Police enforcement: A European evaluation

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Police enforcement: A European evaluation

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Abstract
The knowledge on the effectiveness of police enforcement, its practices and interactions with other behaviour influences on road safety is reviewed from an European perspective. It is shown that after the beginning of the seventies our knowledge, both on the relation between specific behaviours and safety as well as between police enforcement and these behaviours, increased markedly. Also the interrelations between enforcement, societal norms, behavioural habit formation as well as effects of punishment and rewards are discussed. Optimal police enforcement strategies and optimized combination with other effective influences on road users are indicated on the basis of the acquired knowledge of the past twenty years. Last some needs for research on important unresolved topics on police enforcement and its influence on road user behaviour are discussed.

Introduction
The OECD-report from 1974 "Research on Traffic Law Enforcement" describes the state of the art of knowledge and practices on traffic law enforcements at the beginning of the seventies. It states as part of its main conclusion:
"There is an air of uncertainty surrounding traffic law enforcement as a means of effecting the safe and efficient movement of traffic. This is due to the almost total lack of research into the effects of many components of the traffic enforcement system and their interactions. <....> Most of the experimental work reviewed in the report appears to strongly suggest a positive road safety value in increased police enforcement. However, it cannot be stated categorically that such is the case."(OECD, 1974, p.3).
Although the component of the police enforcement has been researched to some extend before the seventies, this was indeed the state of the art at that time. Now twenty years later the knowledge is accumulated to a vast body of research results on the main areas of road safety related enforcement on driving under the influence of alcohol, overspeeding and seat belt wearing. The cited OECD-report evaluated the period before the oil-crisis, where most European countries had no speed limit for motorfreeways or even rural roads, nor an obligation for seat belt wearing and also European countries had no blood alcohol limit for the enforcement of drunken driving. Compared to the beginning seventies we now know a great deal more about the relation between enforcement and driver behaviour and the relation between driver behaviour and traffic accidents. The cited OECD-report states that there was: "very little information available on the following questions: What is the relationship between the level of enforcement and driver behaviour and the relationship between driver behaviour and traffic accidents" (OECD, 1974, p.9).
As in the seventies we also do not have very many clear research results that evaluates the direct effect of police enforcement on road safety, but the chained relation between enforcement - behaviour - safety is much more clear now. Especially the knowledge on effective ways of police enforcement for some specific road behaviours as well as the knowledge of the effects of these specific behaviours on road safety is increased tremendously.

Lessons learned

The nature of the relation between blood alcohol level and the probability of accidents was already known from the now classical American study of Borkenstein et al.(1964), but the effectiveness of enforcement practices on drunken driving was still unclear at that time. What we have learned since then from European and other research on traffic law and police enforcement on drunken driving can be generalized as: the normative effects of traffic law and the preventive effects of police enforcement can become unnoticeable if not five conditions are guaranteed in advance:

1. the traffic law and regulations must specify in an exact observable way what a traffic offence is;
2. the enforcement practice should be formulated in concrete, easy executable and efficient behaviours for police officers;
3. the enforcement level on particular behaviours must be above a certain rather high intensity level;
4. the enforcement should be unpredictable in time and place, but highly visible and/or with direct feedback to the road user;
5. the follow-up by fines and court procedures should be without delays, exemptions or many withdrawals.

With respect to drunken driving we can illustrate these generalizations nicely.

The change to an exact defined legal blood alcohol limit instead of an apparent inability to drive (tested by such, nowadays considered silly, things as walking on a straight line) and even more the later change to a legal equivalent amount of alcohol per litre out-breathed air have improved the situation with respect to the *first condition* very much.

The lack of the second condition (among others), due to the cumbersome actual blood testing procedures with the professional involvement of medical staff, reduced the practical effect of the change to a legal blood alcohol limit considerable. The breath alcohol limit, sustained by an electronic breath testing procedure, fulfilled the *second condition*, while the random breath testing also made it possible to discard the effects of the human judgement unreliability in the enforcement by the police. For example, as Dutch research has shown (Gundy & Verschuur, 1987), suspicion for drivers of being under the influence of alcohol by the police, judged from talking with stopped drivers, is very inaccurate. Nearly a third of the stopped drivers without any use of alcohol were in this way suspected and, therefore, tested. Also about the same amount of the stopped drivers were not suspected by the police, although their alcohol levels were above the legal limit, and incorrectly not tested.

The procedure of random breath testing (RBT) with electronic devices made it possible to increase the efficiency of the enforcement by about 60% or more controls with the same police manpower (Verschuur & Noordzij, 1988). Together with priority for an intensification of the level of enforcement, this enabled the police force to satisfy the *third condition* in most North-West European countries. In several other European countries and Great Britain, however, RBT is still not in practice, due to legal objections against police interventions without suspicion of law violations.

The increased subjective probabilities of detection, which apparently are induced by new laws for traffic behaviour, are not maintained on a high level if the actual rate of detection is not

also simultaneously increased. This can be learned from the differences for new and changed laws on drunken driving with and without increased enforcement.

Figure 1. The vanishing effect of the blood alcohol law of 1967 in the UK.

Figure 1 shows the vanishing effect from the blood alcohol law of 1967 without a remaining increased enforcement level in the United Kingdom (Evans, 1991). A comparable short-term effect for the Dutch blood alcohol law of 1974 without increased enforcement is observed in figure 2, but this figure also demonstrates the increasing effect of intensified RBT-enforcement after the legal change to breath testing at the end of 1987 (Mathijssen & Noordzij, 1993) as well the increased practice of random breath testing thereafter.

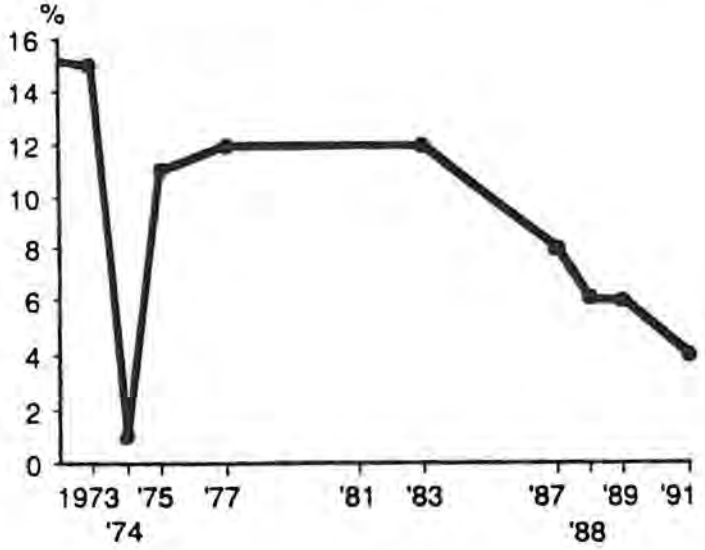

Figure 2. Dutch results: blood alcohol law ('74) and RBT-enforcement ('87 ->)

Subjective detection probability, however, can be increased if police controls are well visible to other drivers which are not actually stopped. Experiences with intensified RBT-enforcement

also has learned that the preventive effects are increased if drivers do not know how to escape the enforcement by other route choices or journey times. Such regionally intensified random breath testing on unpredictable changing places and times has shown to increase gradually the fear for violation detection, while marked reductions in the percentage of drunken driving are observed (Wesemann, 1989), which confirms the fourth condition.

Finally, and illustrating the fifth condition as well as some of the former conditions, if the political and financial priority (Gerondeau, 1992) is present for a many times multiplied intensification of the enforcement level as well as for more consequent court procedures with severe penalties and license withdrawals, apparently the effectiveness of police enforcement in reducing road fatalities can become tremendously. Not European, but Australian results on such an intensified alcohol enforcement in New South Wales (Arthurson, 1985) and on the joint intensification of speed and alcohol enforcement in Victoria (cited in: Gerondeau, 1992) has shown such enormous safety effects. There road fatalities were reduced by 25% (New South Wales) to even more than 43% (Victoria) as a result of an over hundred times intensified enforcement level.

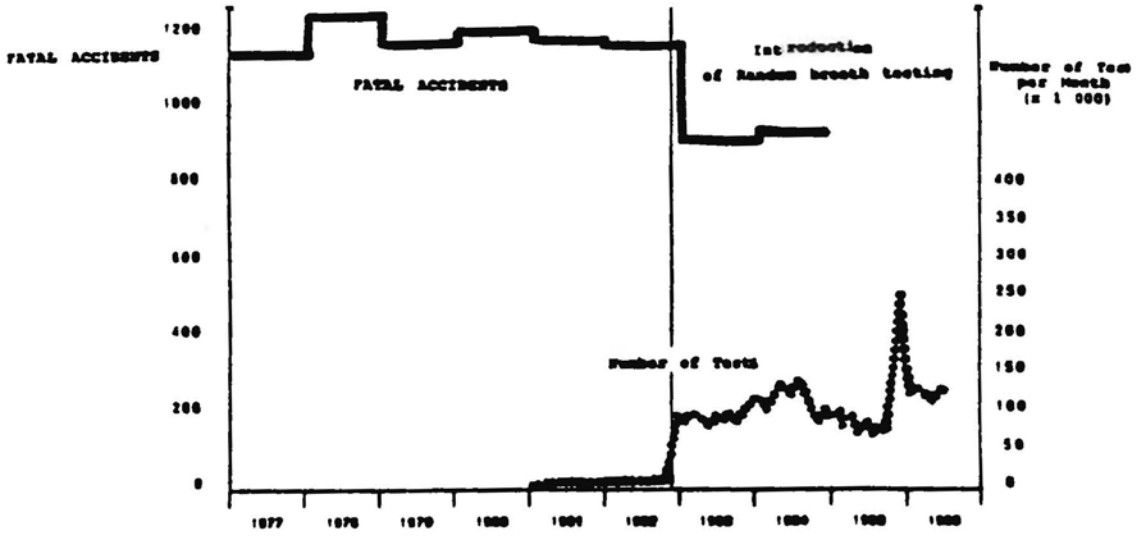

Figure 3. The effect of increased RBT in New South Wales

Behaviour and Safety

In the beginning of the seventies only theoretically the effects of seat belt wearing were conjectured to be very high, while nowadays we know that the reduction effect on road fatalities of the three-point seat belt is about 40% as national evaluations (with correction for 0 to 100% use) in Great Britain (Harvey & Durbin, 1986) and Germany (Ernst & Brühning, 1990) as well as comparative American research (Evans, 1991) has shown. Also the empirical relation between speed and road safety was still in discussion in the 1972 OECD-report on speed limits outside built-up areas. That report discussed the matter and was concerned about the scientific and methodological problems of an empirical establishment of any relationship between speed reduction and road safety (OECD, 1972). The oil-crisis has brought for quite other reasons than safety severe speed limits on motorfreeways in many countries. From later studies on the effect from these speed limits on motorfreeways, for example for the USA (Evans, 1987, 1991) and France (Gerondeau et al, 1991), as well as from other studies on

speed limits on rural roads in Scandinavian countries (Salusjärvi, 1981; Nillson, 1982) and national changes from 60 km/h to 50 km/h limits in built-up areas in Denmark and France, where a 3% to 4% actual speed reduction resulted in about 10% to 15% reduction of fatalities in build-up areas, we now know that fatalities tend to reduce by a factor which is the fourth power of the factor for the mean speed reduction. For example a 10% speed reduction (that is .90) gives about 34% reduction of fatalities (.90 to the power of four, which is .656).

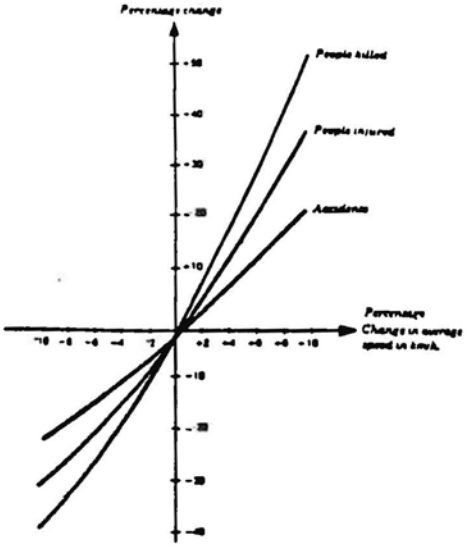

Figure 4. The relationship between mean speed changes and changes in accident types.

This seat belt and speed examples demonstrate that nowadays we know much more about the relationship between specific behaviours and road safety than in the beginning of the seventies. The increased knowledge has been in itself a force towards more priorities for enforcement of behaviours with an established relationship with road safety, since the doubts about the beneficial effects of certain behavioural changes on road safety has diminished.

Enforcement and Behaviour

The most troublesome areas of the relationship between police enforcement and behaviour is illustrated by the research on speed limit violations. In contrast to such behaviours as seat belt wearing and driving under influence of alcohol, overspeeding and many other types of offenses are not trip related violations but momentary events. This makes the question of the effective intensity level of enforcement for a particular detection rate also more difficult to answer. For example in The Netherlands the capacity of the police enforcement for overspeeding on the 2,500 km motorfreeways is limited by the capacity of juridical administration and court processes to 300.000 fines annually. On the Dutch motorfreeway system now about 33 billion kilometres per year are driven, while flow and speed measurements on Dutch motorfreeways show that about 30% of the cars are over the speed limit of 120 km/h and on parts with a 100 km/h limit this percentage is about 50%. What does this imply for the actual detection rate ? Some rough calculation could say that the chance of detection for one minute overspeeding per driver is about 1 in 30.000 times. This also would mean that the detection rate is one in 500 hours of overspeeding. Does it make sense to say so ? Probably not, because at which times and freeways is overspeeding possible and is there also police enforcement present. But if one has the habit of driving too fast, while the

circumstances allows one to do so half the time, it may make sense to say that one's detection rate is one in 1000 hours driving on the Dutch motorfreeway system. If the police enforcement is randomly spread over the freeway system on these times, it may mean for the average Dutch license holder a detection of once in about six years. Clearly the observed amount of overspeeding indicates that such a detection rate is insufficient to establish the correct speed behaviour. Although the publicity on safety and environmental effects of overspeeding is quite immense in The Netherlands, its indicated intensity level of enforcement seems not effective. Speeding is one of the behaviours which in itself is generally self-rewarding, due to its time saving and arousal satisfying aspects. In terms of choice and risk theory we may interpret the situation on the Dutch motorfreeways, which are the safest in the world, such that the risk of a fine or accident is so low that the expected losses do not seem to weigh out the perceived benefits of speeding for most drivers. This example illustrates the tricky relationship between effective enforcement levels and momentary non-trip related violations in driving behaviour.

The most effective measures for speed reduction has been those who adjust the infrastructure as it has been the case for reconstructed calming areas and reconstructed two-lane arterial routes to single lanes as well as for reconstruction of crossings to roundabouts, while higher speeds are observed on wider lanes compared to narrow lanes for same types of roads. The permanently ongoing information gathered from the infrastructure itself determines the amount of observed overspeeding to a much larger extend than incidental information or the incidental enforcement or police presence. This may hint to the effectiveness of permanent feedback information from modern electronics, which may monitor individually adapted speeds in the future (Rothengatter, 1991); a topic research in the European DRIVE-project Europolis.

Information and Enforcement

With respect to the research on overspeeding behaviour and information combined with enforcement we now know from some European research that direct on the spot feedback (Oei & Polak, 1992) is more effective in reducing the amount of speeding than local publicity or delayed warning information of individual speed violation (OECD, 1974: Riedel et al., 1988) which also do reduce the amount of overspeeding, but less.

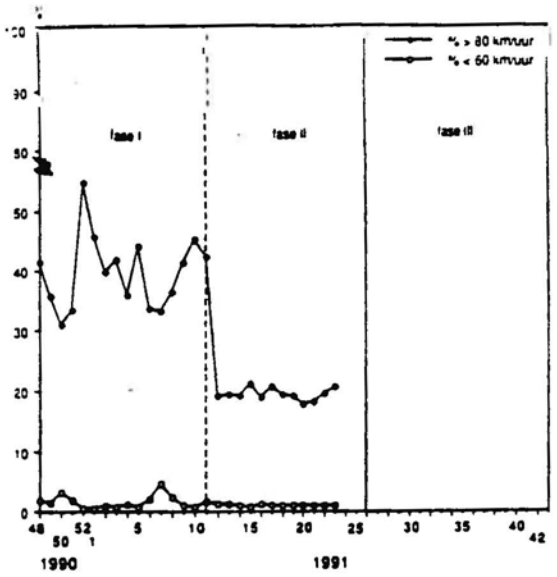

Figure 5. The effect of combined information feedback and speed enforcement.

We also know that stationary police control on speed has only local effects (OECD, 1974), while intensified frequency of very well visible circulating police patrols, which is sustained by increased automatic control, can have a marked broader effect on speed behaviour (Ostvik & Elvik, 1991). Both mentioned facts illustrate that enhancing the perceptual salience and the cognitive awareness of the negative elements in overspeeding does influence the implicit choice and risk evaluations and the behaviour of drivers. However, actions which subjectively increase awareness of speed enforcement will not show lasting effects if the actual level of enforcement in the long run turns out to be not intense enough to meet the subjective expectations, as it was mentioned also to be the case for the enforcement on drunken driving. The rate of overspeeding after such actions without actual increased rates of detection tends to increase again to the former or even higher speed level (Roszbach & Blokpoel, 1989).

The research on strategies for combined enforcement and information on speed limits and belt wearing after the mid seventies is overwhelmingly rich. Many of the results are reviewed in the proceedings of a recent OECD/CEMT-symposium (Koornstra & Christensen, 1991) and will be discussed in a forthcoming OECD-report (OECD, 1994). From this research we gained much more insight on the effects of combined information and enforcement and on information feedback on violations. The effects of enforcement are larger if accompanied with congruent publicity on the enforced behaviour. The effects of such a strategy of combined information and enforcement are also more or less lasting, while either of both can be ineffective. The so-called STEP-procedure for the increase of seat belt wearing in Canada (Grant et al., 1991) has been confirmed in Europe (Wegman, 1989). So habit formation in safe behaviour can be brought about collectively by periodically repeated actions of combined enforcement and publicity.

It seems that the expected reward aspect in the information is an indispensable aspect of habit formation besides the expected punishment aspect of enforcement. Also explicit studies on rewards for actual seat belt wearing (see several reports in: Koornstra & Christensen, 1991) have confirmed the predictions from the learning theoretical analysis of behaviour modification (OECD, 1994).

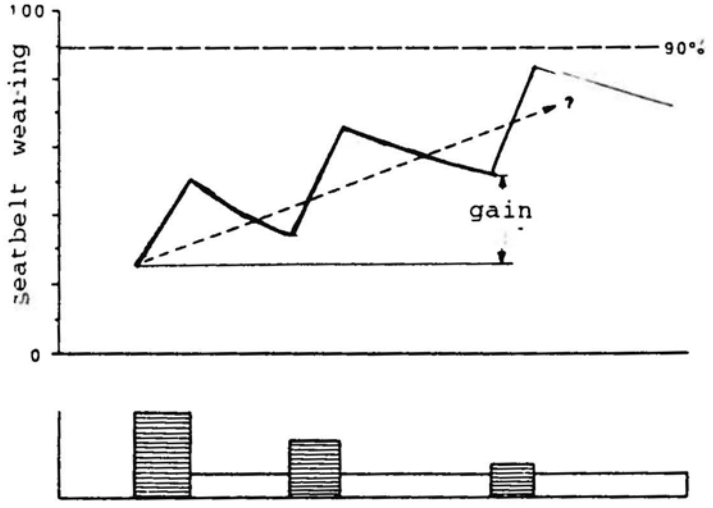

Figure 6. The STEP-programme of repeated information campaigns on seat belts.

The analysis of learning theory in psychology shows that punishment leads, apart from some reduction of the punished behaviour, foremost to escape behaviour, while rewards will shape the correct behaviour. It also shows that correct behaviour is easily learned by rewards in the early formation of behaviour, while the modification of already learned risky or incorrect, but in some way self-rewarding, behaviour is hard to achieve. Such achievements are certainly not to be expected from mild, remote and infrequent punishments of self-rewarding behaviour and that applies to many types of behaviour which are enforced by the police.

Norms and Enforcement

Once the behaviour becomes more or less accepted by a majority of the road users the normative effects of laws as well as the social aspects of attitudes and interpersonal control come into play. This can not only be conjectured from the mentioned results on driving under the influence of alcohol, but is also nicely illustrated by the normative effects of the Swiss seat belt laws.

The facts from Switzerland clearly show the normative effects of the seat belt law on the behavioural compliance as well as on the resulting safety effects. The remarkable switches to periods with and without seat belt law in Switzerland were possible due to the withdrawal of an initial national law by the delayed disapproval of the Canton-governments and the later re-establishing of the national law by a positive nationwide and overruling referendum.

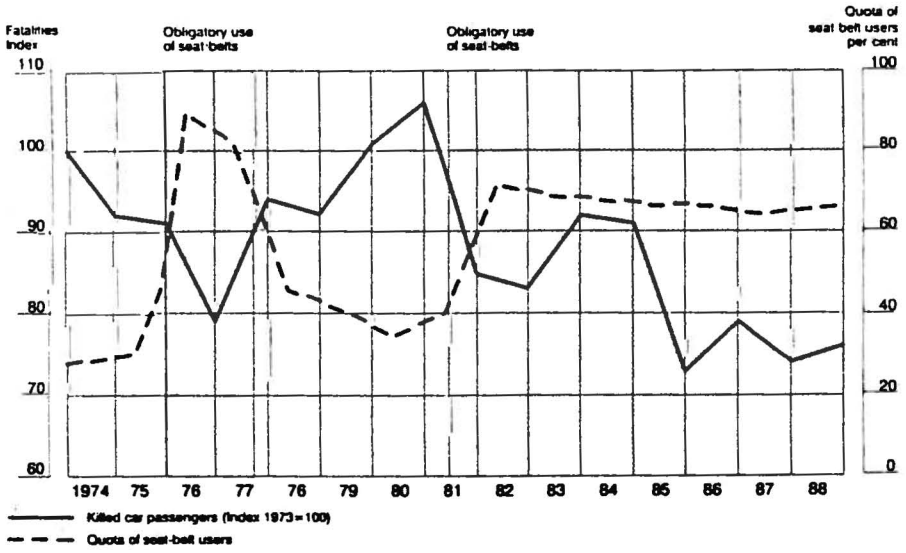

Figure 7. Effects of periods with and without seat belt law in Switzerland.

Amplifying effects of laws and existing societal values are also shown by the close to 100% rates of seat belt wearing in Great Britain and Germany. These high rates are observed after a change in seat belt law, while in these countries already before the change of law about a majority was wearing seat belts. This contrasts the lower wearing rates after such law changes in most other European countries where also much lower wearing rates in the pre-law period. It suggests that nearly a full compliance to laws can be expected if the pre-law behaviour applies already to the majority of road users. The additional normative effect of a law seems to do the rest, without actually increased police enforcement.

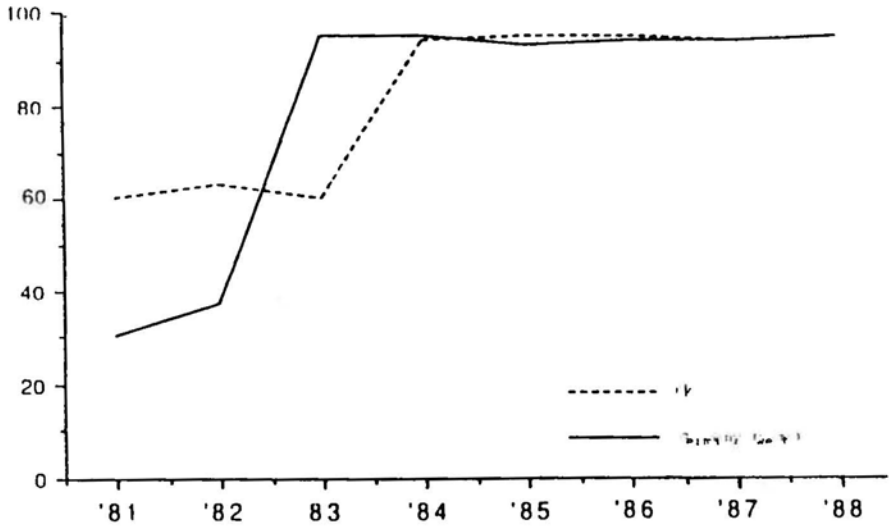

Figure 8. The effects of seat belt law changes in the UK and Germany (west).

Such a condition of an already existing majority of conforming road users was not the situation for the earlier laws on blood alcohol limits and neither for speed limit laws in general or for seat belt laws in most countries.

From countries with low levels of seat belt wearing it is known that seat belt wearing is more often observed for drivers with passengers than for single drivers. Normative influences and social control can become a self-reinforcing state of affairs which may reduce the level of police enforcement to a minimum as a side condition for the maintenance of an established socio-behavioural pattern. It is shown for some behaviours concerning environmental protection and health and it is also concluded in the forthcoming OECD-report (OECD, 1994) that the achievement of such socialized safety behaviours as norms of society asks for a long term strategy of targeted and consistent publicity and enforcement.

Research needs

If we compare the state of the art now in Europe with the beginning of the seventies, where concealed police patrols were sometimes even favoured and no effects of interaction between information and enforcement or enforcement intensification were known, we can really speak of progress in this field of knowledge and practice. We also can observe that strategies for police control and publicity are emerging which are more and more based on the application of theoretical principles of behaviour modification discussed in the forthcoming OECD-report (OECD, 1994). However, there are still not known facts about the effective intensity level of enforcement. The relation between enforcement intensity and preventive reduction of violations can be assumed theoretically to be reversely S-shaped, as illustrated by the following figure. The tentative curve in this figure is for indicative purposes divided into four sections A, B, C and D to which curve sections we refer in the sequel. From Australian research on the intensity of enforcement we can conjecture that a rate of police control on alcohol of about 1 out of 3 license holders per year in nights and evenings will bring about an effectiveness level in the range after the steepest descent of the reversed S-curve, some where in the middle of part C of that curve.

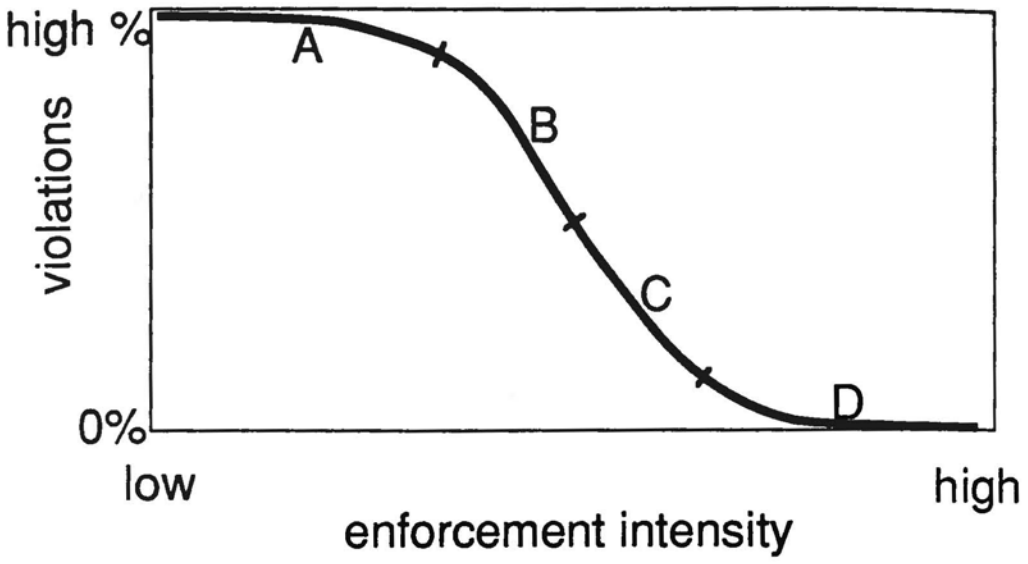

Figure 9. Tentative relation between enforcement intensity and violations

Dutch alcohol enforcement research shows that a control rate of about 1 out of 12 license holder annually has an effectiveness which is somewhere in the range of the transition from part A to B of that reversed S-curve. European studies (Wesemann, 1989; Gerondeau, 1992) show that increases of enforcement levels to higher levels still have a rather high cost-benefit ratio's in a macro-economic sense. Clearly increases of an already very high level of enforcement in range D of the curve will show a diminishing return rate (Wilde, 1991).

It is interesting to note that multiplications of intensity levels within the rather low levels of enforcement in the beginning section A of the reversed S-curve will not show any marked effect. This may explain why many studies of somewhat intensified enforcement levels have shown dissatisfying results. A triple intensity in part B of the reversed S-curve may show a very significant influence on the reduction of violations and accidents, where as a triple level of enforcement in curve section A may have unnoticeable effects. Such unnoticeable effects are probable for intensified enforcement on speeds, where a reported detection rate of 1 in 7.600 speed violations on the spot (Shumate, 1959) or the above estimated Dutch level of once in six years for speed violation are simply too low. Even a ten fold intensification of such levels may be not enough if we compare that with a detection rate of more than 1 in 100 cases (assuming a maximum of 33 drunken trips per year per license holder) from the Australian alcohol enforcement level. The exact quantitative relation of the above figure for different types of behaviours, however, is not researched enough in order to predict what the effects of a certain increase in the enforcement level are. For trip related violations, like driving and drinking, we may deduce from several studies that a control level of less than 1 out of 15 license holders per year is in the left flat upper part A of the curve, while a rate higher than 1 out of 2 annually is in a range which approaches the flat lower part D of the curve. For momentary non-trip related violations, like overspeeding, we do not have up to now any indicative data for the estimation of the curve. Further research directed to this need seems most valuable. It would enable one to predict more precisely the effectiveness and cost-benefit ratio for specific intensified levels of police enforcement.

An other already started and promising area of further research is related to the effects of reward strategies instead of the punishment effects of enforcement. Here the organizations of firms, companies, schools and administrations and probably also insurers can play an important role in relation to road safety. Also the differential effects of individual or collective rewards, especially with respect to their social implications and the internalization of values and norms is mainly unknown. A related area of research is the police organization itself. In how far are the police organizations willing to be open for planned experimentation with new enforcement strategies ? In what way are traffic enforcement activities for police officers themselves something that they can evaluate as positive ? Are the time spend to assist people in emergency situations and to solve criminal acts, compared to time spend on traffic enforcement, not very much more socially rewarding ? The answers to these questions may be of great importance if one wants to change the activities of authorities and the police with respect to the priorities given to traffic enforcement.

Last but not least new questions arise from modern telematics and electronic applications. Not so much the technology is the problem, but the social acceptance of modern technology in the control of driving behaviour seems the major obstacle. For example the technology for an automatic adaptive speed limiter which reacts on road or area dependent speed limit signals do not asks for much more than existing speed limiters combined with a distant channel switching device known from our television sets, but would there be a socio-political acceptance of such police manpower saving devices? Certainly not in Europe at the moment.

Conclusion

We conclude that there has been an immense progress in knowledge and practice on the effectiveness of police enforcement and its interaction with other road user influences on an improved road safety. However, there still are many fields of promising research which could fill the gaps in the knowledge of enforcement and other methods of road user behaviour modification towards a more road safety. In this respect a further co-operation between researchers, police organizations, public authorities and private bodies is most welcome.

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