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Understanding (Transport) System and ?Behavior

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What is a System?

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- A **system** is a regularly interacting or interdependent group of items forming a unified whole.
- Every system is delineated by its spatial and temporal **boundaries**, surrounded and influenced by its **environment**, described by its **structure and purpose** and expressed in its **functioning**. (Wiki)

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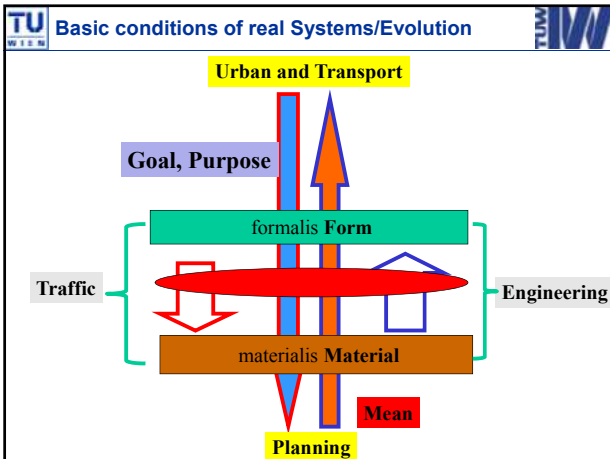
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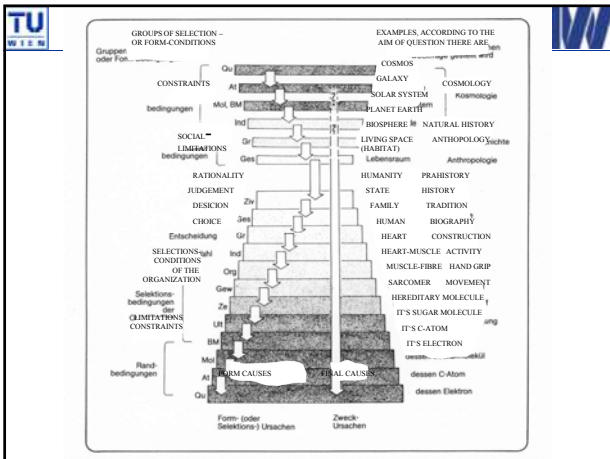
Closed Systems – Open Systems

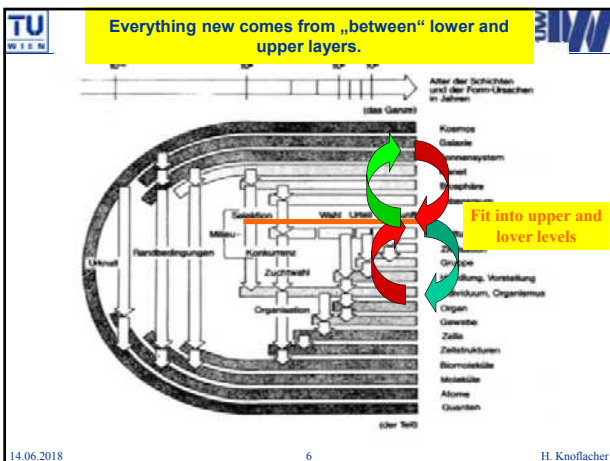
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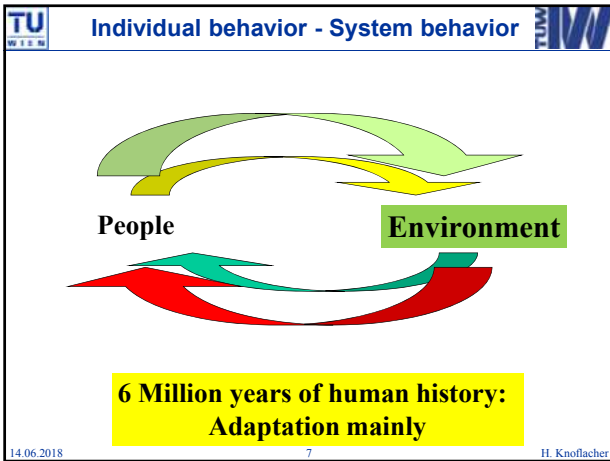
The diagram illustrates an open system. A central grey area is labeled 'OPEN SYSTEM'. This area is enclosed by a dashed line labeled 'BOUNDARY'. Above the system is the label 'SURROUNDINGS'. An arrow labeled 'INPUT' points from the surroundings into the system. An arrow labeled 'OUTPUT' points from the system into the surroundings.

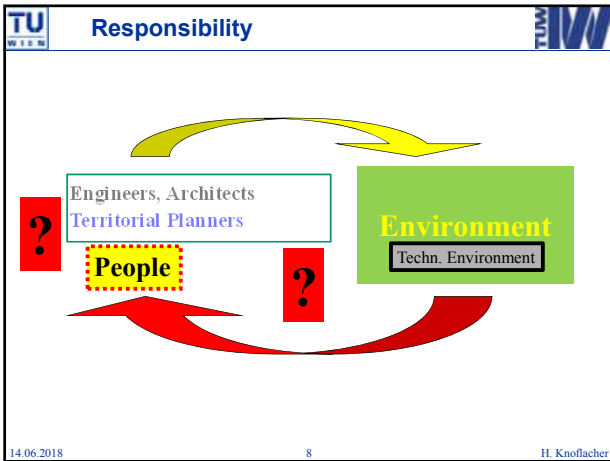
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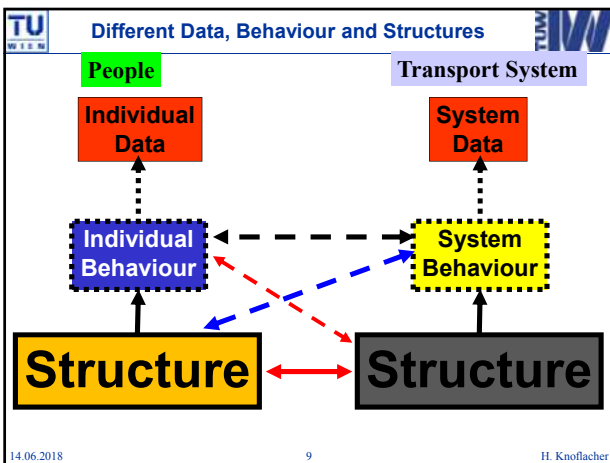
















TU **Understanding** **TUM**

- from Symptoms to Drivers and Causes of
- From simple elements of the transport system to
- more complex structures of Human- and System-Behavior
- From single mode to internodal understanding

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TU **Examples** **TUM**

- **Width of lanes**
- **Speed – Perception**
- **Cycling – Environment**
- **understanding Mobility**

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TU **Individual behaviour – System behaviour** **TUM**

Simple Question?

What is the proper lane width?

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TU **KfZ-Verkehr: Dimensionierung für wen?** **TUM**



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Questions

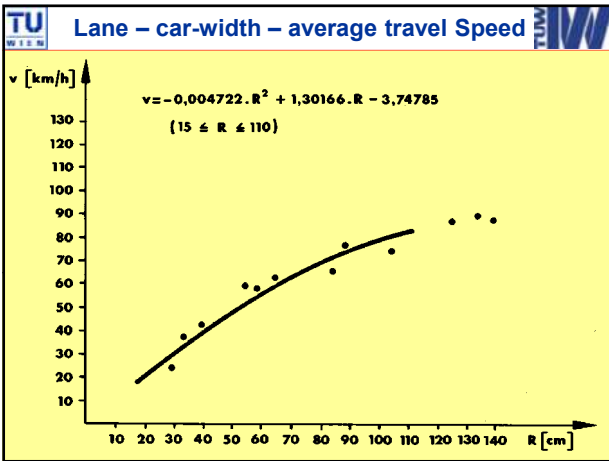
Is there a relationship between width of lane and travel speed??

What is the „mechanism“ which is responsible for this relationship?

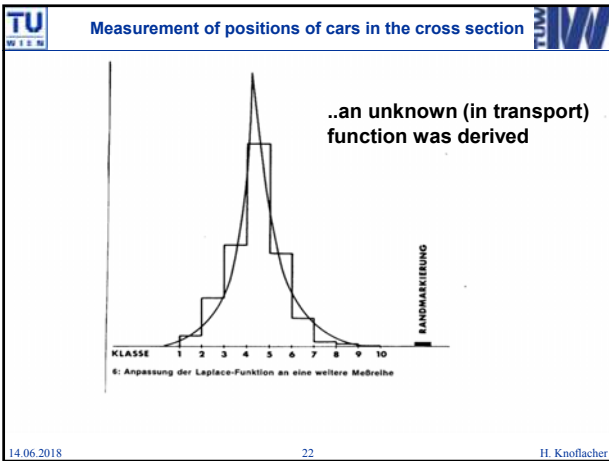
If we know the mechanism, we can exactly choose the width for the right speed.

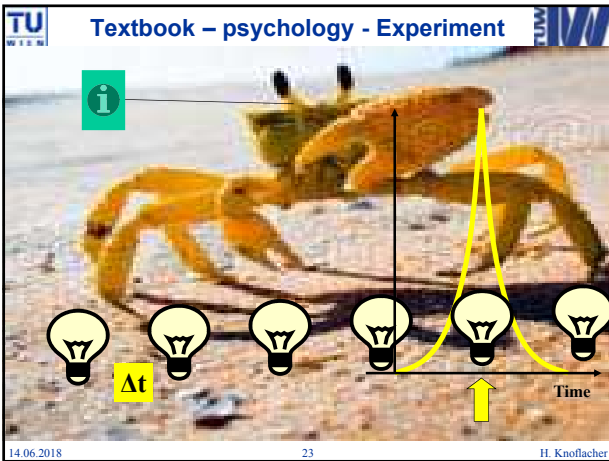
Traffic planning would have a scientific background for this simple element – for the first time!

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TU W I E N Bio-psychology gave the answer **TU W I E N**

Crabs – eyes –irritation by flash lights in constant time-intervals.

Explanation:
latent, periodic Mechanism

Experience with the first minutes driving a car show this mechanism is also valid for the man
Subconscious mechanism of this kind enable us to drive a car

Physiology:
cerebral cortex is to slow, to energy consuming
Deeper layers are needed
History of our evolution

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Physiologie + Kinematic

The perception of deviation from the Ideal line is always delayed – oversteering – periodic mechanism due to $\Delta t!$ (differential equation – sinus function – exponential probability function)

The faster the speed the bigger the deviation

Theory for the proper choice of width of lane was now established. Perfection by further research by Miachel Schopf

Solution: only possible by interdisciplinarity approach!

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Speed an periodic mechanism

High speed $v_2 > v_1$

$a_2 > a_1$

$f(x) = C \cdot e^{-k \cdot x}$
 $x = a \cdot \text{tg} \alpha$
 $a = v \cdot t$
 $a_1 = f(v_1)$
 $a_2 = f(v_2)$
 Time delay Δt

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Restbreite and Vehicle Width

Latent periodical Mechanism

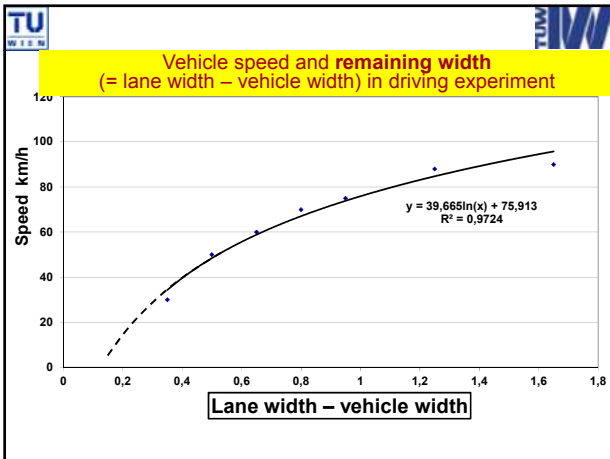
$f(t) = e^{-\lambda t}$

At higher speed bigger deviation from perfect line \Rightarrow

- wider lane needed or
- higher concentration = more Energy (short time)
- lower speed at narrow lane!

Behavior depending on remaining width results in **optimal remaining width**

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Lane width for optimal convenience

b_f	GESCHWINDIGKEIT			ART	Anwendung	
	LKW	BUS	PKW			
3,75 m	krit.	110	140	RICHTUNGSWECHSEL	Freiland	
3,50 m	80	100	125			
3,25 m	70	80	110			
3,00 m	60	70	90			
3,00 m	60				Ort	
2,75 m	50					
2,50 m	50					
2,50 m	50					
3,75 m	krit.	105	120		GEGENWECHSEL	Freiland
3,50 m	80	90	110			
3,25 m	70	80	100			
3,00 m	60	80				
3,00 m	50			Ort		
2,75 m	50					
2,50 m	50					
2,50 m	50					

Tab. 3a: Fahrstreifenbreiten für „optimale Bequemlichkeit“ der Autofahrt (aus KNOFLACHER, H., und SCHOPPE, J. M., 1981)

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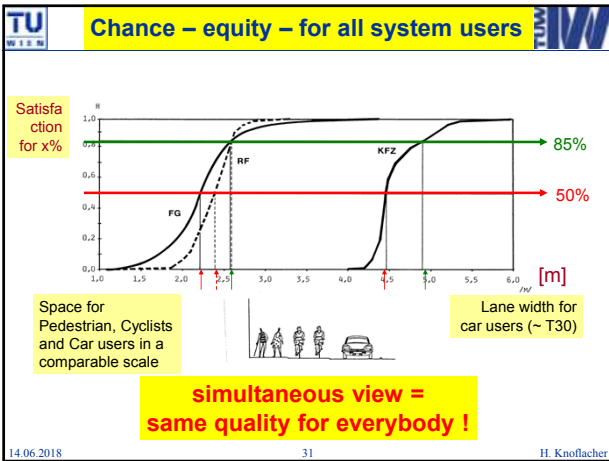
The scientific proper lane width

$v_{50\%b_a}$ /km/h	b_f /m/ PKW		b_f /m/ LKW	
	RV	GV	RV	GV
40	2,05	2,15	2,55	2,65
50	2,10	2,30	2,65	2,75
60	2,25	2,45	2,75	2,85
70	2,40	2,60	2,90	3,00
80	2,55	2,75	3,00	3,15
100	2,90	3,05	3,30	3,45
120	3,25	3,45		
130	3,40	3,60		

RV – one way traffic
GV – two way traffic
V50% - average speed

Tab. 3b: Fahrstreifenbreiten mit Rücksichtnahme auf die maximal erwünschte Geschwindigkeit – die vom Planer zu verantwortenden Mindest- und Maximalbreiten (aus KNOFLACHER, H., 1985).

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Cycling

Practical Question

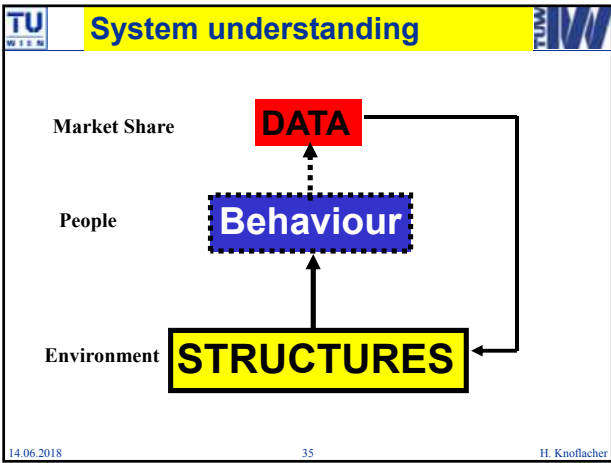
How to encourage or stimulate people to use the cycle?

The answer should be given on sound scientific base.

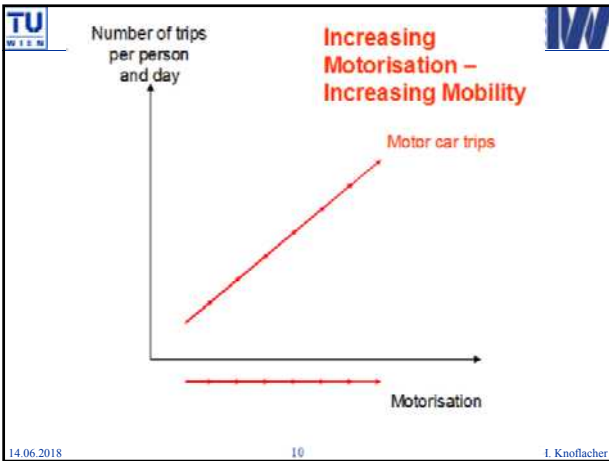
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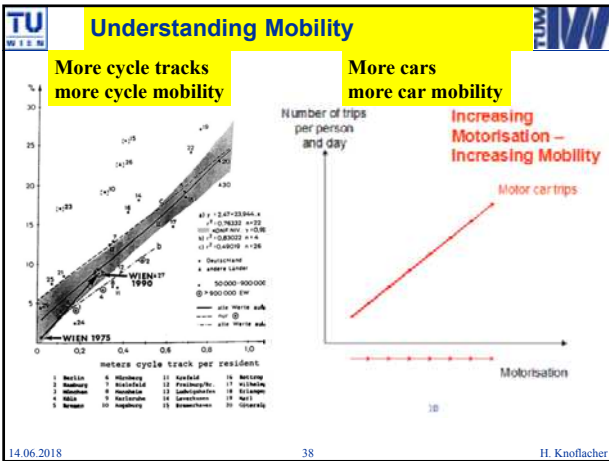


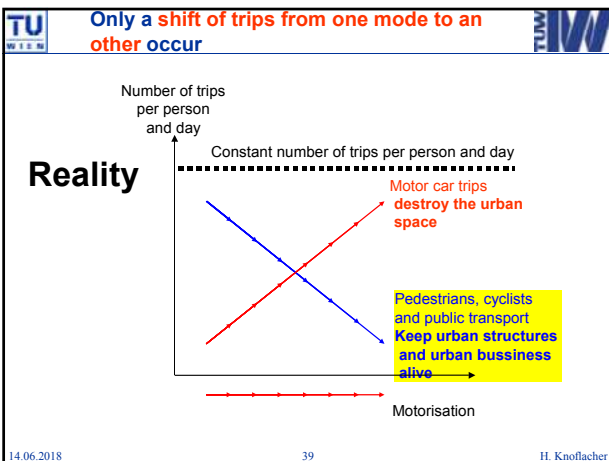


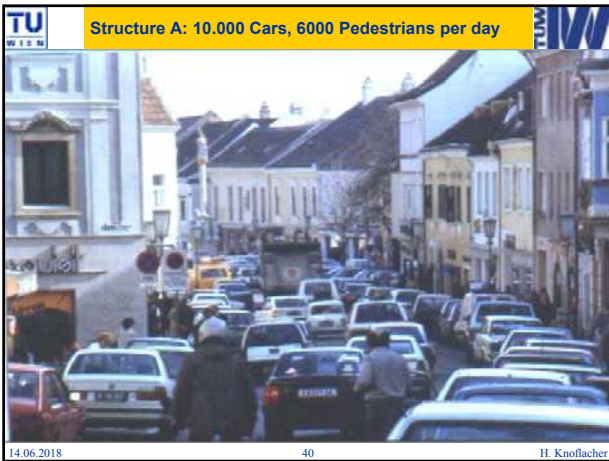


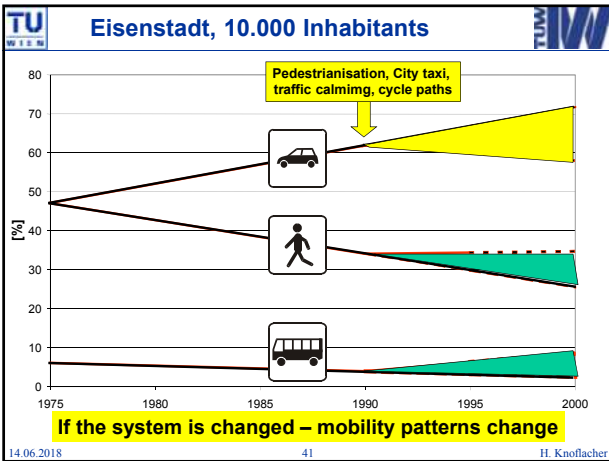














Conclusion: Mobility

There is no „Growth of (physical) Mobility“ in the System

Only a Shift from one mode to others is happening and can happen

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Speed
the leading indicator of modern transport system

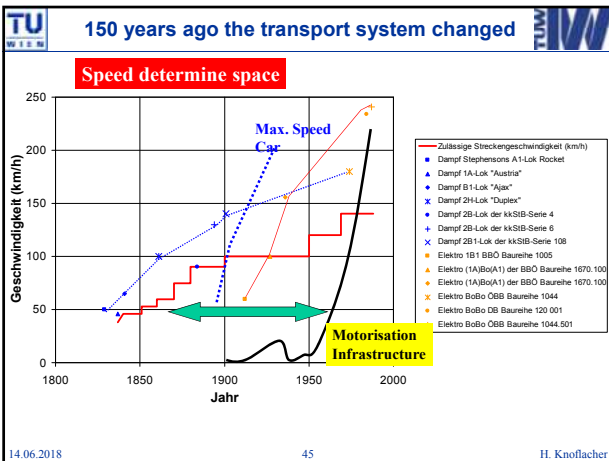
Question:

Which speed is appropriate for us?

What is fast? to fast?

What is slow?to slow?

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Man: 6 – 8 Million years as a biped on the globe
 ..the only mode we are really familiar with

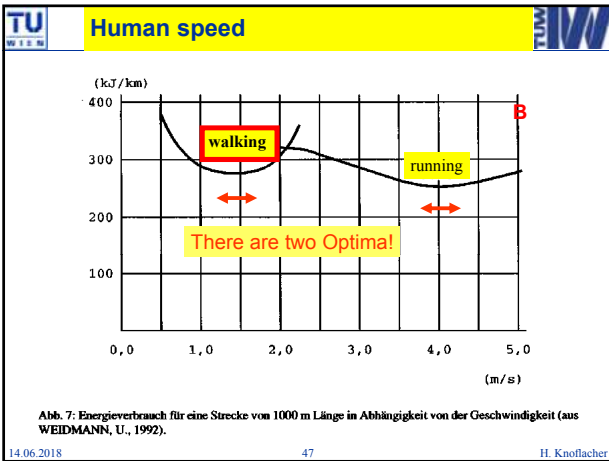
sechs Millionen Jahren...

Neue Funde in Kenia bringen der Paläontologie eine wichtige Erkenntnis: Erste Vorfahren des Menschen existierten schon 1,5 Millionen Jahre früher als bisher angenommen. Sie waren etwa so groß wie Schimpansen, konnten gut klettern, gingen aber aufrecht. Dreizehn Knochen erzählen eine neue Menschheitsgeschichte...

*Text: Brigitte Eggert
 Fotos: Deville/Gamma/Contrast*



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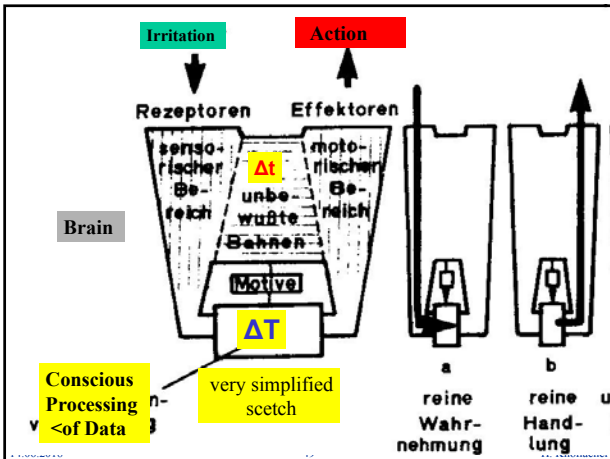
Understanding
 Quantitative Effect of Speed on information

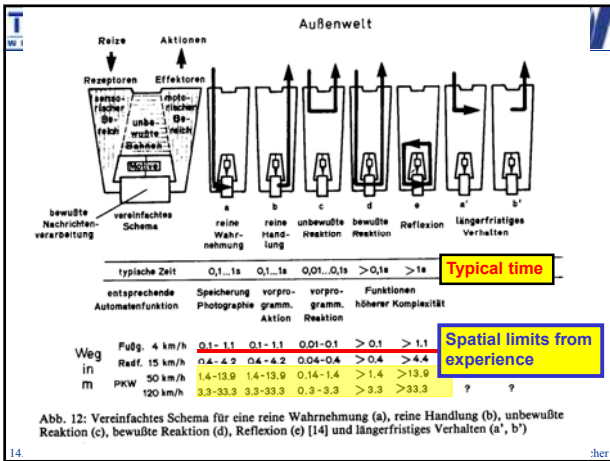
Speed

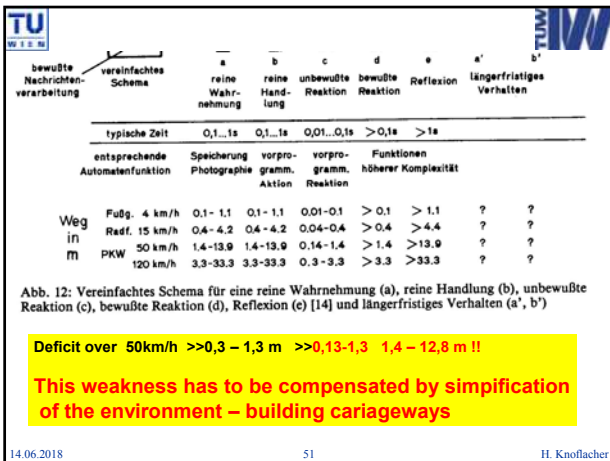
4	A car is approaching from the left with high speed	0
8	A a sprahn rmtelf ihhg pe	100%
16	Aasrh mefih e	100%
32	Ashmfhe	100%
64	Ahfe	100%
128 km/h	Af	

Risk of misunderstanding the message

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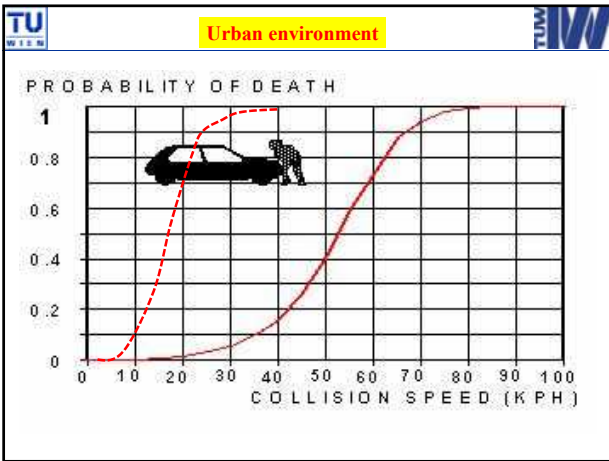
Restricted human perception has to be compensated by simplification of the environment = space

Platzbedarf

„Zum Fortschritt brauchen wir Platz, und die historische Altstadt von Salzburg, die aus über 4000 Wohnungen in 920 Häusern, 400 Gewerbetrieben, 36 Kirchen, 17 Schulen und einer U-Bahnstation besteht.“ (Bernd Rambert)



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Speed: The core indicator for B/C

**Travel Time Saving:
The core of Transport Economics**

Question:

How much time can we save if we enhance the speed of the Transport System?

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Dogma Nr 2: time saving by increasing speed

All investments into transport infrastructure are based on calculations which assume less travel time by increasing speed

This is based on our individual, personal experience – and taken as a fact.

But is this the system effect???

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Common method for the calculation of time benefits

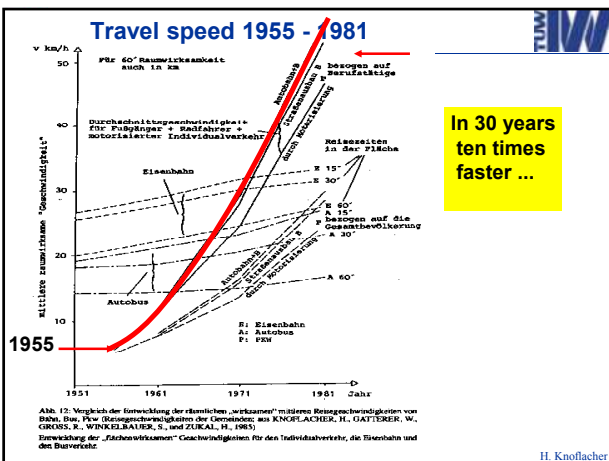
Speed: $V_2 > V_1$
Distance L_{0D}

Time saving: $\Delta t = L_{0D} \cdot (S_2 - S_1) / S_1 \cdot S_2$

Benefit = $\Sigma \Delta t \times \text{money per time}$

CB-factor = Benefit/Cost > 1 (3)

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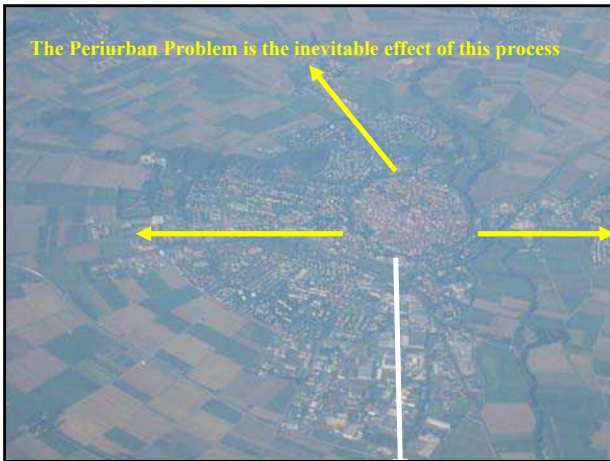
TU W I Z M **The example of home and shopping** **TUM W**

The effect:
City
Sprawl

Housing, Shopping etc. within a walking distance, in harmony with the city and the environment

The city of today (car orientated)

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TU W I Z M **The result Exponential Growth of Problems** **TUM W**

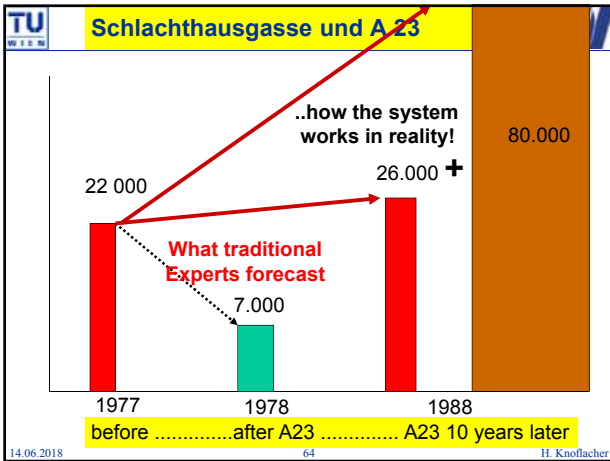
System effects $Q = D \times V$ Medium and Long term

Local measure $Q = D \times V$ short term

Effects

...if capacity is enhanced

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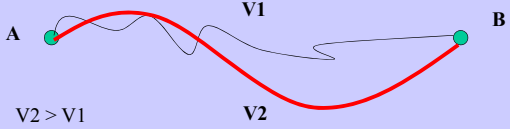






TU Calculation based on real system effects **TUM**

• i



A B

$V_2 > V_1$
Länge L_{AB}

$\Sigma \Delta t = L_{AB} \cdot (V_2 - V_1) / V_1 \cdot V_2 = 0 = \text{Nil!!}$

Benefit = $\Sigma \Delta t \times \text{Money} = \text{Nil}$

Only costs and problems remain

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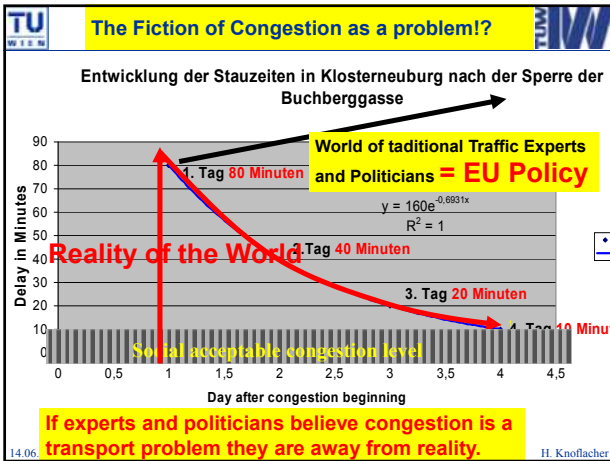
TU Congestion – a Problem? **TUM**

We **can not save time** in the transport system if we enhance the speed.

We **can also not lose time** in the transport system e.g. congestion!

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Understanding the System behavior

Congestion is not a Problem

Congestion in car traffic is a **tool**

to be used to help people

to choose the right urban mode

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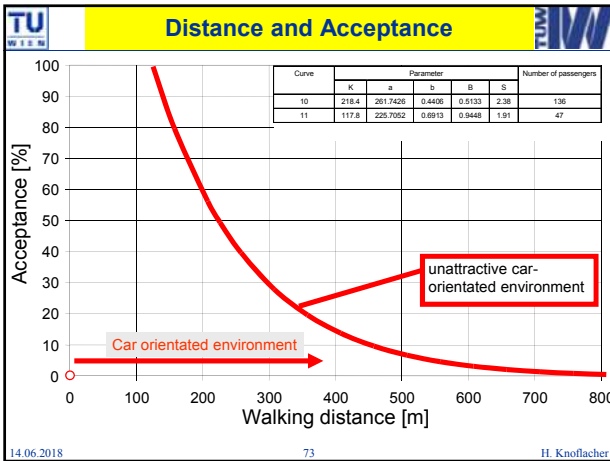
Dogma Nr 3

Freedom of Modal Choice

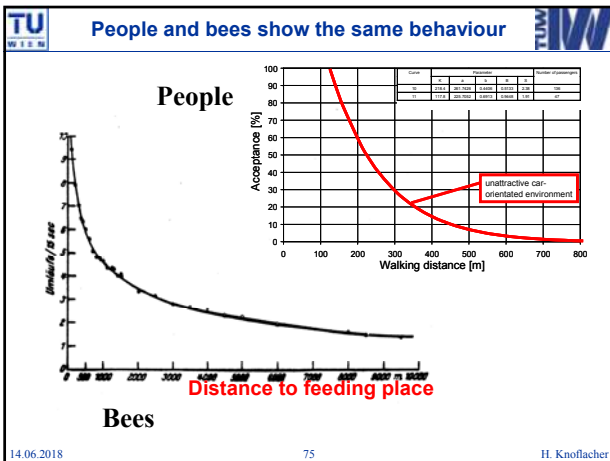
We park the car at home but should use public transport.

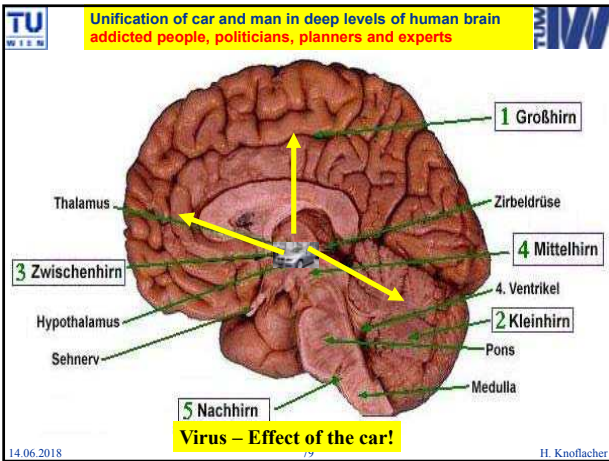
If not – car user must pay toll, parking fee, etc

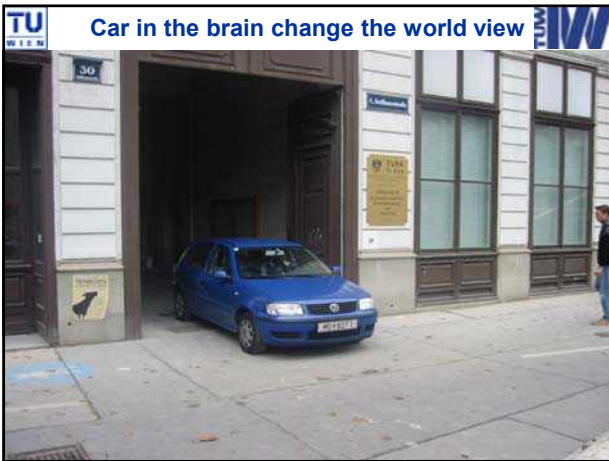
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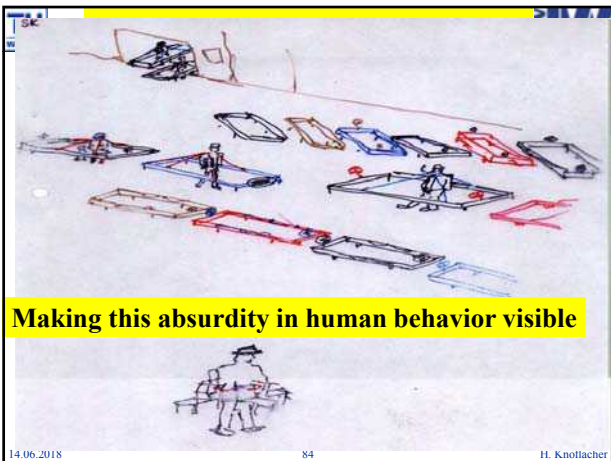




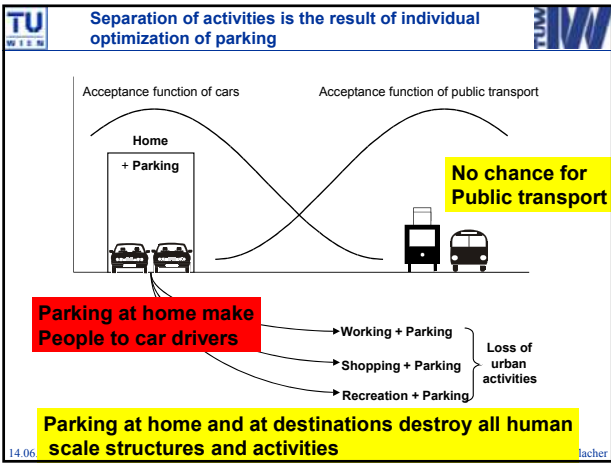


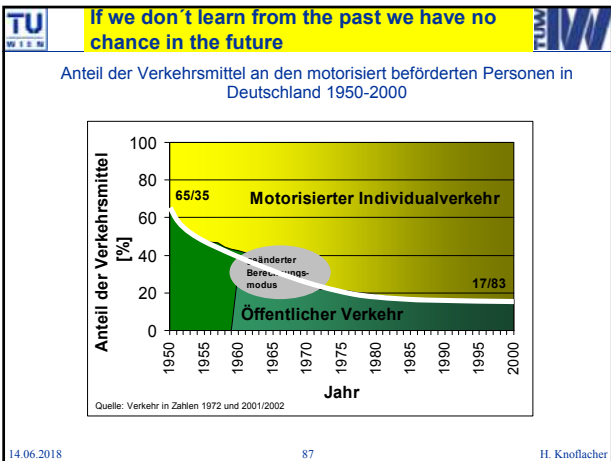


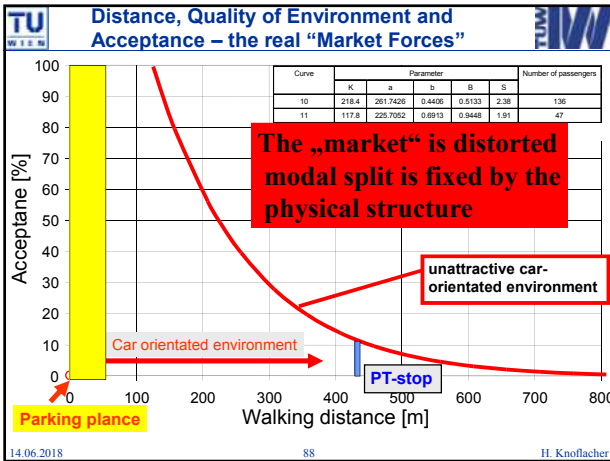












Effects

Environment: Deterioration

Social System: Isolation and Individualism

Economy: Monopoly and lack of competition

Decline of Efficiency

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Solution

Problem has to be treated where it occur – at the source.

This is the man, before he or she become a car driver.

There is no solution by treating traffic flow, also not in poad pricing, or in the tariffs of PT

The intelligent solution is the reorganisation of origins and destinations of all trips – a radically change of the organsiation of parking

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TU W I T T M **Key for the Solution: New organisation of Parking** **TUM W**

Precondition for a sustainable TP:

Akzeptanzverteilung für Aktivitäten
Housing and ...
+ work
+ shopping
+ leisure etc.

Akzeptanzverteilung für Öffentlichen Verkehr und Auto
PT - Stop

Parking in Garages

Minimum Requirement: Equidistance of Parking Place and Public Transport Stop (PP = PTS)

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TU W I T T M **....or a better solution** **TUM W**

Acceptance of walking
Living and ...
+ work
+ shopping
+ leisure etc.

Acceptance function of public transport
PT stop

Garage

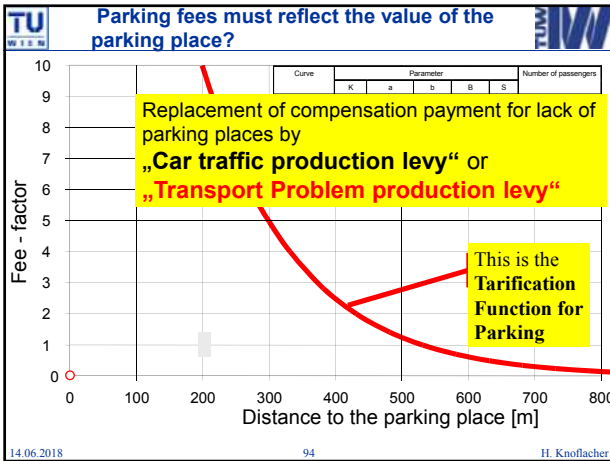
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TU W I T T M **Fiancial Structures have to be changed** **TUM W**

„The money is on the parking places - and on the roads“

But it is unfair to provide the society first with a physical structure which force people to use the car – and punish this behaviour later on, by introducing financial barriers like road pricing etc.

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Organisation

Main mistake in traditional transport system was:

Transport was not organised as a system
 Interlinked parts have been optimised **individually**
 Without taking into account effects on the whole system.

The worst mistake was and is:
Optimisation of parking on individual level.
 If this happen, no optimisation of the system
 is possible any more

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Organisation has to be changed

Parking is not a private affair
Parking organisation has to be a public affair

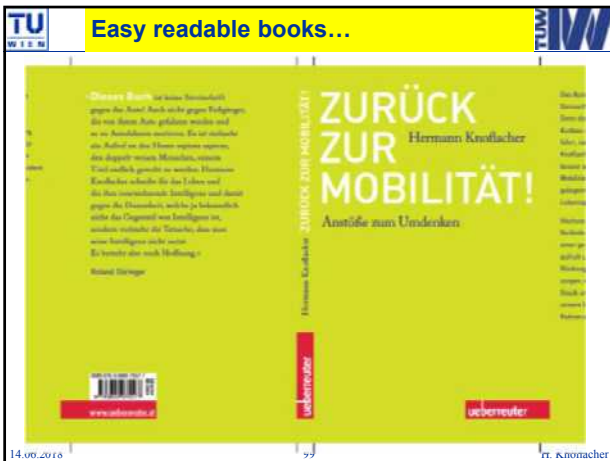
Provision of parking has to be done
by an organisation
 equal to the organisation for public transport

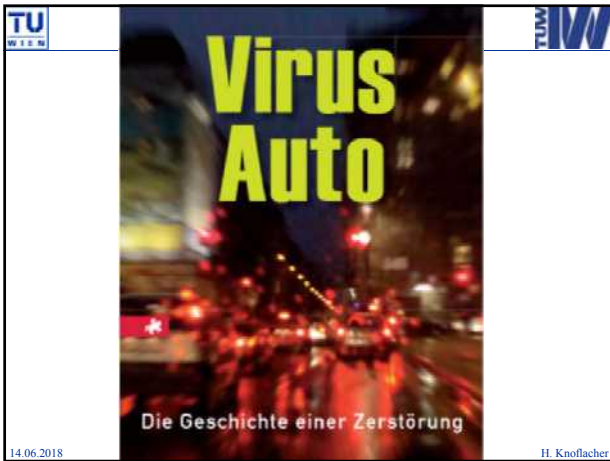
.....in accordance with the goals of the system
 and the **reality of human behaviour**

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TU W I E N Literatur zum Thema **TUM W**



Verkehrsplanung für den Menschen.
Band 1: Grundstrukturen.
Verlag Orac, Wien 1987.
(ISBN 3-7015-4129-9) EUR 32,70



Zur Harmonie von Stadt und Verkehr. Freiheit vom Zwang zum Autofahren.
2., verbesserte und erweiterte Auflage.
Böhlau Verlag Wien - Köln - Weimar, 1995.
(ISBN 3-205-98586-9) EUR 23,80

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TU W I E N Literatur zum Thema **TUM W**



Katalysatoren für Nichtmotorisierte.
Verlag Professor Hermann Knoflacher,
Wien 1985.
(ISBN 3-900657-00-9) EUR 10,90



Fußgänger- und Fahrradverkehr.
Planungsprinzipien.
Böhlau Verlag Wien - Köln - Weimar,
1995.
(ISBN 3-205-98308-4) EUR 26,90

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Thank you very much

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