BEHAVIOURAL ADAPTATION TO VEHICLE DESIGN

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"PROMETHEUS" and "DRIVE" are the names of international research programmes involving a new generation of technological developments intended both to make the existing road traffic system more efficient and environment-friendly and also to offer individual drivers maximum levels of safety.

These efforts are undoubtedly to be welcomed in principle. From the psychological viewpoint, however, a word of warning must be raised: it is unrealistic to assume that vehicle improvements themselves will have a positive effect on road traffic accident rates. In addition to the safety potential created by the technical improvement, the decisive factor with respect to accident rates is the manner in which this potential is exploited by the human being, i.e. the driver.

A survey was recently concluded in Germany on the relationship between vehicle characteristics and accident rates (DÖRSCHLAG and SCHLICHTING; 1987). The survey report includes ranking of the accident rates of 70 vehicle types. Ranking was based on the proportion made up by the relevant vehicle type in the total number of passenger car accidents in North-Rhine Westphalia, the most heavily populated state in the Federal Republic.

The average mileage covered by the individual vehicle types was also taken into account. The ranking showed the upper range (high proportion of accidents) to include high-performance, largely sporty vehicles which are, in fact, recognized to be well equipped in terms of active vehicle safety. Accidents on rural roads, in particular, remarkably frequently involved top-range vehicles where no expense is spared in terms of the active safety equipment provided. The lower end of the ranking included many less powerful vehicles which are usually less well equipped in terms of active safety. These results demonstrate that the high safety standard of a vehicle is no guarantee for favourable accident statistics. When safety improvements are paired with the possibility of faster, sportier driving or are implemented with a view to opening up new speed potential, the increased safety margin is often quickly lost again.

Another survey team in Germany (BOCK et al 1989), which also investigated the effects of improved vehicle technology on accident rates and obtained similarly negative results, drew the following sobering conclusion: "Measures to increase traffic safety should not be restricted solely to technical optimization of the vehicles, but should also integrate the control behaviour of the human being in this optimization process. Measures restricted solely to the vehicles themselves may even produce the opposite of the desired result."

The principle of the relativity of technical improvements entered the theory of traffic safety science as early as the seventies. A major contribution was made here by the Canadian psychologist, G. WILDE. His original theory of "risk compensation", which he developed into the "risk homeostasis" model, regarded the motivation of the individual driver or the values and conventions of society as being the decisive "comparator" in the "man-vehicle-road" safety system (see figure 1). According to this model, the number of accidents experienced by any one person or occurring in any one country depends solely on the level of risk the individual is prepared to accept or the level of accidents a society is prepared to tolerate.

WILDE's model has undoubtedly contributed to better understanding of developments and effects in the field of traffic safety. The risk compensation model provides a good explanation for example for the fact that drivers whose vehicles are equipped with antilock systems (ALS) are involved in rather more - and not fewer - accidents than drivers with conventional brake systems who drive the same mileage under similar driving conditions (ASCHENBRENNER, BIEHL and WURM, 1988).

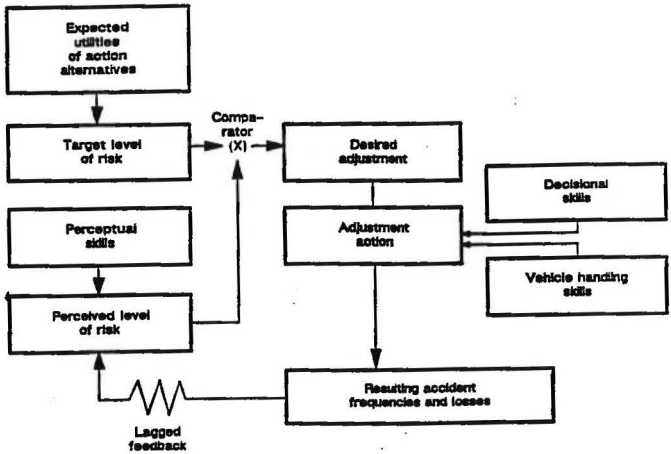

Fig. 1: HOMEOSTATIC MODEL RELATING DRIVER BEHAVIOUR, ACCIDENT RATE AND TARGET LEVEL OF RISK (Source: OECD, 1990)

In spite of all the credit due to WILDE's theory, its significance should not be overestimated as, for example, happened in Britain during the introduction of legislation making seat-belt usage mandatory. ADAMS, a leading supporter of WILDE's theory, opposed mandatory seat-belt usage and took his objections as far as the House of Commons. He was vehement in stressing the danger that car drivers, aware of their increased personal safety, would behave more hazardously towards other road users, in particular pedestrians and cyclists. He claimed that the reduction in accident victims to be expected among car drivers and passengers would be cancelled out by an increase in the number of other victims soon after the implementation of mandatory seat-belt usage. Following ADAMS' intervention, the British parliament insisted that the introduction of mandatory seat-belt usage be accompanied by stringent scientific studies. The results were available two years later: ADAMS' fears had not materialized (SCOTT & WALLIS, 1985). The controversy aroused by the risk compensation theory led the OECD to set up an expert group to report on the matter. Road safety measures, naturally swallow large sums of money, and improved knowledge of the human being's behavioural mechanisms allows for more efficient usage of safety budgets which are always limited.

The results obtained by the OECD expert group, did not question the phenomenon of risk compensation. Nevertheless, in adopting the term "adaptation", the group avoided the theoretical implications of WILDE's concept. The term "adaptation" is an entirely neutral description of the adjustment process affecting the driver following the introduction of a safety measure.

The literature survey of the OECD presents a large quantity of examples of behavioural adaptations on different fields of safety measurements. Table 1 gives an overview of the field of vehicle safety. The first column shows the elected safety feature, the second the overall safety effect, the following the influence and the direction of behavioural adaptation effects.

Safety measure Adaptation	Safety Effect	Influence of Behavioural Adaptation	Direction of Behavioural Effect
Primary safety in conjunction with sporty vehicle design	Negative if any	Proven	Negative
Daytime running lights	Positive	Not proven	--
High-mounted braking lights	Positive	Suggested	If present, negative
Studded tyres	Positive	Proven	Positive & negative
Antilocking system	Not proven	Proven	Negative
Seat belts	Positive	Not proven (often suspected from accident comparisons)	--

Tab. 1: SAFETY EFFECT, INFLUENCE AND DIRECTION ON BEHAVIOURAL ADAPTION (Source: OECD, 1990)

The group also attempted to bring about theoretical advances in the risk compensation debate. On the basis of numerous studies, for example, it formulated psychological criteria upon which the occurrence and intensity of compensation processes or adaptation appear to depend. These criteria were mainly derived from experience in the field of vehicle safety.

Interaction with the measure
Behavioural adaptations by the driver to new conditions require him to perceive the effect of a measure (or at least be informed about it) and to be able to exert an influence.

Immediacy of feedback
Adaptations to a safety measure are particularly likely if the driver receives direct feedback on the effects of this measure.

Extending the freedom of action
If changes in the man-vehicle-road system give the driver greater scope for experiencing new risk-exposure conditions, more extreme driving situations, higher speed ranges, etc., there will be an increased likelihood of behavioural adaptations detrimental to safety.

Increase in subjective safety
Behavioural adaptations detrimental to safety are also always to be feared when the driver's subjective safety, i.e., his feeling of safety, is increased. The driver comes to believe that he is better equipped and hence better able to cope with critical situations.

Superimposing of the driving goals by extra motives
The way in which the driver exploits the available possibilities is determined by his motivation, driving style or the "thrill" he seeks from driving. The more readily improvements can be translated into performance- and "thrill"-oriented driving styles, the greater is the likelihood of the intended safety improvement being overshadowed.

These criteria summarize a large amount of practical experience and fundamental traffic psychology theory from Europe and overseas. If the development-engineers and marketing experts of the automobile industry were to pick up such criteria and incorporate them in their design and sales strategies, inappropriate developments and disappointments could surely be better avoided.

The OECD-report also included a list of methodological recommandations for empirical research: the surveys should be designed as prospective studies on the basis of theoretical models of behaviour. The aims of the measure must be formulated clearly and the hypotheses regarding adaptation behaviour, too. We need more exact field studies consisting of before-and-after-comparisons and control groups. Last but not least the process of adaptation, that is the so-called "black box", should be studied too in order to get more information about the psychological background of adapted behaviour. At the present we are preparing an empirical survey in East Germany where we try to take into account the mentioned methodological recommendations: Old

and slippery road surfaces at different locations in East Germany will be altered to improve the skid resistance. In theory we expect the drivers to notice the change and modify their behaviour. We will measure the behavioural adaptation by modifications of speed behaviour and other indicators. We will also study the reasons for the expected behavioural adaptations by questionnaire. We will apply a sober with/without - before/after-design. I believe that, on the basis of the results the benefits of the technical measure can be calculated very precisely, not only by means of technical but also psychological measurements. Our hypothesis is that there will indeed be a safety benefit, but reduced by behavioural adaptations.

All literature references in:

Behavioural adaptations to changes in the road transport system.
Road transport research, OECD, Paris, 1990