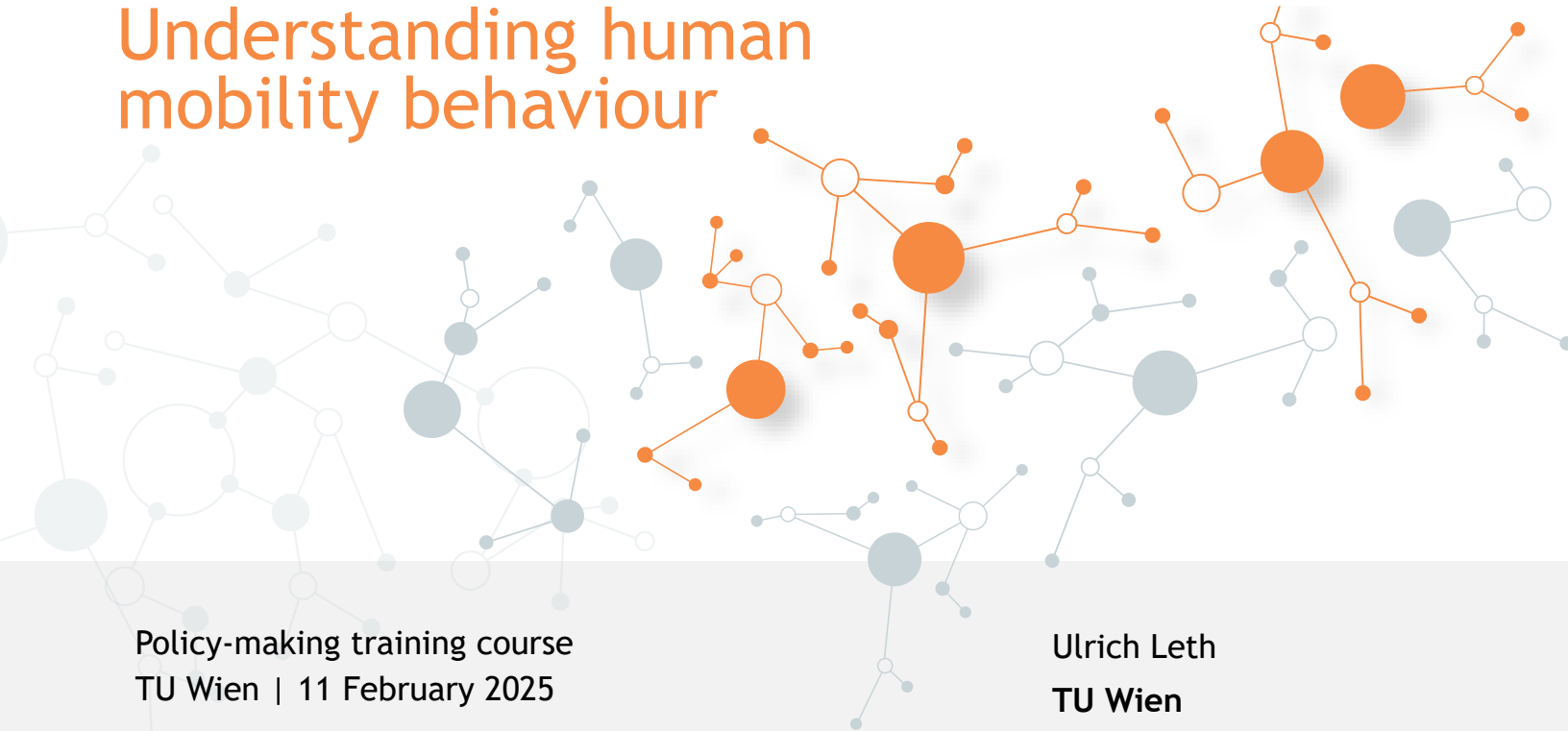


# Understanding human mobility behaviour



Policy-making training course  
TU Wien | 11 February 2025

Ulrich Leth  
TU Wien

30 people getting a coffee 🇺🇸

vs.

30 people getting a coffee 🇫🇷



# LEARNING GOALS IN THIS SESSION

## What will we talk about?

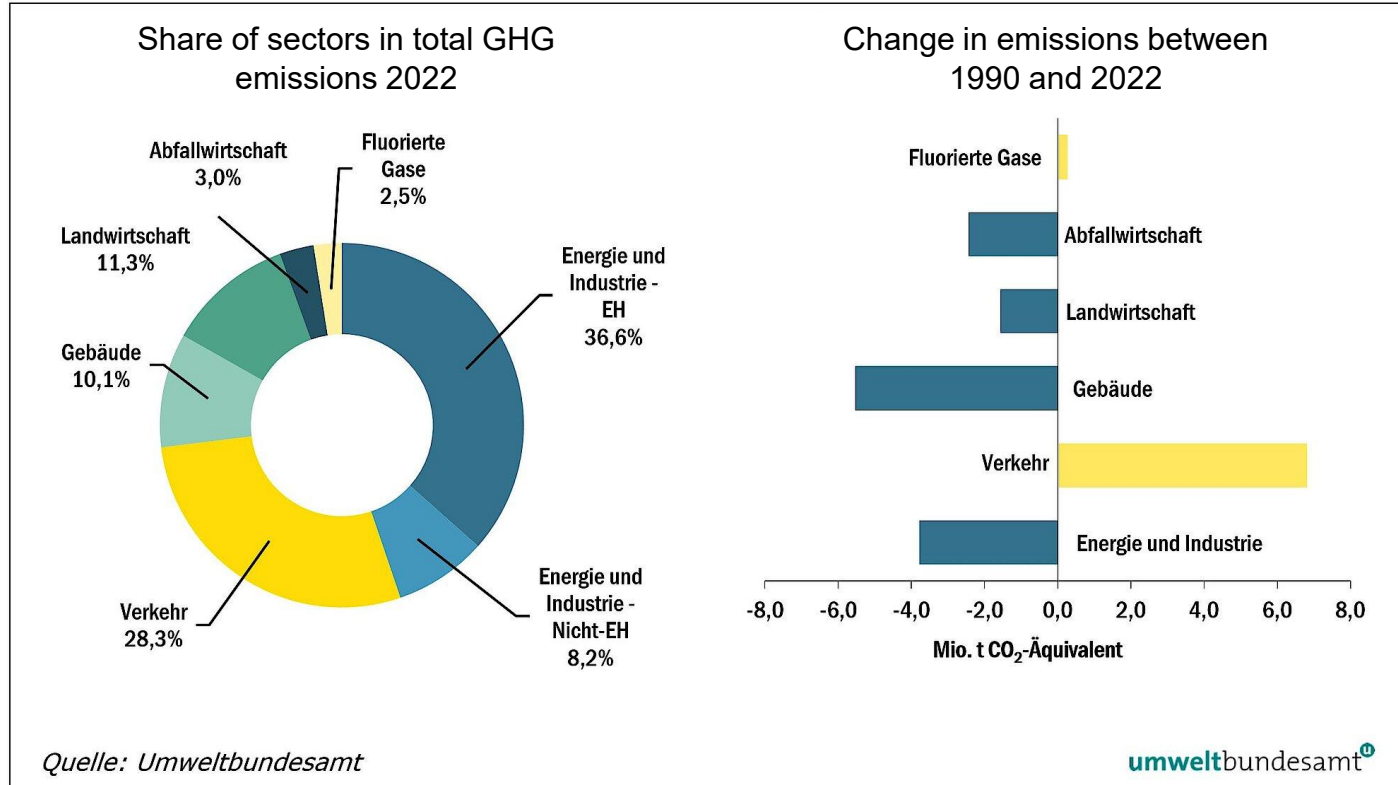
- Why act now?
- Basics of human behavior
- Technological innovation will save us, right?
- Planning principles
- Best practices

# Why act now?

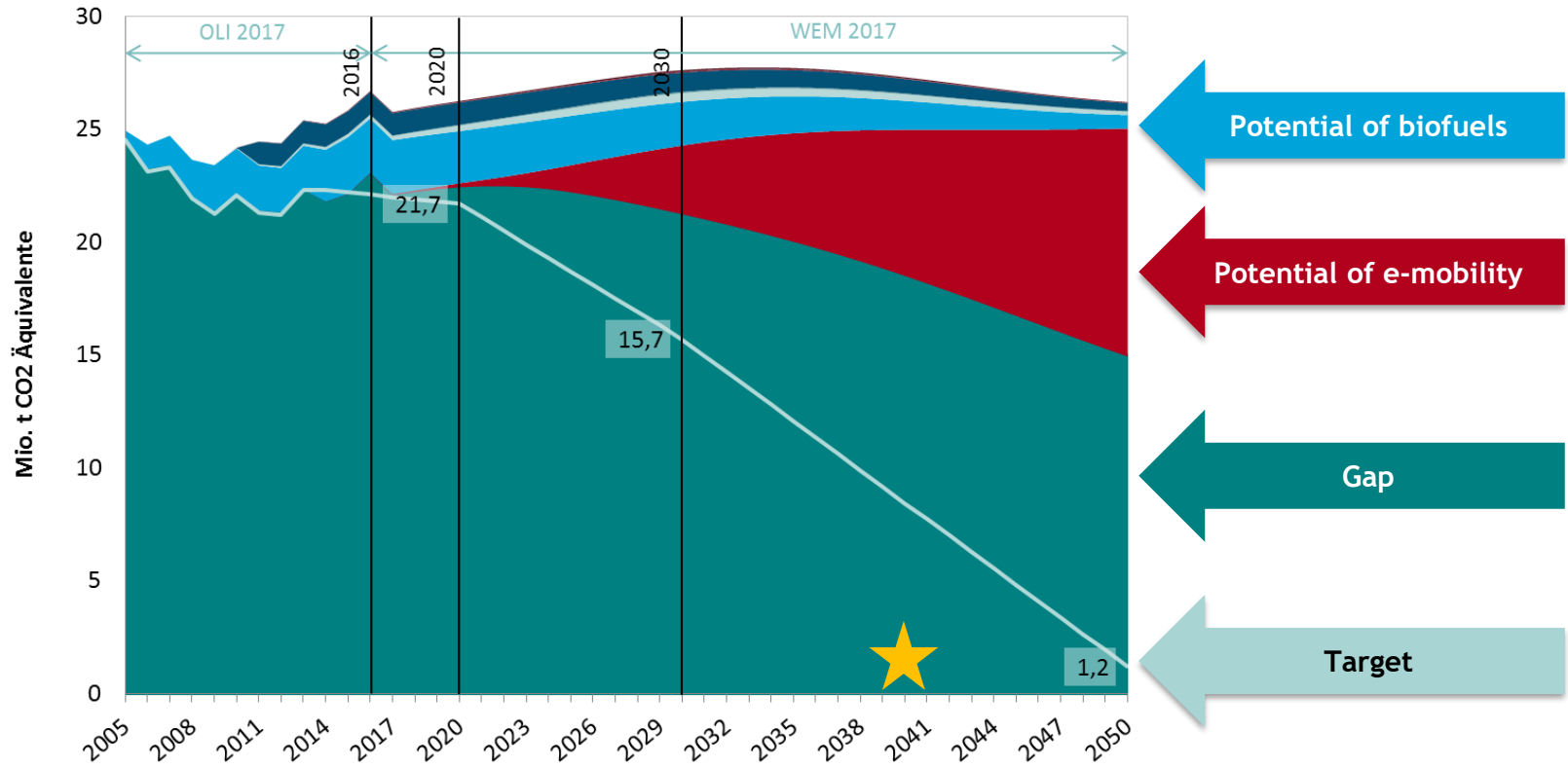
---

The need for action

# GHG-EMISSIONS IN AUSTRIA



# POTENTIAL FOR REDUCTION (EXAMPLE OF AUSTRIA)



# Basics of human behavior

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# UNDERSTANDING HUMAN BEHAVIOR

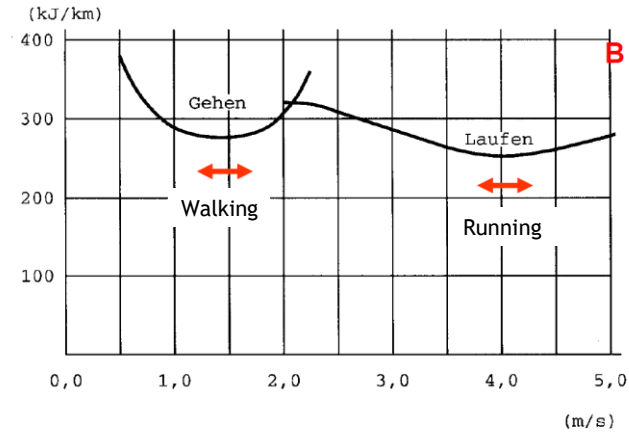
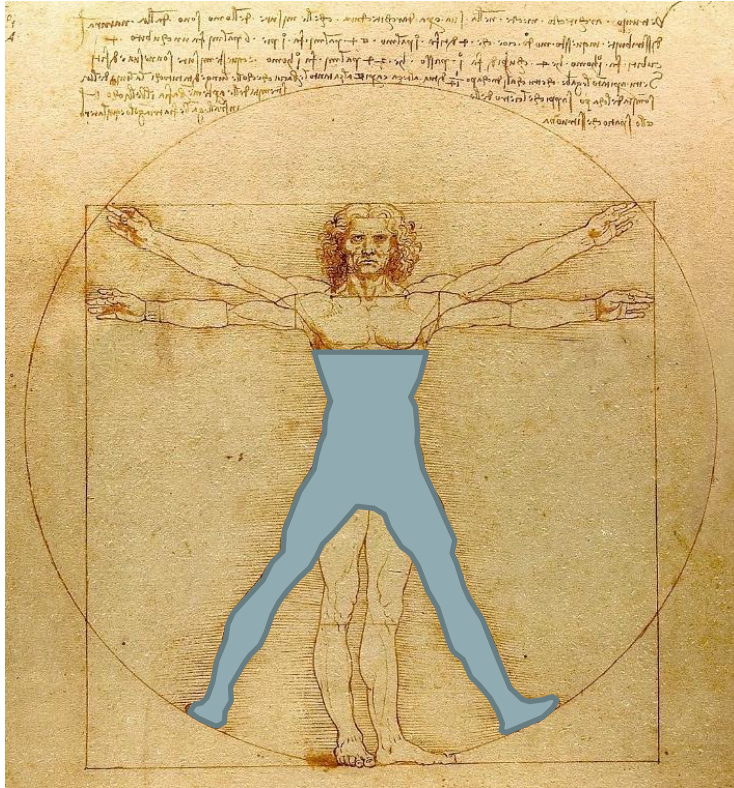
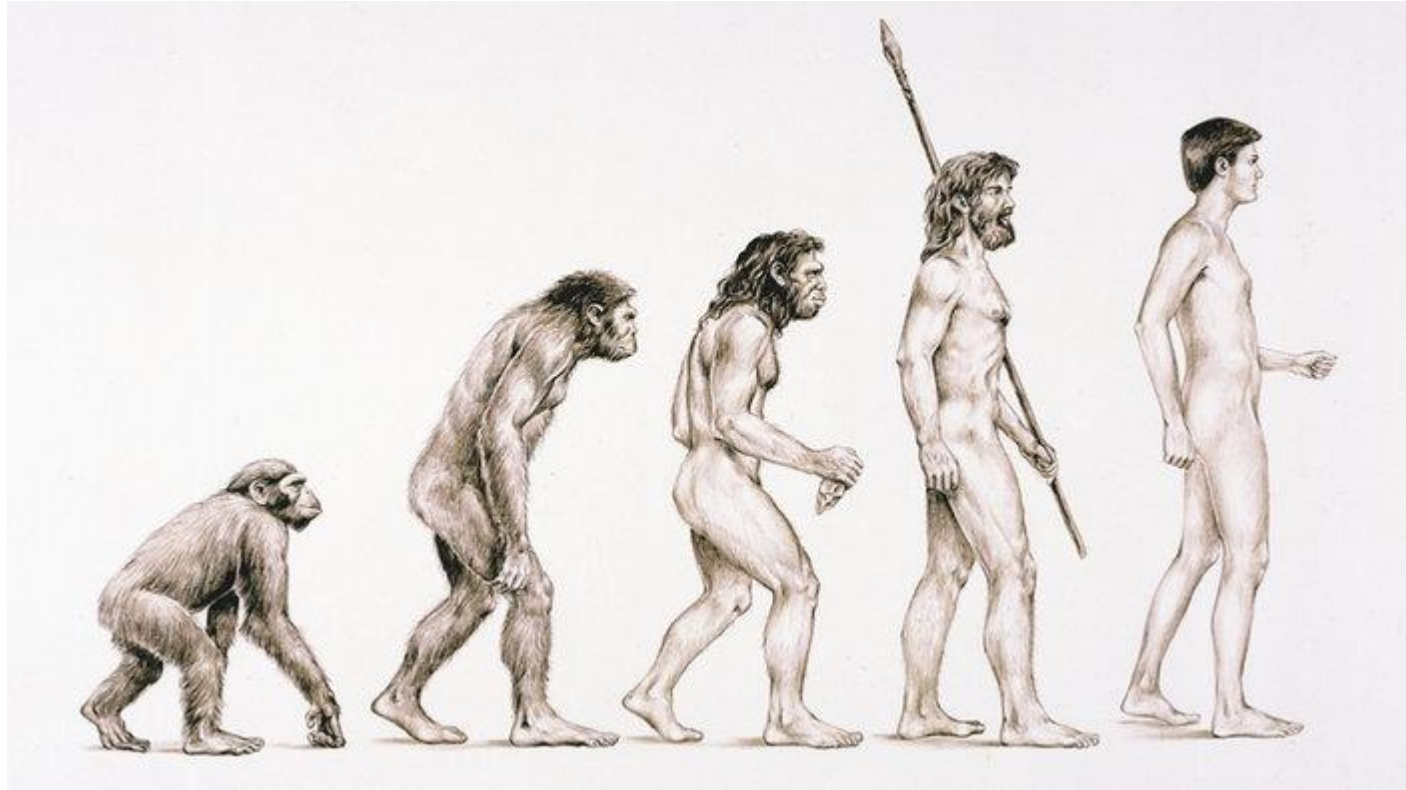


Abb. 7: Energieverbrauch für eine Strecke von 1000 m Länge in Abhängigkeit von der Geschwindigkeit (aus WEIDMANN, U., 1992).

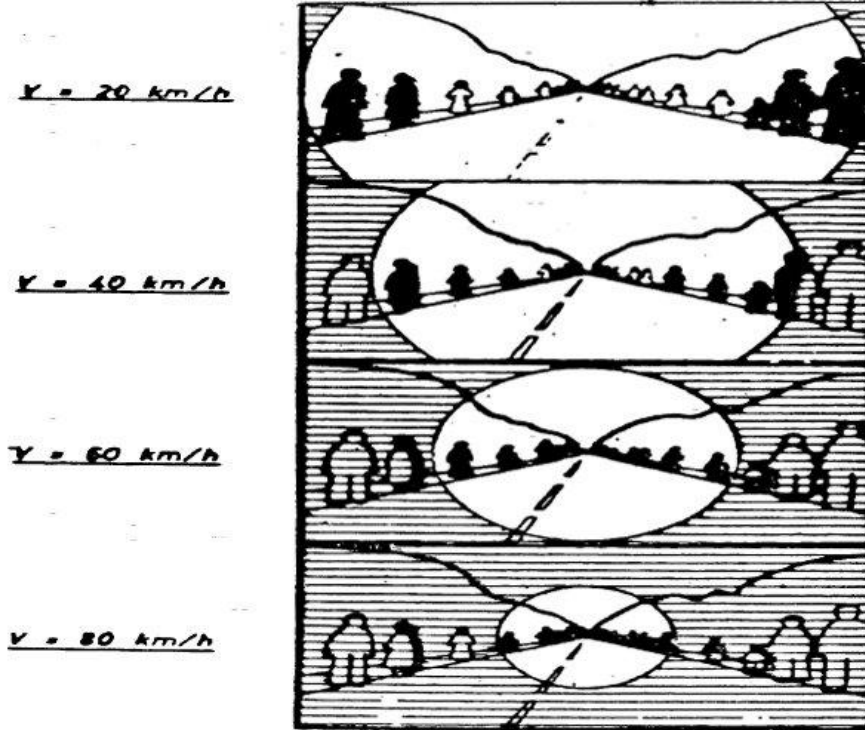
Average walking speed: 3 - 4 km/h  
Maximum speed: 44,72 km/h

# UNDERSTANDING HUMAN BEHAVIOUR



# UNDERSTANDING HUMAN BEHAVIOUR

Field of vision and changing of fixation point  
at increasing driving speeds



# HUMANS LIKE VARIETY



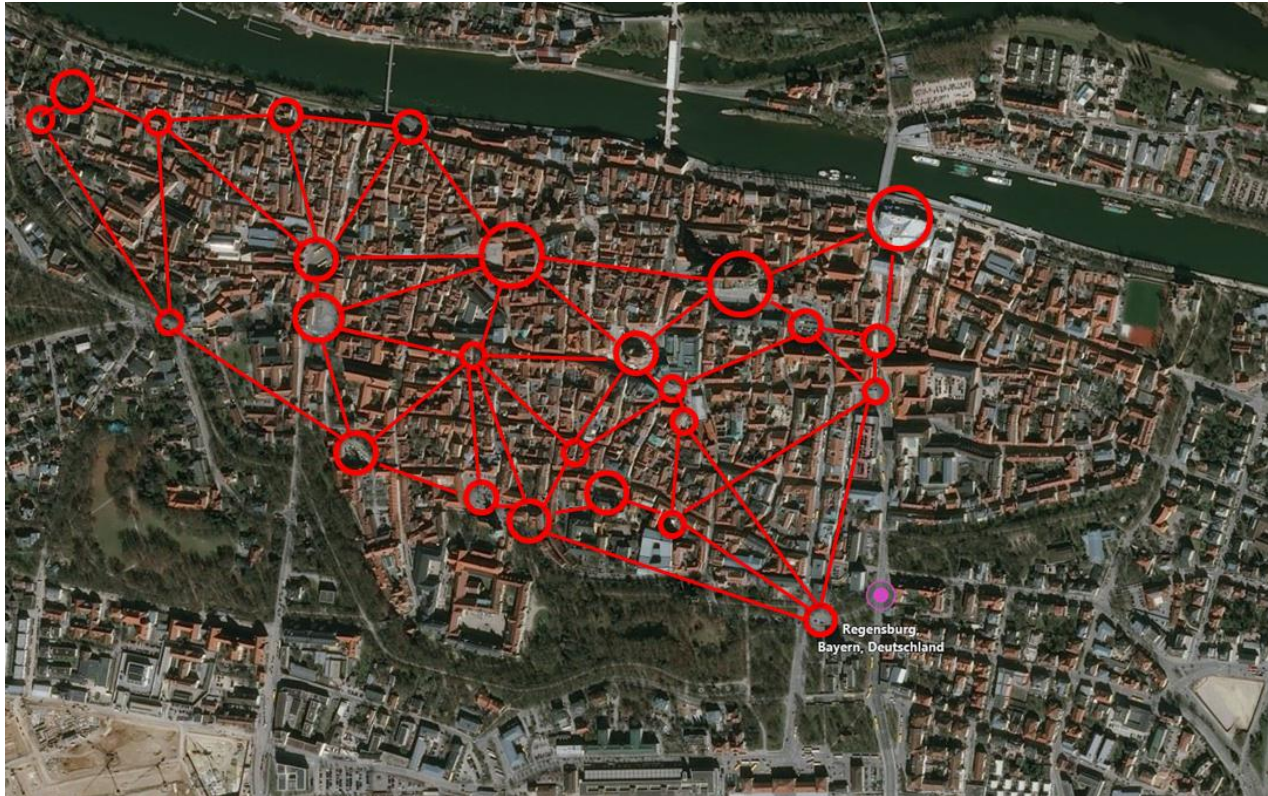
# HUMANS LIKE PROTECTION



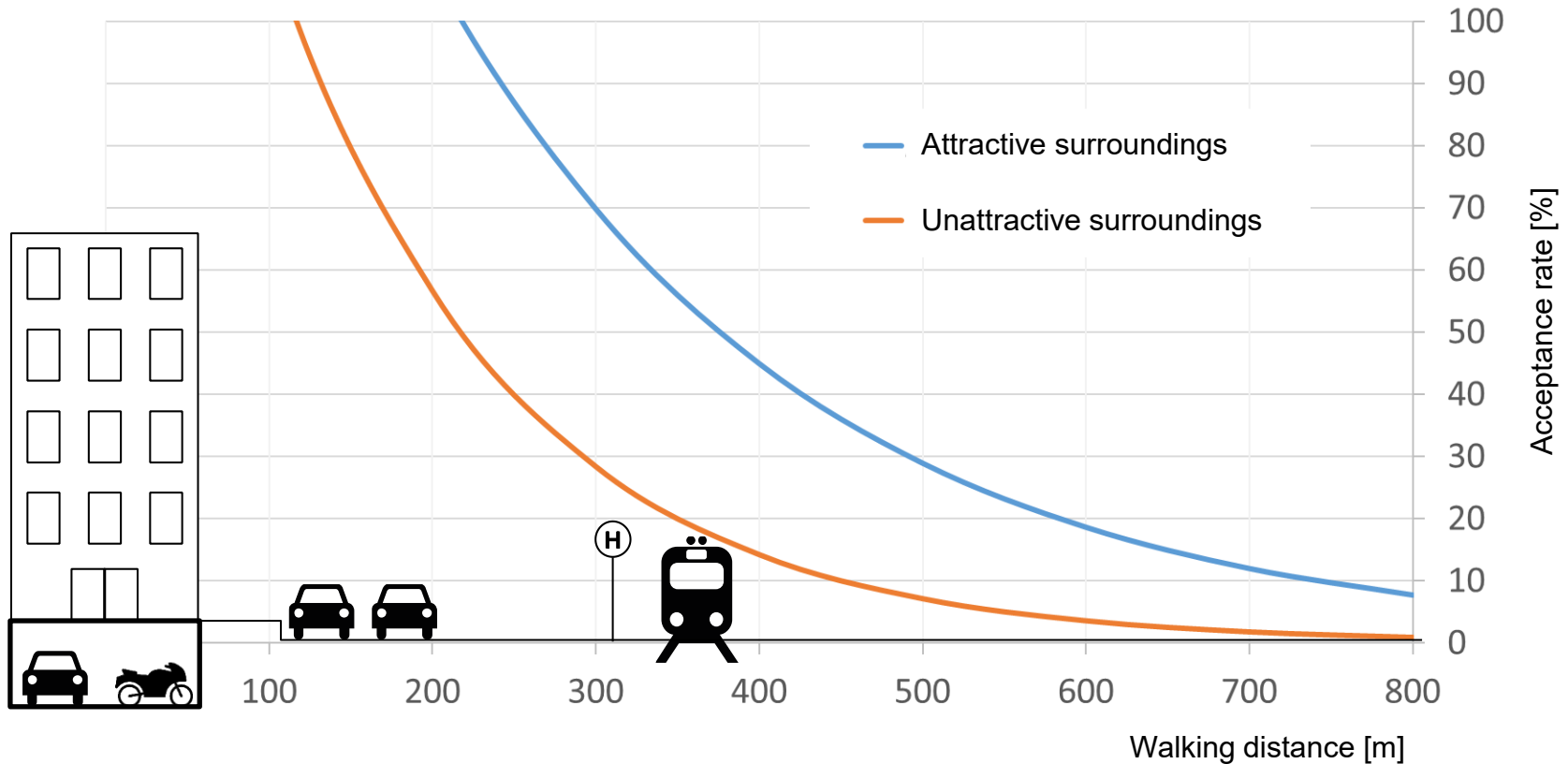
# HUMANS DON'T LIKE MONOTONY



# THE PEDESTRIAN CITY IS SMALL-SCALED AND DIVERSE



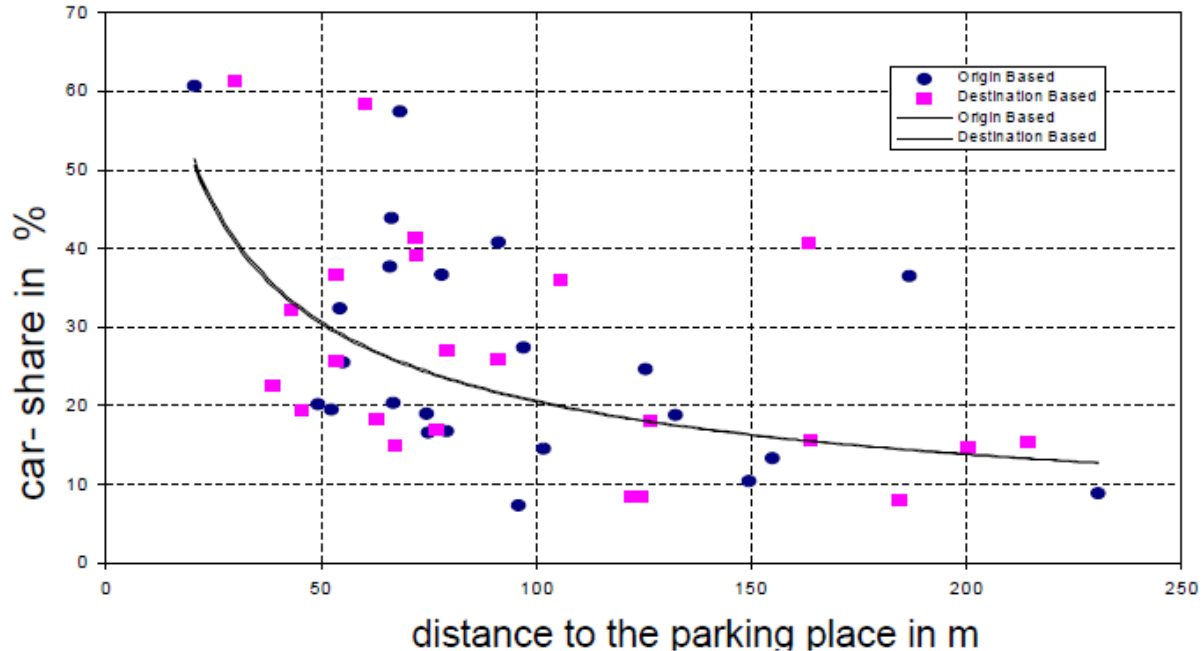
# ACCEPTED WALKING DISTANCE



Source: Peperna, (1982); Knoflachner (2006)

# „FREEDOM OF MODE CHOICE“ IS A MYTH

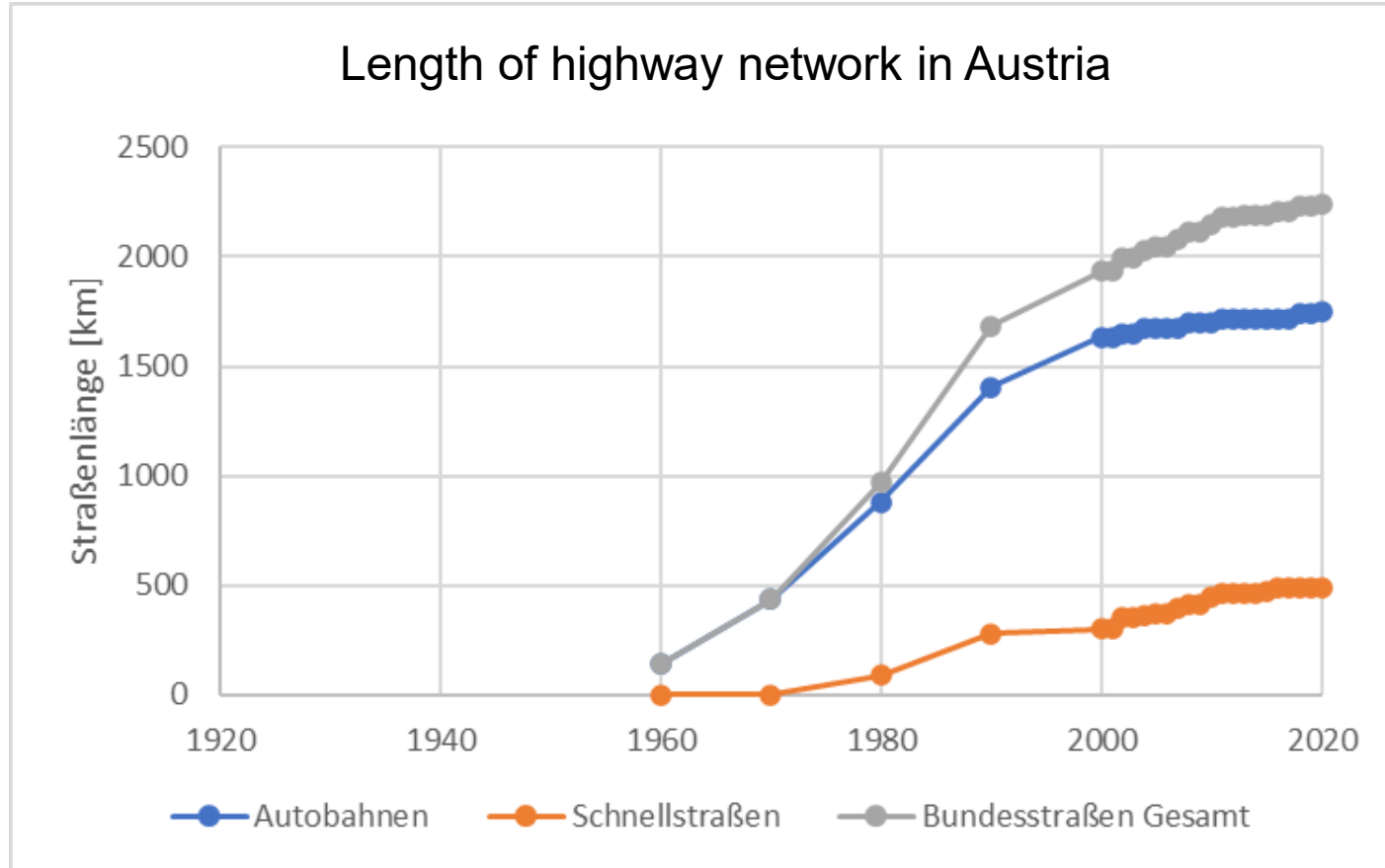
Car share depending on parking place distance



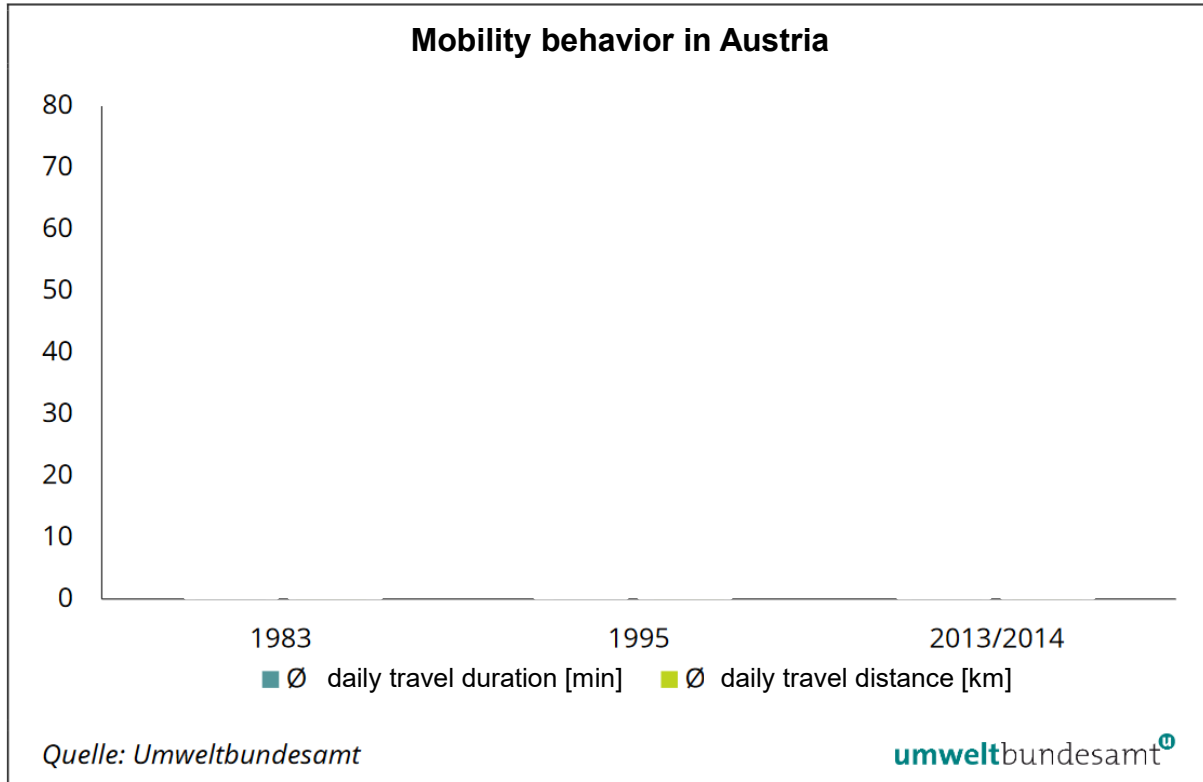
# „FREEDOM OF MODE CHOICE“ IS A MYTH



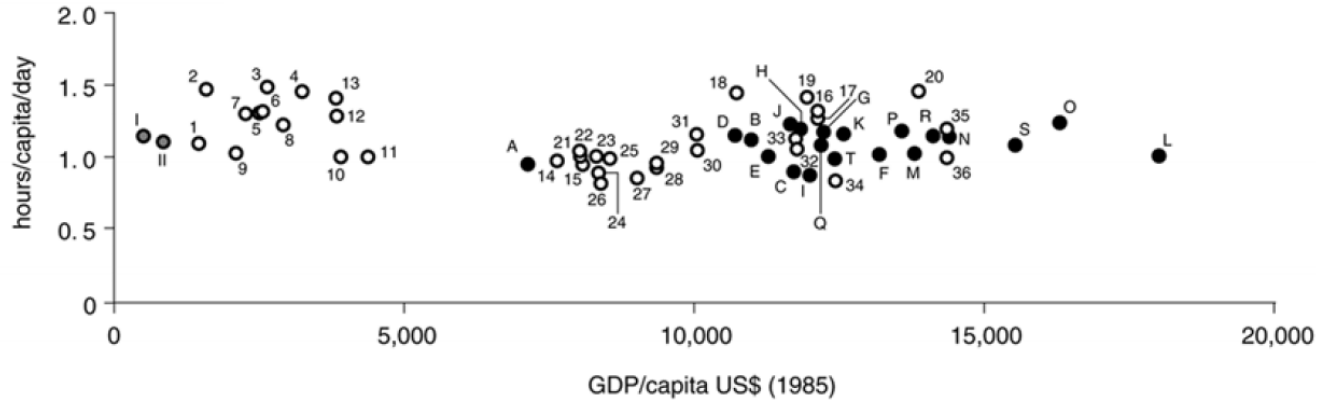
# WHERE ARE THE TIME SAVINGS?



# WHERE ARE THE TIME SAVINGS?



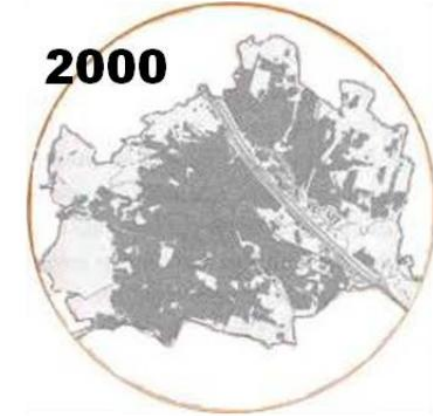
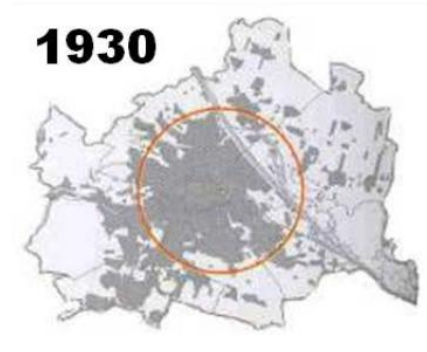
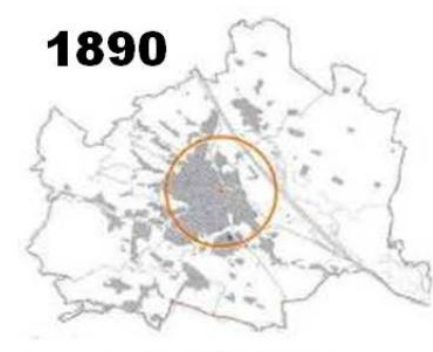
# TRAVEL TIME BUDGET = CONSTANT



# SO WHAT HAPPENED?



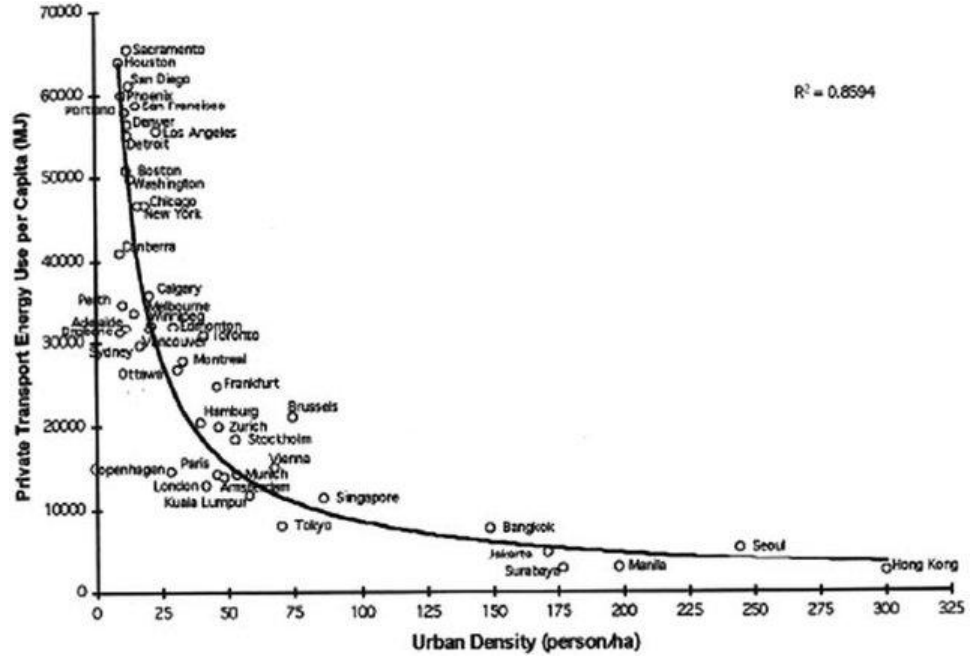
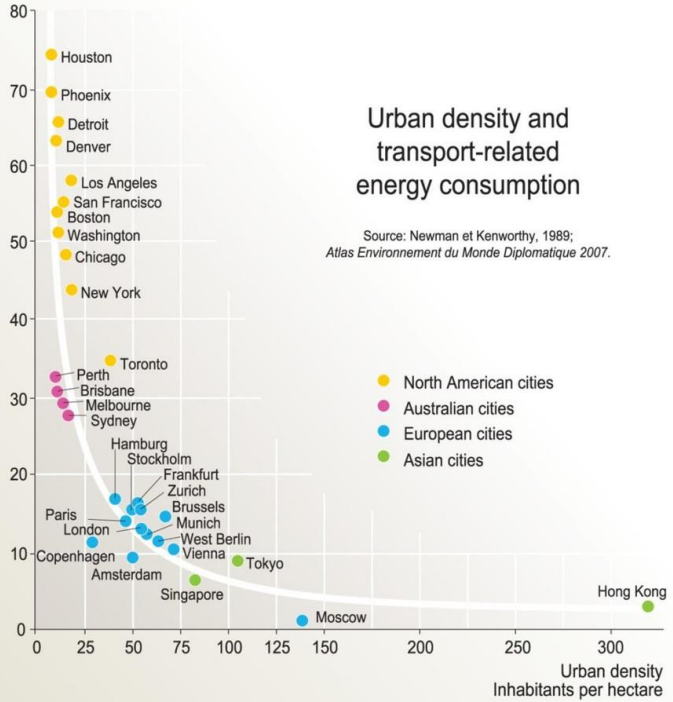
Half-hour catchment  
area from  
St. Stephens cathedral



Quelle: (Békési, 2005)

# SPRAWL = CAR DEPENDENCY = ENERGY CONSUMPTION

Transport-related energy consumption  
Gigajoules per capita per year



Quelle: Urban density versus energy use, 1990 (Source: Newman and Kenworthy, 1999, p. 101).

# INTERRELATION SPATIAL STRUCTURE <> MOBILITY



**Toledo, Spanien: Compact medieval city with mixed use**



**Atlanta, Georgia (USA): sprawled, monofunctional structure**



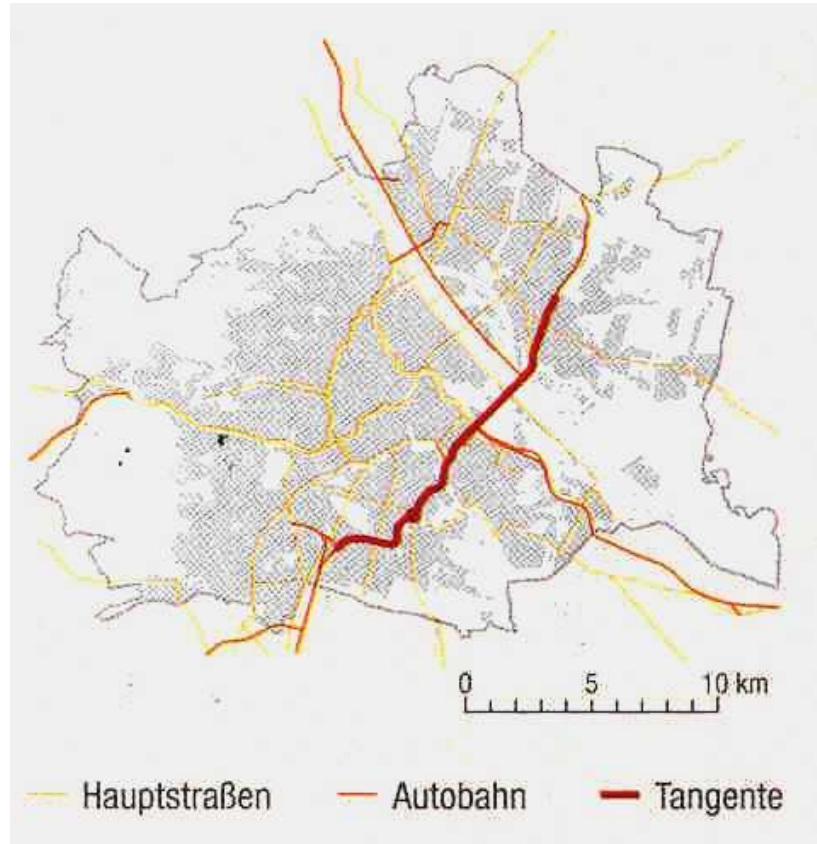
**SATURN PRIMARK**



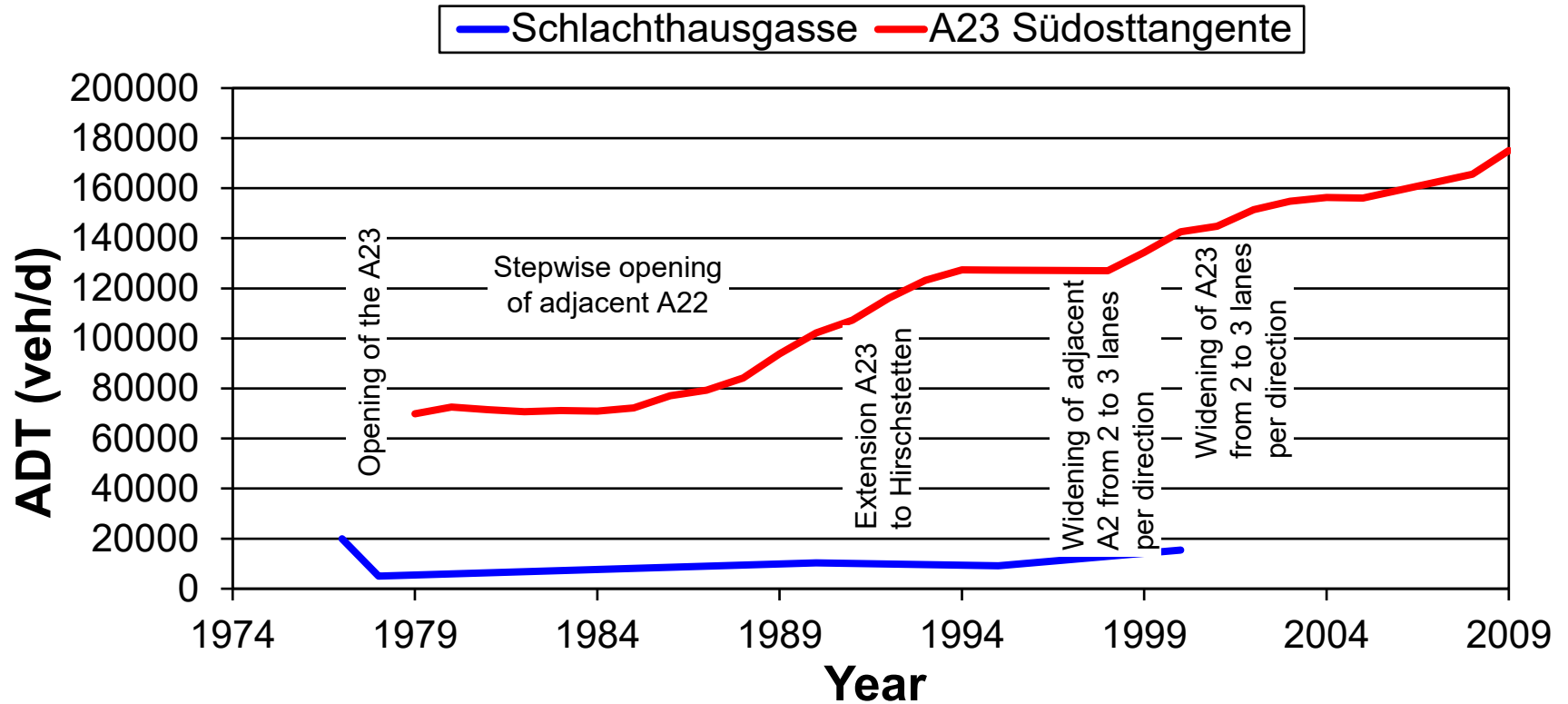
# Eggenburg/Horn



# CAN WE AT LEAST BUILD AWAY CONGESTION?



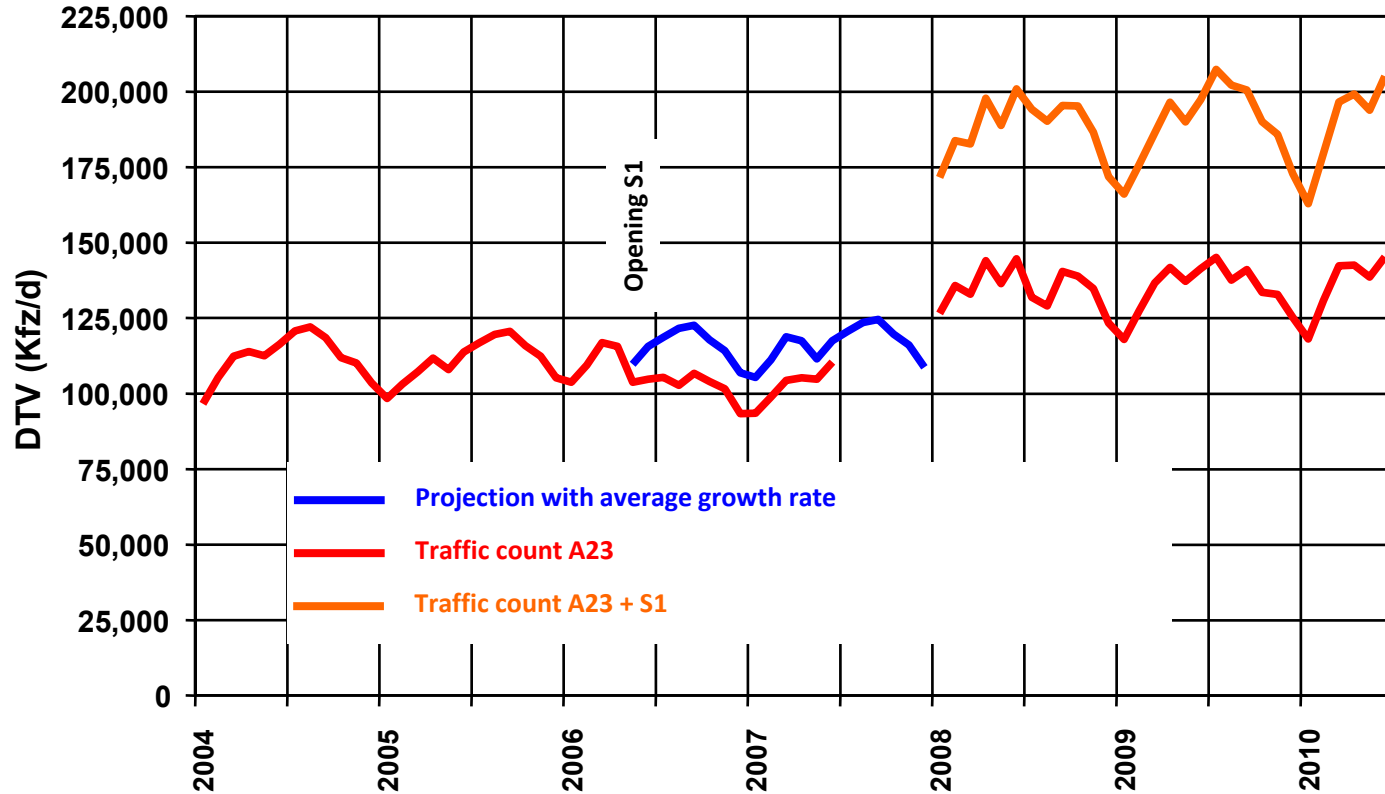
# CAN WE AT LEAST BUILD AWAY CONGESTION?



Source: Händische und automatische Straßenverkehrszählung 1977 bis 2009



# CAN WE AT LEAST BUILD AWAY CONGESTION?



# NO, WE CAN'T!

**“Building more roads to prevent congestion is like a fat man loosening his belt to prevent obesity.”**

LEWIS MUMFORD, *The New Yorker*, 1955

bikeboom.info

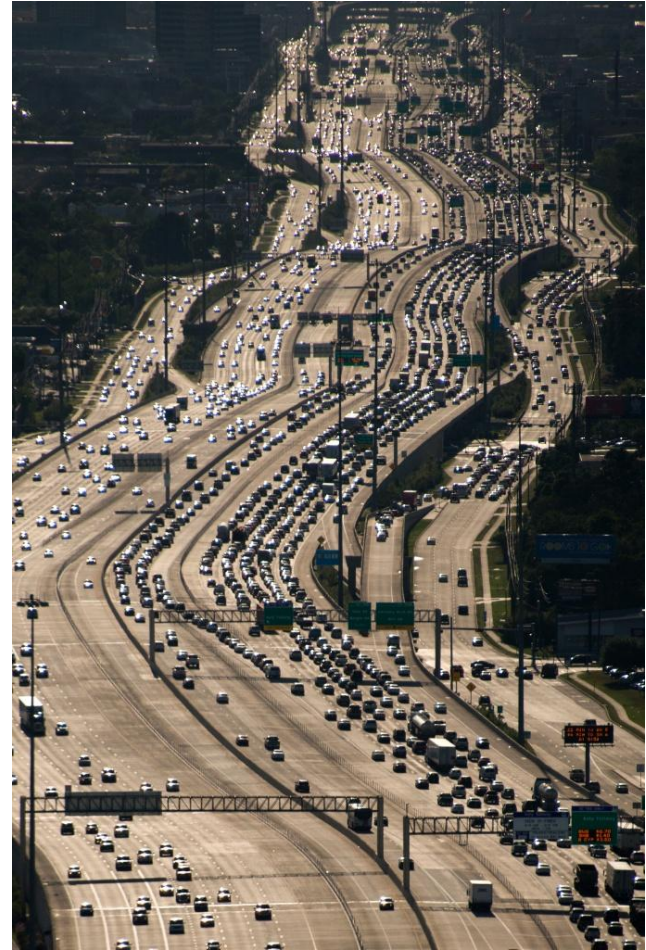
roadswerenotbuiltforcars.com

## THE SKY LINE

*The Roaring Traffic's Boom—III*

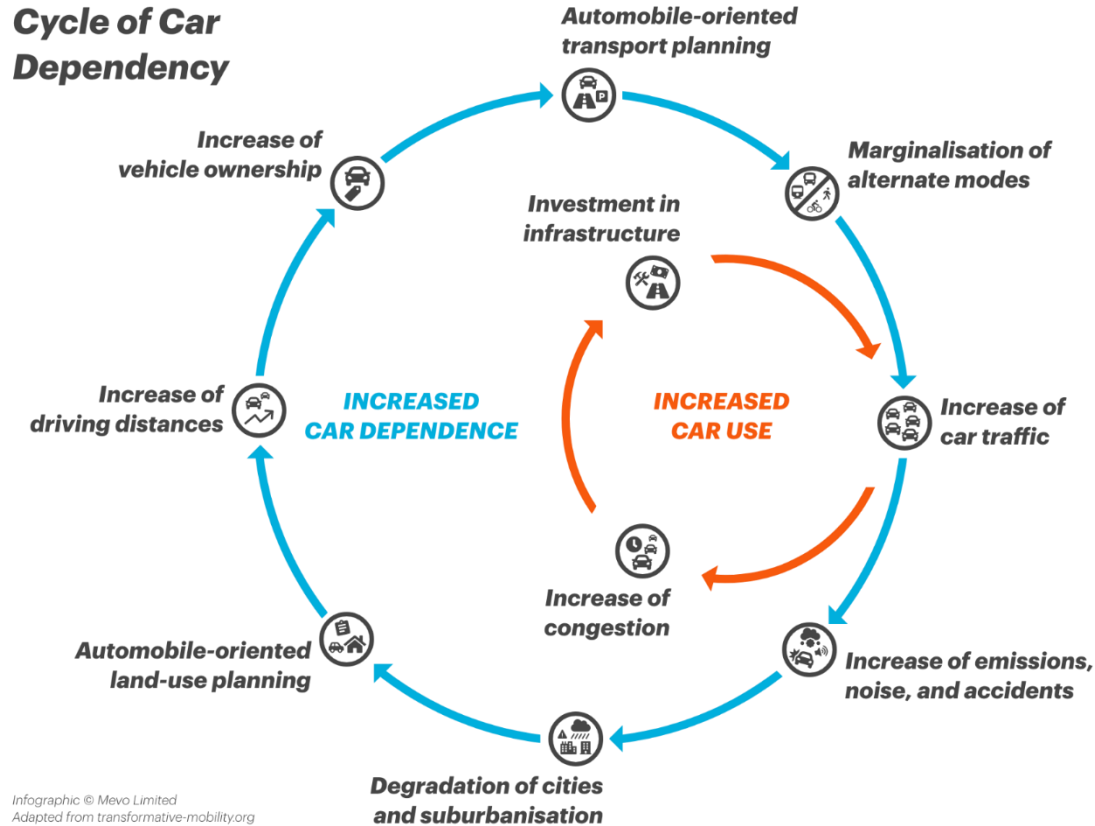


**M**OST of the fancy cures that the experts have offered for New York's congestion are based on the innocent notion that the problem can be solved by increasing the capacity of the existing traffic routes, multiplying the number of ways of getting in and out of town, or providing more parking space for cars that should not have been lured into the city in the first place. Like the tailor's remedy for obesity—letting out the seams of the trousers and loosening the belt—this does nothing to curb the greedy appetites that have caused the fat to accumulate. The best recent book on the subject, "Urban Traffic," by Robert B. Mitchell and Chester Rapkin (Columbia University), takes quite another view—that traffic is but one "function of land use," which is to say that streets and highways should not be treated as if they existed in a desert inhabited only by motorcars. How different that attitude is from the prevalent conception, as succinctly summarized by a one-time city-planning commissioner: "The main purpose of traffic (surely) is to enable a maximum



Source: <https://twitter.com/carltonreid/status/687321878915117056> . bzw .  
Smiley N. Pool / Houston Chronicle

# THE VICIOUS CIRCLE



Infographic © Mevo Limited  
Adapted from transformative-mobility.org

# Technological innovation will save us, right?

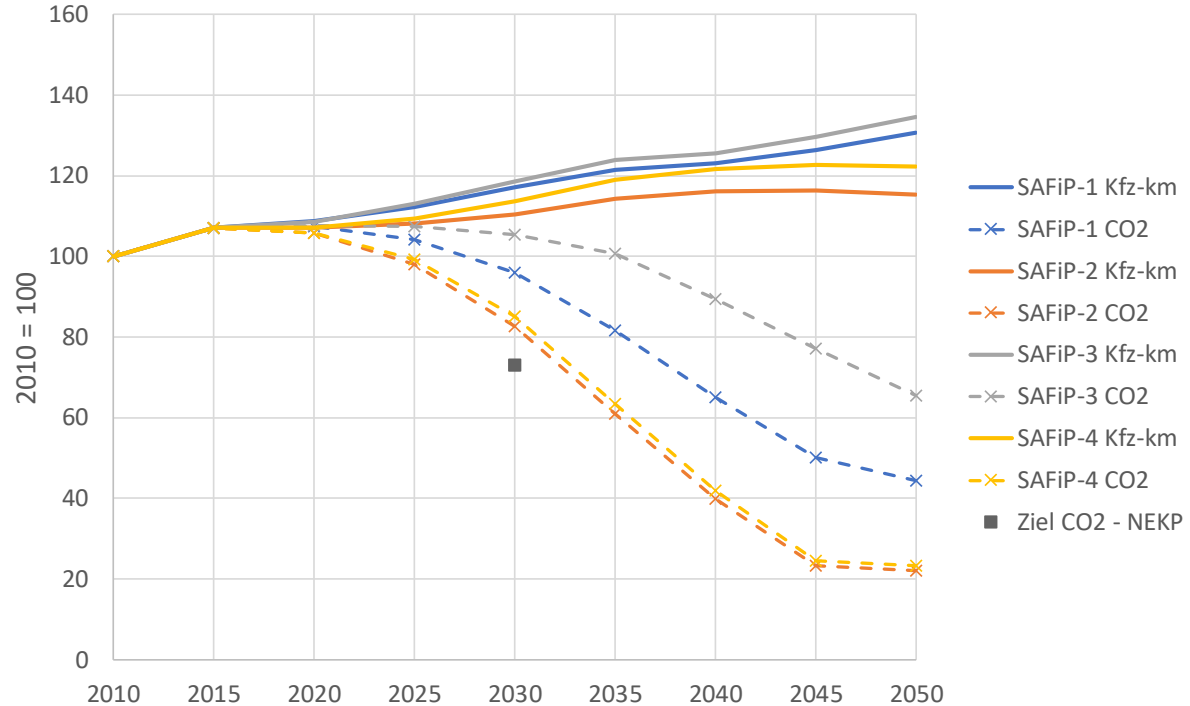
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Limits and  
rebound effects

# WILL AUTONOMOUS VEHICLES SAVE US?

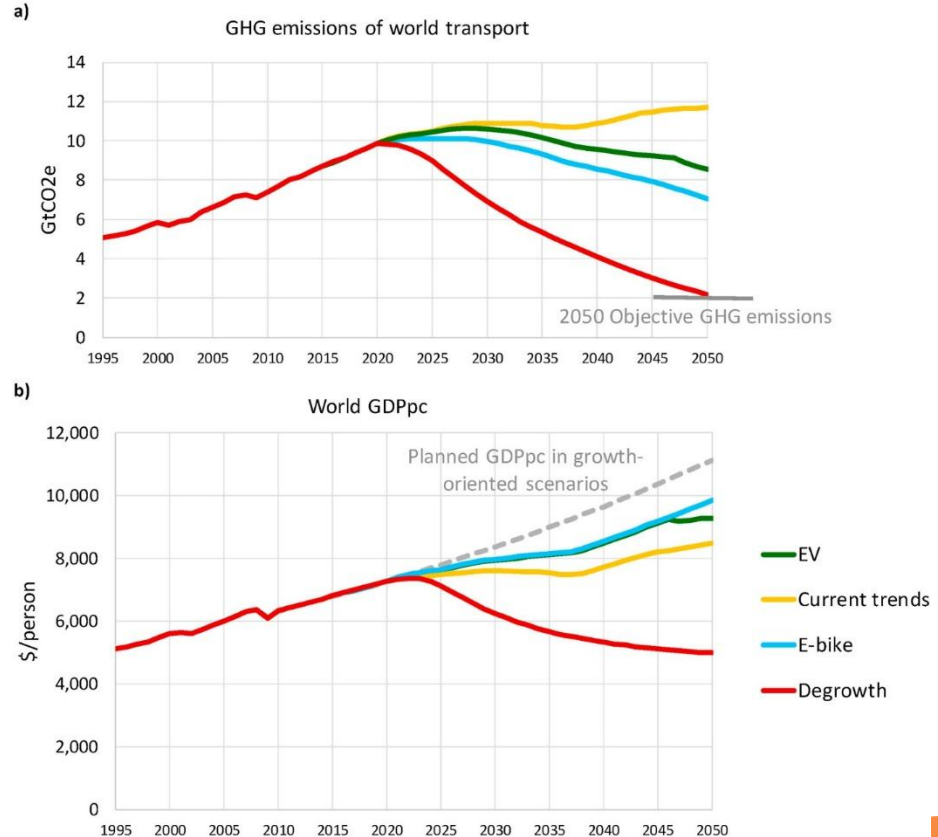
SAFiP 1	Market driven AV euphoria
SAFiP 2	Policy driven AV development
SAFiP 3	Individualised mobility and slow AV development
SAFiP 4	Wide community- driven AV euphoria

Comparison vehicle-km & GHG emissions

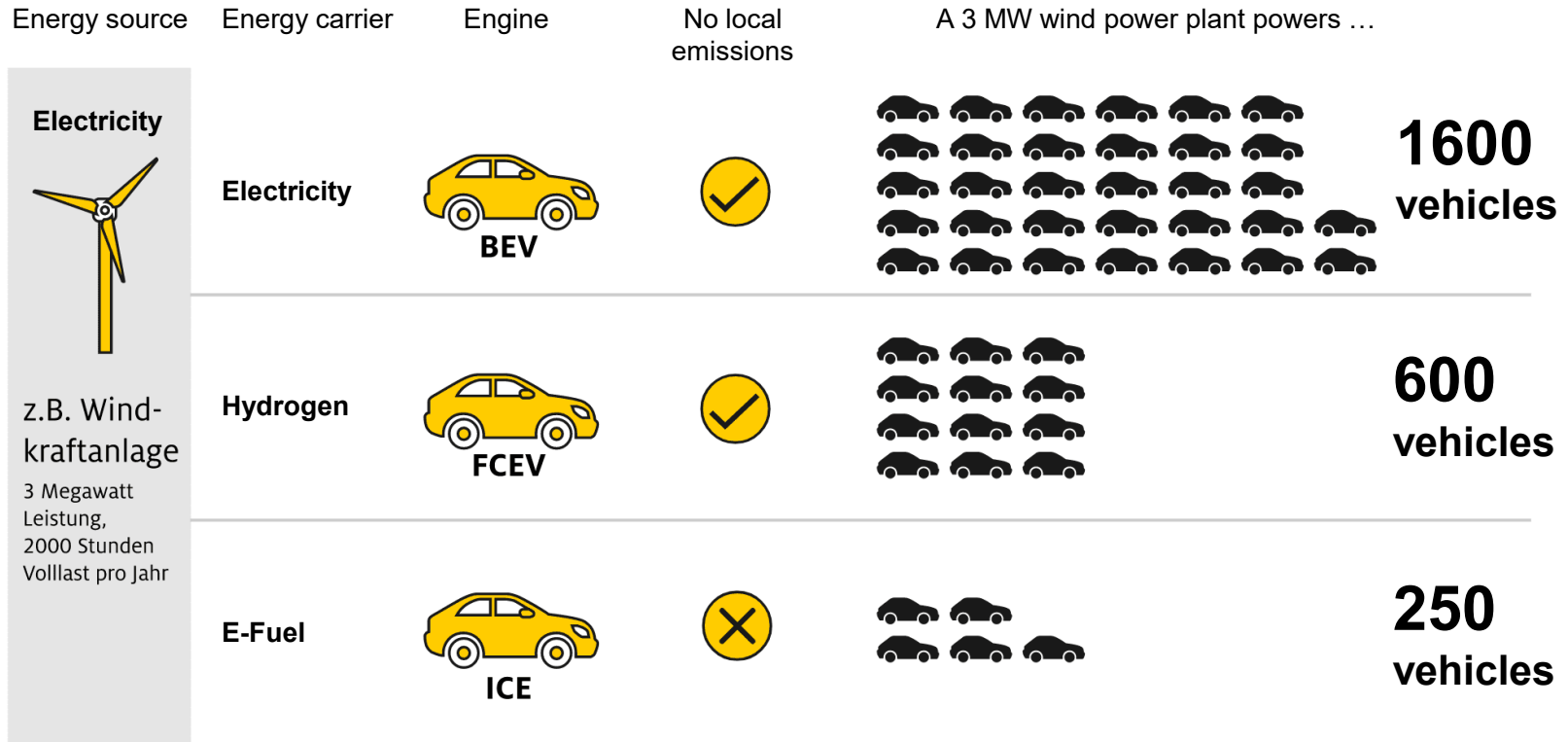


# WILL E-MOBILITY SAVE US?

- Technological change alone cannot achieve ambitious GHG reductions.
- Transport decarbonization can only be achieved with a strong reduction in demand.
- Strategic minerals are a serious limit to the expansion of electric vehicles.
- Models show the limits and rebound effects of transport electrification.



# WILL HYDROGEN OR E-FUELS SAVE US?



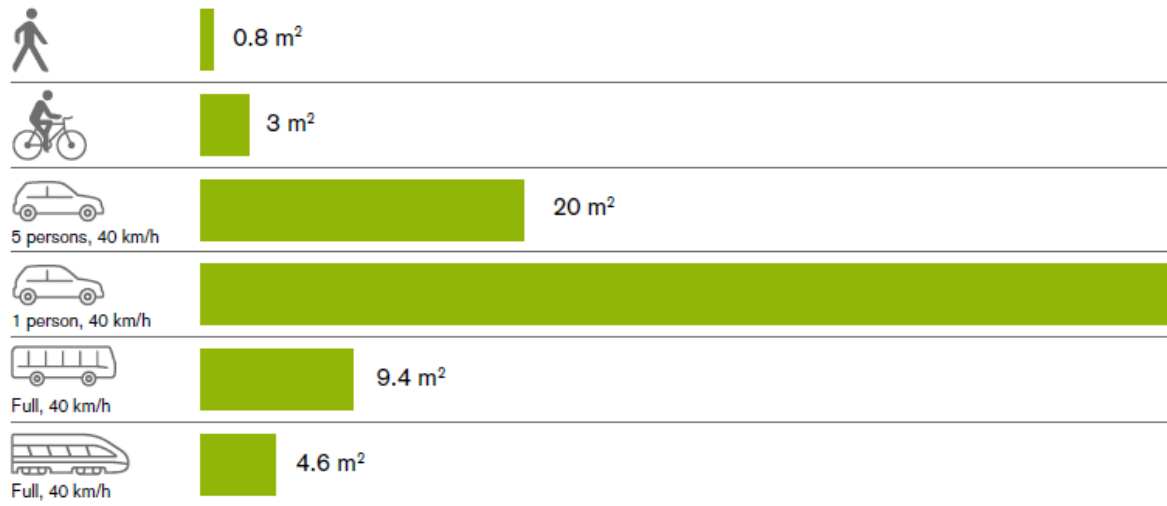
# Planning principles

---

Which modes to  
prioritize?

# SPACE EFFICIENCY

Space used per person according to mode of transport



There is a tendency for the infrastructure capacity in a growing city to be overused, so that existing space must be used in the best way possible. The diagram shows the space used by each mode of transport.

Adapted on the basis of: John Whitelegg (1993), Transport for a Sustainable Future: The Case for Europe, Bellhaven Press (1993).  
Representation by: Flow(n)/Mobility in Chain

# SPACE EFFICIENCY

Cars



Bikes



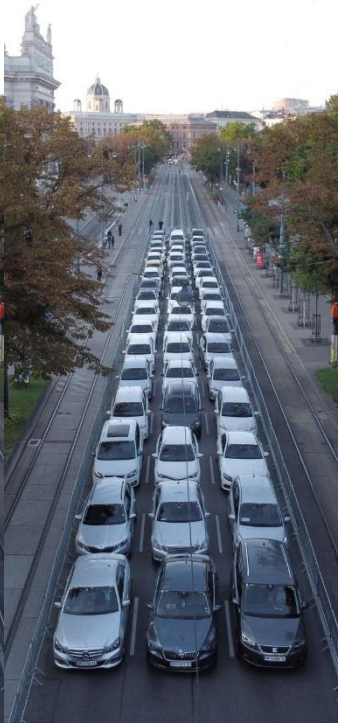
Pedestrians



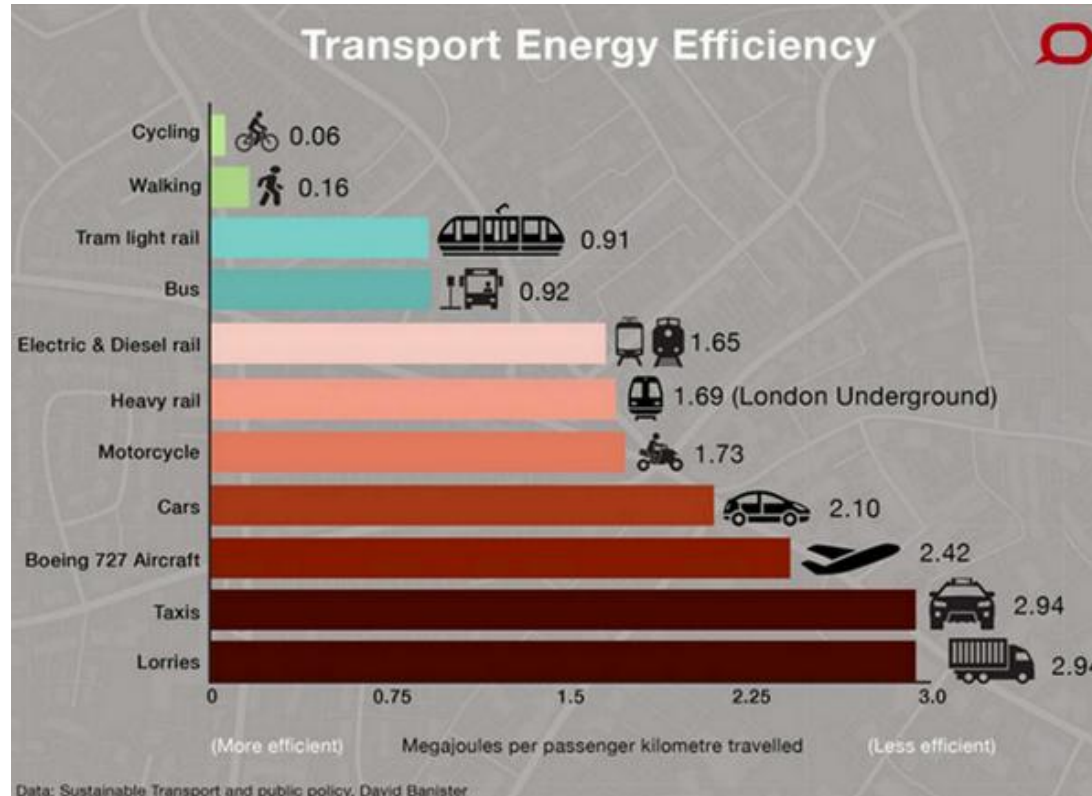
Electric cars



Autonomous cars



# ENERGY EFFICIENCY



Quelle: [https://www.energieleben.at/wie-ist-man-effizient-in-der-stadt-  
unterwegs](https://www.energieleben.at/wie-ist-man-effizient-in-der-stadt-<br/>unterwegs)

# COST EFFICIENCY



**10,8c/km**  
Costs



**4,3c/km**  
Costs



**2,9c/km**  
Costs



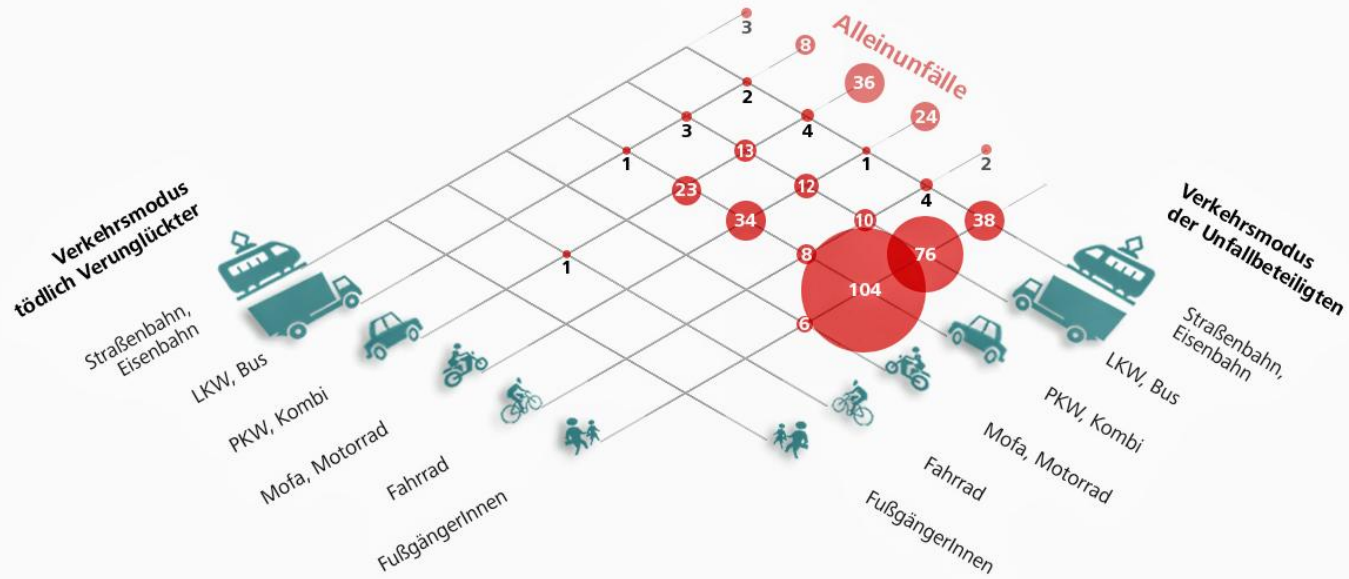
**18,4c/km**  
Benefits



**37c/km**  
Benefits

# TRAFFIC SAFETY

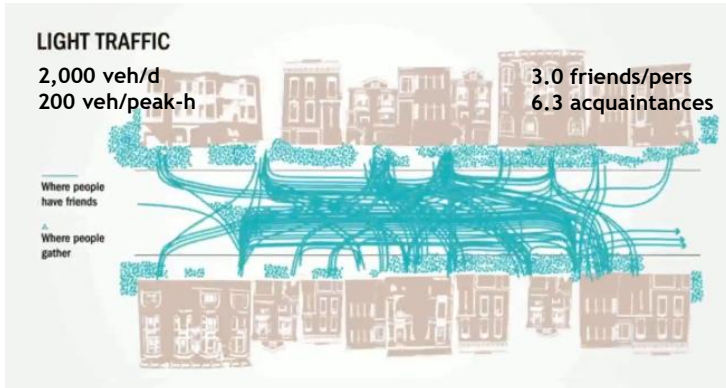
## Traffic accidents with casualties in Vienna 2003-2017



Fünf tödlich Verunglückte sind in der Grafik nicht enthalten, weil sie nicht eindeutig zuordenbar sind ("sonstige Beteiligte").

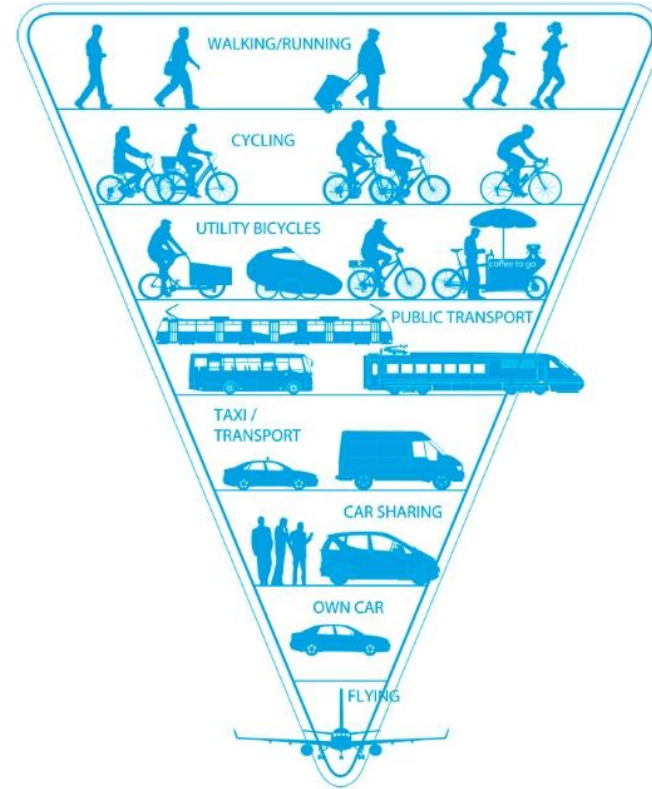
Daten: MA 46, Grafik: Mobilitätsagentur Wien

# SOCIAL INTERACTIONS



# PRIORITIES

- Space efficiency
- Energy efficiency
- Cost efficiency
- „Vision zero“
- Cities for people



# Best practices

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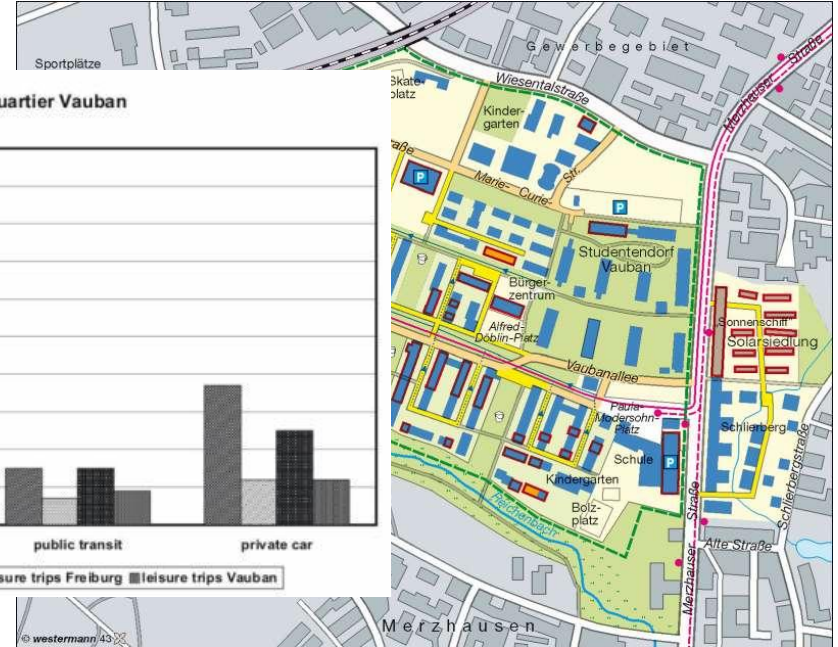
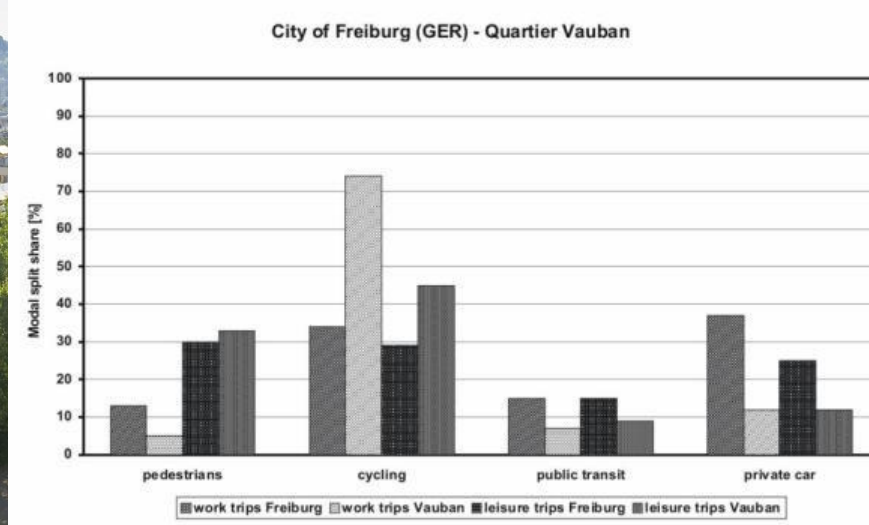
Whom to imitate?

# RENAISSANCE OF TRAMWAYS

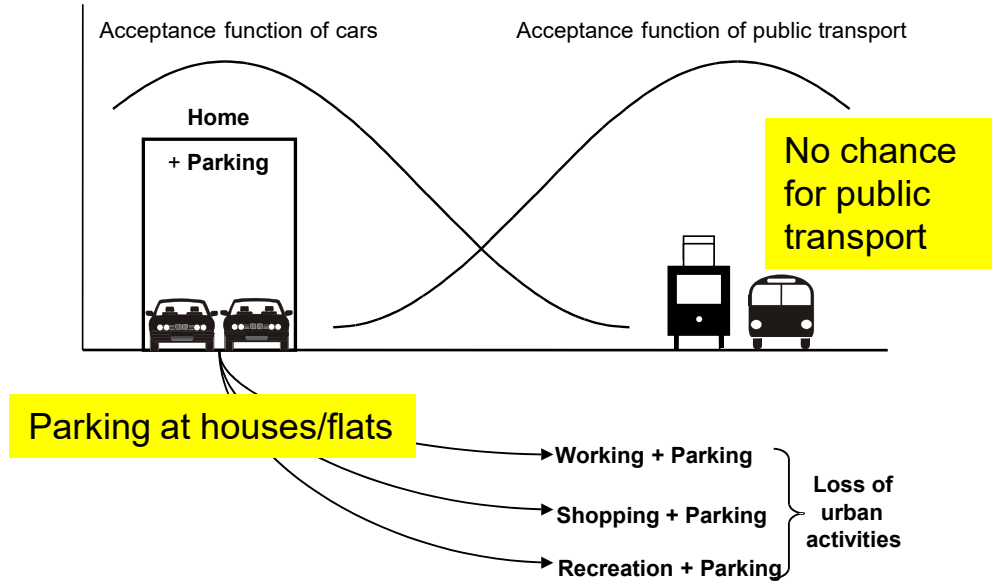


# CAR-FREE SETTLEMENTS

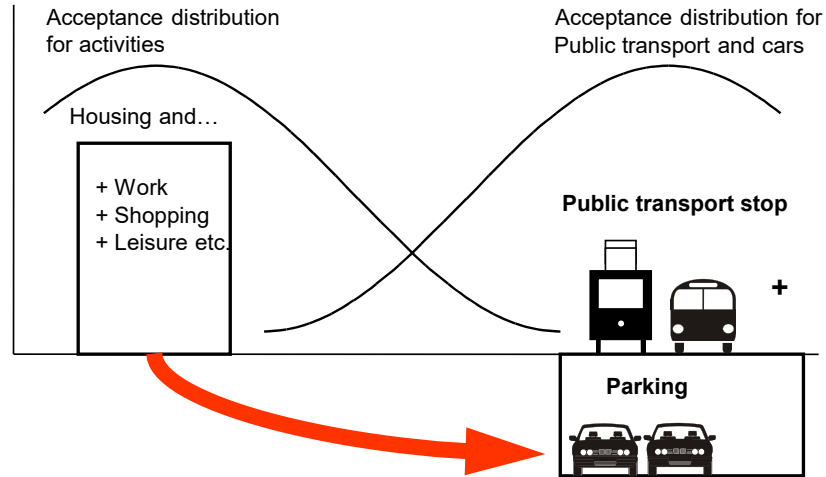
- Vauban, Freiburg, DE - Equidistance garages & PT
- Ca. 5,600 inh.



# CAR-FREE SETTLEMENTS



# CAR-FREE SETTLEMENTS: EQUIDISTANCE



**Distances between any kind of activities and the parking must be at least as far as the one to the PT stop.**

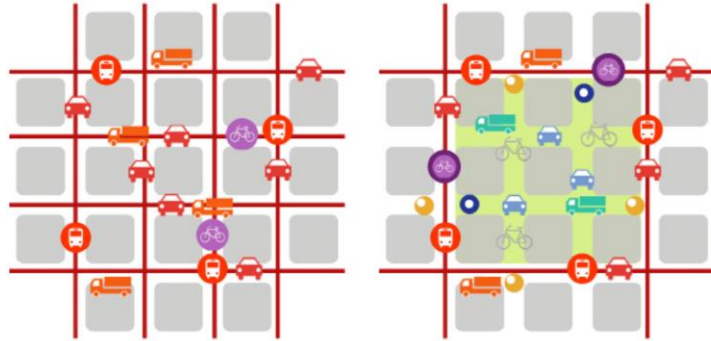
# SUPERBLOCKS - TRAFFIC CIRCULATION PLANS

## Barcelona

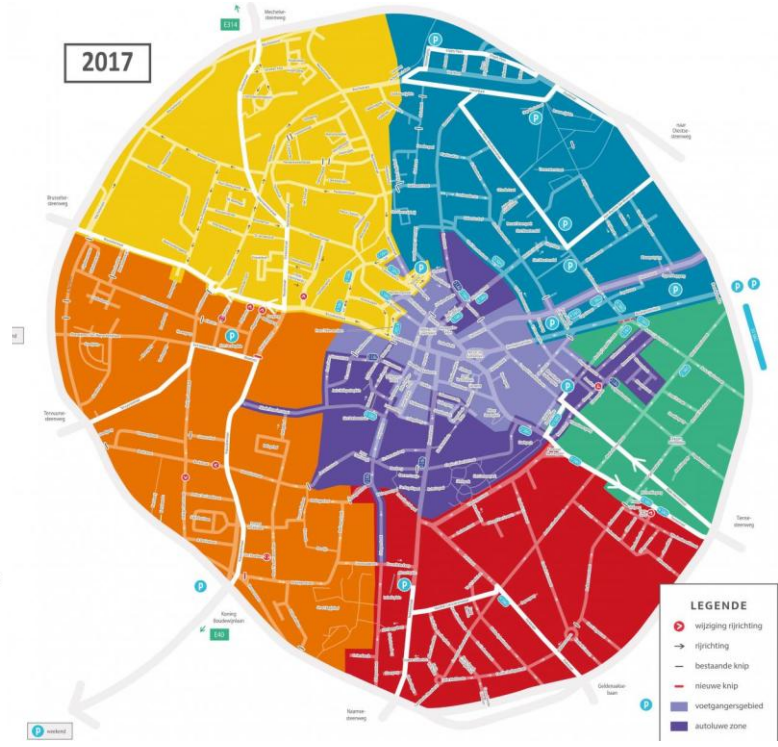
## Leuven

Current Model

Superblocks Model



- PUBLIC TRANSPORT NETWORK
- BICYCLES MAIN NETWORK (BIKE LANE)
- BICYCLES SIGNPOSTS (REVERSE DIRECTION)
- FREE PASSAGE OF BICYCLES
- PRIVATE VEHICLE PASSING
- RESIDENTS VEHICLES
- URBAN SERVICES AND EMERGENCY
- DUM CARRIERS
- DUM PROXIMITY AREA
- ACCESS CONTROL
- BASIC TRAFFIC NETWORK
- SINGLE PLATFORM (PEDESTRIANS PRIORITY)



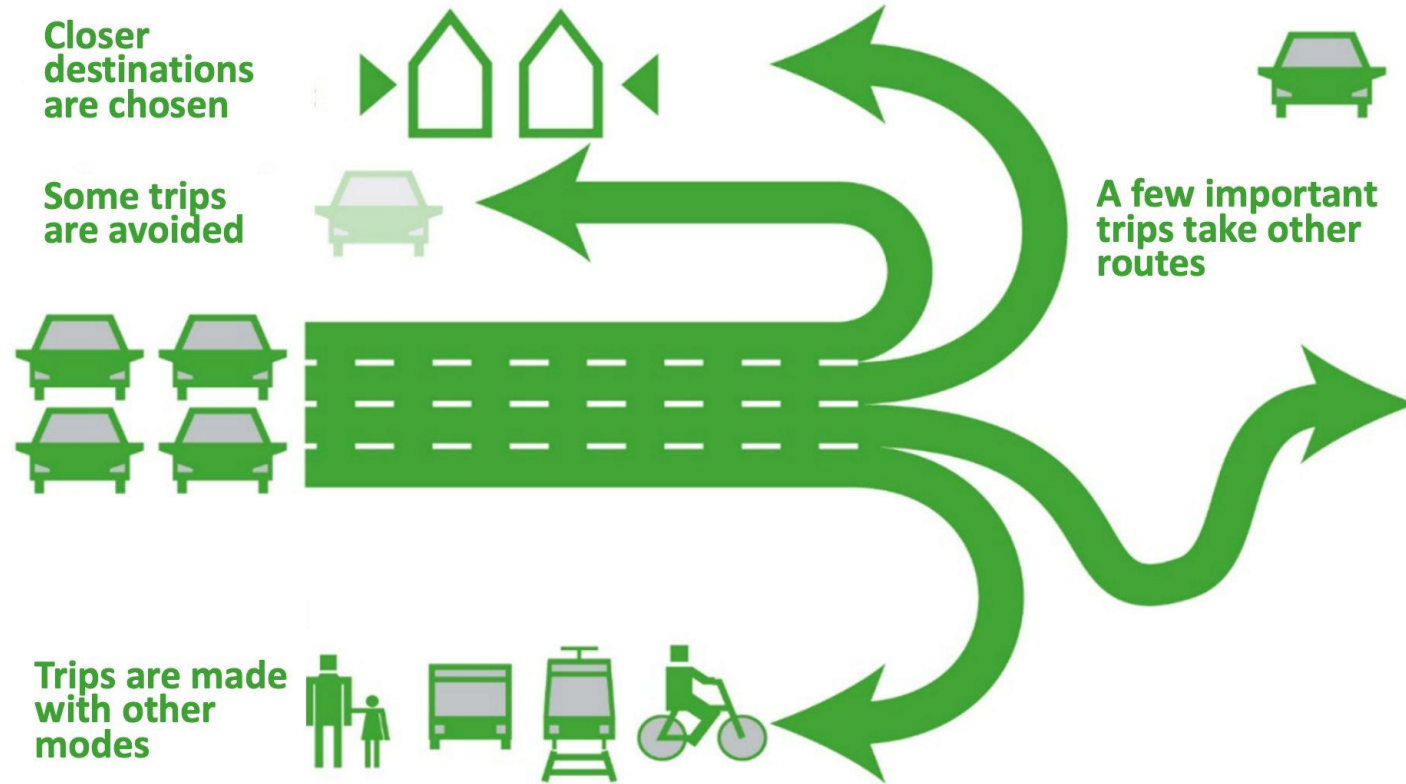
Source: [http://prod-mobilitat.s3.amazonaws.com/PMU\\_Sintesi\\_Angles.pdf](http://prod-mobilitat.s3.amazonaws.com/PMU_Sintesi_Angles.pdf)  
<https://ecf.com/news-and-events/news/32-more-cycling-one-year-after-eliminating-through-car-traffic-centre-leuven>

# REDUCING CAPACITY FOR CARS



Source: <https://www.citylab.com/transportation/2017/03/the-cars-that-ate-paris/520710/>,  
<https://twitter.com/VotreParis/status/1142140684880830466>

# TRAFFIC EVAPORATION



Source: Fietsprofessor (<https://x.com/fietsprofessor/status/1684187391714553857>)  
after Difu (2023) Verkehrsberuhigung: Entlastung statt Kollaps!  
(<https://repository.difu.de/handle/difu/53>)

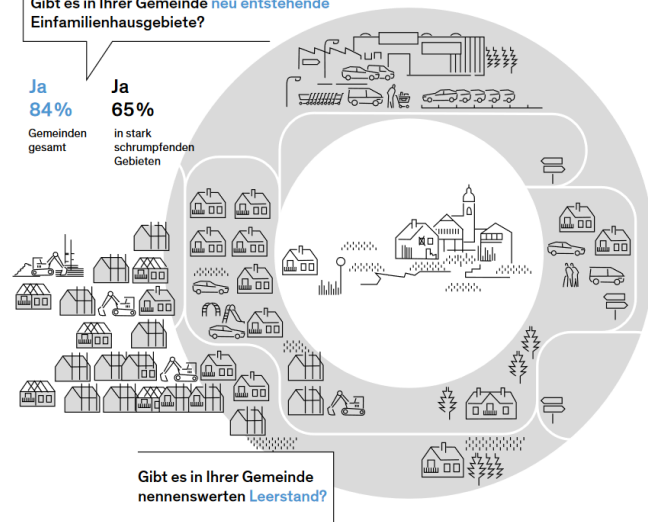
# REVIVING TOWN CENTRES



Gibt es in Ihrer Gemeinde **neu entstehende** Einfamilienhausgebiete?

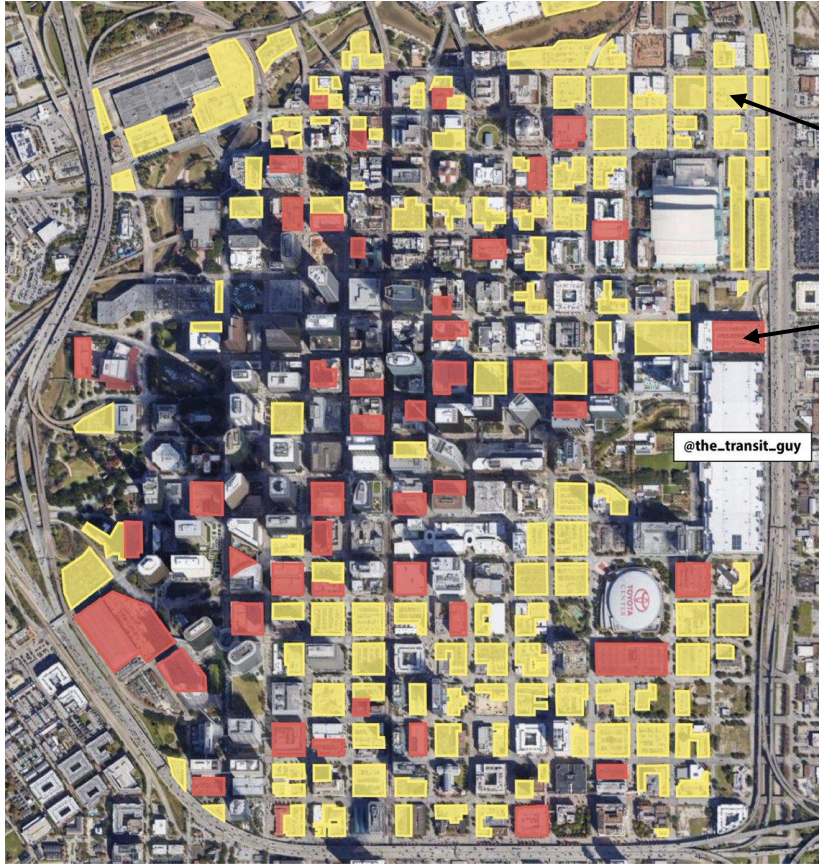
**Ja**  
**84%**  
Gemeinden  
gesamt

**Ja**  
**65%**  
in stark  
schrumpfenden  
Gebieten



Gibt es in Ihrer Gemeinde nennenswerten **Leerstand**?

# THE CAR DESTROYS DENSITY

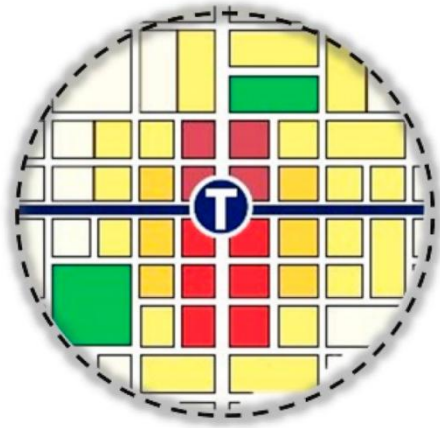


surface parking

garages

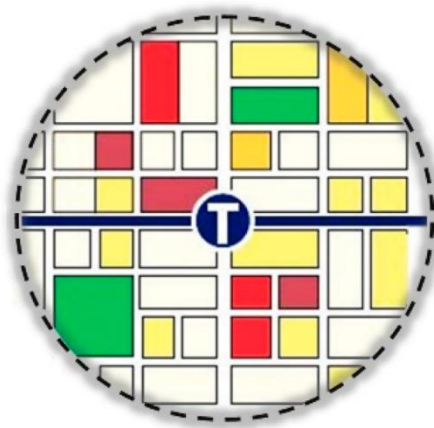
# THE PT-CITY NEEDS DENSITY

Transit-oriented development



Land uses planned around transit

Non-transit-oriented development



Land uses not planned around transit

- Low density residential
- Medium density residential
- High density residential
- Commercial
- Mixed Use
- Park
- Transit stop
- Transit route
- 10-minute walk

# LEARNINGS

- Basis of human behaviour is the biological energy consumption.
- There is no growth of mobility. Only displacement.
- There is no time saving. Only extension of the travel distance.
- There is no long-term congestion easing by road construction.
- There is no freedom of mode choice, except for equi-distance situations.



NUTSHELL@CE



NUTSHELL@CE  
TU Wien



<https://www.tuwien.at/>



[ulrich.leth@tuwien.ac.at](mailto:ulrich.leth@tuwien.ac.at)



0043-1-58801-23120



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[linkedin.com/in/ulrich-leth-aab88541/](https://linkedin.com/in/ulrich-leth-aab88541/)



# End of session 1

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Start of session 2: 1045h