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Identification of the personality factors of the driver and road safety

Identyfikacja czynników osobowościowych kierowcy a bezpieczeństwo ruchu

Abstract

The study presents an overview of the available research results concerning the analysis of the impact of factors characteristic for the behavior of road users that influence road accidents. Intellectual fitness, personality and temperament as well as psychomotor skills were analyzed. The aim of the article is to present the current results in terms of selected psychological factors, i.e. intellectual performance, personality and temperament traits as well as psychomotor performance in the field of road safety. It is also the basis for setting directions for further research in this field.

Keywords:

road safety, driver, the personality factors of the driver

Streszczenie

Opracowanie przedstawia przegląd dostępnych wyników badań dotyczących analizy oddziaływania czynników charakterystycznych dla zachowań uczestników ruchu drogowego, mających wpływ na wypadki drogowe. Analizie poddano sprawność intelektualną, osobowość i temperament oraz zdolności psychomotoryczne. Celem artykułu jest przedstawienie dotychczasowych wyników w zakresie wybranych czynników psychologicznych, tj. sprawności intelektualnej, cech osobowości i temperamentu oraz sprawności psychomotorycznej w zakresie bezpieczeństwa ruchu drogowego. Jest to również podstawa do wyznaczania kierunków dalszych badań w tym zakresie.

Słowa kluczowe:

bezpieczeństwo na drodze, kierowca, czynniki osobowościowe kierowcy

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Introduction

The issue of road safety is the subject of many scientific investigations (Borucka et al., 2021; Świdorski et al., 2018; Stasiak-Cieślak et al., 2021). Research works in this area concern all elements of the human-road-vehicle system. The analysis of factors contributing to road accidents is particularly important. The most important of them, subject to research, is the traffic participant — the driver (Bęczkowska et al., 2012). His proper functioning requires adequate psychophysical fitness. It includes many elements, but according

to the authors, the most important is intellectual performance, personality and temperament, as well as psychomotor performance, including cognitive processes, e.g. eye-hand coordination, reaction time, etc.

The analysis presented by the authors aims to present the results achieved so far regarding the impact of the above-mentioned factors on the road safety, as well as the definition of directions for further investigations. The study is therefore not only a valuable review of the literature, but also an introduction to the planned research in the field of personality traits.

Methods and materials

The methodology of driver evaluation carried out by transport psychologists is adjusted to the examined person and is each time preceded by an interview covering such areas of human functioning as intellectual performance, personality and temperament, cognitive processes, and psychomotor ability.

Many psychologists consider personality to be a key factor in driving safety. The importance of temperament is also emphasised, which, to a greater extent than the motor and cognitive fitness of the driver, determines the so-called safe behaviour. The motor skills of the road users and the psychological properties characteristic to dangerous behaviour are taken into account.

Based on the methods of conducting research used in the literature, as well as the knowledge and experience of the authors, the article distinguishes and considers 4 categories of features, i.e. intellectual fitness, personality, temperament and psychomotor ability. Then, the results of research in these areas were discussed and presented.

The areas set out are an element that is subject to research in the field of transport psychology through the use of questionnaire and apparatus methods. Such tests are subject to the Road Traffic Act (Journal of Laws of 1997, No. 98, item 602); Act on vehicle drivers (Journal of Laws of 2015, item 155); Regulation of the Minister of Health on medical examinations of people applying for the license to drive vehicles and drivers (Journal of Laws of 2019, item 1659); Regulation of the Minister of Health on psychological tests of drivers and people applying for the authorization to drive vehicles and persons performing work as a driver. The methodology of conducting psychological tests in the field of transport psychology is set out in Annex 5 to the regulation (Journal of Laws of 2014, item 937).

In research, an authorized transport psychologist uses: diagnostic procedures that differentiate the type and purpose of the test; diagnostic methods and tools to verify the features and abilities; tests and diagnostic devices that meet the conditions of standardization, objectivity, normalization, reliability and validity; procedures for conducting and interpreting test results, as indicated in the manuals for tests and devices.

The psychologist has methods and research devices to assess and verify the variables that are important for the purpose of the study. In terms of intellectual efficiency and cognitive processes, he selects tools that allow to determine the efficiency of perception, attention, understanding of the situation and anticipation. In terms of personality

assessment, he selects tools to determine social and emotional maturity. In the field of psychomotor efficiency assessment, he selects tests and devices that allow to determine hand-eye coordination and reaction speed.

Selected studies on the four separate categories of intellectual performance, personality and temperament, cognitive processes, and psychomotor skills are presented below.

The authors of the article in the future plan research related to the individual personality traits of the driver based on the personality traits identified by P. T. Costa and R. R. McCrae (neuroticism, extraversion/introversion, openness to experience, agreeableness, conscientiousness), with particular emphasis on neuroticism, confirming or refuting its significance affecting road traffic safety (McCrae & Costa, 1997; Biela & Biela-Warenica, 2015; Łuczak & Tarnowski, 2013; Biernacki, 2013).

Results

Intellectual fitness

A driver candidate should, by definition, be intellectually fit. Only such persons can be licensed to drive. However, meeting certain standards does not mean equality in the implementation of intellectual tasks which every participant of the traffic has to deal with. The driver's ability to evaluate the risk and make a reasonable assessment of the traffic situation as well as accurately create possible reaction scenarios and make rational decisions are a function of his level of intelligence.

One of the measures of the level of intelligence may be the type of education possessed. In line with this assumption, studies on the correlation of education and the number of accidents are conducted. e.g. in (Fort et al., 2010) found that a low level of education is associated with an increased risk of road accidents. In (Sami et al., 2013) on the other hand, the death rate in road accidents was examined, stating a significant relationship between the level of education and mortality. Interesting research on fatalities in Iran was presented in (Lotfi et al., 2019). The authors conclude that the level of education plays a key role as a factor in road accidents, making the death rate among illiterate and poor readers very high. Similar conclusions confirming the relationship between education and accident rates are confirmed by many authors, including (Munteanu et al., 2014; Moafian et al., 2013). It should be

emphasised, however, that there are studies showing an inverse relationship, e.g. in the case of sleepiness as the cause of an accident, the risk is higher among people with higher education (Sagberg, 1999), similar are the results of studies on stress (Amini et al., 2018). However, it may also result from higher workload, stress and fatigue in the group with higher education.

According to some authors (Stephens & Ukpere, 2011) the level of intelligence is not necessarily related to education and knowledge. The leading factor is rather emotional intelligence, as well as the level of training of drivers before obtaining a driving license. The significance of emotional intelligence is also confirmed by studies carried out in a group of motorcyclists (Asgarian et al., 2017), which showed that components of emotional intelligence, such as happiness, optimism, flexibility, self fulfilment, autonomy and interpersonal relationships, are more common in the group of drivers with no experience of road accidents.

A positive correlation between a low level of emotional intelligence and the ability to make safe behavioural decisions while driving is also suggested by the authors in (Hayley et al., 2017), and in (Smorti et al., 2018), based on the research in a group of students, the authors show that emotional intelligence is significantly negatively correlated with the number of tickets for dangerous driving. The same results are presented in (Megías-Robles et al., 2021). The conclusions from the study of Spanish drivers show a lower propensity to take risks and a lower number of accidents and traffic fines among people with greater emotional intelligence. Analogous research (Arnau-Sabatés, 2012) was carried out in a group of Spanish students, showing that risky attitudes negatively correlate with emotional abilities.

Personality and temperament

The research on accidents and their relationship with the driver's individual traits focus on the personality traits formulated by Costa and McCrae (Łuczak & Tarnowski, 2013), who distinguish:

- neuroticism, i.e. a trait that determines emotional balance;
- extraversion/introversion, describing social relationships and the level of activity and energy;
- openness to experience, characterised by a tendency to favourably define life experiences;
- agreeableness, describing attitudes towards other people;

- conscientiousness, determining the degree of persistence and motivation in pursuing a goal.

Studies on undesirable behaviors while driving under certain conditions show their significant association with personality (Dahlen & White, 2006). The authors indicate (Hilakivi et al., 1989; Horta, 2005; Sousa, 2005) that people with higher anxiety, extroversion and lower self-control tend to be more risky on the road and therefore cause more accidents. Risk is especially the domain of young people (Ferreira et al., 2009; Scott-Parker et al., 2009; Scott-Parker et al., 2010; Graham et al., 2018). The likelihood of an accident is also increased by susceptibility to stress, depression, anxiety and aggression (Dula & Ballard, 2003; Miles & Johnson, 2003; Schreer, 2002).

The research in (Horoszkiewicz, 2019) also showed that drivers who participated in the road traffic collisions were, compared to "safe" drivers, more extrovert and conscientious. It turns out that positive psychophysical features coexist in drivers involved in road accidents, which raises the hypothesis that as mediating variables they influence the level of self-esteem being "responsible" for the propensity to risk with all its consequences.

Determining the safe (older) driver profile based on personality traits was the aim of the research conducted in the 65+ age group. The research (Classen, 2011) has shown that the extraversion/introversion dimension can be used as a reliable and accurate predictor of safe behaviour in older drivers. Introversion correlated with worse results in the fitness test, which, according to the researchers, results from the reduced attention of introverts to the outside world.

The relationship between neuroticism, extraversion and emotional reactions while driving, ways of coping with stress and the types of mistakes made were the subject of research (Biernacki, 2013) of professional drivers aged 65–81 (Choudhary & Velaga, 2017a, 2017b). The results showed that strong neuroticism in older drivers coexists with negative emotions and outward-directed aggression.

Research conducted in the group of higher accident risk (participants of collisions and road accidents, and those punished for drunk driving) allowed to define the profile of personality dispositions. A significant influence of individual features on the number of road accidents was demonstrated i.e. neuroticism ($p < 0.05$), tendency to lie ($p < 0.001$), extraversion ($p < 0.05$), agreeableness ($p < 0.05$) and conscientiousness ($p < 0.05$) (Biela & Biela-Warenica, 2015).

Cognitive processes

Among the studies on psychophysical capacity as an important cause of road accidents, it is worth mentioning (Kahneman et al., 1973) where selective auditory attention, selective orientation ability and resistance to distraction among professional bus drivers were tested. The relationship between susceptibility to disturbances and accident rate was demonstrated.

In (Underwood, 2007) visual attention was examined in the context of experience. It has been shown that with practice, the ability to visually perceive the road, its surroundings and the ability to perceive more complex situations increases.

Research on visual perception is presented in (Duchek et al., 1998). The authors investigated the relationship between visual attention and driving performance in healthy elderly people and people with Alzheimer's dementia. The results indicated that cognitive status is strongly associated with driving performance, which clearly declines as dementia increased in severity. Therefore, it is necessary to introduce screening tests for the elderly.

In (Brook & Boaz, 2006), in turn, the adolescents with attention deficit and attention deficit hyperactivity disorder (ADHD) as well as with learning disabilities (LD) were studied. The 5 subject of interest was to check whether the risk of an accident in the case of people with such problems is higher. It has been shown that people with ADHD/LD type disorders are much more prone to all kinds of accidents. It is favoured by their impulsiveness, hyperactivity, motor impairment, problems with coordination and spatial orientation impairment.

An incorrect assessment of perception, incorrect interpretation of the situation and, as a result, the lack of an appropriate reaction and incorrect decisions are indicated in (Green & Senders, 2004) as the main cause of accidents. Also, distraction from the use of devices such as a telephone can contribute to misjudging the situation. Extensive research in this area is presented, *inter alia*, in (Choudhary & Velaga, 2017a, 2017b; Koushki et al., 1999). All of them showed an increase in reaction time and a reduction in driving performance.

Psychomotor skills

Psychomotor skills tests performed by psychologists indicate the complexity of activities performed by the driver in the road traffic. The problematic nature of the processes that make up

the speed and adequacy of responses and coordination has a significant impact on the road safety. Therefore, tests should include assessment of, for example, the complexity of attention, disturbances in manual and visual functions, speed abilities, and distinguishing colours.

In (Truszczyński et al., 2012) it was proven that general intelligence can be considered a determinant of the effectiveness of drivers' coping in tests to study psychomotor performance, conducted in laboratory conditions. Intellectual ability correlates with faster and more accurate visual perception, promotes better sensorimotor coordination in the conditions of imposed speed of action.

Conclusions

The above considerations, allowing for a qualitative and quantitative description of the relationship between the level of road safety and selected issues, including the personality traits of road users, enable to identify factors contributing to accidents. Isolating the most important variables allows to focus on shaping the right attitudes and patterns, profiling the right behaviours and skills favouring correct reactions in the road traffic. Consequently, they model directions related to education in the field of road safety. An important task of transport psychologists is undertaking educational tasks in the field of road safety prevention.

According to the researchers, such variables as neuroticism, conscientiousness, and openness to experiences correlate with the tendency to be a participant and/or perpetrator of a road accident. The components in the main traits, e.g. aggressive behaviour, impulsiveness, and depression, may also be predictors of undesirable behaviour, which probably influence the behaviour of a given individual. Possessing the knowledge about the predisposition to risky behaviour due to personality traits is an extremely important value. To ensure road safety, a constant analysis of these factors and monitoring of the changes taking place is necessary as well as continuous education in this regard.

The research presented is part of shaping a comprehensive approach to improving road safety. Coherent, systemic solutions give a chance for lasting changes and reducing the number of road accidents. Such initiatives, however, must be preceded by a lot of detailed research, allowing to precisely identify and evaluate the impact of all factors. The analysis of personality factors is an introduction to research related to the individual

personality traits of the driver based on the personality traits identified by the aforementioned Costa and McCrae. There is no unequivocal definition of the term "driver personality", nevertheless the variety of personality theories makes it possible to select certain features important for road safety, and the available

diagnostic tools allow the selection of appropriate measurement techniques. The study highlights some personality components that affect safety. The above considerations constitute a valuable clue for further discussion on the influence of personality traits (including neuroticism) on safe/unsafe behaviour.

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Absolwentka Wydziału Mechanicznego Wojskowej Akademii Technicznej w Warszawie oraz Wydziału Ekonomicznego Wyższej Szkoły Zarządzania i Administracji w Opole. W 2015 r. uzyskała stopień doktora nauk technicznych w dyscyplinie budowa i eksploatacja maszyn, w zakresie: eksploatacja sprzętu technicznego. Stopień naukowy doktora habilitowanego w dziedzinie nauk inżyniersko-technicznych w dyscyplinie inżynieria lądowa i transport uzyskała w 2021 r. Od 2009 r. zatrudniona w Wojskowej Akademii Technicznej. Autorka ponad 100 publikacji naukowych poświęconych zagadnieniom dotyczącym analizy, oceny i modelowania systemów transportowych oraz procesów logistycznych zarówno w przedsiębiorstwach cywilnych jak i jednostkach wojskowych.