

Cars and behaviour: psychological barriers to car restraint and sustainable urban transport

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in:

Sustaining sustainable transport

Planning for walking and cycling in Western cities

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Table 1 Cars and behaviour: symbolic-affective motives (see also Diekstra, 1993)

- * 'Auto'regulation: freedom of movement and autonomy (Man as nomad/hunter)

- * Archetypal meaning: chivalrous/macho/heroic/superior (Autobahnkrieg)

- * Power motive: dichotomy of the desire for power and community spirit

- * Territorial/possessive aspect (car as mobile territory)

- * Individualism/status/communication: I am what I drive

- * Anthropomorphisation: the personification of the car, identification

- * Emotional/relational aspect: the car as an object of desire or love (car as a toy)

- * Social cohesion function: the car as a common interest

- * Neuronic stimulation: speed and neurobiochemistry (narcotic effect, speedaholism)

- * Pilot or engineer function: the skill and fun of handling a complex machine
- * Structuring the day: the car as a time-filler
- * Protective function: the car as a second skin,womb or friend

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This article analyses the phenomenon of the motor car and driving behaviour in terms of current psychological theories, particularly the motivation theory of Henry A Murray (1938) and the acceptability/availability model of behaviour as described by Rose (1990). These theories contain a set of concepts for the analysis of car ownership, car use and driving behaviour and for the development of intervention strategies to influence these. Psychological and social/contextual aspects of human behaviour are partly the product of previous developments in the meanings, functions and appraisal of that behaviour. Behavioural analysis of car use and driving therefore is not complete without an initial examination of the phenomenon of the motor car in a historical and social-cultural perspective and of the extent to which historically defined meanings and motives determine the current car culture and driving behaviour, such as done by Sachs (1984). This will be followed by a detailed analysis of the most significant motivational functions of the car. In as much as the car is a technique par excellence of satisfying

basic human motives and needs, current car ownership, use and driving habits can largely be explained in terms of the acceptability/ availability hypothesis (Rose, 1990), on the basis of which recommendations for reduction and control can then be made. In the context of democratic market-based economies the extent to which reduction and control of car ownership and use can be achieved, however, is modest at the most. For the car-industrial-cultural complex is both an economical and psychological force of enormous magnitude as well as an expression of contemporary types of personality.

Introduction

Measures to restrict or influence car use can rarely count on broad public support. On the contrary, the more effective they are, the more resistance they evoke. Every initiative that limits the freedom of the car-driver runs up against a fierce lobby defending an alleged freedom of movement for motorists. The arguments for cars are well-known: convenience, speed, comfort, individual freedom and, not least, their economic significance. These rational arguments and functions cannot, however, explain why measures to restrict car use generate such strong emotions, not to mention the wide range of paradoxical behaviour that surrounds the car. The following urgent questions testify to this:

- * Why do most car owners use their car when in many cases it would be more cost-effective, sensible and feasible [in The Netherlands about one in three car trips] to go by bicycle or public transport?
- * Why are car owners prepared to spend such large sums of money on their cars at the expense of the basic needs of themselves and their families, and why do they drive so uneconomically?
- * Why do most car drivers think that they drive far better and more safely than the average car driver in their country?
- * If 90% of Dutch people are prepared to make an effort to preserve the environment, why are 70% not prepared to use their cars less (despite a bicycle fleet twice the car fleet)?
- * Why does the 'social-dilemma paradigm' (Vlek et al 1992) play such a dominant role in car use?
- * Why are politicians apparently so unconcerned about the fact that over 40,000 people die in road accidents in the European Union every year and about a million globally?
- * Why do most transport researchers neglect the role of psychological motives for car ownership and transport choices, despite their dominance in the car culture and in car marketing?

The phenomena implicated by these questions, cannot be explained simply in terms of the enormous demand for mobility or the actual function of the car as a mode of transport. Nor can the social-cultural developments which have led to the present individualistic techno-culture explain the success of the car. We must dig deeper and

seek out the emotions and motives that this inanimate piece of machinery summons up. To do this we have to return to the early years of the motor car.

History

In the summer of 1902 the German author Otto Julius Bierbaum drove from Berlin to Italy and back in an open Adler Phaeton. In his account of this trip, Bierbaum describes in unmistakable terms why the car is usually favoured above the train:

“The train merely transports us; it bears no relation to real travelling. We are forced to be passive - whereas travelling is the ultimate expression of the freedom of movement. The train subjects us to a timetable, makes us the prisoners of a schedule drawn up by someone else, shuts us up in a cage that we cannot even open, let alone leave if we wish to.... Anyone who calls that travelling might just as well call a military parade a walk in the woods (Bierbaum, 1903).”

As Sachs (1984) explains, the coming of the train in the second half of the 19th century caused our conceptions of distance and time to shrink. The train was faster and more comfortable than any other form of transport. But the wealthy could enjoy these benefits only at the expense of their traditional privileges, such as a **‘sovereign’ mode of travel**,

whereby the vehicles in which they travelled were entirely their own domain, equipped according to their own status and taste, as saloons, boudoirs or even bedrooms. The coach, with its coats-of-arms and emblems, was a symbol of nobility and power and was therefore a way of keeping the common people at a respectful distance. It enabled its occupants to come and go as they pleased. To enjoy the benefits of the train (speed, comfort and distance) the upper classes had to subject themselves to the timetable and network of the railways. They had to use the same personnel, carriages, schedules and stations as the common people.

In short, the aloofness and the social [and physical] superiority guaranteed by the coach was no longer possible in the train. And then came the automobile. Suddenly it was possible to benefit from the transport revolution without having to forfeit the advantages of travelling by coach. Only the nobility and the wealthy could afford the first automobiles, which were built by hand and constructed, fitted out and used in almost the same manner as coaches. Even the terminology of the coach era was adopted and is still used today (coachwork, horsepower). The **automobile culture** was born among the upper classes - the nobility, bankers, manufacturers, theatre stars and prominent academics. The rich demonstrated to the astounded masses what the motor car signified: social status, freedom and independence, and - above all - an opportunity to escape from the crowd.

From the early years of the automobile, the belief that the car is a symbol of **social superiority and individuality** became deeply embedded in the soul of elite and mass alike. Motor racing added to this a sense of **sport and adventure**. Many car drivers still

consider themselves superior to those who use a less powerful form of transport or a less powerful type of car. Once behind the wheel of a car, the driver is often - for himself and for others - no longer just the 'man in the street'. He demands and is given priority, which implies superiority and sets him apart from cyclists and pedestrians. In the Netherlands, for example, car drivers have had priority over cyclists coming from the right from the 1940's [a rule set by the occupying German Army!] till 2002.

Initially, the popularisation of the automobile - starting with the Model T Ford and symbolised by the Volkswagen (what's in a name?) - seemed to have adversely affected its position as a **status symbol**. The car industry, taking its lead from General Motors, responded by producing a wider variety of models and accentuating the differences between them. Such a wide range of models with varying engine capacities and features is now available that there is something to suit everyone's real or imagined status. Some makes of car and the images associated with them exist purely as a reflection of the status assigned to them, as illustrated by this slogan from a Jaguar advertisement: 'A car built to standards that start where everybody else stops'. More of a paradox was the once BMW 7 series slogan: "a car you buy not for status but for driving!" The symbolic value of the Mercedes star, or the renowned BMW or Alfa Romeo grills are unrivalled. In the allocation of company cars, the close link between the status of the car and the position of the employee within the company is jealously guarded as though it were a system of military ranking.

The car has also become a widely available means of **exercising power**, whether it be a Mini or a top-of-the-range sports car. This function of the car is a permanent feature of

American TV series and action films where cars are used to perform spectacular stunts and to humiliate adversaries. With abundant horsepower at his disposal, the car driver is able to escape from others, hunt them down and defeat them. Every motorway is a breeding place for conscious and unconscious power games, played by adults who seem to have regressed to an infantile stage of development. The car has acquired such psychological power that, for many people, the superior qualities of their own machine over those of their neighbours and other road-users no longer has to be proved on the road. The car and its features, described in turbo-speak using sacred codes like V8, 16V, GTI, ABS, ASR, ESP, CBC, EBD, TCS and 4WD, radiate superiority. Inflated this might be, some top class models offer no-code versions, leaving green light competitors in doubt about engine size and performance. Meanwhile, all car models are continuously upgrading their engine size and power/performance levels, thus widening the gap between safe speeds and the right foot's lack of self restraint. Never have there been as many fast cars on the market and never have the possibilities of testing them to their limits been so restricted.

Motivational aspects

This historical examination of the popularity of the car has already shown that, in addition to economic factors, psychological motives play a significant role in the development of ownership and driving behaviour. Table 1 shows the most important

psychological motives affecting ownership and driving behaviour and may explain the car's epidemic effect throughout the world. In analysing these motives it is important to realise that, although they can be distinguished from each other, they cannot always be kept separate. Motives vary from individual to individual and from group to group (man/woman, young/old, etc.). The examples given are illustrative and no general conclusions can be drawn from them. Most readers will most probably only recognise the *car-fanatic* who lives next door. Nevertheless, recent studies by Steg e.a. using new social research methods and avoiding socially desirable response patterns, reveal that the symbolic-affective motives are as relevant as traditional instrument-reasoned motives based on cognitive-reasoned behaviour models.

The sequence in which the following symbolic-affective motives are discussed is not inflexible, nor is it based on the idea of fundamental versus superficial or innate versus learned. As Murray's motivation theory makes clear, such distinctions are more difficult to make for humans than for animals. From a primate's stick as a primitive instrument to the 6-speed gear stick is a giant psychological leap for top-mammal man, who may enjoy following 'auto feelings' shown in Table 1.

Cars and autonomy

Perhaps the most important motivation for driving a car is: it puts an end to dependence on Nature's own forces to move from place to place. Complete freedom from this (animal) dependence was achieved when man succeeded in moving over land, across the sea and in the air faster and carrying greater burdens than any other living being.

With the compact combustion engine, running on fossil fuels, he has acquired the most advanced form of individual mobility. In short, with the car, man has reached a provisional peak in his **'auto'-regulative capacity**. Because *homo sapiens* was originally a nomadic hunter-gatherer, our response to the opportunities for mobility offered by the car are a direct extension of tendencies anchored deep in our genetic and neural make-up. In addition, the car makes our 'auto'-regulative capacity available on an individual basis. Both lower and higher animal species (including humans) almost always prefer situations and devices with the most 'auto'-regulative potential or opportunity for autonomy. The individual freedom that the car offers is therefore not a by-product but the principal motives for car ownership and use .

Cars and power

An increase in individual freedom of movement means an increase in power. The car is a **'magnifying technique'**, a technique that magnifies and reinforces qualities which human beings already possess, such as the power of mobility, the ability to mark out territory or to attack and to defend. The car increases human power and speed to such an extent that it also constitutes an increase in a qualitative sense. With the aid of the car, man is capable of claiming territory practically anywhere in the world. This is a completely new phenomenon. Never before have so many people had the opportunity to claim territory - albeit temporarily - simply by driving there or by parking.

Another aspect of the territorial character of the car is its function as a second living room which. Like the traditional coach, we can take with us wherever we go and furnish

with sound systems, carpets, colourful upholstery, climate-control, a (mini) Christmas tree in December, telephone, PC, DVD or a coffeemaker. In the car, each individual can lead his or her own life, including the physical expressions of one's personality. For this reason alone it is naive to hope that traffic congestion will drive many people out of their cars. The advertising slogan for car telephones - "This is a mobile estate agency" - illustrates clearly that, even when it is not moving, the car is an extension of our 'fixed' territory. New market trends, such as the massive introduction of once-luxury accessories like air-conditioning, hifi-sets and GPS navigation systems in "ordinary" cars, and the growing popularity of 4WD, SUV and MPV type of cars are tribute of the need to extend one's territory into all terrains and without loss of home comfort.

The consequence of the car as a **mobile territory** is that - unlike in the past - car-man with his territorial urges can - and does - become embroiled in territorial conflicts at any place and any time. Using a variety of visual, audible and verbal signs and signals, the car driver can chase his rivals off his provisional territory. This was once referred to by the German magazine *Der Spiegel* as 'der Autobahnkrieg' - the motorway war: who hasn't seen the BMW and Mercedes warriors as they chase each other down the fast lane? This motive can explain the highly emotional character of any debate about establishing a speed limit for German Autobahns: it is limiting territorial conquest, competition and defense. But even this cannot explain the almost tabooing reactions of German politicians and car drivers when one tries to raise that question. So let us look at the unconscious effects of current power levels under our right foot.

As Alfred Adler (1929) and others have explained, the greater the desire for power, the less human behaviour is motivated by community interests and empathy with others. In that sense, when driving a car, man undergoes a **personality change** and a motivational reverse, no matter how little he may himself be aware of it. The caring parent, the safety-conscious airline pilot, the Christian or Buddhist attempting to live an exemplary life, all of them may become aggressive and take all kinds of risks once they are behind the wheel of a car or driving a motor-cycle. A human being in a car (and particularly a man) becomes a different person, and different motives and behaviour patterns may take over. The extraordinary psychological effect of the speed and power which the car and motor-cycle give to their driver does not receive enough attention in traffic studies and transport policy (Steg et al., 2001, Kroon, 1996). In the car, the individual has an instrument, a **weapon** - for which a driving licence is the only form of permit required - with which he can threaten the lives of other road-users. Finally, we see real bullets being used for conquering a parking place, aggression that may have begun by raising a middle finger.

With the coming of the car, a lethal weapon has become generally available without any form of control whatsoever. The freedom enjoyed by the driver - compared, for example, with the restrictions imposed on air traffic - and the speed, design and materials from which the car is constructed make it a costly piece of machinery in terms of human lives. In the current car culture, this and the power motive are justified by legislation which imposes light punishments for negligent homicide or aggressive behaviour on the road compared to offences committed with 'real' weapons. An endless range of technical safety features such as ABS, ASR, ESP, SIPS and collision impact zoning succeeded in

making people believe modern cars are safe cars, while in the USA big cars are labelled as “safe” anyway. Despite sustaining casualty levels and differing risk statistics all over the world, even road safety experts neglect the increasing evidence of risk compensation and power & performance-related risk profiles of individual vehicle-driver combinations. Moreover, car manufacturers cover-up the potential gunship character of many powerful modern family cars, using - like Volvo and SAAB - safety records for lower powered models as overall selling argument for high powered new models (Kroon, 1996). The new Porsche Cayenne SUV with 450 HP and 0 – 100 km/h in 5,6 seconds is no doubt the ultimate level in weaponry and macho-ism a modern car can offer for those who need to beat and show-off all others in a so-called “means of transport”!

‘The brotherhood’ motive

The car’s **potential to impress** satisfies another significant motive - the desire to be heroic. This is known as the ‘**archetypal**’ motive, symbolised by the knight in shining armour. It is best illustrated in terms of a variation on the car - the motor-cycle. Motor-cyclists seem to prefer to operate together in groups or gangs which closely resemble medieval orders of knights. Some time ago, one of the authors experienced a clear example of this when passing a coffee bar where a Harley-Davidson club had gathered. There were seven tough-looking choppers parked outside, some with ‘sawn-off’ exhausts (acoustic power!). The riders were dressed in black leather suits decorated with chrome studs so as to give the appearance of chain mail. They all wore boots with silver spurs. Their enormous gloves were also covered with studs, like the gauntlets that medieval knights wore for jousting. Their black helmets bore the name of the club - *The*

Gauntlets. As they left on a tremendous wave of noise, the image conjured up by the departure of the last bike was striking. Behind the driver, whose long blond hair flowed out from under his helmet, sat a young blond girl, without a helmet and with her arms around his waist. Substitute the bike for a horse, the rider for a knight and the young girl for a damsel and you can see how 20th century technology fulfils ancient, archetypal psychological needs.

Related to the need to be heroic and to be admired is often the desire to belong to an elite group. This brings us to the **social-cohesion function** of the car. In pubs, at parties and on other social occasions the car is a popular topic of conversation. The car itself is also a major source of communication. A new car in the street will attract massive neighbour's attention, unlike a bike or washing machine. Throughout the world there are clubs for owners of particular makes of car or motor-cycle. As with medieval orders of knights or religious sects, the members are predominantly men, they adopt emblems and coats-of-arms, and membership often involves lifelong dedication to a specific make or type of car or bike (and its restoration). In extreme cases this can lead to a celibate existence.

Car personalities and the personalities of cars

There is yet another psychological aspect to the car: the process of fusion through which man and car acquire a single identity. One striking phenomenon linked to the car has

been the creation of a new kind of **personality typology** which is largely ignored in the scientific literature but is bread and butter to marketing people. It is quite common to hear people's personalities described in terms of makes of car. For example, 'he's a real Volvo type', 'a typical BMW driver' or 'a Fiat Panda woman'. People also apply the typology to themselves. They think that they suit a certain make or type of car. The car itself also acquires a personality, becomes a companion or even a partner. This is known as '**anthropomorphisation**'. The star of the Herbie films, for example, is a VW Beetle with eyes for headlights, a mouth for a grill, a friendly character and a life of its own. All cars have a face. Car designers are anxious to create individually distinctive faces for every new model in a family of cars, from which every interested car man can tell which car type and year of birth or "facelift" it is.

The driver expresses his emotional bond with the car by talking to it, thanking it, cursing or caressing it, and by feeling guilty for not devoting enough attention to it. Thus the car is even more than a **toy** for old boys, it lives. On the other hand, we can treat our cars as slaves. They will obey and never protest, even if we torture them and treat them without mercy, as is the case in cold winter starts for short trips. Though we might be treated as slaves ourselves at work, in our cars we are the boss.

Hedonism

Not infrequently cars have a kind of **erotic effect** on their owners and on on-lookers. Expressions like 'hot', 'sexy' and 'exciting' are often used to describe them. Certain models, like the Renault Twingo, are cute and cuddly while sports cars often possess

more obvious sexual attributes, such as oval air inlets, huge exhausts, short, racy gearsticks (the ultimate phallus symbol) and wide wings. The macho jargon in car magazines ('nice tail', 'sleek body') leaves the reader in no doubt at all about the intended associations. Indeed, the possession of a car (and in particular certain models) increases the chances of successful seduction and of engaging in 'autosex'.

The car moreover is a means of **self-love** when somebody feels he deserves a big or expensive car to reward himself [for a full life of hard work], a grown-up's way to caress oneself.

Cars and speed as 'speed'

In addition to being an object of desire and vehicle of happiness, the car - at high speed - is also a source of **stimulation for the central nervous system**. The sensation of speed, the sound of the car, the rhythm of the wheels and the continually changing lights and colours induce a trance-like state in some drivers. Many people see driving a car as a form of meditation, feeling at one with the machine. Others are excited by the thrill of speed. Though for many elderly and women driving a car in modern traffic is no thrill at all, the skill of **manoeuvring this complex machine** through demanding and risky traffic conditions is an experience that only modern times can offer to the masses.

The car - and the motor bike - allow the individual to expose himself to exactly the level of danger he wants. It is not an overstatement to say that, at these times, drivers are experiencing a kind of **narcotic effect**, which can produce the same addictive response as more conventional drugs. There is sometimes a very fine line between 'speeding' and

'speeding'! This addiction to speed among some drivers is excellently expressed in the term 'speedaholics'.

Cars and time-structuring

The car also helps to satisfy another fundamental human need: **to structure one's time** - an antidote to boredom, the quest for new excitement and stimulation, driving for the sake of driving. Every Sunday evening, for instance, between 10 and midnight, in Los Mochis, Mexico, half of the local inhabitants cruise around the town, a ritual 'constitutional' on wheels. Business, social or shopping trips can serve the same purpose.

An antidote against vulnerability

Lastly, the car fulfils the human need for **protection and security**. As well as being a second home, the car is also a second skin, a suit of armour that is stronger than our own vulnerable skin - the weakest part of our bodies - which can protect from the perils of the outside world. Familiar, warm and rocking gently back and forth, the car is the adult's womb, albeit a womb of metal. And so, the feminine Peugeot 205 was labelled by its marketeers: "comrade, partner and friend", expressing the emotional protection female drivers may be looking for. Less romantic, during the Yugoslav and Kosovo

crisis the small and overloaded Yugo and Lada cars were the last protection against the cold and the enemy for thousands of homeless refugees.

A device of psychological superiority

Rarely, as our analysis shows, has technology provided a more successful satisfier of basic humans needs and motives than the car and it is very unlikely that the feat will ever be repeated. Neglecting the car's psychological assets, common in transport research, may lead to considerable harm and ineffective political choices. Large investments in either roads or public transport, when primarily based upon economic reasoning and considerations of public acceptability, let alone pressure from the car-industrial-cultural complex, will not contribute to restraint and control. Furthermore, it may prevent the necessary R&D into new behaviour-modifying technologies such as ISA [Intelligent Speed Adaptation] and new forms of road pricing. Public transport is clearly at such a great and insurmountable psychological disadvantage that it can never hope to close the gap on its own.

Interventions

The question then remains, how is man to protect himself against the car when it poses a threat to himself and his environment? A psychologist's answer would be to see the car-man as a predator and the pedestrian and cyclist as its prey. It is up to the latter to devise methods of increasing their freedom of movement - and at the same time reducing their fear - while restricting that of the predatory car. These methods must be

designed to keep the car-man at a distance, because in hand-to-hand combat, the pedestrian would, of course, always be defeated. The following physical and psychological solutions might be effective.

Psychological measures

The use of psychological weapons and methods which would give those without cars greater power. This would involve devising a system of signs and gestures enabling pedestrians and cyclists to clearly communicate their wishes to car drivers, such as 'slow down', 'stop, I want to cross the road', etc. Ignoring these signals would be an offence comparable to driving through a red light. Such empowerment requires changing traffic laws so that the weaker always have priority over the strong and slow traffic over faster, and the introduction of strict civil liability for injury or damage to non-motorised traffic.

Technical measures

These are measures which would make cars (and drivers) less powerful - and therefore less attractive - including speed limiters, ISA and restrictions on engine power and capacity ('vehicle self-control'; Kroon, 1996). Light signals –and aggressive music levels inside cars which cause drivers to speed - should definitely go and be replaced by instruments that give direct feedback on driving behaviour and its effects, such as an econometer or on-board computer, an emission meter and a 'taximeter' giving the total cost per km. Acoustic feedback should be reintroduced by the

introduction of statutory minimum noise levels inside cars travelling at high speed. Finally, very strict CO2 emission limits must bring about the necessary downsizing of all relevant features of modern cars which are not needed for transport purposes such as very high rates of acceleration. Furthermore, since most 4WD and SUV-type of cars are rarely used for their original function as off-road vehicles, manufacturing and purchasing of these particularly environmentally-unfriendly types of vehicle should be severely limited. A first step towards downsizing these non-transport features could be a EU-directive for built-in speed retarders set at 130 km/h, the general speed limit in many countries.

Infrastructural measures

Such measures would be designed to restrict the freedom of movement of the car and to keep it at a greater distance from people. These include speed ramps, cycle tracks and separate lanes on roads for cyclists, and extension of existing car-free zones and times.

Free of charge parking should be limited to rural areas. Decreasing highway speed limits and more effective enforcement of all existing speed limits should be given more political and policing priority, as part of a civil and safe society.

Distributive and fiscal measures

These measures would make the car less attractive than its alternatives. Each car owner could be given a basic kilometre quota per year. If he required more than this he would

have to submit an application or pay a surplus charge. If he used less he would receive a certain amount back in the form of a tax rebate. A differentiated kilometre charge could be a first step towards such a system. Every car would be fitted with a black box, which could also be used as evidence of speeding offences. Tax relief could be given on collective ownership and use of cars. Public transport could offer the option of reserving a place in the train or bus for a season or at certain times providing one's own territory in the train, perhaps with facilities for working while travelling. Reducing business car fiscal benefits is a precondition in countries with high rates of business car sales, such as Sweden and The Netherlands.

Ultimately, these measures result in cars that are slower and less powerful, offer less freedom of movement and less fun, while at the same time travelling on foot, by bicycle or by public transport would become more attractive and safe. People would then be more inclined to leave the car at home. The problem then arises: where are all these cars to be parked? As long as they are outside the front door, abstention will be difficult, given the theory of acceptability/availability, according to which the more acceptable and available something is - like cars, guns, drink or food - the more we will use it. That is why people usually drink more in pubs than at home and why, for example, the use of firearms has reached epidemic proportions in the United States compared with the Netherlands.

As long as the car is under our noses, it is very probable that we will use it more often than is necessary or desirable. It must therefore be removed from the street where we

live and left at a collection point somewhere further away than the shops, school and church, to which we use to travel by car. In short, we must no longer be able to see our mobile living rooms from our homes or our offices, because - being the territorial animals we are - we will always take the road of least resistance and greatest autonomy.

Conclusion

A psychological analysis of the strengths and weaknesses of measures aimed at controlling car use is no guarantee that psychologically effective instruments will be applied. The measures described above would lead to a considerable reduction in car use affecting not only the primary transport function of the car but even more so its psychological functions and values, as described above. Given the mass popularity of the car, the effectiveness with which the values associated with it are protected and the economic and other instruments involved, it would be illusory to expect that in a parliamentary market democracy, decisions will be taken that will have any real impact on these values and interests. Taking into account the above-mentioned motivational assets of cars can also help political scientists to explain the 'automobile voting behaviour' of citizens and politicians alike (an area which has hardly been explored) or, in other words, to establish why politicians pay lip service to measures to protect road safety and the environment while doing their utmost not to set effective barriers to the suffocating use of an ever growing armada of cars.

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**Rij
schoner,
rij 80
in z'n 5.**



van A naar Beter

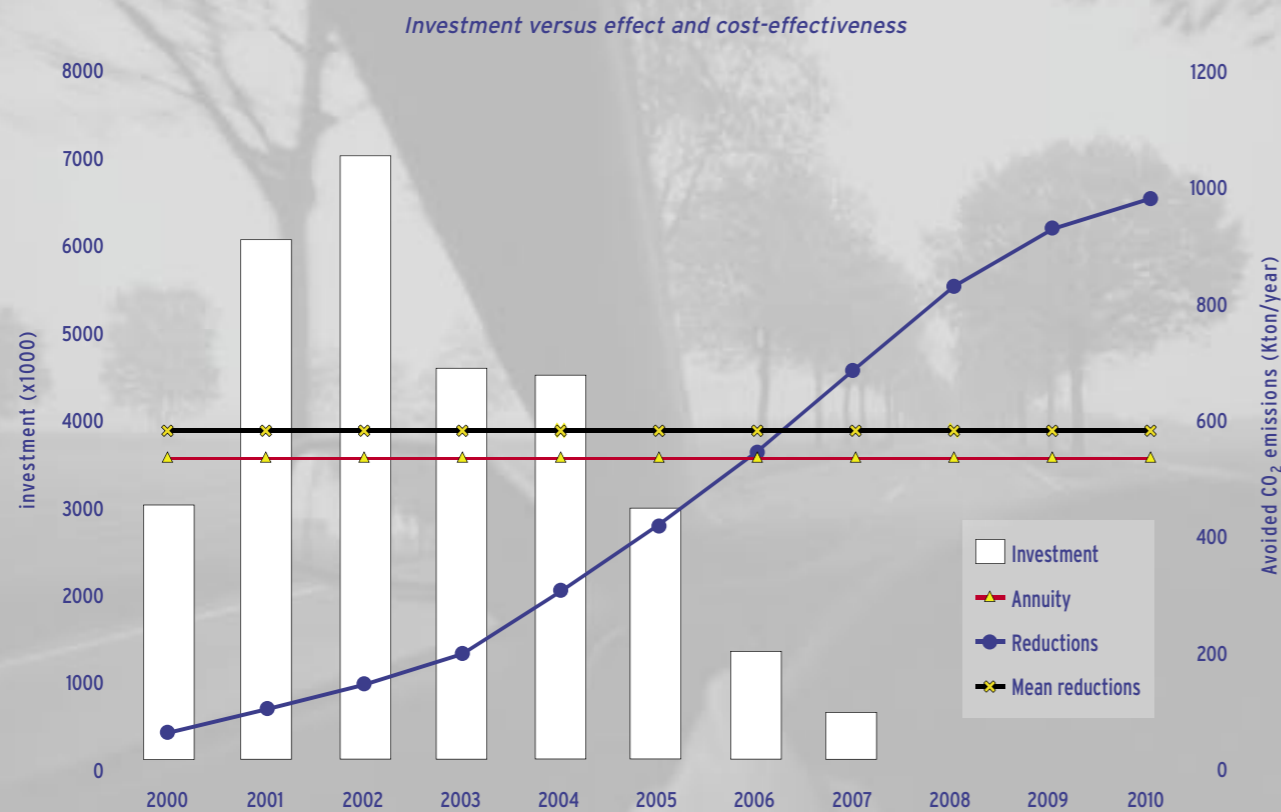
Many projects and actions are being initiated, started and carried out within the programme, in co-operation with a large network of consumer and retail organisations in the transport and car business. The projects result in:

- The number of people participating in the projects (*participation rate*)
- The actual change in behaviour of a person participating in a project or other kind of action (*effectiveness*)
- The reduction rates of CO₂ emissions by changing driving style and purchasing behaviour (*efficiency rates*)

The results have to be adjusted for autonomous developments and other relevant policy measures, which may have an effect on driving behaviour as well. Afterwards the avoided CO₂ emissions and the cost-effectiveness of the programme can be calculated, making use of the monitoring method.

LONG-TERM INVESTMENTS

Because the ECO-DRIVING activities partly concern long-term investments, they keep influencing the CO₂ emissions in the years to come. To relate investments to avoided CO₂ emissions an annuity computation is applied, including an interest rate for the money invested. In using an annuity method investments are spread over a long period of time and compared to the mean avoided CO₂ emissions over the same period of time.



Over a period of ten years the cost-effectiveness of the ECO-DRIVING programme results in € 7 to a maximum of € 4.50 per ton avoided CO₂ emissions.

HIGH COST-EFFECTIVENESS

The results of the Netherlands ECO-DRIVING programme show that it is possible to assess 'hard' data on a 'soft' issue like influencing purchasing and driving behaviour. From a policy point of view it is evident that the government gets value for money by implementing an ECO-DRIVING programme. The implementation of no-regret ECO-DRIVING programmes, along with technical measures, proves to be successful in meeting policy targets on the reduction of CO₂ emissions.

MORE INFORMATION?

More information on ECO-DRIVING programmes, activities and courses may be found on the web sites www.hetnieuwerijden.nl and www.ecodrive.org.



ECO-DRIVING

Highly cost-effective CO₂ emission reductions in the Netherlands



INTRODUCTION

There is a growing interest in ECO-DRIVING programmes throughout Europe. Several European countries have implemented a more or less successful programme. One of these programmes is the Netherlands ECO-DRIVING programme 'Het Nieuwe Rijden'.

Measures to improve car-driving behaviour have the potential for considerable fuel savings and consequently reduced CO₂ emissions from traffic. Governmental policies so far give little attention to such measures though both the EU and UN/ECE, OECD and ECMT have repeatedly concluded that they are potentially effective.

The European Climate Change Programme (ECCP) calculated in 2001 a potential for driver education and ECO-DRIVING of at least 50 Mton CO₂ emission reductions by 2010. This would mean savings for consumers of about € 20 Billion per year. Therefore ECO-DRIVING is a promising low-cost "no regret" option that helps achieving Kyoto targets.

A new style of driving

In the last decades, the engine technology and performances of both passenger cars and lorries has improved rapidly, while most drivers have not adapted their driving style.

ECO-DRIVING is an adapted driving style, which best fits modern engine technology. ECO-DRIVING means smart, smooth and safe

driving at lower engine speeds (1,200 - 2,500 RPM), which saves 10% fuel on average. Without increasing travel time.

Supporting in-car devices

ECO-DRIVING is supported by in-car devices like on-board computers, cruise controls, stop-start systems and automatic tyre pressure check systems.

Benefits

- ECO-DRIVING reduces:*
- fuel consumption (10% on average)
 - vehicle maintenance costs
 - stress
 - noise nuisance
 - local air pollutants
 - green house gasses
- ECO-DRIVING improves:*
- traffic safety
 - comfort

THE NETHERLANDS ECO-DRIVING PROGRAMME

The Netherlands ECO-DRIVING programme 'Het Nieuwe Rijden' results from the Kyoto agreement and from national policy documents targeting CO₂ emission reductions in traffic and transport. The programme concerns a long-term strategy for the period 1999 until 2006, involving about € 20 Million. There already was a long tradition of ECO-DRIVING projects and activities in the Netherlands since 1988. After the Kyoto agreement however, the programme grew to maturity.

The programme is implemented by Novem (Netherlands agency for energy and the environment) on behalf of the Dutch Ministry of Transport and in co-operation with the Ministry of Environment. It aims to motivate (professional) drivers and fleet owners to purchase and drive passenger cars, delivery vans and lorries more energy-efficiently. The programme creates conditions and organisational and logistic structures to achieve CO₂ emission reductions.

The programme co-operates with over 20 consumer and retail organisations, mainly in the transport and car business. These organisations have signed an agreement to implement ECO-DRIVING activities. Among these organisations are the Royal Dutch Touring Club (ANWB), the Dutch Consumer Association (Consumentenbond) and the Dutch Association of Car Importers (RAI-Vereniging). These organisations are best fitted to address the target groups with the ECO-DRIVING mission.

CONTRIBUTION TO POLICY TARGETS

The Netherlands ECO-DRIVING programme has proven to realise substantial reductions in CO₂ emission and to contribute to Environmentally Sustainable Transport. It also has shown to have positive effects on other important policy issues like road safety, traffic noise nuisance and stress. The Dutch ECO-DRIVING programme is to be evaluated annually. Until 2010 'within national borders' the programme must result in the avoidance of about 1 Mton CO₂ emissions per year. This means that over a period of ten years the cost-effectiveness of the programme results in € 7 to a maximum of € 4.50 per ton avoided CO₂ emissions (see 'long-term investments' as well). In plain English this means that the avoidance of 1 ton of CO₂ emissions through the ECO-DRIVING programme costs less than € 7. Additionally the programme achieves CO₂ emission reductions abroad as well. These reductions however are not included in the calculations.

ISSUES ADDRESSED BY THE PROGRAMME

The Netherlands ECO-DRIVING programme addresses the following issues: 1. Driving style of (professional) drivers 2. Driving school curriculum 3. Fuel-saving in-car devices 4. Tyre pressure 5. Purchasing behaviour (e.g. car labelling). Important elements of the programme are also international co-operation, communication and evaluation and monitoring. The Netherlands ECO-DRIVING programme is already involved in several joint international projects and the number of international activities is growing, e.g. collaboration with new accession countries in Central and Eastern-Europe.

Driving style recommendations

1. Shift up as soon as possible. For petrol/LPG cars at a maximum of 2,500 RPM, for diesel cars at a maximum of 2,000 RPM.
2. Maintain a steady speed, using the highest gear possible.
3. Look ahead as far as possible and anticipate to surrounding traffic.
4. When you have to slow down or to stop, decelerate smoothly by releasing the accelerator in time, leaving the car in gear.

COMMUNICATION AND MARKETING

The programme is supported by a corporate communication and marketing strategy, which stresses individual benefits and hedonistic elements, such as safety, comfort, fun of driving and cost reductions. Energy savings and CO₂ emission reductions come as a side effect with the individual benefits. In communication and marketing ECO-DRIVING is presented as the driving style for the 21st century, the driving style, which best fits new engine technology.

EVALUATION AND MONITORING

The aim of the Netherlands ECO-DRIVING programme is to reduce CO₂ emissions. The calculations for the estimated reductions in CO₂ emissions are done with a specially developed monitoring method. The premises

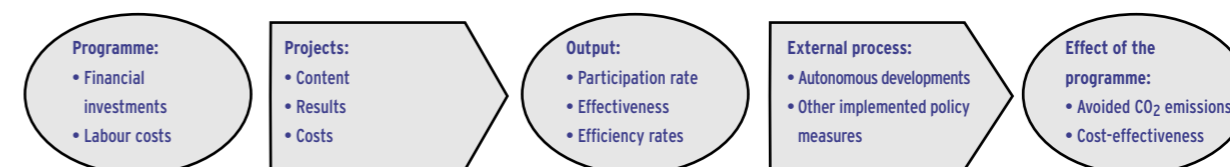
Some achievements and aims of the Netherlands ECO-DRIVING programme

- More than 90% of the Dutch driving instructors and examiners (6,500) were trained in ECO-DRIVING
- ECO-DRIVING is already part of theory exams for driving instructors, examiners and learner drivers. Shortly ECO-DRIVING will also become part of practical exams.
- The ECO-DRIVING programme aims at the standard equipment of all newly sold cars in the European Union with fuel-saving in-car devices such as on-board computers and cruise control.
- A large mass media campaign (a/o TV, radio and

print) starts in 2004, mainly focussing on private car drivers.

- Aim of the campaign is to stimulate car drivers to apply the main driving style recommendations.
- The programme co-operates with a large network of consumer and retail organisations, mainly in the transport and car business. These organisations actively promote ECO-DRIVING to the target groups.
- A certification and education system has been set up for ECO-DRIVING trainers.
- The number of providers of ECO-DRIVING courses as well as the variety of courses have increased significantly since 2001.

of this method have been approved by the Dutch Governmental Institution on Environment Protection RIVM (Rijksinstituut voor Milieuhygiëne). The monitoring method is an essential tool in a step-by-step evaluation process:



The evaluation process of the ECO-DRIVING programme

DOWNSIZING POWER AND SPEED, THE SAFE ROAD TO FUEL ECONOMY, ROAD SAFETY AND SUSTAINABILITY

paper for the Safety of Transportation Congress, Delft 1998

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SUMMARY

The power and speed of cars, trucks and motorcycles are unnecessarily high. Enforcing motorway speed limits and setting lower speed limits are effective instruments for reducing fuel consumption and emissions and improving road safety. The trend towards more powerful engines and higher performance must be halted if the desired reduction in CO₂ emissions and the desired improvement in fuel efficiency and traffic safety are to be achieved. Specific power ratings need to be halved at least and performance levels need to be reduced substantially if future vehicles and traffic are to be "sustainable". The "Car of the Future" can embody every reasonable consumer feature such as interior space, comfort, safety and image profile, but - to be sustainable - its engine power, performance and weight need to be reduced. Putting "less of the same" into a new generation of vehicles - instead of putting more (technology toys and performance) into them - is a promising, safe and cost-effective route towards real fuel economy, safety and sustainability.

Introduction

Traffic is one of the main causes of the most serious environmental problems world wide, such as acidification, photochemical air pollution, climate change, local air quality and noise levels. When assessed against the criterion of "sustainable development" introduced by the Brundtland Commission and in the light of the concepts of sustainability and safety [1], and given road traffic's total dependence on oil, the current transport system is clearly environmentally *unsustainable*. Above all, growth is the problem. Assuming that the number of vehicles will rise to over one billion worldwide within two decades, and taking into account its contribution to CO₂ emissions and the referring to the Kyoto agreement, the consumption of oil by the Transport sector will have to fall sharply. In addition to curbing car use - an illusion at current fuel prices - the only effective measure is a forced decline in the average fuel consumption per vehicle per km of at least 50% between now and 2010. This seems a feasible target if technical vehicle improvements are geared more towards fuel efficiency instead of upgrading power, performance and weight and if, at the same time, driver behaviour could be guided towards fuel efficiency and away from speeding and strong acceleration. Recent research projects in the Netherlands show that a combined approach of downsizing power and speed, enforcing speed limits and in-car guidance of drivers' behaviour can achieve a 50% reduction target. How can this be integrated into future road safety and environment policy?

Speed, emissions, fuel consumption and other vehicle characteristics

Speed kills. But what is the effect of speed to the environment? It is widely known that fast driving speeds up fuel consumption. Nevertheless, little is known about the overall environmental and fuel efficiency effects of reducing vehicle speeds in various degrees through enforcing and lowering speed limits in various ways. This question has been targeted in a recent research project in the Netherlands into the costs and benefits of speed limit enforcement and of reducing speed limits [2]. Reducing speeds through strict enforcement or through introducing intelligent, in-car speed-retarding systems

and downsizing the performance levels of cars will yield large benefits to society at large. Up to 1% of GNP could be saved, according to this study, if speed limits are fully enforced and optimised to their maximum effectiveness, giving overall CO₂ emission and fuel consumption reductions of up to 30 % and risk reductions of up to 40 %. Thus current Dutch climate change policy target for passenger cars (CO₂ :-10% by 2010) could be achieved by enforcing and lowering speed limits alone. Table 1 shows the potential effects of these approaches.

Table 1: Direct and indirect effects of lower speed limits and optimised enforcement

Parameters Base index	Base = current limits (1995)	Improved enforcement	Optimum in-car enforcement plus lower speed limits	
			Average	High
VMT	100	94	91	86
Energy	100	89	79	68
CO ₂	100	89	79	68
NO _x	100	85	64	48
Casualties	100	85	83	73
Fatalities	100	79	75	60
Travel time	100	99	99	98

The connection between vehicle design and speed on the one hand and emissions and fuel consumption on the other has been examined in detail [3], showing the following correlations (though exceptions occur in practice). In so far as these lead to avoidable effects (extra emissions or fuel consumption), they should be given priority in abatement policies designed to achieve optimum cost/benefit ratios.

- A. *Vehicle weight ---- fuel consumption/CO₂ emissions*
Large, heavy cars consume more fuel than small, lighter ones. Heavier vehicles require a higher power output for the same performance, especially when accelerating and under urban driving conditions
- B. *Cylinder capacity/power/performance ---- fuel consumption/CO₂ emissions*
Cylinder capacity, maximum power, acceleration capacity, top speed, and, above all, the specific power rating (kW/kg) are significant indicators for fuel consumption and CO₂ emissions. The largest engines and highest power and performance ratings tend to be found in the heaviest vehicles. High-powered (petrol) cars consume more fuel - other things being equal - than those with smaller engines.
- C. *Speed ---- fuel consumption/CO₂ emissions/NO_x emissions*
Above about 60 - 70 km/hour, fuel consumption, CO₂ emissions and NO_x emissions increase. Above about 80 km/hour in the case of goods vehicles and about 100 km/hour in the case of private cars, the increase begins to rise faster on account of the increase in air resistance. On average, a modern 1,100 kg car requires a power output of less than 30 kW to travel at 120 km/hour.
- D. *Driving habits ---- fuel consumption/CO₂ emissions/ other emissions*
Consumer surveys and car tests show that the difference in fuel consumption between a "racy" and an economical driving style can be over 40%.
A "racy" or "aggressive" driving style with frequent accelerations and braking also causes a sharp and even extreme increase in CO, C_xH_y and NO_x emissions.
- E. *Speed ---- accidents and fatalities*
Accident frequencies and fatality rates increase more than proportionally when speed levels increase, especially above a given speed limit. Passive safety features such as crush zones are most effective at lower speeds that triggered their design. The so-called safe German

Autobahns without a general speed limit, are twice as unsafe as the Dutch highways with a mixed speed limit system of 100/120 km/hour.

The above shows that there is a significant causal relationship between fuel consumption, CO₂ emissions and emissions of NO_x, CO and C_xH_y on the one hand and vehicle design features such as weight, specific power, performance, and behaviour patterns (speed and acceleration) on the other. TNO Motor Vehicles Test Lab concludes that **optimum speed**, with the lowest emissions and fuel consumption, is between 60 and 80 km/hour for goods vehicles and between 70 and 90 km/hour for private cars. Thus, reducing the power and speed of vehicles is highly effective in attaining environmental as well as road safety goals.

Road safety: the hidden power > risk paradox

In the USA a fierce battle has been going on concerning the (assumed) lack of safety of small and fuel efficient cars in connection with the possibility of achieving further energy savings by means of body downsizing [4]. As regards *passive safety*, there is indeed a general statistical connection between vehicle weight and risk. But accident statistics do not prove that large, heavy cars are intrinsically safe. Collision tests and statistics from, inter alia, the US Highway Loss Data Institute (HLDI) and the Swedish Folksam [5] prove that in practice it is not weight or size that determines risk, but the quality of the safety structures and, above all, the vehicle's "character" in terms of (too much) power, performance, roadholding and "macho" image. Vehicles in the same weight class perform very differently in both collision tests and accident statistics. In German statistics the highest risks occur not only in the structurally unsafe category of very small cars (minis) designed in the 50s and 60s, but also in the category of the latest fast sports cars, with twice the weight, such as the Audi Quattro and BMW M3.

What is the reason for this?

The *active safety* of private cars has increased significantly in recent decades thanks to improvements in vehicle design. In this connection, a paradoxical phenomenon, which can be explained in terms of *compensatory behaviour*, occurs: the so-called "*ABS effect*". German experiments revealed that, contrary to expectations, a disproportionate number of cars with an anti-blocking system were involved in accidents. Apparently, the perception of extra safety removes inhibitions characteristic of a safe, defensive driving style. Available insurance statistics [5] show that cars with perfect road-holding and a high power rating are involved in accidents to a disproportionate degree, especially sports cars and Mercedes, BMW and SAAB models, which achieve high scores for both active and passive safety. In the USA, the two-door (first generation) SAAB 900 - usually a Turbo - has been found to be three times as unsafe for its drivers as the four-door model, whereas the passive safety of both is the same. In conjunction with specific driver characteristics such as age (young) and sex (male), this aspect resulted in recorded risk variations in the USA of up to 800% within the same weight category (see table 2).

The obvious conclusion is that, in the case of fast cars, design features (such as character, performance, perfect active safety features, airbags and sophisticated crash testing) in conjunction with psychological factors, such as overestimation of one's own abilities and risk compensation, lead to a high level of *active unsafety*. Since the new car fleet average top speed is now up to 190 km/hour, this phenomenon is true for all cars except real minis.

Indeed, some cars must be regarded as "killers", especially large and heavy cars (such as 4WD and pick-ups) and "muscle cars". Taking into account the not monitored fate of "collision partners", any car's risk profile should include accident frequency and active unsafety as well as risk and crash test figures. Furthermore it must be noticed that specific car model risk statistics vary considerably over time and place. For example, the Volvo 240 or Mercedes 200 series perform less well in Australian risk ratings than in the US ratings.

It is therefore disappointing that HLDI and the US Insurance Institute for Highway Safety completely ignore these hidden risk factors and wrongly proclaim vehicle size to be the best safety guarantee ("buy big").

Table 2 Accident risk within size classes.

Type	risk of death	accident frequency
Average	1.0	100
Mercedes S	0.9	160
Cadillac Fleetwood	1.0	87
BMW 520	1.0	157
VOLVO 240	0.5 - 0.8	91
VOLVO 740	0.7	88
SAAB 9000	0.5	135
SAAB 900 4D	0.6	143
SAAB 900 2D	1.9	178
Porche 944	2.2	very high
Nissan 300 ZX	4.0	very high
Corvette	4.7	very high
VW Jetta	1.1	93
VW Golf	1.5	130
Golf GTI	1.5	164
Mazda 323	1.9	100

Source: HLDI statistics 1985 - 1989 (USA)

Trends in vehicle performance, market segments and car culture

On the basis of the correlations described above, a review of recent developments can help to indicate the necessary remedies. After a century of development, the car has been perfected technologically, with enormous improvements in user friendliness, comfort, handling, safety, performance, costs and emissions. In every respect, the car is big business and in many industrialised countries it accounts for over 10% of GNP. The dominant impact of this industrial product on our streets, the economy, activity patterns, our culture and emotions cannot be explained in terms of economic and demographic factors alone. A study of the factors determining car ownership, car use and driving habits [6] shows that "intrinsic" (affective) motives, connected with life style, satisfaction of emotional needs and cultural trends, have a major influence on motorists' behaviour and, consequently, on vehicle design and road safety.

Viewing the subject from a psychological angle, Sachs and Diekstra [7] show how the car fits in perfectly with the **factors determining behaviour**: the need for security and a territory; auto-regulation; anthropomorphisation; the need for physical power, heroism and social superiority (chivalrous competition); the desire to be different and project an identity; and the need to experience risks (neurotic stimulation). Car design and the irrational aspects of the car system cannot be properly understood without taking these unconscious motives into account. The usual concepts of status, freedom and privacy do not provide an adequate explanation. Being aware of these motives, one can notice how they work out in our culture and in political decisions that relate to cars, fuel prices or the car industry. Indeed, no other industrial product offers so much satisfaction for so many desires.

In recent decades, almost unnoticed [8], it has become customary for each new car model to be faster, more powerful, larger and heavier than the last model in its own range. As a rule, cars are distinguished by their exact place in a hierarchy that is strictly dictated by dimensions, engine capacity, power, performance and image profile. The technological, psychological and economic developments of the car market are expressed in various forms of *upgrading*, which are part of the car culture and our spending patterns, and which counteract fuel efficiency:

A. *All cars are getting larger and heavier.*

Every model change since WW II proves that there is a law of continuous upgrading, due to the competition between car manufacturers, designing towards offering more than the current models or competitors in class. The interior space and the weight of the average European and Japanese car in each model range is now at the same level as that of the range above in the 1970s. The VW Golf Diesel body weight increased from 830 kg (model 1) to 1130 kg (model 4). The new Mazda 626, BMW 5 series and Mercedes S are the first exemptions, offering more interior space and performance with less size or weight than their predecessors.

B. *All cars are getting faster.*

Current small cars have the same performance as medium-range models 25 years ago, while medium-range models have the same performance as sports cars 25 years ago, and sports cars have the same performance as racing cars 25 years ago.

The proportion of affordable cars with a top speed of over 200 km/hour is soaring, thanks to turbos, four-valve cylinders, more swept volume and power output and low air resistance. It is not so much the upgrading in the top range that is striking, but that in the bottom and medium ranges. The average European family car now has a higher performance rating than the renowned Mini Cooper S or the SAAB 850 GT, with which Eric Carlsson won the toughest rallies in the 1960s.

C. *The number of models and variants is steadily increasing, as is the use of accessories that increase fuel consumption, such as air conditioning, tuning sets, and wide tyres. Uneconomical models such as Jeep-type vehicles, Pick-ups and MPVs are increasing their share of the market. Turbo-DI diesels offer petrol-level performance, and low powered variants (2CV, R4) have disappeared anyway. The number of engine variants (in cm³ and kW) and performances levels for each model range have dramatically increased. The result is a dynamic and more enticing range of models, with (upward only) variations in power, comfort and accessories to suit every taste. Publicity is generated by means of a massive multimedia campaign, with the trend being set by car magazine journalists, who, in their professional capacity, come into contact almost exclusively with the fastest cars.*

D. *Motorists are buying ever larger, faster and more expensive cars.*

The sale of large cars and model variants with a high power rating and fuel consumption is of great commercial value: more is earned from these cars than from smaller or simpler versions of the same model. For instance, the basic VW Golf or Mercedes E or S is about half the price of the 1996 top versions.

For many motorists, each car they buy is larger and faster than the last.

Effects of upgradings

A comparison between European car models today and those of 10, 20 or 30 years ago in terms of power ratings, fuel consumption and performance shows that nearly all the progress in engine technology and efficiency has led almost exclusively to an increase in top speed and acceleration. From the standpoint of global warming, energy conservation and road safety, these trends are all in the wrong direction. The upgrading of the vehicle fleet has ensured that in most OECD countries the average fuel consumption of new (petrol-engined) cars has ceased to decline, after falling continuously since the first oil crisis. As a result of engine and materials technology and of lower air resistance, the performance of new car models will steadily increase, and at the same time they will become slightly more economical at constant speeds (by an estimated 1% per year) but not in practice.

The Kyoto CO₂ reduction targets and the energy conservation targets of most OECD countries will nevertheless not be achieved, if these trends are to sustain. Forecasts of transport CO₂- emissions in OECD and ECMT countries tend to show large increases rather than reductions or a standstill [9]. In a word, sustainable development remains unachievable within current "laissez-faire" approaches that do not address upgrading and performance.

As far as road safety and driving habits are concerned, the future looks even less rosy. Add-on (passive and active) safety features increase weight and offset part of the efficiency gains. Road network speed levels and driving dynamics have risen sharply in just a few decades. Speed limits in the Netherlands are exceeded during a third of the total mileage driven and the problem of overall and effective enforcement seems insoluble on the basis of current priorities.

Attempts to improve driving habits by the "soft" means of information, education and public campaigns will remain virtually ineffective as long as performance continues to provide the wrong behavioral "stimulus configuration". Assuming that the intrinsic and affective motives [Diekstra], or the quality of the infrastructure, cannot be influenced in the short term, a reduction in the potential speed of vehicles is an absolute prerequisite for achieving speed reductions. Thus, since driver self-control is becoming increasingly difficult to achieve voluntarily, one must think of "vehicle self-control" [10].

Limitation of speed, power and performance

Significant reductions in fuel consumption and CO₂ emissions per vehicle require not only best available technology but also the limitation of the top speed and - even more - the limitation of acceleration capacity by means of reducing power output and power-to-weight ratios. These ratios need to be reduced by at least 60% in every vehicle class to enable CO₂ emissions to be halved in the medium term despite a moderate growth in car use. In addition, weight reduction will remain necessary to compensate for the effects of the growth in car use. This would require a structural shift in the market so that the share of compact cars increases at the expense of cars weighing over 1,000 kg. The use of large capacity engines of over 2,000 cc or 100 kW would not be appropriate any more. Specific power ratings would have to fall gradually to under 3 kW/100 kg.

Reducing absolute speed in all traffic conditions and collisions and reducing the frequency of overtaking behaviour will reduce both accident frequencies and fatalities dramatically!

Technologically, engine and performance downsizing is not a problem. The motor industry is quite capable of designing vehicles which meet modern safety and comfort requirements while being extremely economical in terms of fuel consumption (3 litres/100 km). On the basis of the performance level of popular diesel-powered cars from around 1980, such as the VW Golf and Mercedes 200D, the average fuel consumption can be halved if - using the best technology available - driving habits improve and the average vehicle weight declines.

*The semi-sustainable European medium-range (Golf class) petrol-fuelled car in the year 2000 geared to a low fuel consumption, could have following characteristics:
length: 4 metres; 4/5 seats; weight: <800 kg; engine capacity <700 cc; variable valve timing and/or compressor for high torque at low rpm; fully electronic engine management and intelligent transmission; top speed: <140 km/hour; 0-100 km/hour >20 seconds; 3 l/100 km fuel consumption. A fuel consumption computer ("economy-meter" or "black box") will optimise driving habits and save an extra 5% fuel.*

Policy consequences

How can current trends be reversed, given that fierce competition, low oil prices and the dominant car culture force manufacturers to participate in the race to constantly upgrade car models? What role can governments play in rolling back current upgrading and in downsizing power and speed? How can car manufacturers and retailers be brought to develop and sell fuel-efficient/low-powered cars that they do not believe to be profitable under current market conditions? And how can consumers be brought to purchase cars which they feel do not meet their basic needs as far as power, performance and image are concerned? One thing is for sure: those cars will not sell on the basis of current market preferences.

The first political statement in this direction was made by the European Conference of Ministers of Transport (ECMT). In their resolution of 21 November 1991, they came out unanimously in favour of limiting power and performance ratings for all categories of vehicles in the interest of road safety, environmental protection and energy conservation. The ECMT's call is also directed at the OECD, ECE and EU. More recently, in its communication on "A Community strategy to reduce CO₂ emissions from passenger cars and improve fuel economy", the European Commission finally acknowledged the role of upgrading and the need for reducing power and weight. The Commission under-lines the need

to encourage fuel efficiency through fiscal incentives, but unfortunately it fails to identify engine downsizing and in-car feedback instruments as a "no regret" approach. The question therefore needs to be addressed: what single or combined measures should be taken to achieve the "downgrading" of market trends and the downsizing of power and performance? Four different but related approaches can be distinguished:

- A) social-psychological instruments, such as communication and education;
- B) fiscal and economic incentives;
- C) covenants or voluntary agreements with manufacturers;
- D) (international) regulations, directives and standards.

A brief survey of these different instruments suggests that instrument A) cannot be considered effective, given current market preferences and "auto-cultural" values. The measures under B) and C) are favoured as an alternative to D) and can be highly effective once industry supports a target or a deal. But this will not happen in the foreseeable future, given current market preferences and the low oil prices and the promise of abundant future supplies, at least in the medium term. Thus the regulatory approach seems inevitable if politicians have the courage to promote stricter fuel efficiency and road safety at the expense of the current emphasis on performance. However, even if this were to happen, we should not harbour any illusions about the resistance which limiting the power-to-weight ratios or performance of cars will provoke. The "car-industrial-cultural complex" is likely to prevent any such approach from being embodied in directives until serious oil crises arrive. It must be concluded that it is the car industry that holds the key to any effective implementation of downgrading, be it voluntary or regulatory. In view of Kyoto and the long way to go, the first steps should now be taken by the OECD and EU member countries towards a comprehensive set of measures, starting with "no regret" measures and shifting to more unpopular and painful ones, as set out below:

- A. Tax measures should be introduced to encourage purchase and ownership of compact and economical cars and discourage purchase and ownership of powerful, heavy and uneconomical cars. Such measures are currently being prepared in the Netherlands.
- B. CO₂ emission standards and fuel consumption standards should be formulated for relevant vehicle size classes, and regularly tightened up. CO₂ standards need to prevent market reactance to upgrading, so fleet-average efficiency standards need to be incorporated as well. Standards can be set voluntarily or by EU directives.
- C. Econometers, board computers and cruise control devices should be fitted as a standard in-car instrument that supports drivers in safe and fuel-efficient driving.
- D. Speed limits should be enforced continuously and effectively so as to reduce real vehicle speeds and to improve driver's awareness of speed and fuel consumption. Current speed limits should be lowered to the levels where total costs/benefits to society are optimal: 90 or 100 km/hour on highways (LDV only; HDV: 80 km/h).
- E. Speed limiters should be fitted not only to goods vehicles and buses but also to motorcycles, private cars and delivery vans, as a transitional measure towards the limitation of power ratings in all vehicles.
- F. Power-to-weight ratios and the performance of passenger cars, motorcycles and, to a lesser extent, goods vehicles and buses should be limited within a tiered stepping-up time table for 2000, 2005, etc.

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Monitoring and evaluation of behavioural programmes

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Introduction

There is a growing need for government programmes that aim at changing consumers' behaviour to monitor the output of activities. In assessing programme resources, activities and objectives systematically, government interventions can be evaluated and adjusted periodically. In this paper we show how the results of behavioural programmes can be assessed by the application of monitoring methods. We will discuss the development and construction of a monitoring method. The importance of monitoring government programmes is stressed with regard to long-term policy making and review. The Netherlands ECO-DRIVING programme 'Het Nieuwe Rijden' is used to demonstrate how monitoring and evaluation of behavioural programmes can be performed.

The Netherlands ECO-DRIVING programme

In the Netherlands the Ministry of Transport together with the Ministry of Environment initiated the ECO-DRIVING programme 'Het Nieuwe Rijden'. The programme is implemented by SenterNovem, an agency of the Ministry of Economic Affairs, in co-operation with a large number of consumer and retail organisations. The programme's main objective is the reduction of CO₂ emissions. It aims at influencing driving style, checking tyre pressure, car purchase and the use of in-car devices.

The programme activities and results are being evaluated on a yearly basis. For this purpose a monitoring method has been developed. It comprises sets of indicators and measurement procedures for data collection as well as computational and decision rules for the assessment of behavioural effects and the overall evaluation of the programme.

Why monitoring?

The general objective of monitoring relates to 'quality' and 'control' of the processes that are being monitored. It implies that monitoring relates to the policy making process. In fact,

Why monitor behavioural programmes?

There are several strategic reasons for monitoring behavioural programmes:

1. These programmes are often characterised by long-term objectives and activities. They combine sizeable and structural investments with several packages of programme activities. The ECO-DRIVING programme for example, lays the foundation for a substantial reduction of CO₂ emissions in the long term.
2. Behavioural programmes function in a highly complex environment. They involve many stakeholders such as consumer and retail organisations.
3. The programmes focus on behavioural change. Behavioural change relates to many factors. Often, there are uncertainties about the persistence of the behavioural effects. By monitoring, a clear understanding of these effects can be obtained.

In monitoring the ECO-DRIVING programme consistently, SenterNovem was able to prove the effectiveness of the programme. Consequently policy makers approved a continuation of the ECO-DRIVING programme.

monitoring can be seen as a tool in guiding management. Monitoring not only provides insight into the processes under study. It points out possible problems as well. In case an intervention turns out not to have the desired result, it is possible to make timely adjustments. Monitoring provides information about the progress of policy implementations. It is a means to account for the cost-effectiveness and efficiency of policy interventions ('Is the money well spent?'). It allows outcomes of government programmes to be evaluated at different levels; i.e. outcomes of project activities and the overall outcome of a programme. Monitoring information can be used for communication purposes as well.

Monitoring methodology

In general, developing a monitor will comprise the phases shown in Figure 1.

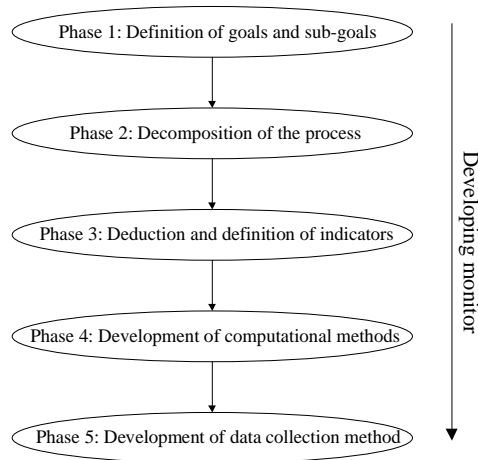


Figure 1: Phases in constructing a monitoring method

Phase 1: Definition of goals and sub-goals

In the first phase, the main goal and sub-goals of a government programme have to be stated. The goals serve as guidelines in determining the foci and the scope of the monitoring method and how the monitoring is to be performed. It depends on the nature of the information, the setting in which the information is to be obtained, and the state of knowledge.

Phase 2: Decomposition of the process

In the second phase the process under study is decomposed into several components that are logically ordered in time. The following components are distinguished:

- input
- policy process
- output
- external process
- effect

‘Input’ denotes financial resources and labour requirements of a project or a programme. ‘Policy process’ refers to administrative processes in which decisions are being made about the organisation and implementation of programmes. ‘Output’ refers to programme instruments such as communication activities or measures that influence behaviour. ‘External process’ denotes factors that influence the results (effects) of a programme, such as general economic growth or activities of other organisations. By definition, the programme has no influence on these factors. They can have however a positive or negative impact on the programme results. In assessing the effects of a programme one has to check for these external influences.

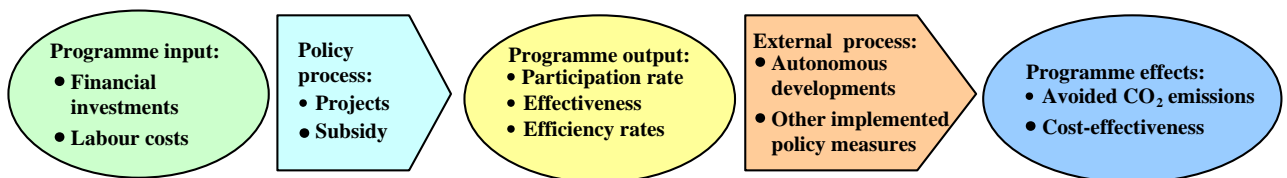


Figure 2: Components of the ECO-DRIVING programme

Phase 3: Deduction and definition of indicators

In the third phase, indicators are constructed that represent the different components of phase two. Indicators are defined for ‘programme input’, ‘policy process’, ‘programme output’ and ‘programme effects’. For example, one can measure the input by the amount of money spent. In case a programme targets improved road safety, the number of car-accidents might be a

good candidate for measurement. In monitoring indicators, the effects of each intervention are analysed, as well as the combined effects of any interactions between them. One general indicator that is used to determine the effectiveness of the programme in relation to the investments made is the cost-effectiveness of the programme.

Indicators of the ECO-DRIVING programme

For ECO-DRIVING two effect indicators are defined to monitor the overall result of the programme:

- *Avoided CO₂ emissions* (in tons per year) represents the annual amount of CO₂ that is not emitted as a result of the programme activities;
- *Cost-effectiveness* relates the total costs (subsidies and labour) of the programme to the amount of avoided CO₂ emissions.

Phase 4: Development of computation methods

In the fourth phase the computational method is developed. It depicts how to quantify the indicators of phase three. Computational methods can be aggregate or disaggregate. In the first approach one measures the overall effect of the programme thereby controlling for the influence of external factors. In the second approach the effects of all programme activities are quantified separately and added into a composite or overall measure of change.

The way avoided CO₂ emissions are computed is illustrated by a project concerning the training of driving school instructors and examiners in 2002 and 2003. The main objective of this project was to incorporate ECO-DRIVING in driving lessons and exams for novice drivers.

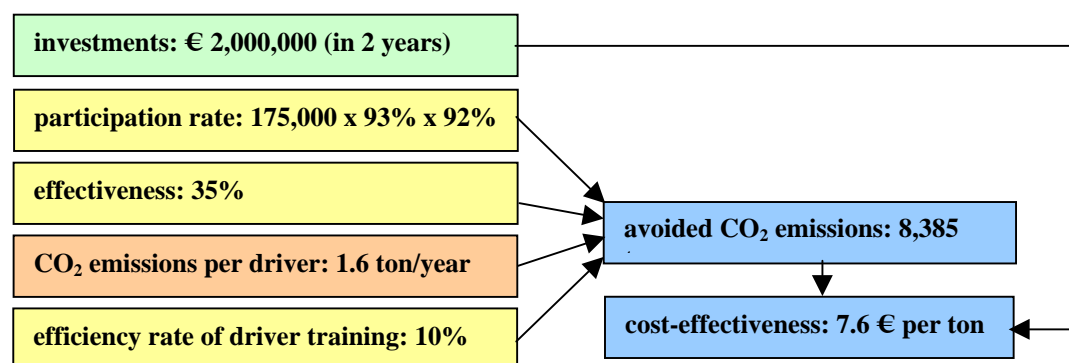


Figure 3: Application of the evaluation and monitoring method

A significant majority of the driving instructors and examiners was trained (6,500 out of 7,000 in total is 93%). Many trained driving instructors will teach novice drivers the main ECO-DRIVING principles as well. According to an inquiry 92% of the trained driving instructors stated that they would incorporate ECO-DRIVING within their driving lessons. Annually about 175,000 novice drivers pass the driver's license exam. The investment amounted to € 2,000,000 in two years. The percentage of novice drivers that will apply the ECO-DRIVING style was assumed to be 35%. The average amount of CO₂ emissions from a typical novice Dutch driver equals 1.6 Ton per year. Based on the results of several field experiments, it is assumed that CO₂ emissions will reduce by 10% if car drivers apply an ECO-DRIVING style instead of applying a usual driving style. Therefore the efficiency rate equals 10%. By means of these figures the avoided CO₂ emissions and the cost-effectiveness could be computed (see both the figures 3 and 4).

The cost-effectiveness is a relevant indicator that relates the investment to the effects. Because government programmes that aim to change consumers' behaviour are typically investments for the long-term, these programmes also influence the behaviour in the years ahead. For ECO-DRIVING this is shown in figure 4. To relate investments to avoided CO₂ emissions, an annuity computation is applied. In using this method investments are spread out over several years and compared to a mean amount of avoided CO₂ emissions in the same time period.

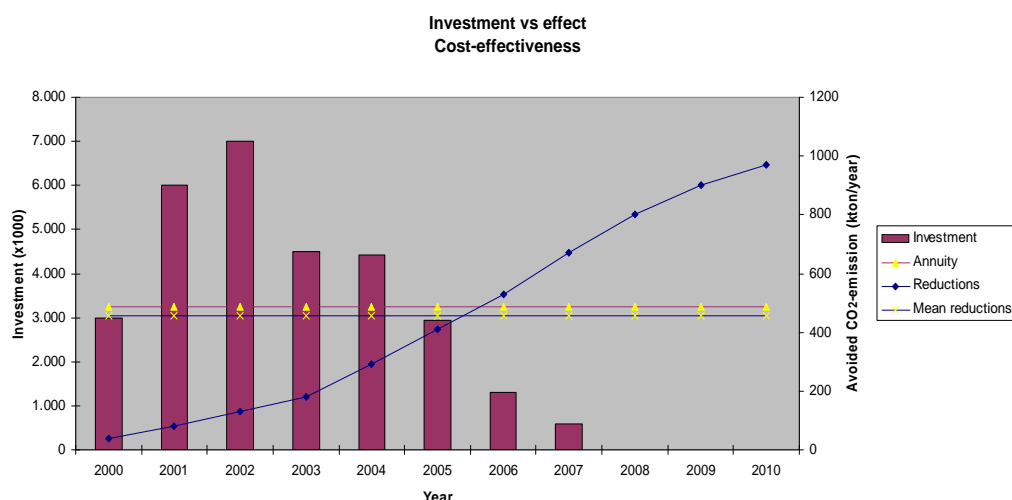


Figure 4: Investment versus effect: the cost-effectiveness of a programme

In computing intervention effects, a number of assumptions have to be made. For instance, with regard to the average CO₂ emissions of motorists (in tons per year), the effectiveness of driving style training, the persistence of behavioural effects over time and the degree in which consumers are effectively reached by communication

Evaluation of the Netherlands ECO-DRIVING programme
 In the past four years the Dutch ECO-DRIVING programme has been evaluated. The evaluations resulted in extended information about programme effects and about the different activities that had been performed. The programme is already widely known by the Dutch people. The number of people that are familiar with the programme increased up to 26% in 2003, compared with 18% in 2000. In 2003, 172 kTon CO₂-emissions was avoided as a result of programme activities. In 2003 therefore, the cost-effectiveness was at the height of 7 Euro per avoided Ton CO₂ emissions.

activities. Assumptions are based either on scientific research results or on expert opinions. Especially with regard to the policy making setting it is important to clarify any underlying assumptions.

Phase 5: Development of data collection method

In the final phase empirical information is collected. In this phase it is decided what data are actually needed to quantify the indicators of interest. Information can be retrieved from several sources:

- Project documents provide information on programme inputs and on project activities.
- Interviews with people involved with the programme implementation, such as programme managers.
- Large-scale surveys provide information about consumers.
- Research.

Conclusions

There is clearly a need for political justification of governmental programmes that are essentially non-technical and from which so-called ‘soft’ measures arise. In applying a monitoring methodology and performing intervention analyses policy makers can get a pretty clear image of the cost-effectiveness of programmes that aim at changing consumers’ behaviour. By systematically assessing programme resources, activities and objectives interventions can be evaluated periodically and adjusted. As many factors are involved in behavioural changes, it can be difficult to determine these actual results from programme activities. The experiences with monitoring and evaluation of behavioural programmes in the Netherlands can be used for behavioural programmes in other countries as well.