

Summary:

Inexperienced at the wheel

What explains the risk reduction during the first months of driving?

Background and hypotheses

It has been clearly documented that novice drivers have very high crash risk immediately after licensing, and that the risk falls considerably during the first months of driving. It is obvious that the learning of certain skills causes the marked risk decrease, but the exact nature of these skills is still not sufficiently specified. This study is an attempt to test the following three hypotheses about possible skill acquisition of novice drivers.

Hypothesis A: Hazard perception

Driving experience increases the ability to identify early warnings of possible dangers in traffic, making drivers able to take precautionary actions sooner.

Hypothesis B: Better car handling skills

Driving experience increases gradual automation of handling skills in operating the car, and thus reduces the risk of potentially dangerous errors.

Hypothesis C: Improved interaction with other road users

Better understanding of the social interaction among road users and the informal rules of this interaction, results in better adjustments to other road users' behaviour, and makes one's own behaviour more predictable to others.

The three hypotheses are not mutually exclusive, and the supposed mechanisms may all contribute to the observed risk development among novice drivers.

Research design and procedure

Subjects were recruited among newly licensed drivers at five licensing offices in the area surrounding and including Oslo. The drivers who signed up were divided into three groups, which were invited to participate in the study either 1, 5, or 9 months after the driving test. Thus, the three groups of drivers would differ in average amount of driving experience. There were 130 drivers altogether in the three groups.

An additional sample of 28 experienced drivers was recruited by external advertisement about the project.

Data for testing hypothesis B and C were collected by means of a questionnaire about different aspects of driving behaviour, as well as exposure, crashes, and various background information. Hypothesis A was tested by means of a video-based test of reactions to potentially hazardous traffic situations. The subjects were tested in groups of up to ten persons at a time.

The test consisted of two 10-min video sequences recorded by a camera approximately in driver eye-view position during driving in various traffic situations. All situations were real incidents selected from several hours of footage shot in various traffic environments, and there were no staged situations. Each subject held a pushbutton and was instructed to push the button as soon as possible whenever (s)he detected a possibly hazardous situation, defined as any situation where the driver should be prepared for a sudden braking or avoidance response. The two sequences contained 15 and 16 predefined situations, respectively, and reaction times were measured to these situations, by means of a PC receiving input from the videotape as well as from the pushbuttons.

In addition to reaction time for responses occurring during predefined intervals for each situation, irrelevant responses outside of these intervals were also recorded.

For the computation of average reaction time for several situations, it was important that all subjects had a value for each situation. Missing values for subjects who did not respond during the critical interval were therefore substituted by the maximum possible reaction time, individually determined for each situation. Average reaction times were computed both with inclusion of non-responding participants (*corrected reaction times*), and with non-responders excluded (*uncorrected reaction times*). During one of the video sequences (counterbalanced across participants) a mental arithmetic task was added, in order to assess the possible effects of increased mental load on the hazard perception performance.

The questionnaire was sent to an additional sample of 4000 drivers who did not participate in the hazard perception test. Like participants in the test, the larger sample was also divided into sub-samples, responding to the questionnaire 1, 5, or 9 months after the driving test.

Hazard perception

Comparisons of the three experience groups gave the following results:

- There was a weak albeit not significant tendency that those with 1 month of driving experience reacted to fewer situations than those with 5 or 9 months of driving experience. In one situation, the proportion of drivers reacting was significantly lower among those with the smallest amount of experience.
- There were no differences between the groups in the number of irrelevant reactions, but female drivers had significantly more irrelevant reactions than male drivers.
- There were no significant differences between groups in average reaction time to all situations.

- For *uncorrected* reaction times to single situations there were no significant effects of driving experience.
- *Corrected* reaction times, on the other hand, decreased significantly with increasing driving experience in three situations. In all three situations the differences were in the expected direction.
- There was no interaction between experience and the effect of the arithmetic task on the number of reactions or average reaction time.
- There was a non-significant tendency towards more correct answers on the arithmetic task with increasing experience.
- A combined performance score was calculated, based on both the results from the arithmetic task and the reaction times, in order to measure the total mental load during the test. There was a non-significant tendency towards better scores with increasing driving experience.
- There were significantly more irrelevant reactions when drivers also were given the arithmetic task.
- The reaction times with the additional arithmetic task were significantly longer in 4 situations, and almost significantly longer in one further situation. In two situations, the reaction time was shorter with the additional task.
- Women reacted almost significantly faster (and/or more often) than men in two situations. Men reacted significantly faster than women in one situation.
- Women reacted faster and/or in more situations with the additional arithmetic task than without. For men it was opposite.

The comparisons between inexperienced drivers (all three experience groups taken together) and drivers with several years of driving experience gave the following results:

- There were no significant differences in the average number of reactions, neither relevant nor irrelevant, or in average reaction time.
- In two situations, significantly more of the experienced than of the inexperienced drivers reacted.
- The experienced drivers had significantly shorter reaction time than the inexperienced in two situations, but in one situation the inexperienced drivers had the shortest reaction time.
- Among males, inexperienced drivers tended to react in fewer situations (and/or more slowly) with the arithmetic task than without the task. Among experienced drivers there was a tendency in the opposite direction.
- Among experienced drivers, there was no tendency towards more irrelevant reactions with the arithmetic task, as it was among inexperienced drivers.

Handling skills

- Handling skills improve significantly during the first months of driving, both for male and female drivers. The more inexperienced, the more frequent drivers report to have used the wrong pedal, put the car in wrong gear, used wrong instruments (e.g. put on the wiper instead of the blinker), or driven without releasing the hand brake.
- Handling skills may consequently be one important reason why inexperienced drivers have higher accident risk during the first months of driving.
- Inexperienced male drivers have better handling skills than inexperienced female drivers, and the potential for improvement is thus greater for female than for male drivers.
- Among males, there is reason to believe that poor handling skills may contribute to the higher accident risk during the first 3 or 4 months of driving. With five months of driving experience, male drivers have the same handling skills as more experienced drivers.
- Among females, there is reason to believe that poor handling skills may contribute to the higher accident risk during the first year of driving, and possibly even longer. Female drivers with 9 months driving experience have poorer handling skills than more experienced female drivers.

Road user interaction

- The ability to interact with other road users can be separated into “active” and “passive” interaction. Active interaction implies that one is able to correctly predict what other road users are going to do, and thus able to choose an adequate action. Passive interaction implies that one’s traffic behaviour is such that it is easy for others to predict one’s future actions.
- As for passive interaction, novice drivers behave increasingly more like experienced drivers, as they gain more experience. This applies to when to change lanes when two lanes are merged into one, how often they drive on amber light, and how often they speed up in order to pass during the amber light phase. It also applies to close following.
- Also when driving in the dark, novice drivers behave more similarly to experienced drivers as they gain experience. The more experienced, the longer they wait before switching to high beam when meeting another car in the dark. As they gain experience they increasingly use the lights in accordance with normal practice and not in accordance with what they were taught at the driving school.
- As for active interaction, novice drivers (all three experience groups taken together) are not as good as more experienced drivers when it comes to recognising traffic situations of doubt. There are also just a few situations where the ability to interact in an active manner seems to be improved during the first nine months of driving.

Conclusions

Hypothesis A that drivers' hazard perception is improved during the first nine months of driving, gets only limited support in this investigation. However, there are some significant results in the expected direction, and thus it seems reasonable to conclude that drivers' hazard perception is somewhat improved during the first nine months of driving. Some situations seem to capture this development better than others. Experience may be of particular importance in order to recognise and handle situations that are complex, unexpected and demanding a far sight. Further studies based on a systematic classification of hazard situations are necessary in order to improve our understanding of these matters.

It looks as if the capacity to react in traffic situations with extra mental load is improved with experience. Accordingly, inexperienced drivers seem to have less cognitive ability to handle unexpected situations. The results show a somewhat less differentiated reaction pattern when the load increases, i.e. poorer ability to separate relevant from irrelevant information.

An interesting difference between male and female drivers is that women react relatively faster than men to hazard situations during additional mental load. This ought to be investigated further in order to identify possible explanations and implications.

Hypothesis B that handling skills are improved with experience and thus that errors from poor handling skills are reduced, is largely supported by the results. The improvement of handling skills goes faster for men than for women. After 5 months of driving, the number of technical errors among male drivers is at the same level as for very experienced drivers. Among women, drivers with 9 months of experience seem to make more technical errors than more experienced drivers. This gender difference may be explained by the fact that male drivers drive more both before and after they gain their driving licence, and thus get more driving experience during the first months of driving.

As for hypothesis C, on road user interaction, the results show quite clearly that inexperienced drivers change significantly during the first 9 months of driving, becoming more and more similar in their behaviour to that of more experienced drivers. Thus their ability for passive interaction is improved by the fact that they develop a more normal behavioural pattern in traffic during the first 9 months. This implies however also that the number of violations increases as a consequence of a somewhat more active or offensive driving style.

The ability to actively interact with other road users does not seem to develop during the first 9 months to the same degree as the ability to passively interact. The difference between inexperienced drivers and drivers with long driving experience indicate that this skill takes longer time to develop.

The decline in accident risk during the first months of driving is probably a consequence of a combination of changes in the behaviours and skills shown here. The relative importance of these factors in explaining the risk reduction may be investigated in detailed studies on contributing factors to accidents during the first months of driving. If the changes in behaviour that have been documented here in fact contribute to reduced accident risk during the first months of driving, it

follows that increased driver training before licensing may reduce young drivers' accident risk.

The need for further knowledge

There is a need for more studies on hazard perception based on classification of different possible hazard situations, in order to investigate whether there are certain types of situations that create particular problems for inexperienced drivers. One hypothesis that ought to be tested is that driving experience is particularly relevant in order to perceive situations that are complex, unexpected or demanding attention to traffic far ahead. These relations might be investigated by further use of the data collected here, and supplied with more data from tests with the hazard perception test developed.

In order to study further whether the development of handling skills during the first months of driving in fact contributes to the reduction in accident risk in that period, an investigation into possible changes over time of the distribution of different types of accidents could be appropriate. One would for instance expect that the changes over time of the distribution of accidents were different for men and women. One additional hypothesis that ought to be tested is that errors connected with the handling of new (and not familiar) cars might account for the higher accident risk of new cars.

One would also expect that the proven changes in driving style (passive interaction) influences the distribution of accidents. Are for instance new drivers more at risk of being hit from behind because of an excessive safety orientation making them brake or stop in situations where the normal driver would chose to drive? Rear-end collisions in signalled intersections could be a relevant case in question.