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## Conference Paper

# Ecological sustainability and personal behaviour: Relations demonstrated by the decision-making process of selecting a certain transportation mean

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Reinhold Priewasser

### **Ecological Sustainability and Personal Behavior.**

Relations demonstrated by the decision-making process of selecting a certain transportation mean.

Up to now strategies and approaches of solving environmental problems facing the aim of sustainability have been primarily focussed on improving the ecological quality of products, processes and technologies and on the discussion of structural changes in ecologically relevant sectors such as energy use, industry, tourism and traffic policy.

Only few emphasis has been placed on the fact that the extent of environmental demands and ecological stresses is not only a consequence of certain factual or structural conditions but it is also essentially determined by varying human behavior patterns. Technologies and structures are not ecologically effective by themselves; their environmental relevance strongly depends on the persons way of acting within the prevailing systems

Accordingly it should become more evident in the political discussion and even in environmental research activities, that apart from technical and structural changes also changes of personal behavior patterns play an important role on the way to sustainability.

Recognizing the importance of that perspective psychological and social theories about the generation of personal behavior als well as theoretical models of learning can offer useful indications concerning the intrapersonal and extrapersonal preconditions of environmentally orientated acting.

### **Ecologically orientated selection of traffic modes**

According to the political aim of ecological sustainability that kind of transportation mean should be selected which enables to meet a defined mobility demand under a minimum of ecological stresses.

Doubtless walking and cycling are traffic modes that cause least enviromental loads with reference to a certain transportation performance than any other modes.

The empirical fact that more than 50 per cent of the ways covered in urban areas are finished within a distance of 3 kilometres makes those traffic modes mostly peferable. But in a many cases reality goes to the opposite direction. Very often short distances are covered by using a car: 33 per cent to 40 percent of the ways in towns done by cars are not longer than 3 kilometres. (Gruber et al. 1996)

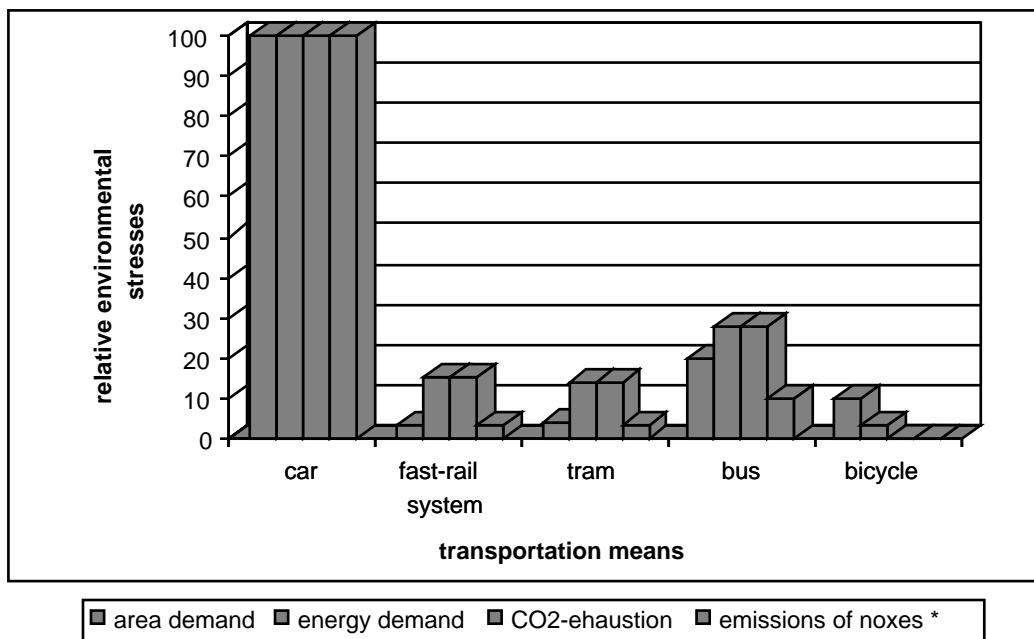
Whereas walking and cycling are suitable alternative modes for short distances public transportation means are the ecolocially corresponding traffic mode in order to cover longer distances. Figure 1 demonstratede the amounts of ecological stress decreases when alternative traffic modes are used instead of car with reference to the same transportation unit.

Neclecting all the environmental benefits the contribution of public transport is going to decrease more and more. So urgently the question arises what could be done in order to bring people effectively to a change from car use to ecologically more compatible traffic modes.

### **Behavioral theories for understanding the decision-making process of selceting traffic modes**

It took a long time to recognize scientific behavior and acting models as being relvant and useful for the field of traffic policy. Before that a mechanistic understanding was dominating the trials to explain, why in a concrete situation people decide to use a certain transportation

**Figure 1: Relative environmental stresses by different transportation means  
(stresses caused by car = index 100)**



\* Weighted emissions of NO<sub>x</sub> and Hydro carbons

Source: Priewasser 1998

mean or refuse other ones. The opinion was prevailing, that behavior of traffic participants is exclusively determined by external conditions and consequently there would not really be a scope for free decision. (Held 1982)

First by the application of theoretical behavior models the fact was taken into consideration that the decision on certain transportation mean is also a matter of personal perceptions and preconditions. Therefore only a synoptical view of objective and personal decision-making conditions enables us to understand the process of transportation mean selection. On the other hand a sufficient understanding of the personal decision-making process and the influences on it is necessary in order be able to take traffic measures that turn out to be really accurate and efficient. (Littig 1995)

With focus on analysing the process of selecting transportation means two theoretical approaches became more important. The one originally coming from the economic sphere is the "Rational-Choice-Approach". Its modification into social terms - done by *Esser* (1990)- is named as "Concept of Subjective Rationality". The second model is the "Theory of Planned Behavior" created by *Ajzen* (1991)

From the point of view of the "Rational-Choice-Approach", first applied to the field of traffic behavior analysis by *Domencich u. McFadden* (1975), the personal process of selecting a certain transportation mean is assumed to be a rational decision among discret alternatives. Which traffic mode will be finally chosen in order to cover a certain route is determined by the benefit differences of the transportation means available for a person in a concrete situation. The benefits perceived are a matter of spezific attributes of the respective transportation means, such as timespent, comfort, costs, as well as a matter of personal conditions (age, sex, education, income, attitudes). (Franzen 1997)

Due to this theory that one transportation alternative will be selected, which brings about the transportation benefits aspired under a minimum of expense, in particular embracing the factors time spent, inconvenience and monetary costs. In determining these expense factors we have to consider that the results of empirical studies analyzing the process of transportation mean selecting are based on subjective opinions of the traffic participants and not on objective data. (Brüderl/Preisendörfer 1995)

Methodologically similar to the scientific approach described above the selection of a certain traffic mode is explained by the "Theory of Planned Behavior" developed by *Ajzen*.

In the understanding of this theoretical approach the decision to use a specific transportation mean is also based on personal expectations about its benefits, which result from

- the attitude to the traffic mode respected
- from beliefs about the subjective abilities and preconditions for using it, and
- from social norms with reference to the transportation mean. (Bamberg/Bien/Schmidt 1995)

The attitude to a certain transportation mode results from specific subjective hypothesis on relevant attributes such as time spent, using costs, convenience, safety and environmental compatibility.

Assumptions about the subjective ability to use one of the traffic means available are based on hypothesis, how easy or difficult it might be for a person to make use of a certain transportation mean. For those opinions personal conditions (age, income, having a driving license or not), situative restrictions (disposal of time, transport of goods etc.) and even infrastructural supply especially concerning the traffic modes play an important role.

The influence of social norms is based on beliefs whether there would be a pressure or an incentive by friends, neighbours or other relevant persons to use a certain transportation mean or not. (Bamberg/Bien/Schmidt 1995)

Theories like those described above can be very useful for traffic policy because the results of analyzing the relevant factors of personal transportation decisions indicate which of the measures available could be more or less effective in order to support an environmentally orientated organization of the transportation sector.

Empirical studies elaborated with reference to the theories mentioned before indicate that the primary influence on transportation mode decision comes from three quality dimensions which make the use of a transportation mean more or less preferable, namely

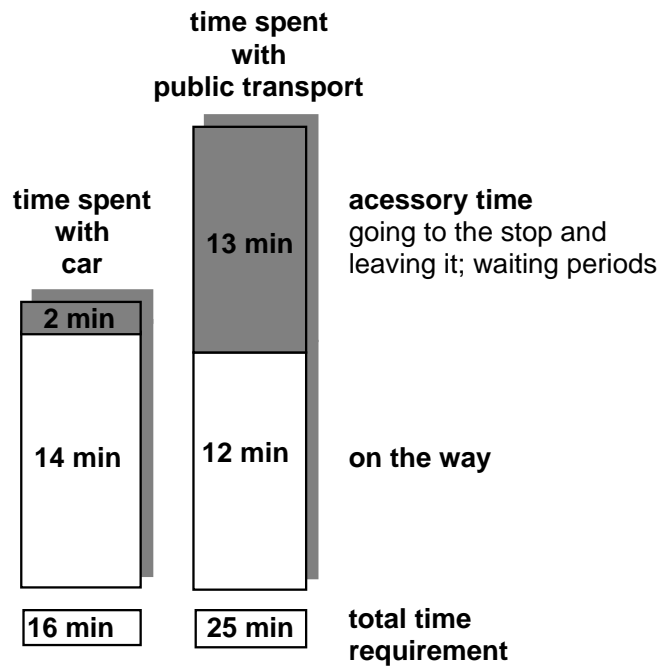
- time spent
- convenience and
- - to a lower extent - monetary costs. (Priewasser 1997)

Primarily differences in time spent and convenience are the most essential reasons why cars are often preferred to public transportation means.

Actually time spent of using the public transportation system is considerably higher than that of private motor vehicles.

But as figure 2 shows us the time disadvantage of public transportation means is not a matter of speed but exclusively caused by accessory time needs e.g. time spent for walking to the busstop or waiting for the bus.

**Figure 2: Average time spent with car and public transport in Linz (Upper Austria)**



Source: Socialdata 1992

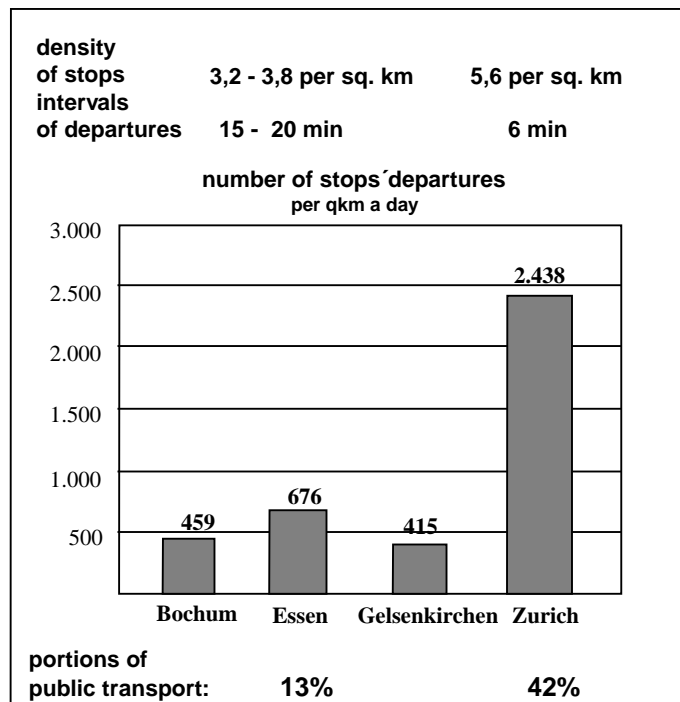
So traffic policy should primarily improve quality factors which have an essential influence on those time components. Empirical studies elaborated on the basis of behavioral theories mentioned above demonstrate that in perception of the road users following quality elements of public traffic systems are very decisive in the process of choosing a transportation mode: the number of stops per unit area, the intervals of departures and the number of necessary line changings.

A comparison of towns in the Ruhrgebiet with the town of Zurich may demonstrate the effects of different stops' densities and different frequencies of departures on the attraction of public transport. As figure 3 shows in Zurich the number of stops per square kilometre is about 50 to 75 per cent higher than in the German towns considered and the intervals of departures only amount to 6 minutes whereas those in the towns of the Ruhrgebiet range from 10 minutes to 20 minutes. (Petersen 1995; Petersen/Schallaböck 1995)

Both of the indicators combined, namely density of stops and the number of departures a day result in " the number of stops-departures" (per square kilometre), which is four times to six times higher in Zurich than in the German reference towns.

In the same figure the effects of those differences in public transport quality on its contribution to traffic volume become evident: In Zurich 42 per cent of the ways covered a day are done by public transport whereas in the Ruhrgebiet towns the public traffic only holds a share of 13 per cent.

**Figure 3: Quality indicators of public transport**



Source: Petersen/Schallaböck 1995; Priewasser 1998

The necessity of changing lines additionally causes time loss at the stops and is seen to be unpleasant in the opinion of the traffic participants. Therefore direct communications should be preferably installed. A study on traffic behavior in Munich demonstrates the effect of direct communications: Only 26 per cent of those persons which reach destinations directly by public transport use a car for these ways. Even when people have to change once the share of the car users only increases up to 28 per cent. When multiple changing is required however the portion of the car users increases up to 57 per cent (twice changes) respectively up to 76 per cent (several changes). (Brüderl/Preisendörfer 1995)

### **Objective versus subjective reasons for car use instead of public transportation means**

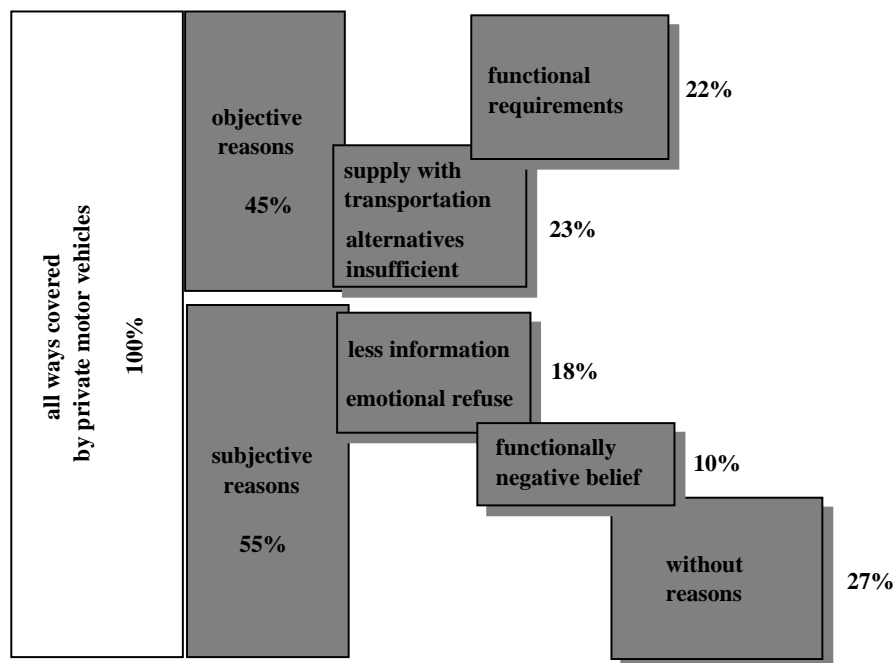
In many cases car use instead of transportation alternatives cannot be justified by objective functional requirements such as transportation of goods or deficiency of alternative transport supply. Empirical studies show us that very often only subjective motivations are decisive for using a car. (figure 4)

Reasons of that kind are

- less information about alternatives existing (time of departure, tariffs, routes)
- negative attitude towards alternative transportation means in general or
- negative assumptions concerning specific attributes of the alternatives such as speed, comfort or costs.

Moreover a considerable number of car users can't give any reasons - neither objective nor subjective ones - why they don't use an alternative traffic mode. In those cases selection of a transportation mean is a kind of habitual acting without a rational consideration of alternatives available.

**Figure 4: Reasons for using a private motor vehicle instead of public transportation means  
(German towns 1995)**



Source: Brög 1997

In those cases where only subjective obstacles stand in the way of using public transportation means considerable increases of this traffic mode can be achieved even without higher investments in traffic infrastructure, namely by taking so called "soft policy"-measures.

Measures of this category are

- Giving informations about the public transportation system in detail (e.g. by installing so called mobility-centers), indicating the subjective advantages of public transport and elimination of prejudices on it;
- elaborating communication strategies such as awareness campaigns in order to improve the acceptance and the sympathy value of public transportation means; and finally
- to care for a user-friendly mobility supply based on target group orientated demand analysis, direct marketing and free trial tickets for potential public transport users.

For German it has been estimated, that as a consequence only of soft policy-measures the portion of the environmentally friendly transportation modes could in total increase from 47 per cent at time to 76 per cent in the nearer future. Nearly 60 per cent of that increase could be covered by the public transport. (Brög 1997)

### **Potentials of changing traffic modes - European cities in comparison**

Different accents in transport policies lead to different portions of the transportation means prevailing, as table 1 demonstrates. So Zurich became a model town in promoting public transport, whereas Groningen and Amsterdam, as well as Salzburg and Innsbruck to a minor extent, can be regarded as exemplary municipalities in supporting cycling

**Table 1: Portions of the transportation means in several European towns**

Towns	Portions of the transportation means (in per cent of the ways covered)			
	by car	by public transport	by bike	on foot
Linz 1992	42	22	4	31
Salzburg 1992	44	13	19	24
Innsbruck 1993	43	15	13	29
Saarbrücken 1989	54	17	2	27
Ruhrgebiet* 1988	53	13	7	27
München 1989	40	24	12	24
Hannover 1990	38	22	16	24
Zürich 1988	29	42	4	25
Amsterdam 1991-93	34	16	23	25
Groningen 1991-93	36	6	35	22

\* Bochum, Essen, Gelsenkirchen

Source: Priewasser 1998

Portions of the public transport sector respectively those of cycling in these towns give an indicator of possible amounts of changing traffic modes.

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