

## About Assessment Criteria of Driver's Accidental Abilities

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### ABSTRACT

The article points at the importance of studying the human factor as a cause of accidents of drivers, especially in loosely structured traffic situations. The description of the experiment on the measurement of driver's accidental abilities is given. Under accidental ability is meant the capability to ensure the security of driving as a behavior that includes activities and interaction with other road users. An approach to the assessment of such component accidental abilities as a sense of danger is suggested. The experiment simulated a vehicle driving process by the movement of a scooter with the requirement to travel at the maximum possible (by the feelings of a testee) speed through the gate with varying distances between the uprights. The pilot experiment was conducted on a group of children 10-11 years old, a group of motorists (men of safe driving age (26 to 45)) and a group of students 17-18 years of age (1 st year students of the Technical University). Criteria for assessing drivers' and applicants' to be drivers accidental abilities are presented in the present paper. Low level of sense of danger is associated with passing the test with a minimum distance between the posts, high speed of the route, using the brake directly at the rack or after it, testees preserving calmness and confidence on the scooter in the event of tension in standing in the racks, high level - with opposite indicators.

### KEYWORDS

Personal factor, accident prevention, accidental ability, sense of danger, evaluation criteria

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## Introduction

Statistics of road accidents in Russia in comparison with the countries of similar and higher levels of motorization is rather sad (Reshetova, 2016). This is connected not only with the peculiarities of traffic safety in Russia (Preventing road traffic injuries, 2012), but also with the dramatic changes in the level of motorization in the country, which took place in a very short period (Kichedzhi & Hatoyama, 2010). If in Soviet

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times, the road was mainly used by professional drivers, now it is dominated by motorists. This led to the fact that at the same time people with different psychological characteristics are involved in road traffic as drivers in varying degrees suitable to the driver's activity. Ongoing research by the authors of this work in the future is aimed at prevention of accidents of drivers with different socio-psychological characteristics based on the convergence of these categories that are particularly important for safe driving qualities, among which accidental abilities take a special place .

The reasons of the accident of a driver (considered as having the experience of accidents that have occurred due the fault of the driver) can be explained in different ways, especially depending on how the actual process of driving is treated - as an activity or behavior (Lobanova, 2014). In the first case the reasons are to be looked at non-compliance of the driver to requirements of the driver's activities, especially his training and qualification level (Bogdanov, 2008; Kozlov, 2012; Yulkin, 2012; Konoplyanko, 2007). In the second case the attention focuses on the influence of the driver's personality on the process of decision making in traffic situations (Leandro, 2011; Miller & Taubman-Ben-Ari, 2010, Paavera et al., 2013; Rosenbloom et al., 2008; Scott-Parker, Watson & King, 2009; Taubman-Ben-Ari & Yehiel, 2012; Abdua, Shinarb & Meiranc, 2012; Chliaoutakisa et al., 2005; Milesa & Johnsonb, 2013; Özkana & Lajunenb, 2006).

In Russia when developing measures to prevent road traffic injuries sufficient importance is not given to personal factors (Oleshchenko & Svatkova, 2014). However, it should be noted that the more clearly specific traffic conditions in traffic code are spelled out, the more likely the problems it encountered are actually caused by a poor level of training (lack of knowledge of traffic code) and the discrepancy of a driver to activity requirements on professionally important qualities (with the exception of those situations where the driver directly violates traffic code, that is determined by his personal attitude to the requirements per se, a measure of normativity of his behavior. The less clearly the situation is spelled out, the more likely that in decision making a personal factor and accidental abilities of a driver in particular, will play the main role (Lobanova & Glushko, 2015).

### Literature Review

Accidental abilities are the abilities to ensure the safety of operations, based on the developed sense of danger and safe motility. S.A. Eliseev (1998) included the following ones associated with the sense of danger:

- 1) an ability to relate the success and safety;
- 2) an ability not to risk in a familiar environment;
- 3) an ability to take a risk in extreme situations;
- 4) an ability not to get used to danger;
- 5) an ability to choose the safest approach to a dangerous situation;
- 6) a forecast of options and hazards;
- 7) an ability to detect weak signals and harbingers of danger;
- 8) an ability to maintain attention for a long time;
- 9) taking into account the experience of facing and dealing with dangers;
- 10) an ability to feel danger and avoid it;
- 11) an ability to communicate safely with others.

S.A. Eliseev noted that different people may have different levels of accidental abilities, ranging from their almost complete absence (it is possible that this category

has notorious "unfellers" allocated as a special group by K. Marbe (1926) to accidental talent (Eliseev, 1998).

With regard to the driving activity (and even more so in respect of certain groups of drivers with specific socio-psychological characteristics) a separate structure accidental abilities is not considered by S.A. Eliseev (1998). According to the authors of the article, if speaking about the requirements for the driver's accidental abilities (and their structure), for the level of their development, then, in our opinion, they have to be different for drivers from groups with different social and psychological characteristics, particularly from employees (professionals) and usual motorists. Substantiating this idea, we give the following example: when evaluating automated, practical driving skills, such criteria as "stability of skills in extreme conditions» is used. But if applied to the driver of special vehicles we are talking about the ability to drive and at the same time to fire at targets with an acceptable level of accuracy, then for a driving school student the extreme situation is an exam in driving in road police.

In addition, the authors of a number of studies have shown that the group of drivers, employed and self- working , are different from each other on the driving style features, on the influence of personal characteristics on the driving style, as well as the characteristics of the style of driving accidents and accident-free drivers for each subgroup (Lobanova, Komkova & Lebedeva, 2010).

Therefore, it is necessary to identify those elements in the structure accidental abilities that are required for all drivers and those that may be required only top professionals, performing special tasks of the activity (for example, drivers of special vehicles and sportsmen). Due to differences for activity tasks and having no possibility for a professional driver to drop certain tasks in the course of activities, it is important for a professional driver to have a deployed structure of accidental abilities, while a usual motorist can only have some one of them. The separation of accidental ability can be suggested, for the following reasons: all measures to ensure traffic safety are directed at the prevention of road accidents and the prerequisites for them, therefore, drivers rarely have to act in extreme circumstances, under favorable circumstances, i.e. the demand from usual motorist to have super abilities to resolve the pre-emergency situations or to show the ability to take risks in situations of this kind is at least inadequate: to develop this type of skills drivers have to be taught counter-accidental driving, such training programs for drivers at driving schools are not provided. Our aim was to study accidental abilities which are necessary for all drivers.

### Research Methods

The experiment was constructed on the analogy with the study accidental abilities of athletes made by S.A. Eliseev (Zhurin, Zhurina & Eliseev, 2013), but the problems solved by the testees during the experiment largely correspond to those arise in the driver's activities. An experiment was carried out in September 2015, at the same time Yu. Lobanova (2014) conducted the first part of the study. The second part was conducted both by Yu.I. Lobanova and K.V. Glushko (2015) in the spring of 2016 (April-May).

The experiment was intended to test the movement of a scooter from the starting line to the gate (some people were standing in the rakes) with maximum speed. The distance between the posts in each new sample was reduced at the beginning with a certain step.

Let's define what exactly the similarity is between the movement of a scooter and a car:

- the use of a wheel vehicle;



- an opportunity to get a speed exceeding walking pace;
- the presence of steering (the ability to manage direction stability);
- an ability to quickly reduce speed (also due to the presence of the brakes);
- an ability to set the speed (simulation of the use of the gas pedal through additional push in motion);
- a possibility of reducing speed in different ways (by friction forces or dismounting).

An instruction that was given to the participants of the experiment is the following: "You have to stand at the starting line, when commanded, start the movement and as quickly as possible to pass, trying to go straight through" live "gates."

With the help of an experiment it was intended to assess:

1) The ability of the testees to correlate the success and safety: the testees had to match their abilities operate a proposed vehicle in the given conditions and regulations requirements (despite the requirement of the instructions, it was expected that the testees would choose not the highest possible, but optimal speed, which allows to provide a certain level of security for themselves and for the other participants of the experiment): further on, to confirm this hypothesis it is necessary to measure the speed of testees' movement in the absence of the gate, and (or) to correlate the speed with posts of gates at different distances.

2) The ability to not risk in a familiar environment: the experimental conditions are not extraordinary, additional danger to the testees are not specially created.

9) Taking into account the experience of facing and dealing with risks (in case when similar circumstances, a testee faces problems, he can somehow use this experience, for example, considering his previous scooter riding experience (or lack of it), the presence or absence of convenient (safe for the exercise) clothing or footwear, finally, assessing the security situation of the experiment for others or for oneself).

10) The ability to feel danger and avoid it: the danger in the experiment in the first place is associated with the possibility of collision with other people, due to which they can be injured as well as a testee, so ideally a testee should choose or adjust the speed of motion so to reduce (minimize) the level of the danger.

11) The ability to communicate safely with other people: this component of accidental abilities in the pilot experiment special emphasize was not made, however, testees could without any restrictions on their own desire contact with other participants of the experiment using any words; furthermore, likely this possibility will be also used and analyzed.

Thus, the pilot experiment conditions were as follows:

- A scooter (for adults, weight up to 90 kg, so the adults whose weight exceeds this figure were not permitted to participate in this part);
- 15 m - distance from the starting line to the gate;
- A split of the center line with a step of 1 m to determine the point of the last push (the point from which the scooter speed will inevitably decrease due to the frictional forces);
- A gate, the distance between racks changed in the step of 0.2 m and 0.1 m (for children the minimum distance - 0.6 m, for adults - 0, 4 m); (Note the fact that in contrast to the dimensions of the car, a scooter and a human body are very close: for the pilot study sizes were as follows: 30 cm (width of the wheel), and 40 cm - average width of the shoulders of adults-testees who participated in the experiment).

- the function of the post was carried out by people who were instructed to leave their place in the event that the situation seems threatening their safety.

The last condition of experiment seems to us particularly important, since it simulates situations that arise in real traffic: in cases where the other vehicle is too close (in the driver's opinion) is approaching his car, he is taking action aimed at collision avoidance. This does not mean that a collision is imminent, but different people have various opinions of danger. Avoiding imaginary dangers and being fixed on it, the driver can by his actions in turn create a dangerous situation and get into an accident, which will (most likely) be treated as an accident that has occurred due to his fault.

## Results and Discussion

In the first pilot experiment children aged 10-11 years: 4 girls and 4 boys were invited. Out of eight participants, one girl and one boy were removed from the experiment: a girl believed conditions of the experiment were unsafe for others; a boy coped badly with riding a scooter about which he warned in advance (in his case it is necessary to speak about unsafe psychomotor system, making meaningless estimation to the actual sense of danger).

After completing the task testees also were questioned about the presence / absence of fear while riding.

1.20m: everybody fulfilled, there is no fear

1.00 m: everybody fulfilled, there is no fear.

0.8m: only L. passed from girls (push 1 m to the gate) and A (push in the gate);

0, 7 m: only L. passed from girls (last push 3 meters to the gate);

0.7 m: M. and C. passed the gate reeling, the last push of the foot was observed 2-2.5 m to the gate, V. - a final push 1.5 m to the gate.

0.6 m - performed only one B., without decreasing the speed and using the brake. He had no feeling of fear, but the children standing in a "live" the gates at his approach retreated to the side.

On the basis of the first experiment it is possible to grade accidental abilities (namely, the sense of danger) as following (in this age group):

- failure (including those caused by the experience of fear or insecurity) when explaining the task - an extremely high level of sense of danger;

- 1.20 m - high (with a stop at this stage);

-1.00 m - medium (with a stop at this stage);

-0.8 m -lowered;

- 0.7 m - low;

- 0.6 m - very low and extremely low (depending on whether or not there is a sense of danger, anxiety, fear).

In the second pilot experiment five part-time students and 1 post-graduate student of the university took part (all have a driver's license and driving experience more than 3 years). The gates were installed at a distance of 1m, 0.8m; 0.6 m; 0.5 m; 0.4 m. Some experimental results are shown in Table. 1.

**Table 1.** The Analysis of the Behavior of the Testees on Individual Characteristics with a Minimum Distance between the Posts of the Gate



Tes-tee	Tes-tee's shoul-der width	MIN distance between posts of the gate	Start of de-ce-ler-a-tion	Type of bra-king before the gate	Type of bra-king after the gate	The pre-sence of the testee's emo-tions (nega-tive: fear, anger, anxiety)	Effect of the post	Emo-tions of the post (tensi-on, anxie-ty, fear)
I.	40cm	-	-	-	-	-	-	-
P.	40cm	0,6	before 5-6 m	By fric-tion	Turn	-	On the spot	-
A.	45 cm	0,5	before 4-4,5 m	By fric-tion	Turn	-	On the spot	-
Ko.	40 cm	0,4	before 1 m to the ent-rance of the gate	-	Turn	-	On the spot	-
Ki.	40 cm	0,4	In gates	Ab-sent	Coast-ing	-	On the spot	State of tension of those standing at the gate

Our comments on the experiment course and some of the results are as follows:

1. One participant (Ivan) refused to take part in the experiment. The reason for refusal was linked to the lack of safe footwear. I. pointed to the presence of the negative experience of driving a scooter in similar shoes.

2. All other testees without hesitation drove through the gates at a distance of 0, 8 m, 0.6 m; One (A.) passed the gate with the width of 0.5 m (width of his shoulders is equal to 43 cm in contrast to the others), two passed the gate with the width of 0.4 m (Ki. & Ko.): that is for adults with the increased size of the body the safe distance was less than for children.

3. There are differences between testees when moving along the route and through the gate, although it is possible that until now they are revealed in a group with average accidental abilities, and those with excessively low and excessively high accidental abilities will be dramatically different from the study of our group.

4. On the basis of available data it is possible to make a gradation between the testees in terms of development accidental abilities (on the feeling of danger).

5. It is possible to talk about getting a number of criteria which can be used to further evaluation as a component of a sense of danger accidental abilities.

Thus, the criteria level of development of a sense of danger, in our opinion, can be the following:

1. The minimum distance between the posts at which the testee was willing to perform the task (taking into account the size of his own body) in decimeters or centimeters.

2. The start point of speed reduction (distance to gate) in meters.

3. The type of braking before the passing the gate: the use of the brakes, the termination acceleration (no pushes), dismounting (one of three variants or more at a time).
4. Average speed (calculated taking into account the time of passing the experimental situation) in meters per second.
5. Dynamic corridor, which characterizes by the movement of the testee.
6. Accelerate (when approaching the gate).
7. Actions of participants, serving as "post": absence or presence of motion (action).
8. The emotions experienced by the participants (according to the survey): the immune response and the choice of four options (joy, fear, anger, anxiety);
9. The emotions experienced by the participants in the experiment, performing the role of the "posts" when passing the test gate at a minimum distance: the absence of the presence of feelings of tension and security-insecurity.
10. Change (no change) of average speed while reducing the distance between the posts (based on a comparison of the results of three repetitions of tasks by reducing the distance between the gate) and (or) speed and acceleration with which the testees pass the same distance in the absence of obstacles (posts ).
11. The type of braking (after passing through the gate): the use of the brakes, turning, dismounting, freewheeling movement (speed reduction due to friction forces) in different experimental situations.

Finally, an experiment to assess accidental abilities was conducted on a group of 1<sup>st</sup> year students: 8 men and 1 woman participated in the experiment. Six young people have driving license and driving experience. A girl also has a driver's license and the vehicle driving experience for about 5 months.

This group is of particular interest as it is mainly young people of this particular age who are increasingly becoming students of driving schools, and therefore, to have criteria for assessing accidental abilities is especially important for this age group.

The results of the exercise in the framework of the experiment can also be displayed in Table 2.

**Table 2.** The Analysis of the Behavior of the Testees on Individual Characteristics with a Minimum Distance between the Posts of the Gate

Testee	Testee's shoulder width	MIN Distance between posts of the gate	Start of deceleration	Type of braking before the gate	Type of braking after the gate	The presence of the testee's emotions (negative: fear, anger, anxiety)	Effect of the post	Emotions of the post-(tension, anxiety, fear)
Na. (has driving license, 4 months driving experience)	35 cm	0,5	For 2,5 m	Frictional forces (free rolling)	Dismounting	-	On the spot	-
K	40 cm	0,4 (less ready)	For 1,5-4	Frictional forces (free rolling)	Dismounting	-	On the spot	-



A.	40 cm	0,4	For 1-4	Frictio-nal forces (free rolling)	Brake on the wheel	-	On the spot	-
V. (has driving license, 4 months driving experience)	40 cm	0,4	3	Frictional forces (free rolling)	Brake on the wheel	-	On the spot	-
Ay. (has driving license, 2 years driving experience)	40 cm	0,5	4-5	Frictional forces (free rolling)	Brake on the wheel	-	On the spot	-
N. (has driving license, 4 months driving experience.)	40 cm	0,5	4	Frictional forces (free rolling)	Brake on the wheel	-	On the spot	-
P.	40 cm	0,5	2-3	Frictio-nal forces (free rolling)	Dismounted	-	On the spot	-
S.	45 cm	0,5	6	Frictio-nal forces (free rolling)	Brake on the wheel	-	On the spot	-
A.	40 cm	0,5	1-2	Frictio-nal forces (free rolling)	Brake on the wheel	-	On the spot	-
S.	40 cm	0,5	3	Frictio-nal forces (free rolling)	Brake on the wheel	-	On the spot	-

Summing up the three piloting studies in different age groups, it should be noted:

- general criteria for assessing accidental abilities in all three groups remained unchanged: testees differed from each other during the passing of the route in the following features: speed, acceleration, distance between the posts, the dynamic corridor, at the start of deceleration to the post, the type used deceleration, experienced emotions, the emotions of the testees in the post, presence-absence of physical contact, presence-absence of communication to interact with participants in the post;

- average (by observation) in certain age groups are obviously different. By focusing only on two indicators, it should be noted that the distance between the posts and the start of braking in the youngest age group is the largest minimum distance and the time of braking the earliest. However, the results of the task in a given group can affect physical development and characteristics inherent in adolescence. The fact of the existence of differences between the results of students' age and safe drivers can more



likely say about the differences in the level of accidental abilities (in fact, by psychophysiological characteristics of 17- 18 years may well exceed the older people).

Here are the values of individual criteria, that can be the basis of assessing the results of the main experiment (adult group) in the future (Table 3).

**Table 3.** Approximate criteria for assessing the level of drivers` accidental abilities (adult group, male)

Assessment criteria of accidental abilities	Low level	Middle level	High level
Distance between posts	0,45 m and less	0,5-0,6	More than 0,6 m
Start of deceleration	0-1 m before the gate	More than less than 3 meters before the gate	3m before the gate and more
Type of deceleration before the post	Absent	Coasting	Coasting 3m and more before the gate
Type of deceleration after the post	Dismounting	Turn	Coasting
Testees`s emotions	Joy	From calmness and confidence to tension	Fear
Emotions of the «post»	Fear	Some tension	Calmness
The actions of the post at testees`s passing the route	Bounce	Additional coordination, concentration	No motions
The presence of contact interaction of a testee with the post	There is contact	None	2-3 cm margin

## Conclusion

On the basis of the obtained criteria it is possible:

- to evaluate the accidental abilities of testees in the first approach;
- to correlate them with personal features and professionally important qualities for a driver's activities;
- to approach solving the issue of a possibility of development accidental abilities in those cases when they are too low.

Further work is expected to experiment with the scooter on a large sample of testees to assess their accidental abilities with the help of present criteria, and to correlate them with the characteristics of the driving style of surveyed drivers, with a number of psychophysiological and personality characteristics as well as the driver's biography of testees (data regarding the accident of drivers). The study of the factors associated with accidental abilities of a driver, opens up new possibilities for understanding the causes of accidents of drivers and road safety in general.

## Disclosure statement

No potential conflict of interest was reported by the authors.



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