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INTERCONNECTIONS BETWEEN AGGRESSIVENESS, HOSTILITY, WRATHFULNESS AND THE MENTAL PERFORMANCE OF DRIVERS**

The traffic behaviour of drivers is determined by a mutual interaction of personal and situational variables. This interaction may be optimal, in the sense of interaction relationships, which result from the optimisation of the relationship between the subjective preconditions to solve the arising situations and the potential development of the current situations. Diversion from an optimal relationship may lead to the growth of inappropriate traffic behaviour, which can result in a road accident. This research is aimed at the search for interconnections among aggressiveness, hostility, wrathfulness, and mental performance of 137 drivers with Class C and D driving licences (truck and bus drivers). The research was carried out by means of a questionnaire for measuring aggressiveness and hostility in road traffic which monitors four scales of irritability, offensiveness, hostile attribution bias, and inhibition of aggressiveness. Another questionnaire consisting of six anger-provoking factors was used to scan provocation of anger in road traffic by other drivers and road users. To determine the intelligence of drivers, a battery for detecting comprehension, thinking in the sphere of illustrative relationships, practical intelligence, spatial intelligence, and flexibility of thinking was used as part of the research as well.

Keywords: inadequate behaviour, intelligence, performance, wrathfulness, drivers

Das Verhältnis zwischen Aggressivität, Hostilität, Jähzorn und Intelligenzleistung bei Berufskraftfahrern: Das Verkehrsverhalten der Fahrer ist durch das gegenseitige Zusammenwirken von Persönlichkeits- und Situationsvariablen bestimmt. Dieses Zusammenwirken kann sich im Sinne der Interaktionsbeziehungen, die aus der Optimierung der Beziehung zwischen den subjektiven Voraussetzungen zur Lösung entstehender Situationen und der potentiellen Entwicklung aktueller Situationen hervorgehen, optimal gestalten. Eine Abweichung von der optimalen Beziehung kann zur Entwicklung eines inadäquaten Verkehrsverhaltens führen, dessen Ergebnis Verkehrsunfälle sein können. Diese Forschung untersucht die Zusammenhänge

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zwischen Aggressivität, Hostilität, Jähzorn und Intelligenzleistung in einem Sample von 137 Berufskraftfahrern. In der Forschung wurde ein Fragebogen eingesetzt, der die Aggressivität und die Hostilität im Straßenverkehr misst und vier Skalen aufnimmt: Irritabilität, Angriffslust, hostile Attributionsverzerrung und Aggressivitätsinhibition. Ein weiterer Fragebogen beinhaltet sechs Bereiche der Zornerregung und wurde zur Aufnahme der Zornprovokation im Straßenverkehr seitens anderer Verkehrsteilnehmer verwendet. Nach Zusammenhängen suchten wir mithilfe der Intelligenzbatterie für Fahrer, die Fassungskraft, Denken im Bereich anschaulicher Beziehungen, praktische Intelligenz, Raumintelligenz und Flexibilität des Denkens untersucht.

Schlüsselbegriffe: Jähzornigkeit, Leistung, Intelligenz, inadäquates Verhalten, Fahrer

1. Traffic psychology

As ŠTIKAR et al. (2003) point out, the centre of attention of traffic psychology is the study of the behaviour of drivers within the 'person – vehicle – traffic environment' system. According to these authors, this system is created by several components where each has its own role and function and thus they all contribute to reaching the goal of the whole system: to secure the traffic and its safety (ŠTIKAR et al. 2003). HAVLÍK (2005) decomposed this system into more detailed variables: person – environment – vehicle – traffic road – social traffic structure. The author points out that the person plays a central role in this traffic system. In order for this person to carry out the activities of a driver driving a motor vehicle fully and comprehensively, they have to have certain capacities such as medical fitness, abilities, skills, experience and knowledge, not forgetting personality traits. The traffic environment or the conditions under which a driver is driving a motor vehicle in the given moment significantly influence their driving style as well as their perception and feelings, therefore also the evaluation of the overall state of the traffic situation and the subsequent reactions to, for example, climatic conditions or visibility. A driver who drives through mountain areas regularly may, most likely, have different capabilities, experience, and driving style than a driver from a big city. Significant differences may be found also between drivers from northern countries and southern ones as well as between driving in the summer and in the winter or during the rainy seasons in our latitudes. Another considerable difference is in driving during the day and at night. The technical conditions of the roadway, lighting or traffic signs as well as the social structure of a traffic situation – the number of participants, their roles and traffic behaviour – also influence the overall ride. The last component is the vehicle itself, its condition, technical and safety equipment, etc.

The range of use of the mosaic of psychological data in traffic management is very wide. The greatest attention is paid primarily to the drivers of transport vehicles (FRANKOVSKÝ et al. 2010). It is generally agreed that a driver should be, from a psychological point of view, reasonable or have such a level of intelligence that they could manage the demands of driving a motor vehicle and be able to solve various

traffic situations adequately. The driver should be efficient, have good perception, reagent, resistance to the neurophysical load, and be properly composed as a person.

The conditions on the road deteriorate significantly. This includes not only traffic density but also – and primarily – the increasing aggressiveness of drivers which can be experienced on the road daily. Aggressiveness considerably complicates safety, fluency, and the necessary calmness of the other participants of road traffic. In accordance with SCHMIEDLER and colleagues (2005), a driver is marked as aggressive when the risk of collision increases and the driver's actions are motivated by impatience, hostility, or the effort to gain more time. Nowadays, aggressiveness is one of the significant risk factors of road traffic. It is encountered on the road daily.

The situation in which any aggressive behaviour originates is often more important than an individual's predisposition to aggressive behaviour. This is connected to the provoking stimuli which are marked as aversive stimuli generating the state of disharmony. People do not evaluate aggression and hostility initiated for the purposes of defense or revenge negatively because they are considered to be a method of achieving a balance (LOVAŠ 2008). Matthews (according to HORÁKOVÁ 2009) claims that aggressive behaviour in traffic situations is connected to the overall predisposition to hostile and aggressive behaviour which manifests itself in common situations. In accordance with the American psychologist JAMES (2002), aggressiveness behind the steering wheel is slowly becoming a cultural norm. They share an opinion that such behaviour is acquired during childhood. In their research the authors further deal with the term 'road rage' (hostility in traffic) which is manifested by extreme arguments, fights, etc. KUCEK and KUCEKOVÁ (2008) highlight the fact that the greater the affective pressure, the more limited the function of rationality.

The emotion causing probably the most traffic collisions is anger. Anger is an instinctive reaction to an obstacle on the road hindering the way to a certain target, and as such, it is biologically effective. Although it provokes offensive behaviour, such behaviour is mitigated and tempered by cultural and social conventions. This however does not mean that they eliminate anger. It stays and is suppressed or transformed into other emotions such as envy, hatred, hostility, vindictiveness. The more anger a driver experiences in such situations, the higher the risk of him or her initiating an aggressive reaction (KUCEK & KUCEKOVÁ 2011). This includes emotional states like rage or aggressiveness which may be manifested in various ways in the traffic situations (speeding, 'pushing' onto the vehicle in front, honking, ignoring traffic rules, physical or verbal threatening, attacking other participants in road traffic, etc.).

Drivers must be reasonably adaptive. Intelligence involves the ability to learn from experience and adapt to the environment (STERNBERG 2002). Among drivers, intelligence should not decrease below the critical level. Various values of this critical level may be encountered in the literature. For example, the authors of the AMT (Adaptive Matrices Test) base their knowledge on the recommendations of the German Bundesanstalt für Straßenwesen (Federal Highway Research Institute) which works with two categories of drivers: those who have an increased accountability (bus drivers, drivers of emergency vehicles, etc.) and those who do

not. Drivers without an increased accountability are stipulated to have a minimum IQ of 70 (or 16 percentile), drivers with an increased accountability should have a minimum IQ of 85 (33 percentile). During testing, the most important mental abilities of a driver are, besides the general abilities, logical and analytical thinking, concentration, perception, spatial orientation, attention, psychomotor coordination, speed and accuracy of reactions, reaction time and others. The fundamental properties of a driver necessary for driving a motor vehicle are: perceptual abilities – visual, auditory, and kinesthetic perception, concentration, spatial orientation; psychomotor abilities – speed and accuracy of reactions, coordination of movement, flexibility; intellectual abilities – experiencing, logical and analytical evaluation, practical and critical thinking, visual memory, etc. (HAVLÍK 2005) Their actions should be efficiently adjusted to the conditions and they should be able to concentrate and apply their thinking to new situations and tasks. Nowadays, driving an automobile is so simple that it could be managed by a person with a low level of intellect. This however cannot be applied to driving a vehicle under contemporary traffic conditions which are marked by high dynamics and bring about many unexpected and new situations, most of which usually emerge suddenly and often under stress. In general, there is an increase in demand for the ability of drivers to think abstractly, use terms and symbols when solving various situations, and transform their experience and knowledge independently from the concrete solution schemes (KUCEK & KUCEKOVÁ 2011). They must be able to predict and plan such events and the course of events which have not yet happened at the given moment.

2. Research methodology

In this research, we have analysed interconnections among the studied personality traits of drivers. On the basis of the identified and specified interconnections among the personality traits of drivers, the research opens a way for analyses of predictive possibilites of drivers' behaviour and searches for the factors which would increase traffic safety. The research results offer a starting point for other studies and researches on the sense of cognition and understanding of the main goal which is to decrease accident rate. Eventually, these results can be useful in determining whether we can use the knowledge gained by observing the variables such as aggressiveness, hostility, and anger in the context of rational performance in the future to correct unfavourable factors of accident rate and road safety determined by drivers' behaviour.

The research is aimed at finding interconnections among aggressiveness, hostility (POAG), wrathfulness (DHD), and mental performance (IBV) of 137 drivers who own Class C and D driving licences. It was carried out by means of the *Methodology for investigation and evaluation of the motor vehicles drivers by traffic psychologists – Yellow methodology* (KUCEK & KUCEKOVÁ 2008). The authors developed a 45-item questionnaire which they labelled DHD and which monitors the *level of anger*

of drivers provoked by various situations in road traffic. An analysis of the results introduced 3 factors which included 58.55% of variance: F1 – factor of perceived self-threat of the driver which is connected to inadequate traffic behaviour of other participants in road traffic; F2 – factor of obstacles created by other participants which prevent the driver from performing the intended action; F3 – factor of open aggression as non-verbally expressed by other participants, aimed at the driver. The final version consists of 35 items grouped into 6 categories, each of which represents a specific area of stimuli and situations which may provoke anger in a driver: A – infringement, B – untactfulness, C – slow driving, D – offensive reactions and hostile gestures, E – presence of the police, F – obstacles on the road in traffic.

The POAG questionnaire, which measures the degree of aggressiveness and hostility in road traffic, contains 55 items which create 4 scales: the scale of irritability, offensiveness, hostile attribution bias, and inhibition/desinhibition of aggressiveness.

1. *Irritability:* A tendency to react impulsively, edgily, also reacting more to weaker stimuli, a tendency to be more distracted by stimuli and to have less control over one's own emotional state and its external manifestations.

2. *Offensiveness:* A tendency towards direct and open enforcement of one's own opinions onto other people without destructing objects. It indicates competitive, even aggressive confrontational behaviour. Besides the two items, this scale also monitors the degree of verbal aggression.

3. *Hostile attribution bias:* The items represent the opinions, beliefs, and attitudes which support the tendency to perceive others as people who are likely to cause harm or to react aggressively. The holder of such attributions may, in certain situations, have a tendency to perceive these people according to his or her own attributions and have less respect for the true nature of the situations. Such attributions support defensively the aggressive behaviour of their holder which is to a great extent saturated by the feelings of fear of possible attack by other people.

4. *Inhibition of aggressiveness:* This scale measures the level of constraints against the expressed aggressive behaviour. It measures the inhibitors of aggressiveness in 3 areas: inhibition/desinhibition of aggressiveness by means of a threat of punishment, inhibition/desinhibition of aggressiveness by means of feelings of guilt, inhibition/desinhibition of aggressiveness by means of diverging the thoughts from aggression.

Assessing the rational performance with the help of the IBV battery enables to observe the *intellect of a driver* in a relatively more complex way and from various points of view: their verbal logical thinking, ability to think abstractly and logically, visual and spatial intelligence, craftsmanship and technical thinking, ability to

adapt to unconventional tasks, their flexibility of thinking, and capacity of verbal and visual memory.

1. *Commands*: test of verbal intelligence. It affects the ability to differentiate between the meanings of words, the significant and insignificant, logical thinking, and the mobility of thinking operations.

2. *Sequences*: non-verbal test of fluid intelligence. It measures the ability to recognise visual relationships. When solving the tasks, the ability to think logically is applied as well as analyses, syntheses, performances, structures, and spatial imagination and thinking.

3. *Mechanical relations test*: performance test which may be included in the area of tests for technical skills. Correct solutions may be achieved by logical reasoning without any special technical knowledge. The success rate is influenced by the overall degree of general rational capabilities as well as technical thinking and practical experience with mechanical relations.

4. *Character counts*: non-verbal intelligence test which measures the flexibility or rigidity of thinking. Task solving requires particularly the overcoming of the negative transfer.

5. *Inverse cube*: non-verbal test of spatial intelligence. It is similar in character to tests that require solving the composition of flat geometric shapes or recognising spatial relationships within the actual spatial interconnections.

6. *B-D test*: non-verbal performance and discrimination test with the primary focus on detecting the level of sensorimotor performance, accuracy of perception and psychomotor reagent, purposeful concentration of attention, and psychomotor tempo. The values express the quantity but also the quality through the percentile of errors.

3. Results of the research

The research was carried out by means of Pearson's correlation coefficient in the SPSS computing program for statistics. The results of the correlation analysis between the degree of aggression, hostility in road traffic (POAG), and the intellect of the drivers (IBV) are illustrated in *Table 1*.

Table 1

Correlations of aggressiveness and hostility in road traffic according
to the POAG methodology and intellect of drivers according to the IBV methodology

POAG	*IBV*	*Commands*	*Sequences*	*Mechanical relations test*
Offensiveness		0.172[*]	0.176[*]	0.182[*]
Hostile attribution bias		−0.206[*]		

Note: [*]p < 0.05

A positive statistically significant correlation was detected bewteen the factors of the IBV methodology – Commands, Sequences and Mechanical relations test – and Offensiveness, the category of aggression and hostility in road traffic (POAG). Simultaneously a negative correlation between Hostile attribution bias (POAG) and Commands (IBV) was found. Offensiveness represents a tendency to direct and open enforcement of one's own opinions onto other people but it excludes destruction of objects. It indicates competitive, even aggressive confrontational behaviour and also monitors the degree of verbal aggression. It increases statistically significantly with the rising level of understanding a verbal text, with higher values of the ability to elaborate the material cognitively, and in connection to the increase of values of visual and logical thinking as well as of technical and practical thinking. Hostile attribution bias represents the opinions, beliefs, and attitudes that support the tendency to perceive others as people who are likely to cause harm or to react aggressively. It supports defensively the aggressive behaviour of its holder, which is to a great extent saturated by the feelings of fear of possible attack by other people. It correlates negatively with the items illustrating the comprehension of a verbal text and cognitive elaboration of the material. This means that the higher the scores in understanding a verbal text, the significantly lower the level of attribution bias. Amongst the other factors of the IBV and POAG methodologies, no statistical significance was recorded.

The results of a correlation analysis between the level of anger and the intellect of drivers are interpreted in *Table 2.*

Table 2

Correlations of the anger level according to the DHD methodology
and the intellect of drivers according to the IBV methodology

DHD	IBV	Commands	Sequences	Mechanical relations test	Character counts	Inverse cube	B-D test (errors)
Infringement							0.213*
Untactfulness				0.216*			
Slow driving							0.183*
Presence of the police							0.209*
Obstacles on the road in traffic				0.196*			

Note: *p < 0.05

Statistical significance was detected between the Mechanical relations test (IBV) and the categories of anger – Untactfulness and Obstacles on the road in the traffic (DHD) – which are provoked by other participants of the traffic and prevent the driver from performing their intended action. Those drivers who arrive at the correct solutions by means of logical reasoning without any special technical knowledge, and whose success rate is determined by the overall level of their general intellectual abilities, are capable of being provoked to anger by other participants' untactfulness and the obstacles on the road in traffic. Statistical significance was also recorded between the B-D-test (errors; IBV) and the categories of the DHD methodology – Infringement, Slow driving, and Presence of the police. Drivers with a well-developed level of psychomotor reagent, intentional concentration of attention, and psychomotor tempo may be provoked to anger by infringement, slow driving, and the presence of the police. Amongst the other factors of the IBV and DHD methodologies no statistical significance was detected.

Recorded correlations between the age of the drivers and the individual factors of the IBV, POAG, and DHD methodologies are very interesting. The correlations of age and the IBV methodology factors are illustrated in *Table 3*. *Table 4* presents the POAG factors, and the DHD factors are interpreted in *Table 5*.

Table 3
Correlation of age and IBV methodology factors

	Commands	Sequences	Mechanical relations test	Inverse cube	B-D test (performance)	B-D test (errors)
Age	−0.294**	−0.288**	−0.190*	−0.220**	−0.177*	−0.179*

Table 4
Correlation of age and POAG methodology factors

	Irritability	Offensiveness	Hostile attribution bias	Inhibition of aggressiveness
Age		−0.291**		−0.203*

Table 5
Correlations of age and DHD methodology factors

	Infringement	Untactfulness	Slow driving	Offensive reactions and hostile gestures	Presence of the police	Obstacles on the road in traffic
Age		−0.234**	−0.312*	−0.217*		−0.272**

Note: *p < 0.05; **p < 0.01

We have only detected negative correlations with the age of the drivers in all factors, which means that the higher the age of the respondents, the lower their level of anger, aggressiveness and hostility which are provoked by various situations in road traffic, namely, untactfulness, slow driving, obstacles on the road in the traffic, offensive reactions, and hostile gestures.

The higher the age of the drivers, the weaker their verbal and logical thinking and the mobility of thinking operations, the ability to think abstractly, spatial imagination and thinking, craftsmanship and technical thinking, practical experience with mechanical relations, ability to adapt to unconventional tasks, flexibility of thinking, and capacity of verbal and visual memory.

4. Discussion and conclusion

The existing research and investigations on inadaptable behaviour on the road have, so far, distinguished violence from errors and mistakes and defined traffic violence as an intentional deviation from safe driving practices (KUCEK & KUCEKOVÁ 2010). JELEŇOVÁ and BAUMGARTNER (2005) presented a study in which they wanted to map out the relationship between self-assessed aggressive driving style and age. The results of the investigations by traffic psychologists prove that the persons causing traffic accidents are characterised as more distinctive, egocentric, dynamic, aggressive, and emotional with a disharmonious personality structure, weakened self-regulation, distorted self-evaluation but an optimal mental performance (HAVLÍK 2005). Several authors agree that there are certain characteristic differences between drivers who frequently commit traffic violations and cause accidents and drivers who do not. According to HAVLÍK (2005), the persons who fail in traffic situations have some typical characteristics such as maladjustment, impulsiveness, non-conscientiousness, hypersensitivity, rigidity, irresponsibility, carelessness, emotional instability, aggressiveness, and others. For those drivers who do not fail in traffic situations, typical characteristics are adaptability, sanity, responsibility, reliability, self-possession, self-confidence, emotional stability, and conscientiousness. ŠTIKAR and colleagues (2003) distinguish drivers in a similar way. They claim that drivers with frequent traffic violations are typically characterised by the following: they are unable to predict the outcome of situations, they rely on coincidence, they feel the need to be the center of attention, to compensate feelings of inferiority, and they refuse both conventional and informal norms. Anger is also a deviation from an optimal relationship which may lead to the development of an inadequate traffic behaviour, the result of which may be a traffic accident.

The aim of this study was to search for interconnections among aggressiveness, hostility, wrathfulness, and rational performance which are characterised by the ability to elaborate things mentally in various forms. It observes comprehension, thinking in the field of visual relationships, practical intelligence, spatial intelligence, and flexibility of thinking. A positive, statistically significant correlation was recorded between the factors of the IBV methodology's Commands, Sequences, and Mechanical relations test and the POAG metholodogy's Offensiveness, which is the category of the level of aggressiveness and hostility in road traffic. Simultaneously, a negative correlation was detected between Hostile attribution bias (POAG) and Commands. The results of this research demonstrate the fact that the higher the value of intellectual performance in the area of understanding a verbal text, visual, logical, practical, and technical thinking, the higher the value of offensiveness in the sense of enforcing one's own opinions onto other people; therefore, the value of verbal aggression increases. Regarding this result it may be assumed that a higher degree of intellect creates conditions for confrontation and verbal aggression in drivers. Contrarily, the intellectually adept individuals are most likely aware of the hostile attribution bias, with higher intelligence resulting in a lower bias, which is a favour-

able result for the drivers. High values were detected in the calculated intercorrelational coefficients between the individual factors of the POAG methodology which monitors the level of aggressiveness and hostility in road traffic. Another interesting aspect is offered by the negative correlations recorded between the age of the drivers and the individual factors of the IBV and POAG methodologies.

By means of this research, interconnections between the level of anger and the intellect of the participating drivers were monitored. The overall level of general intellectual abilities as well as technical thinking and practical experience with mechanical relations expressed in the Mechanical relations test of the IBV correlates positively with anger caused by untactfulness and obstacles on the road in traffic. The lower quality of attention and concentration expressed by the B-D test correlates positively with anger caused by infringement, slow driving, and the presence of the police.

Aggressive drivers enjoy the feeling of anonymity when sitting inside a vehicle, which gives them courage to let out their frustration on other participants in traffic. Basically they use the car as a weapon to achieve their desire. The objective of this research was to enrich the knowledge regarding traffic psychology by observing anger and intellectual capacities. Our plan is to broaden this research in the future since any new findings that may help improve the accident rate are highly significant and essential to this problem.

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