

Introduction

In dealing with travel and other types of behaviours we have to distinguish between system behaviour and system user behaviour, or more precisely, the behaviour of the transport system and behaviour of users within this system. Historically, the difference between system behaviour and the system user behaviour in transport was not a problem, as long as humans have organised the transport system within their evolutionary limits, which were constrained by their sensual physiological and physical abilities. Action and reaction could be experienced and the space in connection with the road network, in which activities adopted a certain pattern, resulted in a closed entity.

With the invention of mechanical transport systems (powered externally by steam or the combustion and jet engines) and telecommunications, the evolutionary boundaries of man were exceeded. The railways, the dominating mode of transport in the 19th century, had a controlled access but nonetheless a strong influence on the development of the industries and cities. With the invention of the car, an open system on the individual or user level was introduced in human society for the first time in history. Transport science has dealt mainly with the benefits and new opportunities of this system, which resulted in the building of an optimal environment for this fascinating new mode, creating effortless "mobility" over a period of one hundred years. The flip side of the coin, with an increasing number of accidents, environmental and noise problems and later with problems of social, cultural as well as economic degradation, has not been recognised. The effects of the system as a whole were not understood and the elements of the system were very often built on indicators, which are totally wrong or even don't exist at all in the system.

This paper describes the state of knowledge of transport system behaviour arising from evolutionary new (less than 200 years) invention of mankind, which is still quite different from official publications of other points of view.

Current received wisdom suggests that:

- There is no growth of mobility:
(the average number of trips for persons remains the same). It is only a shift from one kind of mobility to the others. (EST seminar of 2000 / 2001 in Paris)
- Travel time in the transport system as a whole is constant:
Increasing speed leads to an increase of distance without time savings. All calculations based on time savings are therefore wrong. If no time saving exists in the transport system, there are no losses of time. The calculation of congestion costs is therefore nonsense. Increasing travel speeds changes the structures, which has been forgotten so far. (Knoflachner 1986, Lill 1889, Schafer 1998, Schmidl 1990).
- Freedom of modal choice:
On the system level modal choice is determined basically by the evolutionary preconditions of man and the physical structures of the transport system.

Understanding human behaviour in the transport system: five approaches?

The "Issue papers" of the workshop provide an excellent reflection on how human behaviour is understood in transport today. "There are almost as many views about how human behaviour is maintained and how it changes as there are people who hold the views." These views can be distinguished in regard to five different approaches.

- Interior constructs
- Brain activities

- Heredity
- Antecedent external causes
- Consequences of behaviour

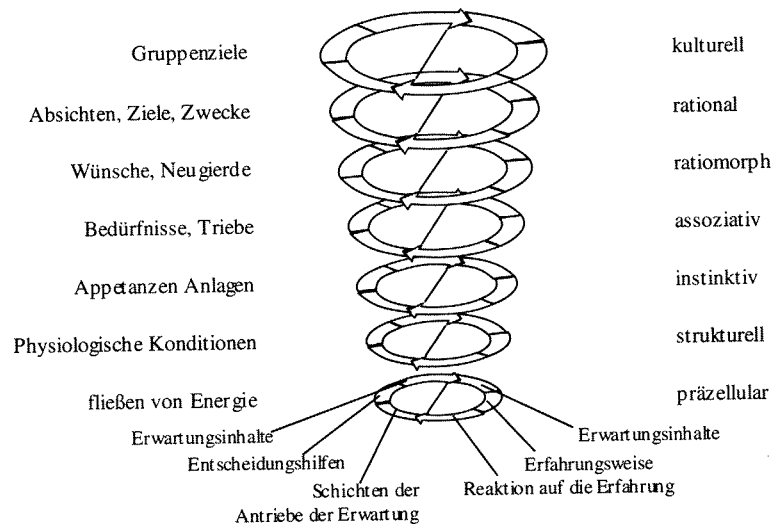
Their conclusion is: "... the approach preferred here implies that the best way to change transport behaviour may be to change the milieu or the context within which it occurs."

This confusion is a result of the not obvious interactions of the different levels, i.e. where the car takes effect on human behaviour, which problems it creates. Therefore, the explanation requires an analysis of these five approaches and afterwards we should be able to understand whether the conclusion is a stringent necessity or only a vague recommendation.

Tools to analyse the approaches:

The tools, which will be used, are based on the theory of evolution and epistemology. They have their roots in the 19th century Darwinian theory and general system theory and were described in a popular way by Konrad Lorenz, Rupert Riedl and others. Riedl has published a hierarchy of disciplines, following the order of evolution. If this approach is applied to find a hierarchical order, i.e. from the basic elements of matter with the processes that emerge from atoms, molecules, bio molecules, to the more complex structures of animals and man, families and societies, civilisations and cultures we find a parallel order of the scientific disciplines.

Schichten des Erkenntnisgewinns



Nach Rupert Riedl

Figure 1: Evolution has formed structures from atoms to societies

Today, the basic problem is the lack of a holistic viewpoint. Each discipline is more or less isolated from the other disciplines. If effects occur on one level they can also affect other levels – and therefore other disciplines. This means that each discipline attempts an explanation on their specific level, and ignores the other level where they actually come from.

At the lower part of this evolutionary process where the molecules are studied, human behaviour is usually not the core issue of this very discipline. From this angle it becomes clear that explanations are usually a reflection of the problem related to the level of the discipline and not related to the process of the level on which it occurs.

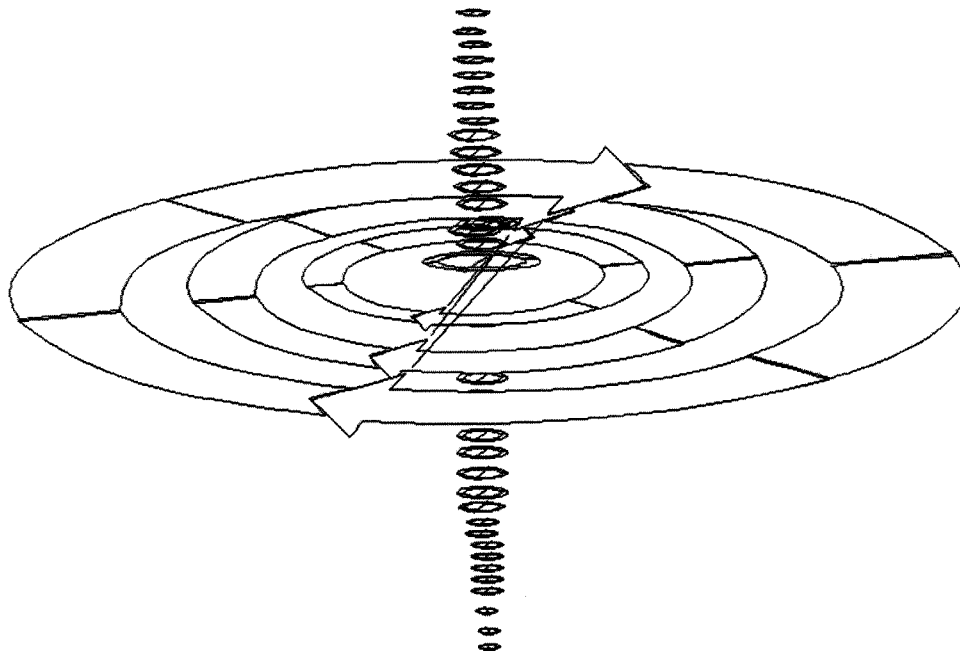


Figure 2: Each discipline recognises mainly its neighbours

According to this distinction, the approach of interior construct comes from the upper levels, not taking into account that this new kind of transport system may also influence the more basic levels, which are far away from the consciousness of man.

The second approach concerning brain activity can be described as a part of the system but not influential enough to deal with the problem.

In this paper heredity is understood as a part of the process, concerning the preconditions of the behaviour. It can be understood as a result of the useful behaviour in response to a circumstantial context or the human environment. However, more specifications are necessary to understand human behaviour in the artificially built-up environment.

Antecedent external causes are, of course, effective in the system but cannot explain the behaviour as a whole.

Finally, the consequences of behaviour describe only one part of the truth, the other part of this group is the feed-back, connecting experience with expectations.

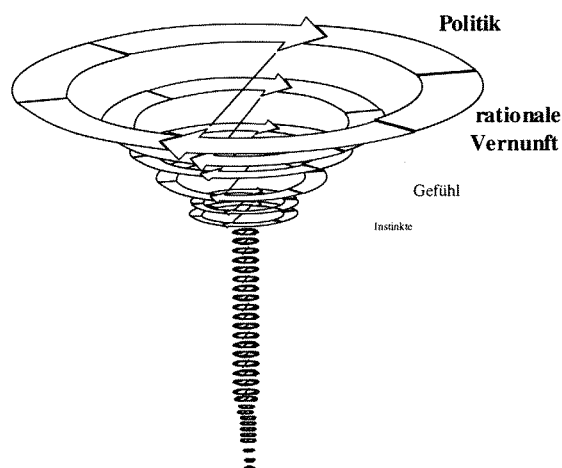


Figure 3: The upper levels of the evolution are overestimated – and their effect also

From this multi-level perspective, the problem can be seen as one of trans-disciplinary understanding of human behaviour and, to a certain extent, as one of the composition of man. And common to all five approaches is the overestimation of the upper evolutionary levels.

On what level does the car interact with the driver? By using the work of Walther, Konrad Lorenz and Karl von Frisch it is possible to develop a hypothesis, which provides an answer for the question of levels on which the car affects human behaviour. (Knoflacher 1981)

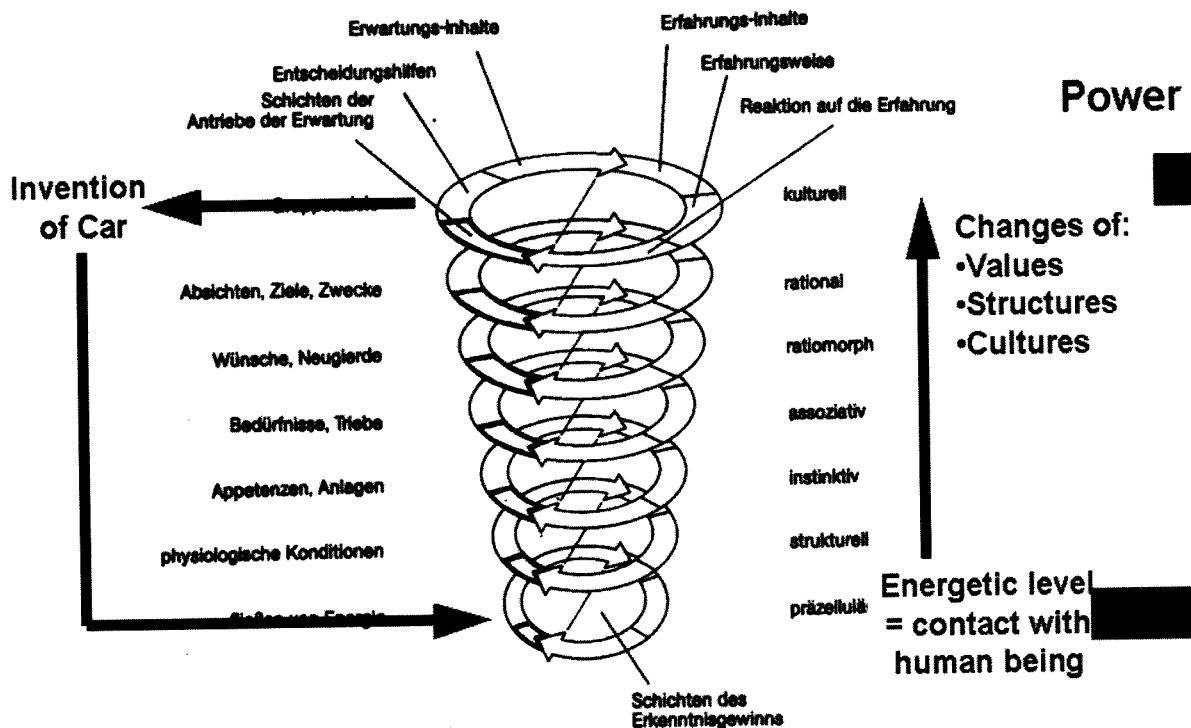


Figure 4: The car saves body energy on the low level of human evolution and moves all levels above

As the main level can be determined the one related to the body energy, i.e. one of the deepest evolutionary levels, and this level affects all levels above. Energy saving was the most successful strategy for survival in evolution. It is probably the deepest rooted driving force for behaviour in general, and human behaviour in particular. For example, the car driver requires only half of the body energy compared to pedestrian per unit of time, or even less. But during the same time he moves ten or even twenty times faster and with more ease. This acceleration must create an unimaginable and wonderful effect of strength and superiority which is much stronger than culture and ethics or everything else which can be derived from the later and weaker levels of consciousness in our evolution.

This effect could be derived from the fundamental Weber-Fechner law of sensation in 1871 (Knoflacher 1981). It can now easily be shown what kind of measures have produced which behaviour and their effects. For example, if we compare the changing degree of motorization within the share of public transport, the relationship of this law can be found.

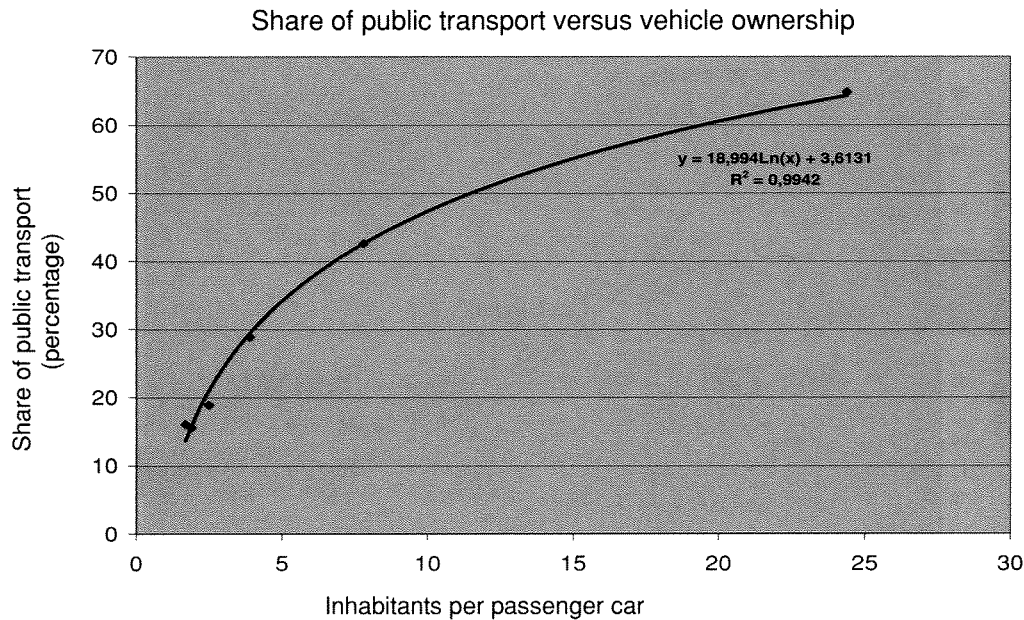


Figure 5: Increasing motorisation reduces the share of public transport

Furthermore, if we analyse human behaviour in cities or countries over time as well as on the microscopic level, this basic relationship between irritation and sensation crops up.

$$\pm E = \ln I$$

↑ sensation ↑ Intensity of Irritation

Important is the sign!

+ positive sensation

- negative sensation (Knoflachner 1981)

Human behaviour is always related to human sensation. Apart from the mathematical function, the sign of the sensation is very important. It is equally valid for positive sensations, i.e. attracting people, as well as for negative sensations which deter people from this particular behaviour.

The transport system as an artificial environment

The transport system of today constitutes an artificial, man-made environment. During the last 200 years, the transport system was developed as an attractor for mechanical transport system users. The effect was increasing distances and with that a change of villages and cities from human related structures to inhuman, mechanic means related agglomerations, from free flow of pedestrians to congestions of car traffic. Congestion is an excellent example of a positive and strong stimulation for car users. But media, public and politicians recognise congestion as a negative effect since they don't understand the cause of it. They try to solve the problem with the method which is again the very cause of the problem, i.e. an increase of the attractiveness for the car user by adding more lanes or building more roads. The inevitable result is an exponential increase of congestion. No one would produce congestion if the stimulation of car usage wouldn't be so overwhelmingly superior compared to all other means of transport. If this is known, congestion can be used as an excellent "soft measure" to change human behaviour.

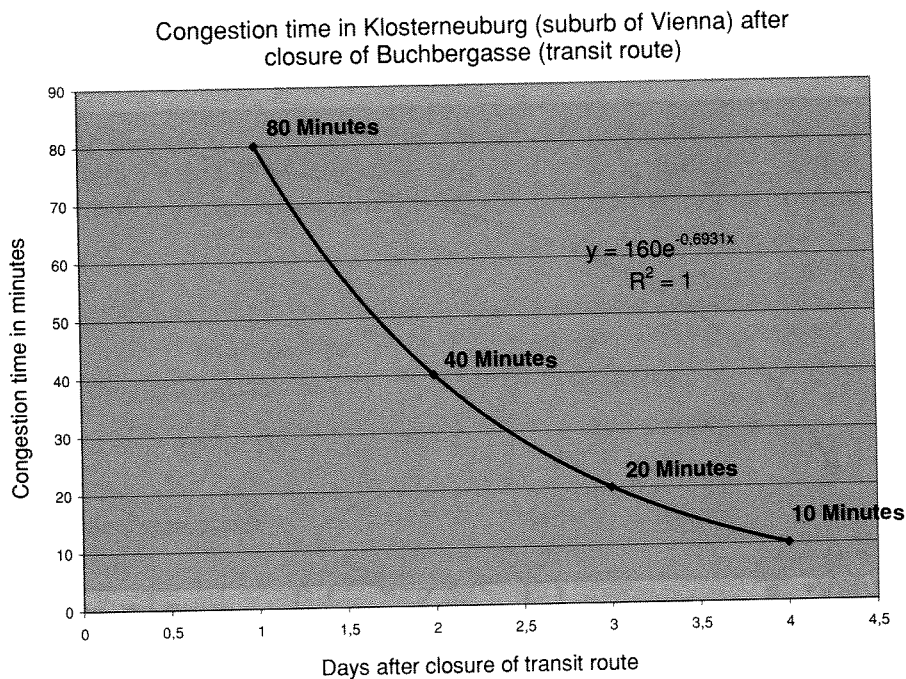


Figure 6: Congestion disappears after few days
(measured congestion time in Klosterneuburg June 2002)

If congestion is permanently installed, the transport system users are extremely flexible and adapt to the new conditions very soon, normally within a few days or at the most within some weeks.

A sound base for the approach

This new approach is not another one in the line of the other five, it is one in its own right, since it can provide explanations for the other five. For the application we can now evaluate different kinds of so-called soft or hard measures (depending on for whom the measure is soft and for whom it is hard).

The question should not be regarding soft or hard: effective or ineffective should be the correct answer.

Soft and ineffective measures can lead to a painful and discouraging process. This process is not only painful for drivers and travellers, but it can also be very dangerous for decision makers and administrators. This happened during the last decades where environmental enthusiasm stirred up hopes for people and politicians which couldn't be fulfilled by this kind of measure, due to a lack of knowledge about human behaviour and to wrong education in transport science and transport engineering. It was a terrible disappointment for all people involved. Examples of these disappointments were the attempts to reduce car traffic by declaring the "city of short trips" (Stadt der kurzen Wege) or to change the modal choice by using strategies related to transport costs, e.g. ticket price strategies in public transport, etc. Another property of an effective strategy is that it must also be sustainable. This is only possible, if the measure tackles the problem on the same level on which it occurs.

What and where is the key point?

The key point is the binding force between car and man on the level of body energy which changes all evolutionary levels above. This has effects for the social, cultural and economic systems and also influences the values in regard to a family and a settlement.

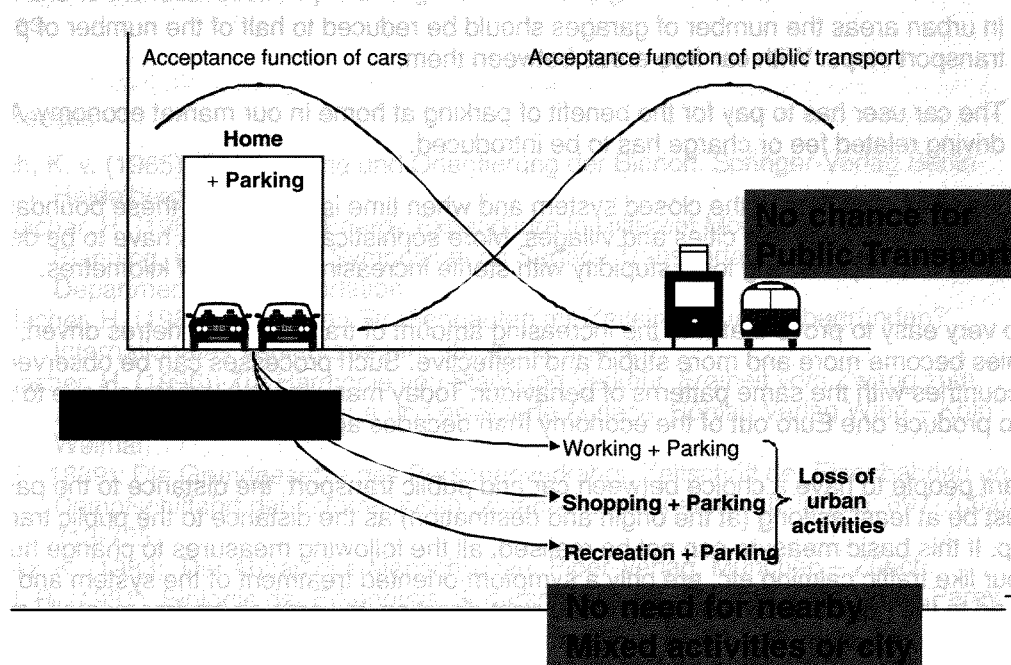


Figure 8: Only if parking is organised in order to give people a chance of choice, can all other soft measures can be effectively implemented to develop an environmental sustainable transport system

Figure 7: Parking close to human activities is the fulcrum for unsustainable behaviour of man in transportation

The problem takes place at the point where people get in contact with the car which is the car park. When man gets in contact with the car before he gets in contact with other people, public transport, shops and so on, he will not use them or get in contact with all those opportunities which lie beyond this point. Since the binding force between him and the car is much greater than the binding force to the family, to the children, or the city, he will do everything to keep his contact with the car as close as possible.

Without a new parking organisation no environmentally sustainable transport will be possible

The parking organisation of today is optimised not for the human system, it is optimised for the individual user not taking into account the system effects for the society, local economy the environment. The winners of the system of today are: Centralisation and big corporations – and, for a short time, also the car user, but captured in his trap for some time.

And this fact produces all the problems in traffic flow, urban sprawl and centralisation. It can also explain to a certain extent, structural unemployment beside environmental degradation. There are many attempts to solve the problems on the level of traffic flows, on the financial level and on the level of traffic calming. But all these measures are not very effective, because they have not changed the basic attitudes of the transport system users.

There has been some success under specific circumstances, where the share of cyclists and public transport users could be maintained over a certain period or even increased. If successful measures are introduced in another environment, the success never was repeated - at least not in the long run. If we analyse such success-stories, we find always a hidden, but strong contribution by effective measures of parking regulation in them. And these measures are always related to parking or basic changes of built structures.

The separation of man and his car park is therefore the key element of any successful sustainable measure. This can be easily done by reorganising existing patterns of parking.

- The number of parking opportunities should be not greater than the number of public transport stops in an area.
- In urban areas the number of garages should be reduced to half of the number of public transport stops. With car-free areas between them.
- The car user has to pay for the benefit of parking at home in our market economy. A driving related fee or charge has to be introduced.

These measures bind time in the closed system and when time is kept within these boundaries, activities must come back into cities and villages. More sophisticated logistics have to be developed instead of compensating local stupidity with sterile increasing number of kilometres.

It is also very easy to prove that with the increasing amount of traffic and kilometres driven, economies become more and more stupid and ineffective. Such processes can be observed in all our countries with the same patterns of behaviour. Today many more kilometres have to be driven to produce one Euro out of the economy than decades ago.

If we want people to have a choice between car and public transport, the distance to the parked cars must be at least as long (at the origin and destination) as the distance to the public transport stop. If this basic measure can not be realised, all the following measures to change human behaviour like traffic calming etc. are only a symptom-oriented treatment of the system and can never lead to the goal, even if they work in the right direction, towards an environmentally sustainable transport system. But if man is disconnected from the car as described above, this set of common measures will become even more effective. They become primary measures and their effects will eventually make sense. As long as the existing parking regulation and habit are maintained, all the other measures will be very soft measures. In that case, we cannot catch the car driver and it will be a painful and stressful process if we want to step forward to an environmental, social and economically sustainable transport system. But if this measure concerning human behaviour and transport system is realised in the form of the new organisation of parking, the system will start to work in the right direction in a relaxed way with a lot of synergetic effects on all levels.

Conclusion

We still have yet to answer the question of whether the conclusions in regard to the issues addressed in this paper can be supported by the above findings.

The conclusion is that they are completely in accordance with the principle. However, since it leaves open specification and this specific approach, which is necessary if we want to introduce environmentally sustainable transport, it is not helpful enough and can even be misused.

The "change of the milieu" is now known: it is the change of parking organisation as precondition for the enhancement of all other measures, from pricing to more attractive infrastructure for non motorised transport system users.

This measure is a priority measure. Since the effect of cars on man is realised at the physical level - human body energy - the measure must be put into position on the same level! If we try to solve the problem with this measure, instant benefits will appear very soon in relation to the limitations of social and political acceptance.

Here we approach zones of taboos, where a wrong interpretation of "freedom" can prevent the escape from this trap, which was built to perfection during the last 80 years of transport planning and policy, far apart from a sound scientific ground.

It is not only the physical structure which has to be changed, it is also the financial one, which is totally in contradiction with the basic principles of market economy: For example, in Austria, somebody who builds a house or a flat without an adjacent parking place today, has to pay a countervailing duty. If he behaves in the right way, he is punished by existing financial regulations. In a market economy the price must reflect the value of a benefit. If we introduce market

economy into the transport system, the owner of an adjacent near a parking place will have to pay for this privilege and for the cost resulting from this privilege to the society, to the environment and to the local economy. Parking has to be charged in accordance with the effect it causes.

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