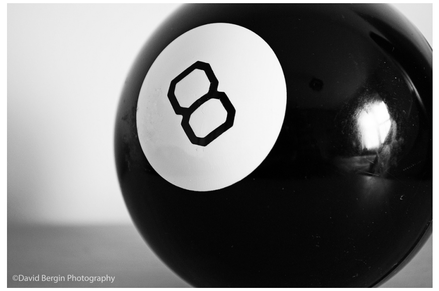
How can emerging and future (urban)(air and surface) mobility concepts contribute to rural and mountainous areas development?



Constantinos Antoniou[1], Emmanouil Chaniotakis[1], Raoul Rothfeld[2], Christelle Al Haddad[1], Santhanakrishnan Narayanan[1]

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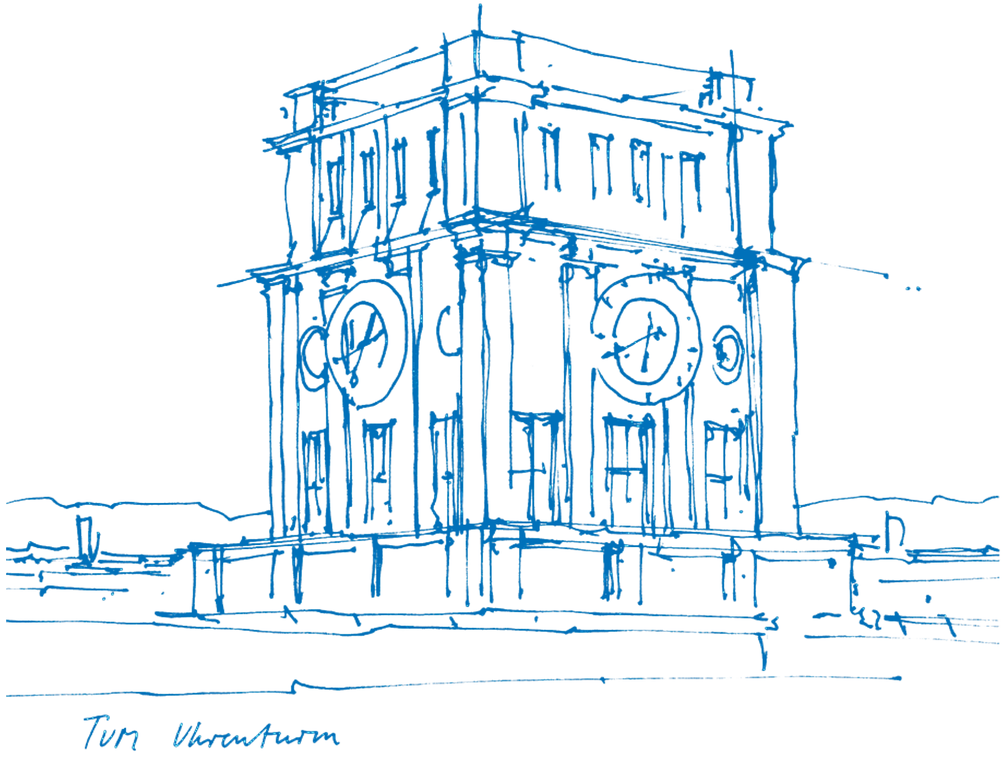
Department of Civil, Geo and Environmental Engineering
Chair of Transportation Systems Engineering

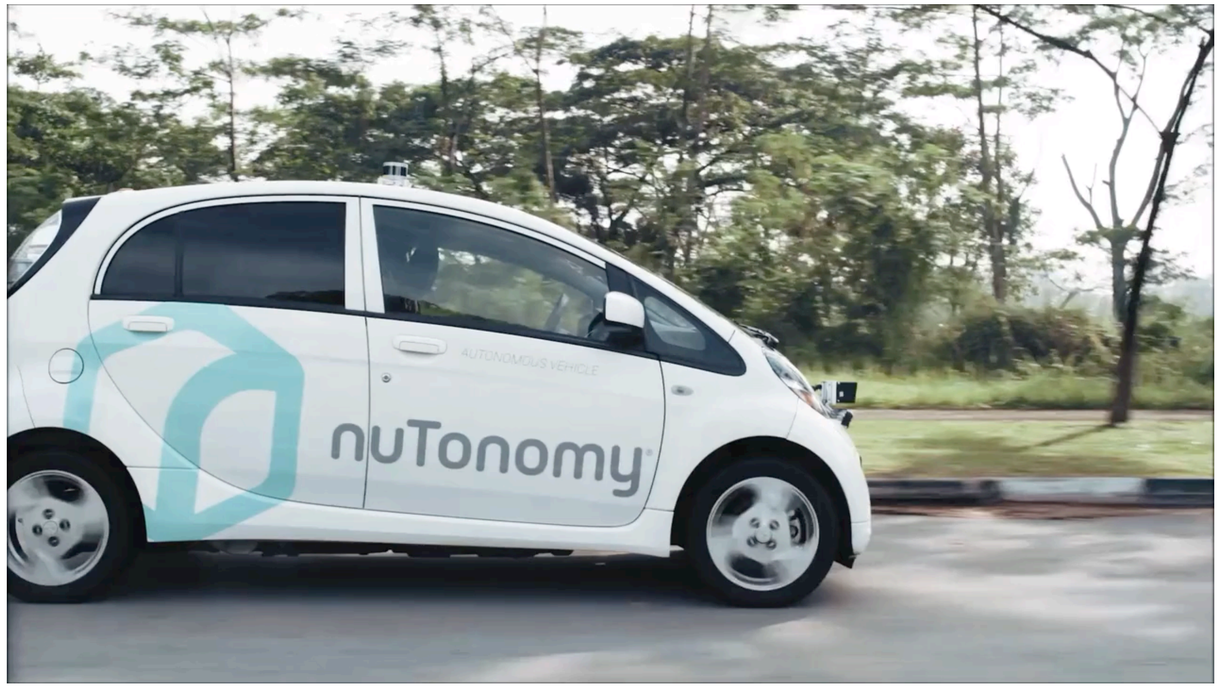
[1]Bauhaus Luftfahrt

International Mountain Conference 2019
Innsbruck, 9/9/2019



The 3 Revolutions (autonomous, electric, shared)

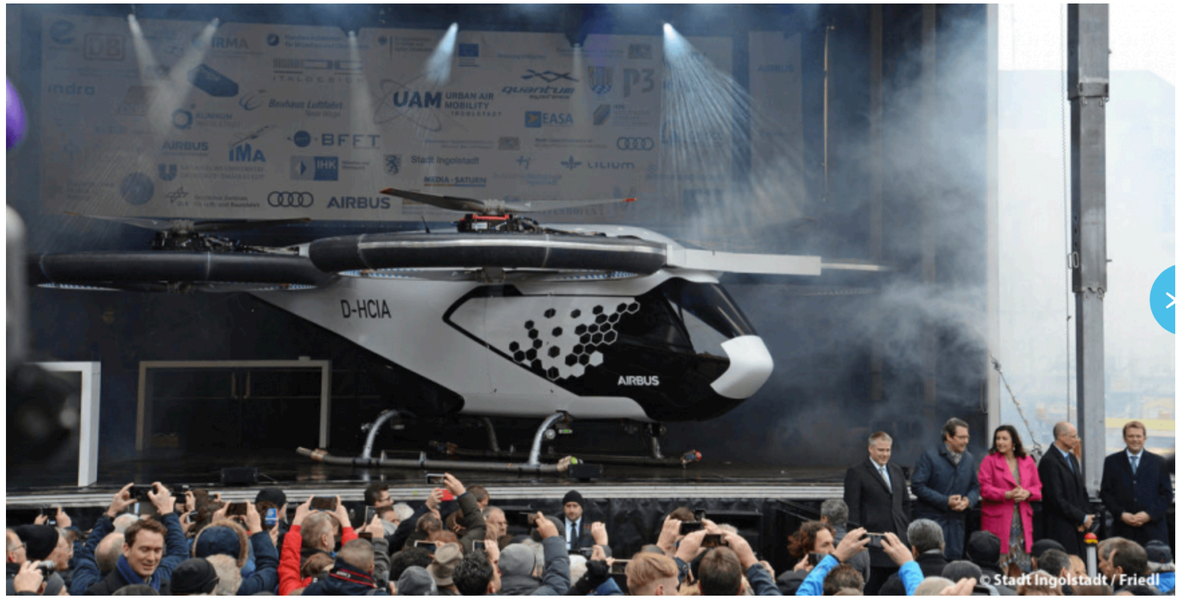
How will public transport of the future look like?



nutonomy.com

Mar 12, 2019 - 04:28 pm

Airbus & Audi reveal electric air taxi CityAirbus



https://www.electrive.com/2019/03/12/airbus-electric-air-taxi-cityairbus-revealed-before-maiden-flight/

Shared Autonomous Vehicle (SAV) services - what are the issues?

Fluctuating demand

Bias of operators towards cities

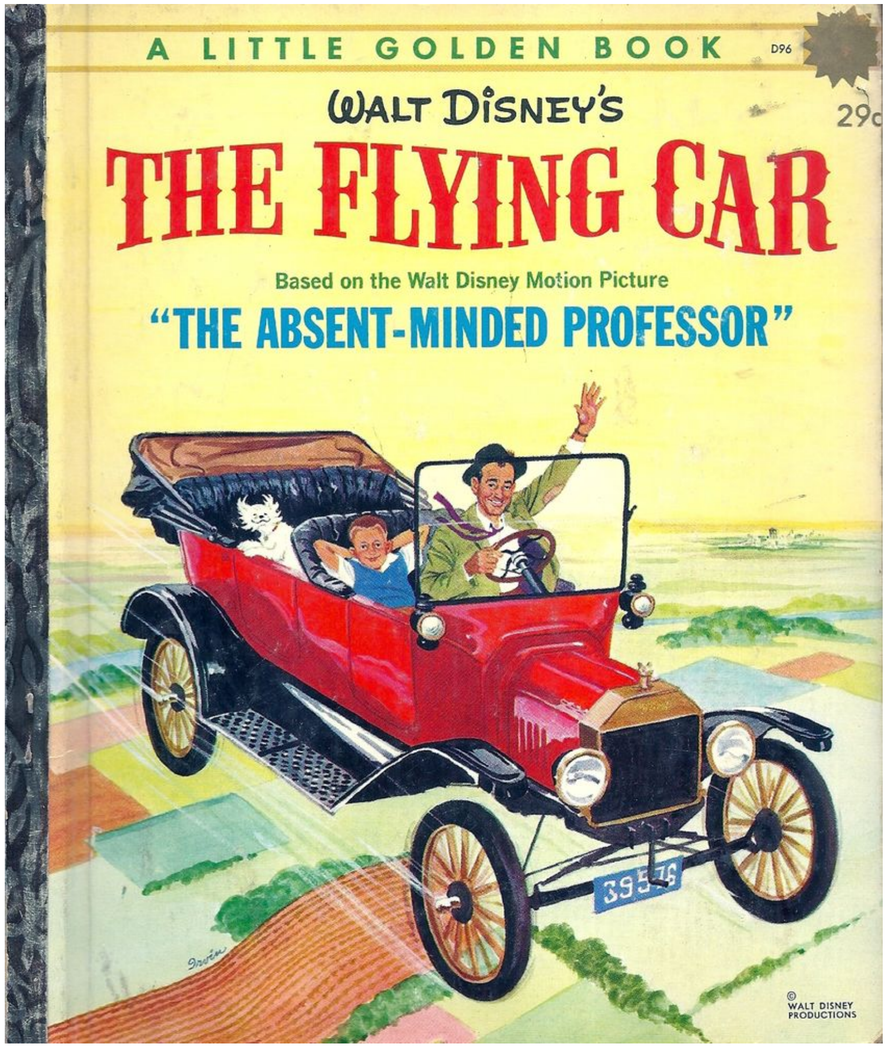
Higher safety & security concerns of users compared to plains and urban environment

More difficult manoeuvres

Comfort (ride quality)

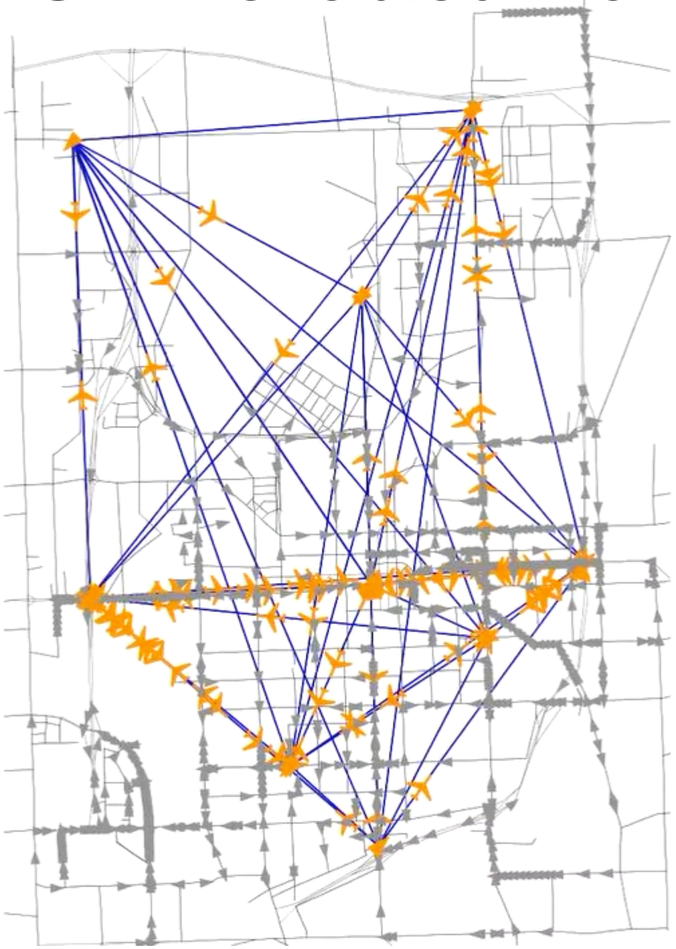
Profile of users during peak & non-peak season

What is urban air mobility?



- On-demand sharing mobility
- Operated by fully automated VTOL
- Intra-city passenger trips

UAM-enabled Transport Simulation (MATSim)



Direct network

The Multi-Agent Transport Simulation
Java-based, open-source, community-driven simulation framework by Horni, Nagel and Axhausen (2016)

Development of UAM-Extension
Features modeling capabilities for UAM vehicles, infrastructure, and aerial networks
Allows for simplistic passenger pooling and dynamic vehicle distribution

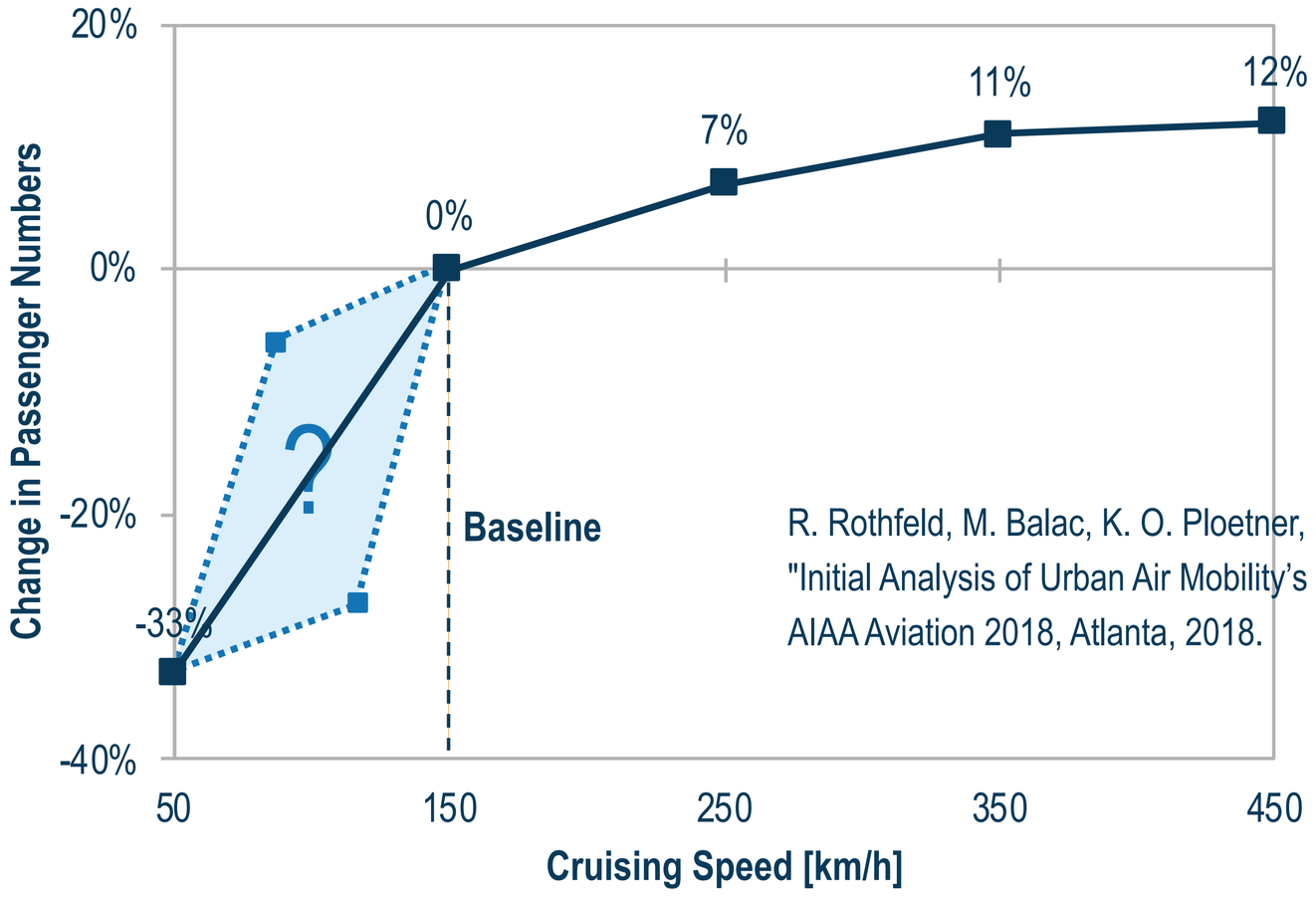
First applications of current version on test case city of Sioux Falls and Munich region

Rothfeld et al. (2018)

Indirect network

Early Sensitivity Analysis Results

UAM Cruise Speed Variations in Sioux Falls



R. Rothfeld, M. Balac, K. O. Ploetner, C. Antoniou,
"Initial Analysis of Urban Air Mobility's Transport Performance in Sioux Falls",
AIAA Aviation 2018, Atlanta, 2018.

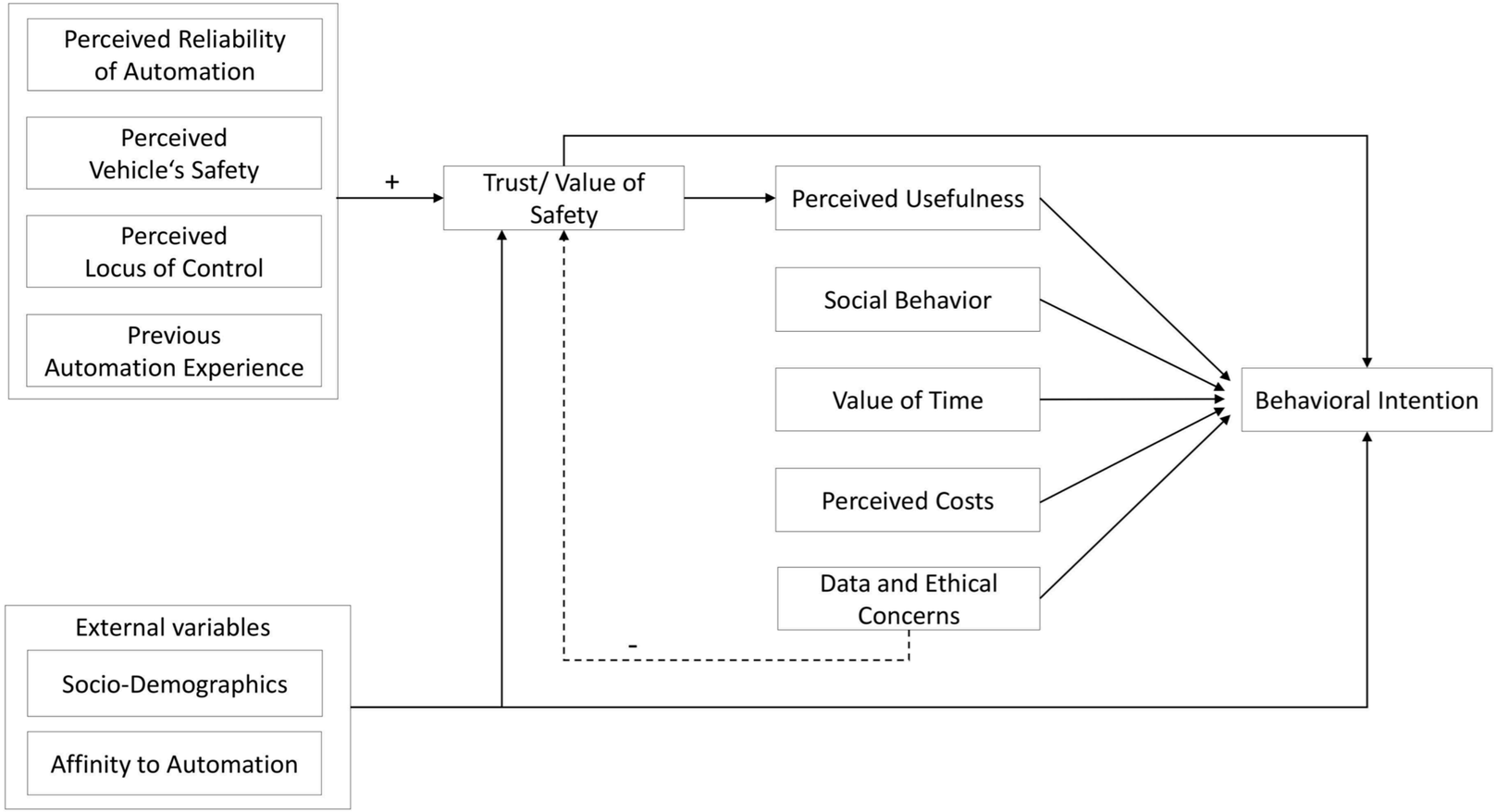
Exploratory factor analysis results

Loadings	Factor 1	Factor 2	Factor 3	Factor 4
Travel time savings 5min	0.78			
Travel time savings 10min	0.98			
Travel time savings 20min	0.59			
Enjoy automation		0.80		
Trust automation		0.75		
UAM is useful		0.51		
Fear of cyber–security			0.70	
Fear that data goes to a third party			0.53	
Loss of job concerns			0.49	
Operator on the ground				0.67
In–vehicle safety cameras				0.50
Sum of square of loadings	2.01	1.66	1.14	0.96
Proportion variance	0.18	0.15	0.10	0.09
Cumulative variance	0.18	0.33	0.44	0.52
Factor interpretation	Value of time savings	Affinity to automation	Data and ethical concerns	Safety concerns

Exploratory factor analysis results (cont'd)

Loadings	Factor 1	Factor 2	Factor 3	Factor 4
Online booking	0.81			
Online banking	0.86			
Online shopping	0.65			
Concerned about global warming		0.99		
Spend on environmental products		0.5		
Instagram			0.99	
Facebook			0.43	
BlaBlaCar				0.67
Airbnb				0.5
Willingness to share				0.5
Sum of square of loadings	1.93	1.28	1.24	1.06
Proportion variance	0.19	0.13	0.12	0.11
Cumulative variance	0.19	0.32	0.45	0.55
Factor interpretation	Affinity to online services	Environmental awareness	Affinity to social media	Affinity to sharing

Proposed Technology Acceptance Model for Disruptive Transport Technologies



Al Haddad (2019)
Adapted from the original TAM by Davis et al. (1989) and the Automation Acceptance Model (AAM) by Ghazizadeh et al. (2012)

Open questions (we need to rethink for non-urban)

Which benefits does * offer for the transport users of a city?
Can * ever be mass-transport mode or will it remain a niche?

How can * infrastructure systematically be placed? Is a systematic approach meaningful?
What are factors influencing passenger and public acceptance of *?
Will * create a modal shift or merely induce even more travel demand? …

where * in {UAM, AVs, dynamic vanpooling, ride hailing, e-scooters, …}

How can emerging and future (urban)(air and surface) mobility concepts contribute to rural and mountainous areas development?

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