

Why some beat the heat while others do not

Understanding private (mal-)adaptation to heat waves based on the Protection Motivation Theory

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Health impacts from heat waves

Over the last three decades, heat waves have led to 198 deaths per 10,000 people in Western Europe (Robine et al. 2008)
The 2003 heat wave resulted in 180 - 330 deaths in Austria (APCC 2014)

Additional health impacts:

- Bacteria growth in drinking water
- UV radiation
- Threat to food crops, ...

Current heat action plans focus on the most vulnerable:

- Elderly
- Infants
- Chronically ill
- Those living in cities (urban heat island effect)

Future heat action plans should focus on:

- General population
- Including suburban areas with lower building density

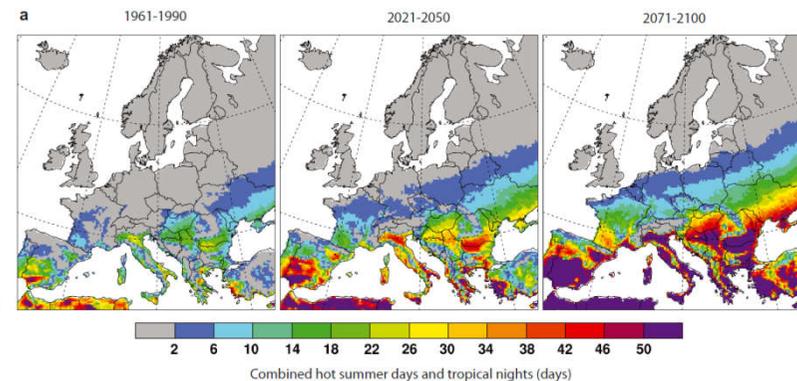




Heat waves increase due to climate change

Observed increase in length of heat waves in Western and Central Europe (Della-Marta et al., 2007)

Heat waves are expected to increase in frequency, intensity and duration (Fischer & Schär 2010)



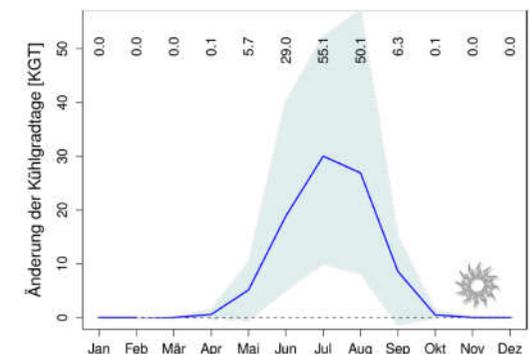
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Increase from 5 to 15 heat waves per year in Austria until 2100 (APCC 2014)

Increase in cooling degree days in Graz until 2050 (Gobiet et al. 2012)

500 to 2200 deaths from heat waves per year in Austria in 2071-2100 (APCC 2014)

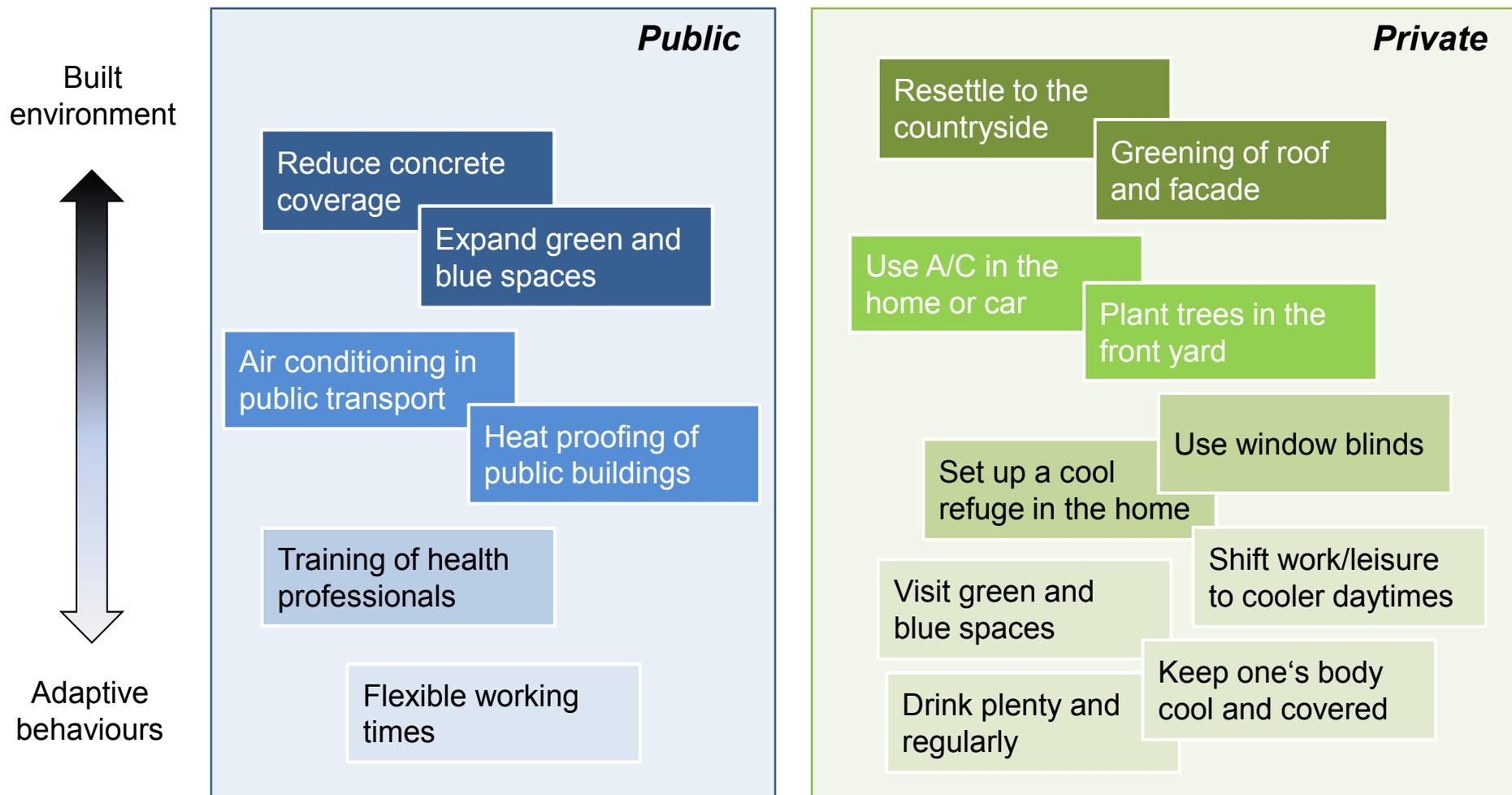
Definition of a heat wave: three consecutive days with $>30^{\circ}\text{C}$ during the day and no less than 25°C during the night



Jahresgang der erwarteten Klimaänderung (Einheit: KGT/Monat). Die dicke Linie stellt die mittlere erwartete Klimaänderung dar, der schattierte Bereich die Bandbreite möglicher Entwicklungen. Die Zahlen darüber zeigen die Monatsmittel der Bezugsperiode (Einheit: KGT/Monat).

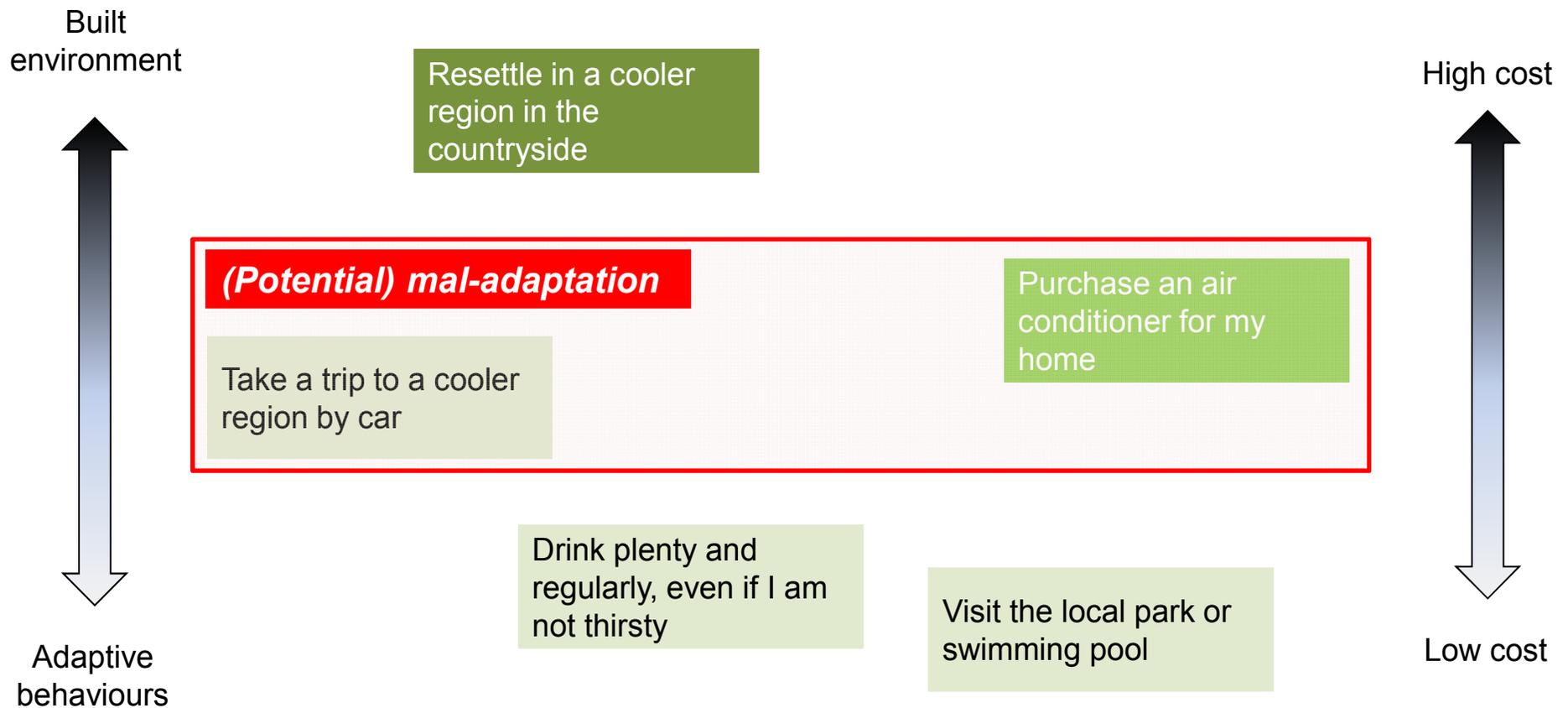


Public and private heat wave adaptation



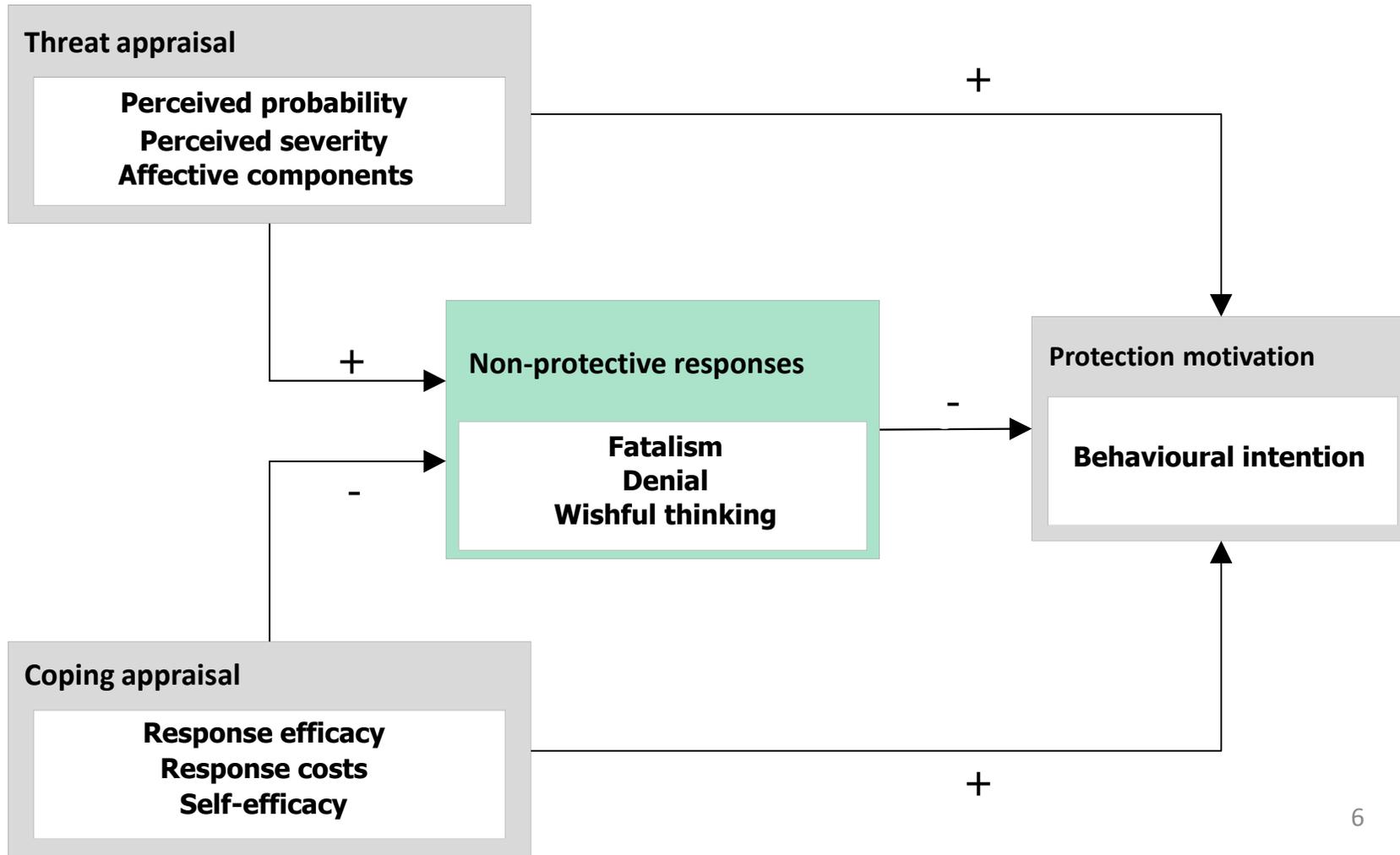


Private adaptive behaviours addressed in this study



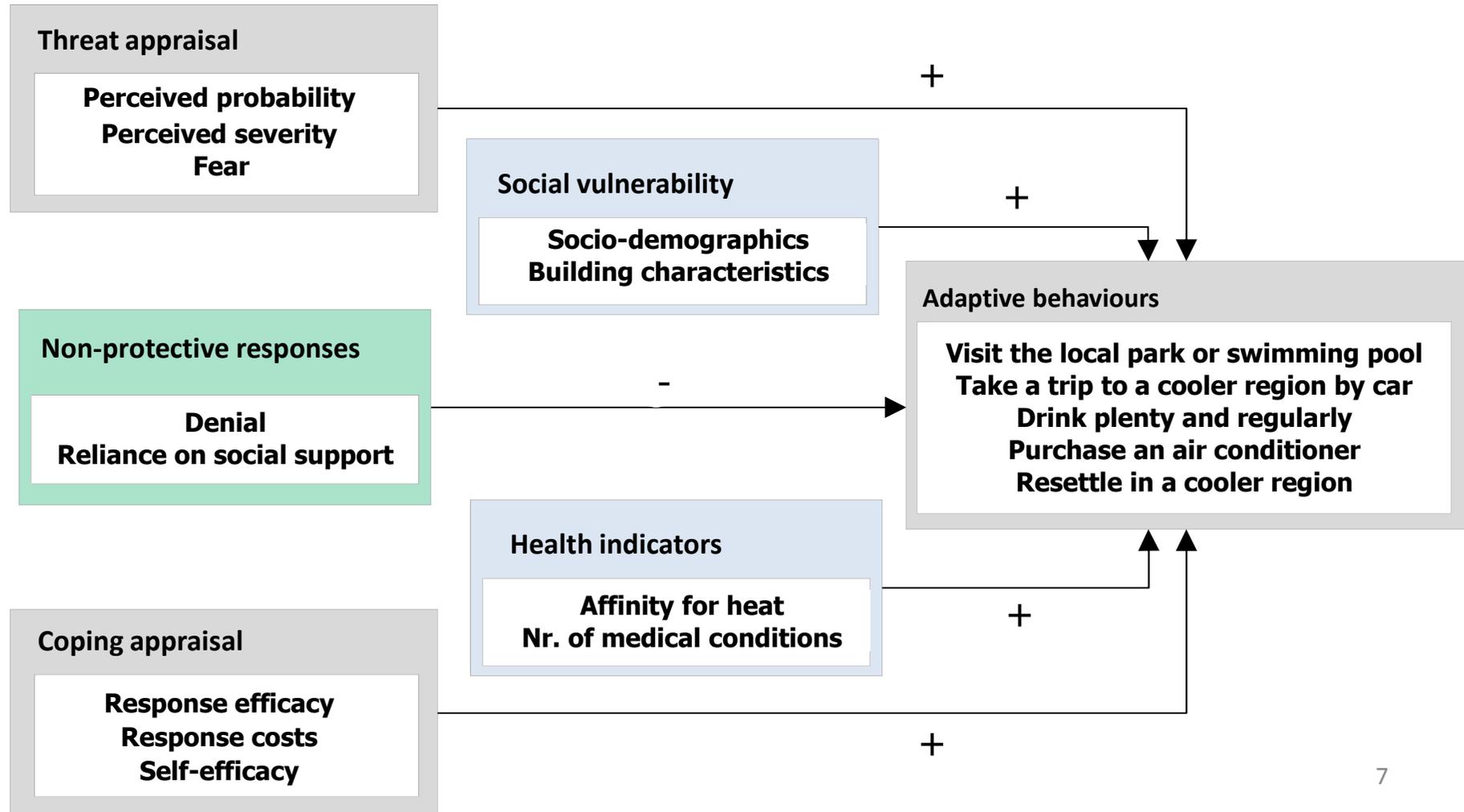


Protection Motivation Theory (Rogers 1975, Grothmann & Reusswig 2006)





PMT applied to private heat wave adaptation





Data

Telephone survey during the July 2015 heat wave

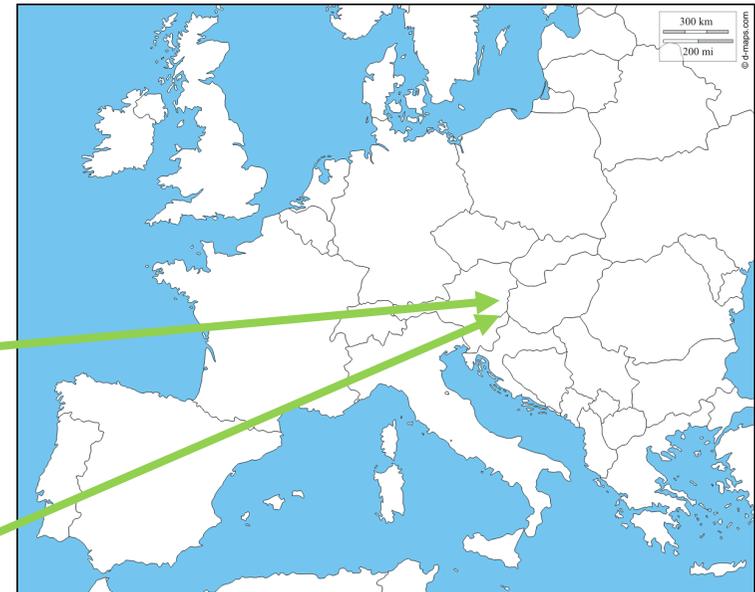
- Temperature > 30°C during daytime
- +2,7°C compared to the mean temperature from 1981-2010

Random sampling from phonebook records
Plus quota by age and gender

Urban agglomeration of Graz
in southern Austria

City of Graz
n=400

Sprawl area of Leibnitz
n=300



Scales

Social vulnerability

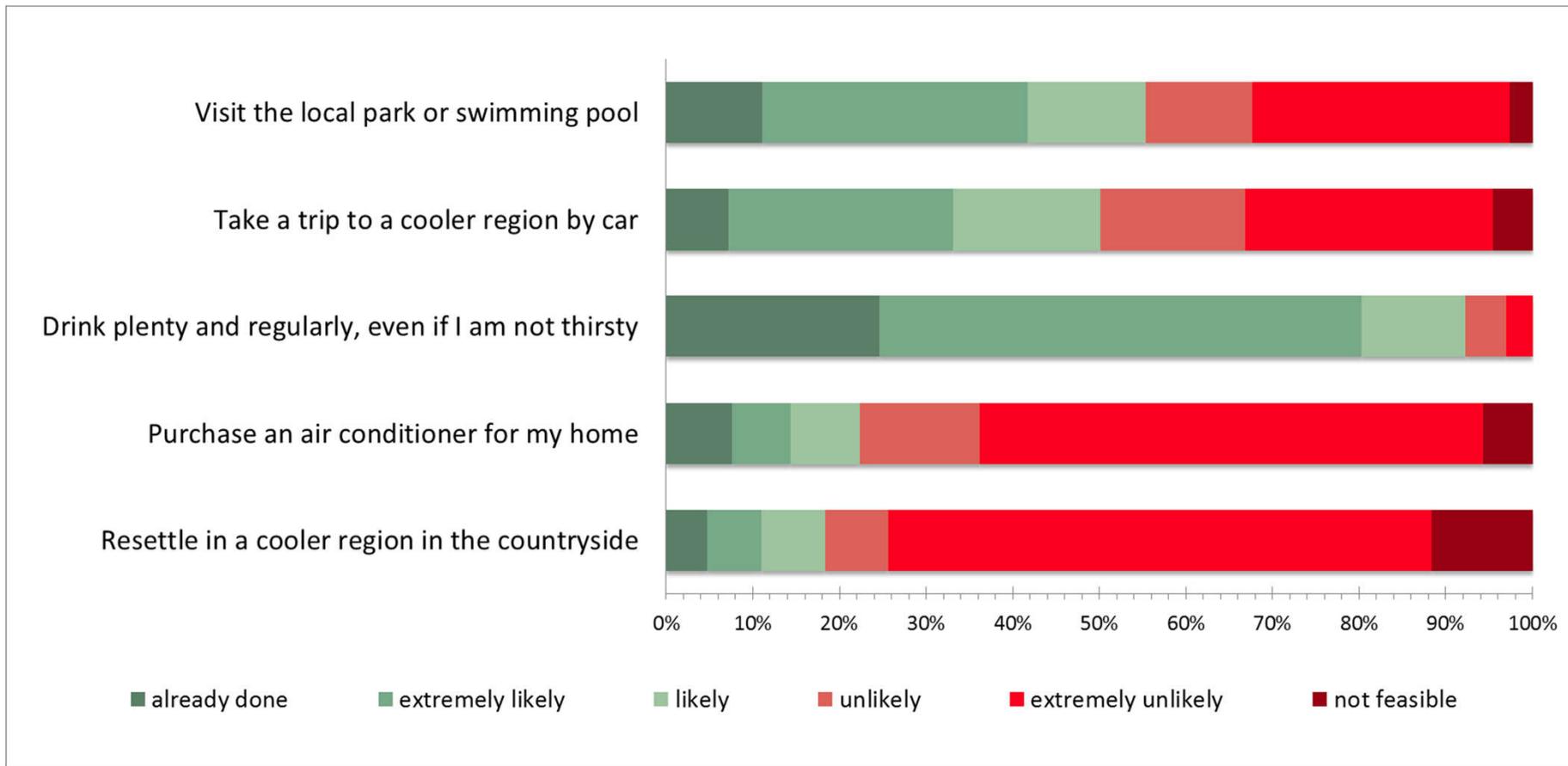
Socio-demographics	Building characteristics
Region	Ownership
Gender	Living on the top floor
Age	Year of construction
Household income	



	Scale	Sample item	Number of items	Cronbach's Alpha
Threat appraisal	Risk perception probability	Likelihood within the next 10 years	1	n/a
	Risk perception severity	Expected negative impacts	1	n/a
	Fear	I am afraid of a potential heat wave.	2	.58
Coping appraisal	Response efficacy	How effective is ...	1	n/a
	Response costs	How high or low would you judge the effort...	1	n/a
	Self-efficacy	Are you able to overcome the effort to...	1	n/a
Non-prot. responses	Denial	Generally, the current threat of heat waves is being exaggerated.	2	.61
	Reliance on social support	In the case of a heat wave, I can count on support by others.	2	.60
Health	Affinity for heat	Hot summer days make feel full of energy.	3	.63
	Number of medical conditions	n/a	1	n/a



Implementation of adaptive behaviours





Drivers	Visit local park/pool	Take a trip by car	Drink plenty and regularly	Purchase an air conditioner	Resettle to countryside
Risk perception probability	-0.08	.00	.03	-.03	.01
Risk perception severity	.03	-.01	-.05	-.04	.08
Fear	.00	.05	-.03	.12	.02
Response efficacy	.39	.36	.19	.33	.26
Response costs	-.12	-.11	-.15	-.21	-.23
Self-efficacy	.22	.28	.32	.29	.37
Denial	.05	.01	-.02	-.03	-.05
Reliance on social support	.08	-.01	.07	-.07	-.07
Affinity for heat	.02	-.02	-.05	-.01	.00
Number of medical conditions	-.03	-.02	.02	.07	.01
Region: Graz	.11	.07	.01	-.06	.04
Owner	-.01	-.01	-.08	-.03	-.02
Living on top floor	-.01	.07	-.01	.03	.07
Well-insulated construction	.08	-.03	-.04	-.02	-.09
Gender: female	.04	.03	.05	.05	-.03
Age	-.10	-.13	-.01	-.14	-.13
Income	-.13	.01	-.06	.09	-.02
Adj. R ²	31.8%	38.4%	21.8%	32.9%	37.0%

Table shows standardized regression coefficients. Bold: p<.05.



Discussion

Adding income as a predictor diminishes the sample size

- Ca. 20% missing responses related to the inclusion of income
- Effects of the other drivers are robust when income is removed

Analyze mediator and moderator effects of non-protective responses

- Weak scale measurement

Expand the scope of private adaptive options under investigation

- Revising daily schedules and dress codes (Liu et al. 2013; Saman et al. 2013)
- Leveraging social monitoring and support (Price et al. 2010; Sampson et al. 2013; Wolf et al. 2010)

Improve R^2 by means of additional drivers

- Cues to action (Akompab et al. 2013)
- Knowledge on heat waves (Akompab et al. 2013)



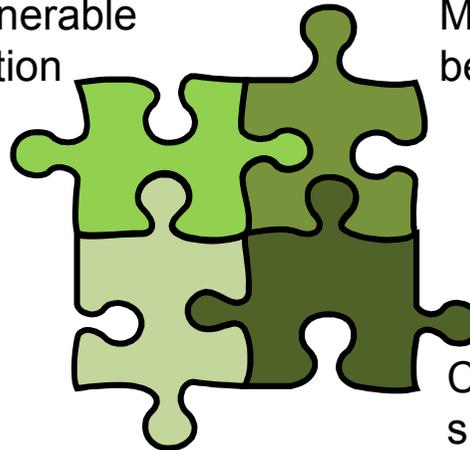
Policy implications

Even experiencing a heat wave hardly leads to private adaptive behaviour

Few people are prone to mal-adaptive behaviours

Those socially or health-related vulnerable do not engage more in adaptive action

Mal-adaptive and well-adaptive behaviours feature similar drivers



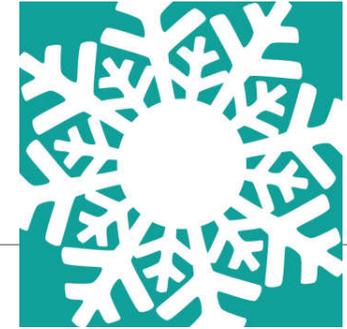
Communication of threat or risk messages is not effective

Communicate efficacy and costs of specific adaptive behaviours

 Heat waves might be perceived as a dichotomous, not as a continuous risk

Build trust in one's own protective capacities

 How do people form their coping appraisals of specific adaptive behaviours?



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