SYNESIS
Journal for Humanities and Social Sciences

UDK 141.32/.33:001.891(091)

https://doi.org/10.63356/sin.2025.013

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The time-savings and the time-loss bias in traffic[1]

Original scientific paper

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Here we investigate the time-saving bias (TSB), the cognitive bias which leads to underestimation of the saved time when increasing vehicle's speed from low initial speeds and overestimation when increasing from high initial speeds, and the time-loss bias (TLB), which leads to underestimation of the lost time when decreasing vehicle's speed from low initial speeds and overestimation when decreasing from high initial speeds. The previous research in Bosnia and Herzegovina showed that people overestimate the saved time when increasing from both low and high initial speed. The goal of this research was to test the TSB and TLB in Bosnia and Herzegovina in a more controlling experimental design and with a larger sample. The total of 1414 drivers (50.50% women), ages from 18 to 82 (M = 33.24), participated in research. There were six questions for the TSB, three with the low initial speed and three with the high initial speed, and six questions for the TLB, three with the low initial speed and three with the high initial speed. The differences between initial speeds and increased/decreased speeds were 10, 20 and 30 km/h. Each participant was randomly assigned one TSB and one TLB question. The results showed that participants on average overestimated the saved/lost time in all cases. Furthermore, average estimations of the saved time correspond to the proportion heuristic increased by the constant k = 6.5 min, whereas estimations of the lost time correspond to the percentage heuristic increased by the constant n = 12 min.

Key words:
the time-saving bias, the time-loss bias, high and low speeds, traffic culture, intuitive knowledge

Pristrasnost u procjeni uštede i gubitka vremena u saobraćaju

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U radu se istražuje pristrasnost u procjeni uštede vremena (TSB), tj. kognitivna pristrasnost koja dovodi do podcjenjivanja uštedenog vremena pri povećanju brzine vozila sa niskih početnih brzina i precjenjivanja pri povećanju sa visokih početnih brzina, kao i pristrasnost u procjeni gubitka vremena (TLB), koja dovodi do podcjenjivanja izgubljenog vreme-

[1] This research was conducted as part of a broader study titled 'Implicit Knowledge of Object Movement and Cognitive Biases in the Context of Traffic,' funded by the Traffic Safety Agency of the Republic of Srpska. In addition to expressing our gratitude to the Road Traffic Safety Agency, Republika Srpska, we would also like to thank the psychology students from the Faculty of Philosophy, University of Banja Luka, who helped us collect an adequate sample and draw reliable conclusions.

[2] The first author was a student at the Faculty of Philosophy, University of Banja Luka, at the time this research was conducted.

na pri smanjenju brzine vozila sa niskih početnih brzina i precjenjivanja pri smanjenju sa visokih početnih brzina. Prethodna istraživanja u Bosni i Hercegovini pokazala su da ljudi precenjuju uštedu vremena pri povećanju kako sa niskih tako i sa visokih početnih brzina. Cilj ovog istraživanja bio je da se testiraju TSB i TLB u Bosni i Hercegovini u kontrolisanijem eksperimentalnom dizajnu i sa većim uzorkom. Ukupno 1414 vozača (50,50% žena), uzrasta od 18 do 82 godine (M = 33,24), učestvovalo je u istraživanju. Bilo je šest pitanja za TSB, tri sa niskom početnom brzinom i tri sa visokom početnom brzinom, i šest pitanja za TLB, tri sa niskom početnom brzinom i tri sa visokom početnom brzinom. Razlike između početnih brzina i povećanih/smanjenih brzina bile su 10, 20 i 30 km/h. Svakom ispitaniku je nasumično dodijeljeno jedno pitanje za TSB i jedno za TLB. Rezultati su pokazali da su učesnici u prosjeku precjenjivali uštedu/izgubljeno vrijeme u svim slučajevima. Prosječne procjene ušteđenog vremena odgovaraju heuristici proporcije uvećanoj za konstantu k = 6,5 minuta, dok procjene izgubljenog vremena odgovaraju heuristici procenta uvećanoj za konstantu n = 12 minuta.

Ključne riječi:
pristrasnost u procjeni uštede vremena, pristrasnost u procjeni gubitka vremena, visoke i niske brzine, saobraćajna kultura, intuitivno znanje

Introduction

According to WHO (2018), around 1.35 million of people die every year in car accidents. Number of deaths caused by car accidents in Bosnia and Herzegovina is 15.7 deaths per 100,000 population (WHO, 2018). Auto-Moto Association of Republic of Srpska (AMS RS, 2016) has reported that 44% of drivers exceed the speed limit in populated areas, 58% drive faster than the speed limit in unpopulated areas and 32% drive faster than the speed limit on highways. Series of research showed that people are not successful in estimating the time they would save by increasing speed (Eriksson et al., 2015; Eriksson et al., 2013; Herberz et al., 2019; Marinković & Dimitrijević, 2020; Peer, 2010a, 2010b, 2011; Peer & Gamliel, 2012, 2013; Peer & Rosenbloom, 2013; Peer & Solomon, 2012; Svenson, 1970, 1971, 2008, 2009; Svenson, & Treurniet, 2017; Tscharaktschiew, 2016) or lose by decreasing speed of their vehicle (Herberz et al., 2019; Svenson & Borg, 2020; Svenson & Salo, 2010; Svenson & Treurniet, 2017). Although there is a formula for calculating the saved/lost time, it seems that people do not use it. The previously mentioned formula is:

$$t = cD\,(1/V_1 - 1/V_2) \qquad (1)$$

where *t* stands for time, *c* is the constant which depends on the measuring unit, *D* is the travelled road, V_1 is the initial speed and V_2 is the increased/decreased speed.

Previous research showed that people tend to underestimate the saved time when increasing vehicle's speed from a low initial speed and overestimate the saved time when increasing from a high initial speed. This phenomena has been called *the time-saving bias* (TSB) and it is a cognitive bias that influences people's estimations (Eriksson et al., 2015; Eriksson et al., 2013; Herberz et al., 2019; Marinković & Dimitrijević, 2020; Peer, 2010a, 2010b, 2011; Peer & Gamliel, 2012, 2013; Peer & Rosenbloom, 2013; Peer & Solomon, 2012; Svenson, 1970, 1971, 2008, 2009; Svenson, & Treurniet, 2017; Tscharaktschiew, 2016). The same effect has been

found in the case of decreasing speed, that is, people underestimate the lost time when decreasing vehicle's speed from a low initial speed and overestimate when decreasing from a high initial speed. This effect is assumed to be present due to the same cognitive bias, but for an easier differentiation, it is called *the time-loss bias* (TLB) (Fuller et al., 2009; Herberz et al., 2019; Svenson & Borg, 2020; Svenson & Salo, 2010; Svenson & Treurniet, 2017).

The real cause of the TSB and the TLB is still unknown, but some researchers assume that the cause could be people's misperception of the relationship between time and speed. The relationship between time and speed is curvilinear and, therefore, if the difference between an initial speed and an increased speed is kept constant, as well as the travelled distance, the time needed to travel that distance depends on the initial speed. Higher initial speed leads to less time saved than lower initial speed in this case. However, it seems that people understand the relationship between time and speed as relatively linear (Eriksson et al., 2015; Peer & Gamliel, 2013). The linearity could be intuitively our first guess when we are confronted with a new dilemma, because it is the most common relationship, or because it is the simplest concept which we learn during our early childhood and we consolidate it through formal education and experience ("SciTechDaily", 2019).

These cognitive biases have been mathematically formulated through two heuristics. Svenson (2008) defined *the proportion heuristic*:

$$t = cD\ (V_2 - V_1)/V_2 \qquad (2)$$

where *t* stands for time, *c* is the constant which depends on the measuring unit, *D* is the travelled road, V_1 is the initial speed and V_2 is the increased/decreased speed. This heuristic postulates that people estimate the saved/lost time based on the proportion between the increased/decreased and the initial speed (Svenson, 2008). On the other hand, Peer and Gamliel (2012) believe that people estimate the saved/lost time based on the percentage of the increase/decrease of speed comparing to the initial speed. This is called *the percentage heuristic* and its formula is:

$$t = cD\ (V_2 - V_1)/V_1 \qquad (3)$$

where *t* stands for time, *c* is the constant which depends on the measuring unit, *D* is the travelled road, V_1 is the initial speed and V_2 is the increased/decreased speed (Peer et al., 2012). Both heuristics have been found in research. No effects of formal education (Svenson, 2009) or question formulation (Peer, 2010b) on estimating the saved time have been found. However, there are other factors that influence our estimations of the saved/lost time, such as traffic cultures (Wang et al., 2019), traffic infrastructures (Uzondu et al., 2020) and driving styles (Sârbescu et al., 2014). In contrast to previous findings, the research by Marinković and Dimitrijević (2020) in Bosnia and Herzegovina showed that people overestimate

the expected saved time when increasing vehicle's speed from both low and high initial speeds. These average estimations correspond to the corrected proportion heuristic, that is, the proportion heuristic increased by the constant *k,* represented by the following formula:

$$t = cD\ (V_2 - V_1)/V_2 + k \qquad (4)$$

where *t* stands for time, *c* is the constant which depends on the measuring unit, *D* is the travelled road, V_1 is the initial speed, V_2 is the increased/decreased speed and *k* is the constant. In this case, the value of the constant *k* was six (minutes). In other words, all values predicted by the proportion heuristic are increased by six.

All factors mentioned above create intuitive knowledge about the time-speed relationship and it is very likely that this influences people estimations about the saved/lost time when changing vehicle's speeds. Considering differences in traffic culture and road infrastructures between Bosnia and Herzegovina and countries in which the TSB and the TLB have been previously studied, Marinković and Dimitrijević (2020) believe that the intuitive knowledge about the time-speed relationship differs in people in Bosnia and Herzegovina comparing to other countries and, therefore, their estimations are systematically different. Namely, intuitive knowledge develops through experience-based learning, whereby individuals form expectations and mental models based on recurring patterns and feedback from specific contexts, including cultural, infrastructural, and professional frameworks (Hogarth, 2001). On the other hand, there is research confirming that driving styles and traffic behaviour are culturally conditioned—that is, there are cultural differences in risk perception, adherence to traffic rules, emotional reactions while driving, and similar aspects (Dong et al., 2024; Hussain et al., 2023; Özkan et al., 2006; Töre et al., 2023).

The aim of this research is to test the TSB and the TLB in Bosnia and Herzegovina using a more controlling experimental design. In the previous research the stimuli were repeated, and all participants were exposed to all questions. The number of participants was relatively small (N = 171) and not all participants were drivers (Marinković & Dimitrijević, 2020).

We hypothesize that participants will overestimate the saved time when increasing vehicle's speed from both low and high initial speed, confirming the results from previous research, and, furthermore, we hypothesize that they will overestimate the lost time when decreasing vehicle's speed from both low and high initial speed.

Given that the effects of time-saving and time-loss biases (TSB and TLB) have been relatively rarely investigated, particularly in countries with specific traffic conditions such as Bosnia and Herzegovina, this study contributes to the expansion of the limited body of research on this topic. Due to the small number of available and relevant sources, certain authors are cited multiple times throughout the paper. This repetition does not reflect a selective approach but rather highlights the cur-

rent state of development in this area of research. By employing a more controlled experimental design and taking into account the specific characteristics of the local context, the study aims to deepen the understanding of time–speed estimation biases and thereby contribute to the formation of a broader and methodologically more diverse body of knowledge on the phenomenon.

Method

Participants

The sample consisted of 1,414 participants (50.50% female). The youngest participant was 18 and the oldest was 82 years old (M = 33.24, SD = 14.55). There were 59.8% participants living in a city area, 24.4% in a suburban area and 15.8% in a village. There were 12.4% participants with a three-year high school degree, 50.4% with a four-year high school degree, 7.4% with a higher studies degree, 6.6% with a bachelor's degree (three years) and 23.2% with higher degrees; 2.5% high school students, 27.4% university students, 55.0% employed, 8.9% unemployed and 6.2% pensioners. In the sample there were 26% beginners (up to two years of driving experience), 19% young drivers (from three to five years of driving experience), 25% experienced drivers (from six to fifteen years of driving experience) and 30% drivers with more than 15 years of experience. When it comes to frequency of driving, 63% of participants drove almost every day, 20% drove once or twice a week, 8% drove once or twice a month, 4% drove less than once a month and 5% did not drive in the last six months.

Design

Two types of questions were used in this research: (1) questions for estimating the saved time when increasing vehicle's speed from two initial speeds (40 km/h and 90 km/h); (2) questions for estimating the lost time when decreasing vehicle's speed from two initial speeds (70 km/h and 120 km/h). The increased/decreased speeds differed from the initial speeds by 10 km/h, 20 km/h and 30 km/h. In both types of questions there were two independent variables: (1) the initial speed with two levels (40 km/h and 90 km/h when the speed is being increased, and 70 km/h and 120 km/h when the speed is being decreased); (2) new speeds with three levels (10 km/h, 20 km/h and 30 km/h higher or lower than the initial speed). The dependent variable is estimated saved/lost time when increasing/decreasing vehicle's speed and it is expressed in minutes. Participants were randomly assigned one time-saving question and one time-loss question. The number of participants per question ranged from 203 to 257 for the time-saving questions (Table 1) and from 216 to 252 for time-loss questions (Table 2).

Procedure

This research was conducted via an online questionnaire using 1KA platform (https://www.1ka.si/d/en). There were six time-saving questions, three with low and three with the high initial speed, and six time-loss questions, three with the low and three with the high initial speed. All tasks are formulated to simulate a stressful situation with clear time pressure and personal stakes, i.e., driving to an important job interview. By placing the task in such an emotionally charged context, greater ecological validity is achieved, as it reflects conditions that resemble everyday challenges. An example of a time-saving question:

> "Imagine you are driving to an important job interview. You are driving with speed of 40 km/h. There is 20 km of the road left. If you continue to drive with the speed of 40 km/h, you will arrive in 30 minutes. How much time will you save if you drive the rest of the road with the speed of 50 km/h?"

An example of a time-loss question:

> "Imagine you are driving to an important job interview. You are driving with speed of 70 km/h. There is 35 km of the road left. If you continue to drive with the speed of 70 km/h, you will arrive in 30 minutes. However, because of the work on the road, you have to drive the rest of the road (35 km) with the speed of 40 km/h. How much time will you lose because of this speed decrease?"

All participants were volunteers who received a link for the questionnaire. Participants were asked to use their intuitive assessment and not to use the formula if they knew it or calculator for calculating the saved and lost time. Participants entered their estimations into the field provided for answers. Participants were informed that the research is anonymous and that, by filling out the questionnaire, they are giving consent for the usage of data. It was possible to withdraw from the research at any point.

Results

One sample t-test was used to compare participants' average estimations about the saved or lost time for each question with the real time that would be saved or lost. Results show that there is a statistically significant overestimation of the saved time when increasing vehicle's speed from both low and high initial speeds (Table 1) and there is a statistically significant overestimation of the lost time when decreasing vehicle's speed from both low and high initial speeds (Table 2). All differences between the estimated and the real saved and lost time were statistically significant at the level of $p < .001$ and $p = .002$ with strong effect sizes, represented by Cohen's d, ranging from $d = 0.53$ to $d = 1.08$, except when changing speed from 40 km/h to 70 km/h (Table 1) and from 70 km/h to 40 km/h (Table 2).

Table 1
The Estimated Saved Time in Comparison to the Real Time Saved

Speed change (km/h)	N	The estimated saved time (min)		The real-time saved (min)	t	df	p	Cohen´s d	95% CI for Cohen's d	
		M	SD						Lower	Upper
40 → 50	203	10.26	7.21	5.71	8.99	202	< .001	0.63	0.48	0.78
40 → 60	212	13.23	6.31	9.85	7.80	211	< .001	0.53	0.39	0.68
40 → 70	235	14.26	5.76	12.82	3.84	234	< .001	0.25	0.12	0.38
90 → 100	256	10.90	7.32	3.00	17.28	255	< .001	1.08	0.92	1.23
90 → 110	232	13.55	9.05	5.41	13.69	231	< .001	0.90	0.74	1.05
90 → 120	257	13.96	8.72	7.50	11.88	256	< .001	0.74	0.60	0.88

Table 2
The Estimated Lost Time in Comparison to the Real Time Lost

Speed change (km/h)	N	The estimated saved time (min)		The real-time saved (min)	t	df	p	Cohen´s d	95% CI for Cohen's d	
		M	SD						Lower	Upper
70→40	219	26.34	18.96	22.32	3.14	218	.002	0.21	0.08	0.35
70→50	216	21.96	15.73	12.25	9.07	215	< .001	0.62	0.47	0.76
70→60	233	17.26	14.30	5.08	13.01	232	< .001	0.85	0.70	1.00
120→90	236	26.12	18.21	10.00	13.60	235	< .001	0.88	0.73	1.03
120→100	252	21.35	16.92	5.93	14.46	251	< .001	0.91	0.76	1.06
120→110	244	18.50	18.25	2.79	13.44	243	< .001	0.86	0.71	1.01

Participants' average estimations about the expected saved time correspond to the proportion heuristic increased by the constant k = 6.5 (minutes) (Formula 4) in all cases except in the case of speed change from 90 km/h to 120 km/h. On the other hand, participants' average estimations about the expected lost time correspond to the percentage heuristic increased by the constant n = 12 (minutes) presented by following formula:

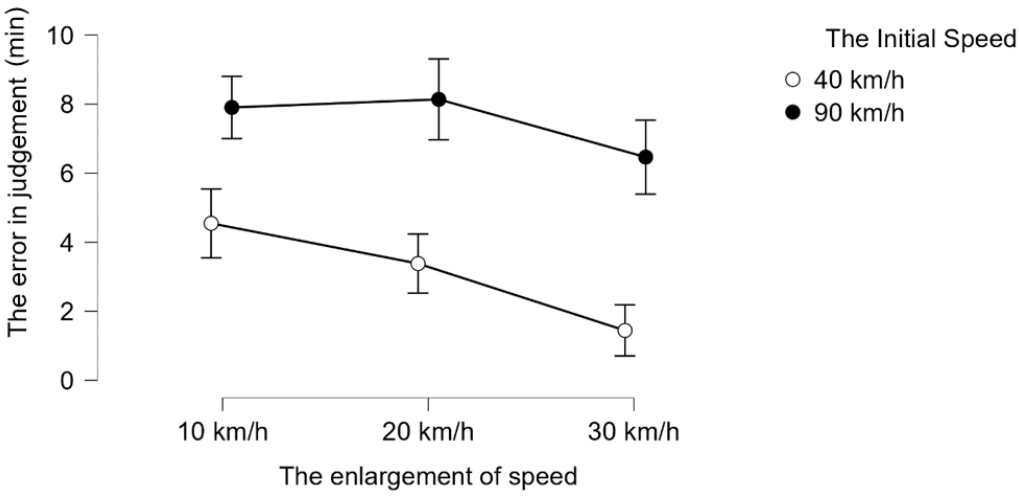
$$t = |cD\,(V_2 - V_1)/V_1| + n \qquad (5)$$

where t stands for time, c is the constant which depends on the measuring unit, D is the travelled road, V_1 is the initial speed, V_2 is the increased/decreased speed and n is the constant.

Effects of the initial speed and the enlargement and the decrease of speed on the magnitude of error in judgement of the saved and lost time were tested using two factorial ANOVAs: initial speed (low, high) × speed change (10, 20, 30 km/h). There were statistically significant effects of the enlargement of speed ($F(2) = 12.066$, $p < .001$, $\eta 2 = 0.016$) and the initial speed ($F(1) = 116.979$, $p < .001$, $\eta 2 = 0.076$) on the magnitude of error in judgement. In cases of both high (90 km/h) and low (40 km/h) initial speeds the error of judgment decreases as the enlargement of speed increases (Figure 1). The difference between the error in the case of the high initial and low initial speed is statistically significant, that is, the error is bigger in the case of the high initial speed ($t = 10.816$, Cohen's $d = 0.58$, $p < .001$).

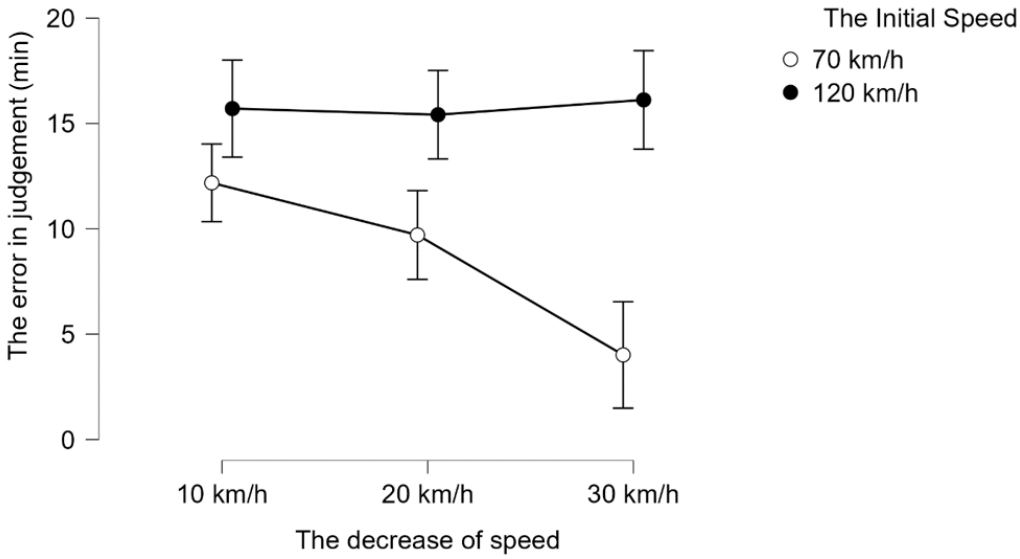
Figure 1

Effects of the Initial Speed and the Enlargement of Speed on the Magnitude of Error in Judgement of the Saved Time



In the case of error in evaluating the lost time, there is an interaction between the initial speed and the decrease of speed ($F = 7.808$, $p < .001$, $\eta 2 = 0.011$), the main effect of the initial speed ($F = 60.034$, $p < .001$, $\eta 2 = 0.041$) and the small individual effect of the decrease of the speed ($F = 6.082$, $p = .002$, $\eta 2 = 0.008$). In the case of the low (70 km/h) initial speed, the error of judgment decreases as the enlargement of speed increases, whereas in the case of the high initial speed, the magnitude of error does not change significantly (Figure 2). The error is bigger in the case of the high initial speed and the difference is statistically significant ($t = 7.748$, Cohen's $d = 0.42$, $p < .001$).

Figure 2
Effects of the Initial Speed and the Decrease of Speed on the Magnitude of Error in Judgement of the Lost Time



Although previous studies (e.g., Svenson, 2009; Peer, 2010b) have not consistently confirmed the influence of formal education, there are theoretical reasons to assume that higher education may reduce reliance on heuristics, while longer driving experience may shape more stable (though not necessarily more accurate) patterns of intuition (Kahneman & Klein, 2009). Accordingly, the analysis based on these variables aims to determine whether education and driving experience influence the time-loss/saving bias in traffic.

The effect of education level on the magnitude of error was tested using Kruskal-Wallis test because the normality and homogeneity criteria were not met to conduct a parametric one-way ANOVA. Participants were split into three groups according to their level of education. The first group consists of participants who only finished elementary school, the second group consists of participants who have high school diploma, and the third group is reserved for participants who have bachelor diploma or higher level of education. The results show that overall, there are no statistically significant differences in judgments among participants of different levels of education (Table 3). The statistically significant differences appear when the speed is increased from 40 km/h to 50 km/h and when it is decreased form 120 km/h to 110 km/h. However, when Bonferroni's correction for multiple comparisons is used, the difference in the case of decreasing speed becomes statistically non-significant.

Table 3
The Difference in Judgments Across Different Levels of Education

Speed change (km/h)	χ^2	df	p
40 → 50	12.24	2	.002
40 → 60	3.43	2	.180
40 → 70	4.36	2	.113
90 → 100	1.09	2	.580
90 → 110	3.41	2	.182
90 → 120	2.32	2	.313
70 → 40	2.91	2	.234
70 → 50	1.11	2	.574
70 → 60	2.43	2	.297
120 → 110	7.79	2	.020
120 → 100	1.07	2	.586
120 → 90	0.35	2	.838

The effect of driving experience on the magnitude of error was also tested using Kruskal-Wallis test because the normality and homogeneity criteria were not met to conduct a parametric one-way ANOVA. Participants were split into two groups. Participants who at that time had the driving licence for 10 years or less were considered as beginners and participants who had more than 10 years of experience were considered experienced drivers. After around 10 years of driving experience, drivers often develop habits that improve their ability to handle complex traffic situations (Rudin-Brown et al, 2014). The results show no significant difference of judgments between beginners and experienced drivers (Table 4).

Table 4
The Difference in Judgments Between Beginners and Experienced Drivers

Speed change (km/h)	χ^2	df	p
40 → 50	0.03	1	.855
40 → 60	0.75	1	.387
40 → 70	1.32	1	.251
90 → 100	0.63	1	.426
90 → 110	2.13	1	.144
90 → 120	2.76	1	.097
70 → 40	0.25	1	.616

70 → 50	1.44	1	.230
70 → 60	3.13	1	.077
120 → 110	0.00	1	.979
120 → 100	0.55	1	.460
120 → 90	1.57	1	.210

Discussion

Car accidents are cause of the death of more than 1 million people every year. In the third-world countries, like Bosnia and Herzegovina, the rates of death caused by car accidents are high (WHO, 2018). Car accidents are often caused by high speeds and the report of Auto-Moto Association of Republic of Srpska shows that 32% to 58% of people tend to drive faster than the speed limits (AMS RS, 2016). Research has shown that people are prone to the time-saving bias (TSB) and time-loss bias (TLB) and, therefore, they are not good estimators of the time they can save or lose by increasing or decreasing vehicle's speed. According to the TSB, people underestimate the time that can be saved by increasing vehicle's speed from relatively low initial speeds and overestimate the time that can be saved by increasing vehicle's speed from relatively high initial speeds (Eriksson et al., 2015; Eriksson et al., 2013; Fuller et al., 2009; Herberz et al., 2019; Marinković & Dimitrijević, 2020; Peer, 2010a, 2010b, 2011; Peer & Gamliel, 2012, 2013; Peer & Rosenbloom, 2013; Peer & Solomon, 2012; Svenson, 1970, 1971, 2008, 2009; Svenson & Treurniet, 2017; Tscharaktschiew, 2016). Correspondingly, according to the TLB, people underestimate the time they will lose by reducing vehicle's speed in the case of low initial speeds and overestimate the time they will lose by reducing vehicle's speed in the case of high initial speeds (Fuller et al., 2009; Herberz et al., 2019; Svenson & Borg, 2020; Svenson & Salo, 2010; Svenson & Treurniet, 2017).

The TSB and TLB are mathematically presented through two heuristics, proportion heuristic and percentage heuristic, which have been found to describe average participants answers when estimating saved and lost time (Peer et al., 2012; Svenson, 2008). Although the TSB seems to be immune to formal education (Svenson, 2009) and question formulation (Peer, 2010b), researchers in Bosnia and Hercegovina found a possible systematic effect of road infrastructures and traffic culture on this bias. In the research in Bosnia and Herzegovina, people overestimated the time that can be saved when increasing vehicle's speed from both low and high initial speeds. Furthermore, their average answers correspond to the proportion heuristic increased by the constant $k = 6$ (minutes) (Formula 4). Considering that participants' average estimations can be predicted by the mathematical formula, it can be concluded with great certainty that their answers are not random but rather determined by the influence of biases (Marinković & Dimitrijević, 2020).

Results from the present research are to some extend consistent with previous findings in Bosnia and Herzegovina, and therefore, contradictory to what research-

ers in Sweden, Israel, the USA, and Germany found. Participants overestimated the saved time when increasing vehicle's speed from both low and high initial speed which is in accordance with the results by Marinković and Dimitrijević (2020). The average estimations correspond to the corrected proportion heuristic, i.e., the proportion heuristic enlarged by the constant *k*, which value is 6.5 (minutes) in this case, except in the case when the initial speed is 90 km/h and the enlarged speed is 120 km/h. The value of the constant *k* differs in this research compared to the results by Marinković and Dimitrijević (2020), which could be due to the larger sample size and changed research design, but we do not have enough evidence to support this claim. There is a possibility that there is a measurement error due to the large number of experimental situations, therefore, the hypothesis should be further investigated in the case of higher speeds. The estimations of the lost time in the case of the low initial speed are, also, opposite of what researchers in Sweden, Israel, the USA, and Germany found. The participants overestimated the lost time when increasing vehicle's speed from both low and high initial speed and their estimation correspond to the corrected percentage heuristic, i.e., the percentage heuristic enlarged by the constant *n,* which value is 12 (minutes) in this case. The effects of initial speed and enlarged/decreased speed on the magnitude of error in estimation have been found. The error decreases as the speed increases/decreases in case of both high and low initial speeds. The error is significantly bigger in the case of the high initial speed. Based on this, we can conclude that participants used cognitive heuristics when estimating the saved and lost time and that their estimations are not the product of guessing. Our results support the hypothesis that people understand the relationship between time and speed as quasi-linear (Eriksson et al., 2015; Peer & Gamliel, 2013). Furthermore, our results indicate that TSB and TLB are education and driving experience resistant. We hypothesize that these consistently different results in Bosnia and Herzegovina are due to different traffic cultures and traffic infrastructure, but we do not have enough evidence to support this. Although results in previous research about the time-saving bias in Bosnia and Herzegovina also correspond to the corrected proportion heuristic, the value of the constant is different, which could be the result of the small sample and, therefore, less precise results. In further research, it should be addressed what impacts the value of constants *k* and *n*, and what factors mediate estimations about the saved and lost time and people's choices about speeding.

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