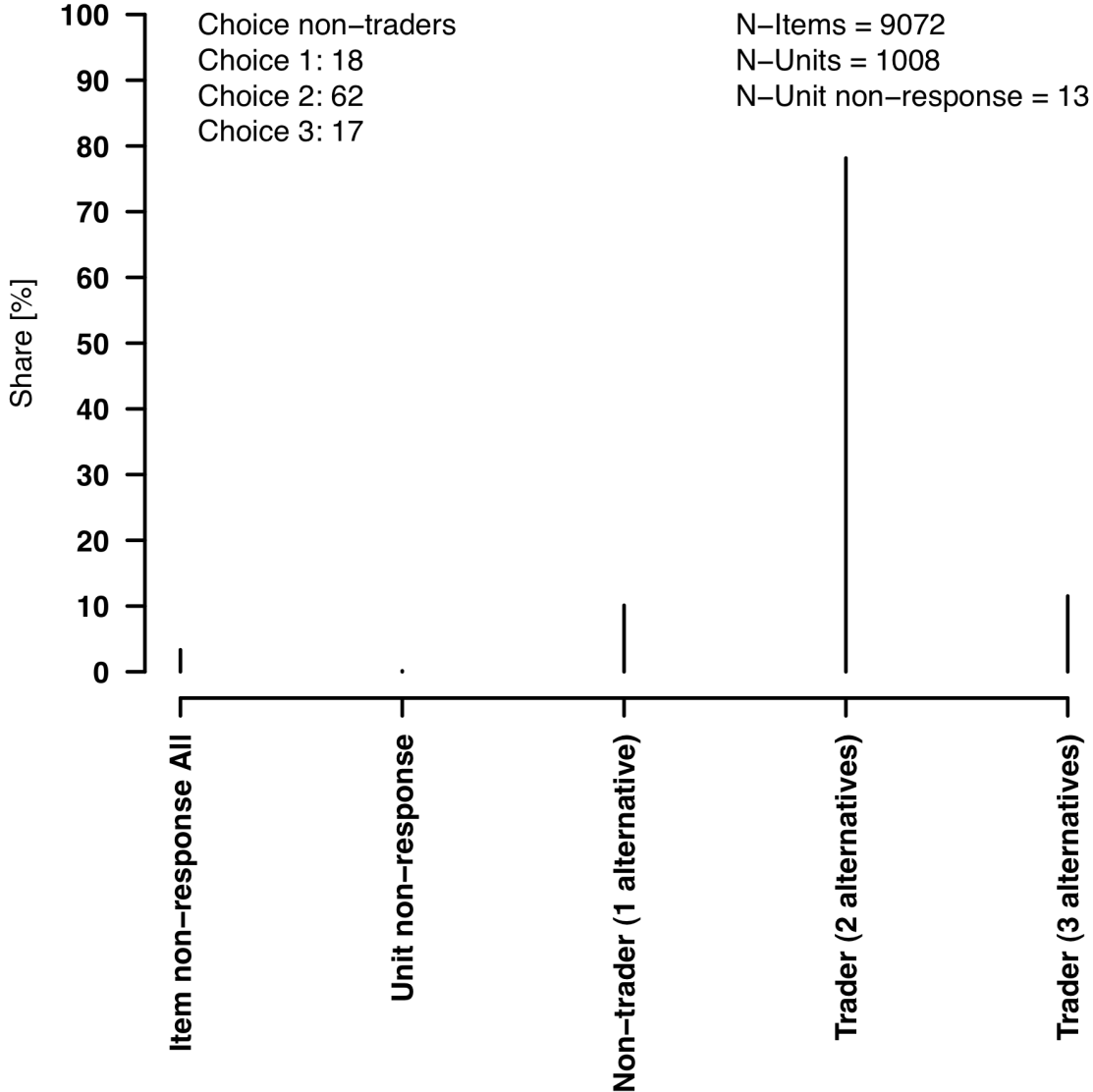




# Survey study: Stated choice experiment

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: Stated choice experiment



## 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 <sup>2</sup>	0.397
Preferring joint evacuation	0.87	2.71	N	6854

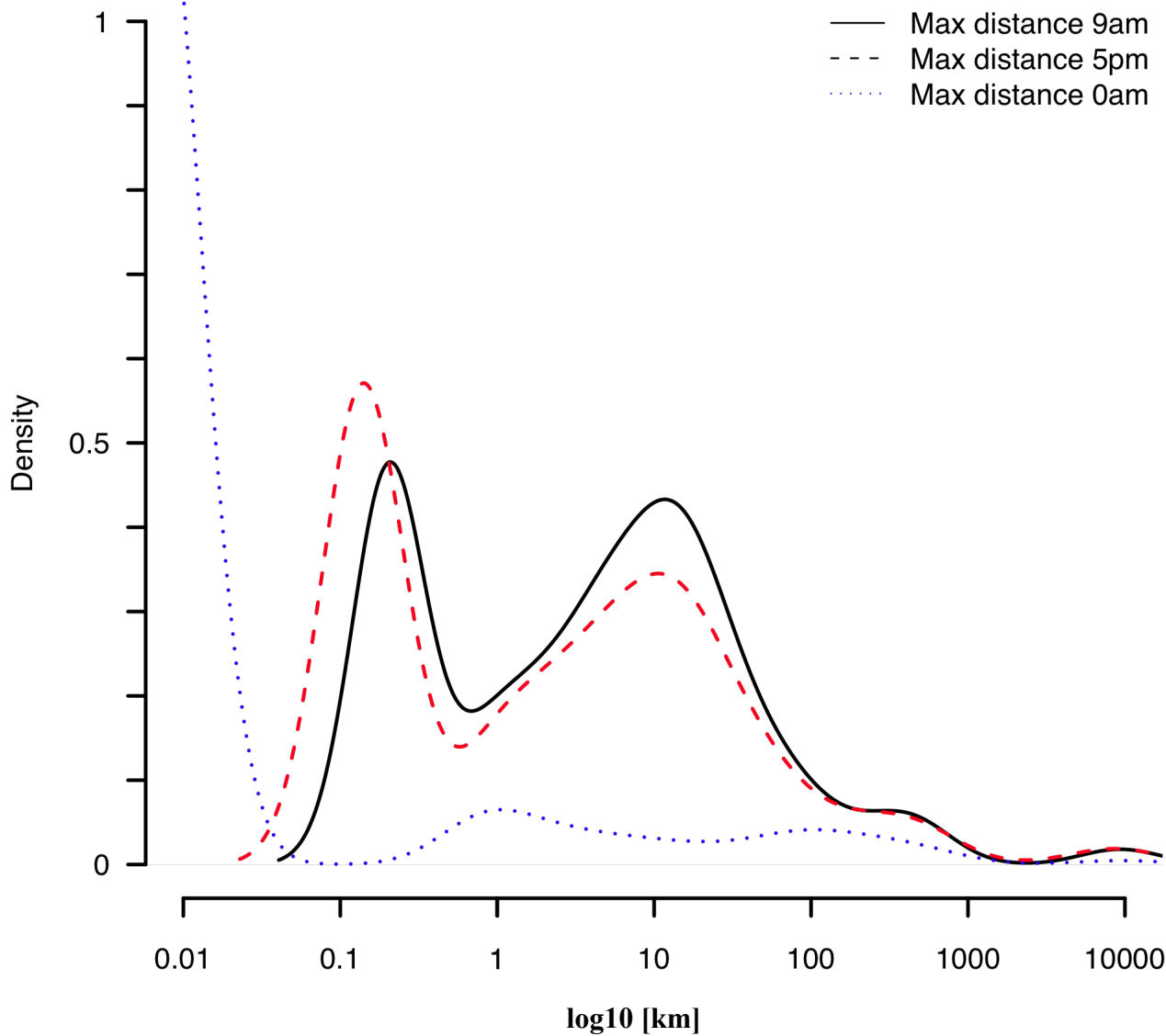
## Survey study: MNL-model on solidaric behaviour

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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 <sup>2</sup>	0.319
			N	664

# Survey study: Distance between household members

Density estimate



# Outlook

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