

**Theses of Doctoral (PhD) Dissertation**

**Examining factors influencing safe driving behaviors  
and traffic safety culture, with the special emphasis  
on methodological issues**

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## **The aim of dissertation and the circumscription of dissertation**

The dissertation is investigating the traffic safety in Hungary, and the factors underlying road traffic safety. Two aims were set in this context. First, identifying factors enhancing traffic safety behaviors: which factors and how influence traffic safety behavior? When investigating road safety, it is necessary to mention the concept of traffic safety culture. Traffic safety culture means perceptions, and expectations on normal behaviors, accepted in the society. In the traffic context, these behaviors are linked to risk of accidents and acceptance of safety policies (Ward, Linkenbach, Keller, Otto, 2010). Second, there is a methodological aim, too: is it possible to develop and use an integrated tool for measuring traffic safety behavior instead of the methods have been used (namely, accident involvement and disobeying of traffic rules)? “Safe driving index” (Hőgye-Nagy, & Münnich, 2015) is introduced, and its usability is investigated.

Traffic, and driving behavior is among the most popular research fields of current science. The main reason is its relevance in everyday life: enhancing safety in traffic via identifying threatening factors (Groeger, & Rothengatter, 1998).

Measuring traffic safety behavior is important. The term usually means accident involvement, and/or obeying or disobeying traffic rules (Groeger, 1997). So it means if someone drives neglecting traffic rules, in how many accidents someone was involved, how risky one’s road behavior is. Safe traffic behavior implies someone not threatening others on the road, with respecting and obeying traffic rules.

Among the factors influencing traffic safety, the ones applied in aptitude tests of professional drivers are the usually in the focus of international literature. Gender, age and driving experience are usually examined in every research. It was proved that men are at greater risk in accidents, especially in severe accidents (for example Dobson, Brown, Ball, Powers, & McFadden, 1999). Younger drivers and drivers above age 65 (or 65) have higher accident liability (Parker et al., 1992). Younger drivers are usually more deviant on the roads, mainly because of disobedience of traffic rules. While older drivers make more driving errors. It was also proves that driving experience influences accident risk, even if the effect of age is controlled (for example Maycock, Lockwood, & Lester, as cited in Sagberg, & Bjørnskau, 2006). Professional drivers have higher accident liability (Broughton, Baughan, Pearce, Smith, & Buckle, 2003). The reason may be that they often drive under unpleasant circumstances, like bad weather, or under stress.

Examining cognitive factors, researches on perception, attention, stress tolerance (loadability), and reaction time can be highlighted. About half of road traffic accidents are attributed to perceptual factors (Freytag & Sachs, as cited by Sekuler & Blake, 2000; Hills, as cited by Cavallo & Cohen, 2001; Hole, 2007). Szlyk, Fishmann, Severing, Alexander, & Viana (1993) found that peripheral perception is more important in driving. Above all, attention is also an indicator of good performance, and one of the most important predictors of safe driving (Groeger, 2000). Severe stress reaction may disrupt driver's attention, so may impair driving safety (Matthews, Desmond, Joyner, Carcary, Gililand, 1997), and also can lead to driving violations (Simon & Corbett, as cited in Hill & Boyle, 2007). Concerning perception of normal, vigilant drivers, under stress and low motivation perceptual errors may arise (Réti, 1977). Adequate reactions, fast and correct reactions are also important (Groeger, 2000).

Examining personality factors, adventurousness, risk-taking in traffic situations emotional stability, self-control, social sense of responsibility are part of the dissertation. Among others, McMillen, Smith, & Wells-Parker (1989) and Arnett (1990) found connection between sensation seeking and risky driving. Drivers with higher level of sensation seeking have tendency to risky behavior, and vice versa. Gottfredson & Hirschi (as cited by Burton, Evans, Cullen, Olivares, Dunaway, 1999) found that people with low self-control tend to behave recklessly and deviant, like smoking, excessed drinking, and may have higher accident liability (as cited by Burton, Evans, Cullen, Olivares, Dunaway, 1999). The lack of respect of traffic rules seemed to be one of the most significant predictor of reckless driving (Oltedal & Rundmo, 2006). Its efficiency is greatly influenced by how drivers trust in authorities (Sunshine & Tyler, 2003).

Sahar (2009) found connection between emotional stability and driving behavior. Achievement motivation is also discussed in the dissertation. This has two aims. First, in organizational context, connection between safety and achievement has been proved (Izsó & Antalovits, 1996). It may be interesting to investigate the connection in this non-organizational context, how achievement motivation affects driving. Second, competitive behavior and risky driving has been already examined (e.g. Grey, Triggs, Haworth 1989).

The term of safety culture – beside of the literature of organizational sciences – is arose in the literature of traffic sciences, too, namely traffic safety culture. It doesn't have a widely accepted definition – just like organizational safety culture –, but most researchers agree that it is necessary to pay attention not only to risky behavior and its consequences, but also to social norms values, beliefs, and how they can be changed (Johnston, 2009; McNeely

& Gifford, 2007; Wundersitz, Hutchinson, & Woolley, 2010). The acceptance of the term can be underlined with the fact that it is used by the Foundation for Traffic Safety too (AAA, 29.07.2008), they conceptualize traffic safety culture as “significant trend in public opinion, which affects safety” (AAA, 2007, p.1). Investigating definitions of traffic safety culture, it is clear, that norms and attitudes are highlighted, they arise in every definition. They are usually measured by attitudes and beliefs on safety rules, and safety policies.

Understanding safety culture helps to reduce unsafe driving behaviors (Ward, Linkenbach, Keller, & Otto, 2010). Unsafe driving behavior is often consequence of perceptual errors, when drivers don't perceive the risky nature of their actions. With the help of safety culture, intensive opposition to safety policies may be reduced. Subcultures representing higher risk can be identified and assessed.

### **Sketching of methods applied**

I was trying to get an insight to traffic safety in Hungary, and factors influencing traffic safety in 3 studies. A new measure “Safe Driving Index” is also introduced, its development is explained, too.

In the **first study**, mainly factors connected to safe driving, namely cognitive, personality, demographic factors, effect of driving experience, and factors connected to safety culture are discussed and examined. The examination was conducted with computerized tests, applying Vienna Test System, version 22.00. Influencing factors were measured with standard tests, traffic safety was measured with items, reflecting traffic violations. The questionnaire involved errors and violences of most common traffic rules, each violation was depicted within a single item. The respondents indicated how strict they would punish the given violation, giving a value on a Likert-type scale. The items were collected through investigating traffic penalty policies. Items not relevant in daily road behavior were neglected.

Based on the literature and former researches, the following hypothesis were formulated:

- Men are at greater risk in driving.
- Younger and older drivers are at greater risk.
- Drivers with more experience drive safer.
- Non-professional drivers drive safer.
- Drivers with better attention drive safer.

- Drivers with better perception drive safer.
- Drivers with better peripheral perception drive safer.
- Drivers with better stress tolerance drive safer.
- Drivers with better reaction time drive safer
- Drivers with lower level of risk-taking drive safer.
- Drivers with lower level of adventurousness drive safer.
- Drivers with higher level of social sense of responsibility drive safer.
- Drivers with higher level of self-control drive safer.
- Drivers with higher level of emotional stability drive safer.
- Drivers with higher level of achievement motivation drive safer.
- Safe driving and traffic safety culture are connected. Stricter attitude to traffic violations implies safer driving.

In the **second study** traffic safety culture in Hungary was examined with an online questionnaire. The aim was to get a wider insight about the local traffic safety culture on a larger sample. Trust in police and its connection to safe traffic behavior was also examined. And this study enabled the examination the Safe Driving Index introduces in the first study. The following hypothesis were formed:

- Men are at greater risk in driving.
- Younger and older drivers are at greater risk.
- Drivers with more experience drive safer.
- Safe driving and traffic safety culture are connected. Stricter attitude to traffic violations implies safer driving.
- Safe driving, trust in police and traffic safety culture are connected. Higher traffic in police, stricter attitude to traffic violations implies safer driving.

In the **third study** the results of Likert-type scale on safety culture are compared to the results stemming from Thurstone pairwise comparison. Potential benefits and disadvantages of the methods were investigated.

## Results

1. A moderate but significant connection between road accidents and traffic violations was proved.
2. A new integrated measure was calculated, which measures safe (or to be correct, unsafe) behavior. The measure is called “Safe Driving Index”. Higher values of the index mean less safe driving behavior with more severe violations and/or traffic accidents. The advantage of the index is that it integrates former accidents and violations, weighted by the values of road traffic penalties (which can be considered as objective indices). So the index is some kind of combined measure of one’s driving past, which orders the sample according to the severity of the driving past. This may avoid the problems arising by measuring traffic safety with purely accident involvement or self-reported traffic violations.
3. The traffic safety culture is multidimensional. In the first study there were three factors (violations rated more strictly, over-taking and turning, speeding and parking), in the second study there were four factors of traffic safety (violations rated more strictly, violations rated less strictly, speeding and parking, drunk driving).
4. Concerning demographic factors, men are at greater risk behind the wheel.
5. Older drivers are at greater risk when driving. But it is important to emphasize, that age was categorized into a 3-value variable, and accidents, violations were reported not only for a given period of time. So this result has limitations.
6. Generally spoken, drivers who drive more often are at greater risk. Though the limitation holds just like in the former case.
7. Professional drivers are at greater risk than non-professional drivers.
8. Less risk-taking drivers drive more safely. Adventurousness seem to have an opposite effect.

9. Drivers with lower emotional stability drive safer. The result is ambiguous because the post-hoc test resulted higher emotional stability on some groups of drivers driving safer.

10. Attention in stress context is better in group of unsafe drivers than in group of safe drivers.

11. Resignation tendency seems to be higher in case of unsafe drivers.

12. Peripheral perception is better in the group of safe drivers.

13. Examining traffic safety culture, in the first study all the three, in the second study all the four factors seemed to have significant effect on safe driving. Safer drivers rated traffic violations more severe than unsafe drivers. Violations rated less strictly seem to have an opposite connection: they were rated more severe by the group of safe drivers. These items were most common in the sample and rated lower generally.

14. Higher level of trust in police seems to be connected to safer driving. While lower level of trust is connected to unsafe driving.

15. Attitude to traffic rules in the factors of violations rated more strictly is more liberal in the group of people with higher trust in police than in the group of drivers with lower trust in police.

16. Drivers with more distracting habits seem to drive less safe.

17. Examining traffic safety culture with Likert-type and Thurstone-type scale, both give a relative exact insight in case of violations rated more strictly. The four violations rated the most strictly are identical with both methods. Comparing the results with an objective index (traffic penalty values), it can be seen, that Thurstone-method gives a better result (more identical order) in case of violations rated more strictly. Concerning advantages and disadvantages of the methods, we can conclude, that if there are a larger number of items, it may be advised to use Likert-type scale, since Thurstone-method generates too many items. And this can be exhausting and boring for the respondents. But if there are only few items, Thurstone-method can give a more differentiated solution.

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### List of publications related to the dissertation

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