ACTUAL SKILL VS. PERCEIVED SKILL; A NEW METHOD FOR ASSESSING OVERCONFIDENCE AMONG DRIVERS

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ABSTRACT: Overconfidence has been discussed in the literature as an influential factor that can lead to dangerous driving. There are two issues regarding past studies in the area of assessing the overconfidence: First, most studies have assessed overconfidence only through questionnaires. While questionnaires can provide information on participants' level of perceived skill, questionnaires cannot provide information on participants' level of actual skill which is a vital measure for assessing overconfidence. Second, there is ambiguity behind the terms used in questionnaires for comparison with a baseline driver, such as "average driver". This study will contribute to the literature on assessment of overconfidence of drivers by suggesting two improvements for research in the area of overconfidence. The first suggestion is to improve the assessment of both perceived and actual skill in evaluating overconfidence by using both questionnaire and driving simulator to make assessing the level of actual skill possible. And, the second is the initiation of a new computerised visual method to overcome the ambiguity of the baseline driver.

Keywords: Overconfidence, Driving behaviour, Driving skill, Questionnaire, Driving Simulator

INTRODUCTION

Researchers (Sabey and Staughton 1975; Treat 1980; Evans 1996) divide causes of road accidents into three main categories: road environment, vehicle, and the human factor. Among the three mentioned categories, human factor has the major share in causing road accidents (Sabey and Staughton 1975; Treat 1980; Lewin 1982; Evans 1996; Sumer and Ozkan 2002). In the examination of road accidents, the role of a driver can be divided into two aspects: driving skill, the ability of the driver to adequately perform necessary tasks, and driving behaviour, the way the driver chooses to drive. One of the possible consequences of inadequate driving skill and/or behaviour is overconfidence (OC). OC refers to drivers' inflated assessment of their own skill and/or behaviour above actual level. Näätänen and Summala (1976, cited in Ozkan et al. 2006b) claim that OC in perceptual-motor and safety skills can lead to bias in drivers' risk

assessment and sense of control in traffic, resulting in a high level of risk acceptance. While numerous researches (Jonah, Thiessen et al. 2001; Bina, Graziano et al. 2006) have addressed issues of risk and risky behaviour among drivers this study focuses on OC and the assessment of OC.

This study introduces a new method for assessing OC by examining participants' level of actual and perceived skills. In looking at the implication of OC in driving, and its relation to particular components of skill, the study assesses the ways in which gender, age, and experience impact on the driving environments, potentially playing a causal role in the occurrence and outcome of road accidents. OC can be defined as "overestimation of one's actual ability, performance, level of control, and/or chance of success" (Moore and Healy 2008). OC itself is a subjective term; however, in this paper it is used as a technical term to identify the interaction between actual driving skill and perceived driving skill. This application of the term OC is in line with (Groeger and Grande 1996; Groeger and Brady 2004; Özkan and Lajunen 2006) and therefore draws on established research in a move to extend the knowledge base in the field of OC.

ISSUES REGARDING PAST STUDIES

To the author's knowledge there are two major issues regarding available research that deal with OC in the area of driving behaviour. The first is the assessment of OC using only questionnaires. The second issue is the way the term "*baseline driver"* has been used in the questionnaires.

Using questionnaires only

Questionnaire can provide us with participants' level of "perceived skill;" in the past, OC has mostly been studied using questionnaires (Svenson 1981; Lajunen and Summala 2003; Groeger and Brady 2004; Özkan and Lajunen 2006). Driving behaviour related to OC was analyzed using questionnaires (e.g. Preston and Harris 1965), an approach that is still being used today (Özkan and Lajunen 2006). It is reasonable to argue that these studies have thereby only provided researchers with participants' perceived level of skill and personal assessment of their driving behaviour.

The main problem with the use of questionnaires alone is that it provides solely a subjective measure of drivers' skill, without any objective measure of actual skill for comparison. Through questionnaires, it is possible to find out how participants assess their own or/and other drivers' performance, but it does not provide information on participants' actual level of skill. In responding to a questionnaire, good drivers who are not overconfident may rate themselves high in driving skill. However, bad drivers who are overconfident also rate themselves high in driving skill. Consequently, in analyzing the results both groups of participants could be considered overconfident.

Use of Baseline driver

Baseline driver is most often identified in past questionnaires by the term “average driver”. For analyzing participants’ perception of their level of skill, researchers have needed to provide a baseline driver as a comparator. However, there are some problems with this term and the way it has been used. One problem is the exact definition of “average driver,” the other problem is the ambiguity of the term. It is not clear what “average” means to a lay person — a lay person could interpret it as a median driver, a mode driver or a mean driver. This issue is not limited to assessment of OC among drivers, the detailed research by Dunning et al. (1989) on the uncertainty of self-evaluation confirms that using the term “average” causes ambiguity and is dependent on the situation. The participants’ perception varies according to the vagueness behind the use of words like “average” driver. For example, many drivers tend to provide a self-serving assessment of their own capabilities and skills; they tend to perceive themselves to be above the “average”. Dunning et al. (1989) point to this “phenomenon” in a survey conducted by College Board in 1976 – 1977 in which one million high school students participated. Interestingly, 70% of the students assessed themselves as higher than “average” in leadership ability.

Using the term “average driver” causes inaccuracy and ambiguity in the research results (e.g. Dunning, Meyerowitz et al. 1989). The need to replace this term was taken up by Groeger and Grande (1996) who used the term “novice driver”, defined as drivers who have just received their driving license, instead of “average driver”. They assume that “novice driver” means an inexperienced driver and is more standard as a term for all drivers compared to “average driver”.

This new term, “novice driver”, is good for assessing *actual* novice drivers, such as the sample group used by Groeger and Brady (2004). In such case the experience and skill level of the “novice driver” is lower than other drivers. Yet, this term still has similar weaknesses to “average driver”. It is expected that most drivers believe that they are better than a “novice driver” but the criteria of a “novice driver” are also unclear.
Another important issue regarding current assessment of overconfidence is that in the current methods overconfidence is solely assessed by asking participants about themselves while their perception of the society and their position in relation to the society is not mentioned. However, if a driver is confident about their skills in a society they perceive has low-level driving skill and behaviour then the driver is not exercising a self assessment when claiming a certain level of proficiency, they are also positioning themselves in comparison to other drivers in the society. This is important information for a researcher to have when analyzing their research data.

METHOD

There are different theories behind OC, among which two of them have been discussed in a majority of studies. The first is a person’s overestimation of their own level of skill and/or chance of success in general: this has been explored in theories such as “Self enhancement”

(Brown 1986) or “Optimism biased” (Weinstein 1980) and “Illusion of Control” (Langer 1975). Second theory is about people’s perceptions of others and their position in relation to others such as “Positive self – Negative others” (McKenna, Stanier et al. 1991). In carrying out self assessments people usually come up with answers that are positive about themselves compared to others. In many questionnaires drivers are asked to compare themselves to the baseline of “average drivers” or “novice drivers”. This positive attitude could be either due to “Positive-self” or “negative-others” judgments (McKenna, Stanier et al. 1991).

The method this research considers both aspects by first asking participants about their perception about other drivers and then by assessing themselves. The self assessment section also provides questions regarding participant’s perception of all drivers in the society and then assessing participants’ perception of their own driving. In addition participants will be asked to locate themselves among all drivers in the society.

In this method it is the participant that tells the researchers what they think, instead of being limited to terms that are pre-designed. This is to avoid limiting participants with terms that can cause ambiguity. Moreover, in order to overcome the above-mentioned weaknesses this study will find participants’ level of OC by comparing their level of “perceived skill” with their “actual skill”. It will also provide a new method for drivers’ self assessment to avoid the problem of “baseline driver”. Participants will also be asked to fill out a set of questionnaires from previous studies in order to assess the accuracy of the new methods.

Perceived skill - Questionnaire

The questionnaires will assess drivers’ “perceived skill” as compared to drivers’ “actual skill” in order to determine their level of OC. As mentioned in previous sections there have been challenges with the clarity of questionnaires used in past research and consequently this study aims to solve these challenges with the use of a narrowly defined questionnaire in which participants will be asked to locate themselves, based on their driving skills, amongst all drivers in the society. The new method of the questionnaire is made up of two tasks. First is to draw a distribution of all drivers in the society based on their own perception regarding all drivers’ different skills’ level. Second task is locating themselves among one of the columns, from “very bad” to “very good”, Figure 1.

The first set of questions ask participants to consider a driving skill, such as “Fast reaction time while driving” and place the entire driving population into categories based on how well they perform this skill; then participants will be asked to place themselves among the driving population.

In order to avoid using confusing “jargon” and/or vague terms participants will be provided with a visual questionnaire. Each question of this visual questionnaire is made of six columns, five

empty columns on the left side which among them only first and last columns and have labels, “very good” and “very bad”, like a spectrum. The first blue column on the right side is assumed to be a jug of water that represents all drivers in the society. For each question participants should distribute all drivers, the contents of the “jug”, using a scale of “Very good” to “Very bad” based on their perception. This can be done by clicking on the “Less” and “More” buttons located below each of the columns or by dragging up and down each of the columns. The experimenter is approachable during the test for a demonstration.

Having established the participants’ perception of the distribution of drivers in the society it is then important for participants to locate themselves in one of the columns which is also in relation to all drivers in the society. In a second set of questions participants are asks to assess their own skill level by making a selection from the options provided. Below each of the five skill level columns there is a choice to select once participants have done the distribution task. Participants should select the column that they think they belong to, based on their own skill level. Figure 1 is snapshot of a questionnaire that has not been answered yet.

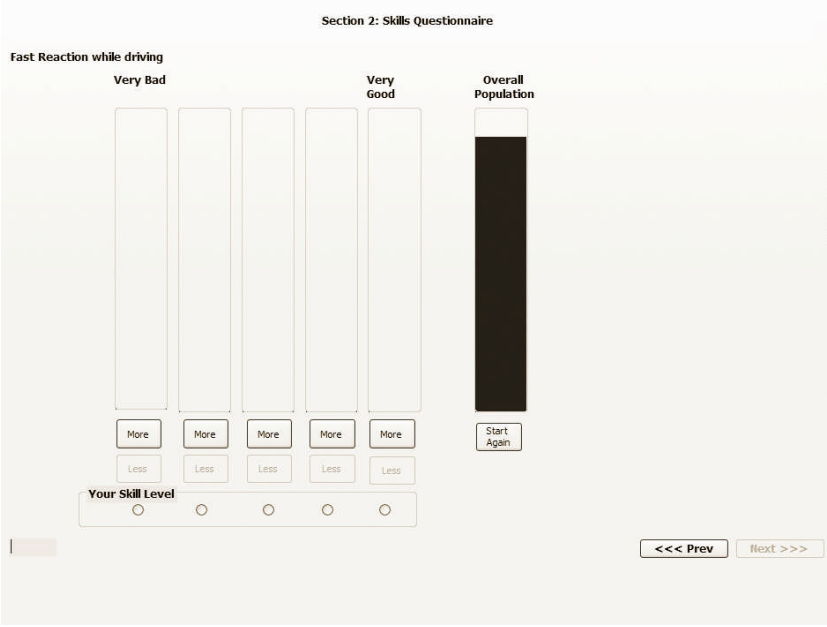

Figure 1 A snapshot of the new method used for assessing perceived skill

Figure 2 is snapshots of a filled distribution graph that questions participant regarding “Fast reaction while driving”. This snapshot shows a completed question, as can be seen the *overall population* column is empty. This means that the participant has answered the questions by distributing the content of the *overall population* column into the other five columns. In this example the participant has distributed more drivers near to “very bad” and has located themselves at belonging in the “very good” column.

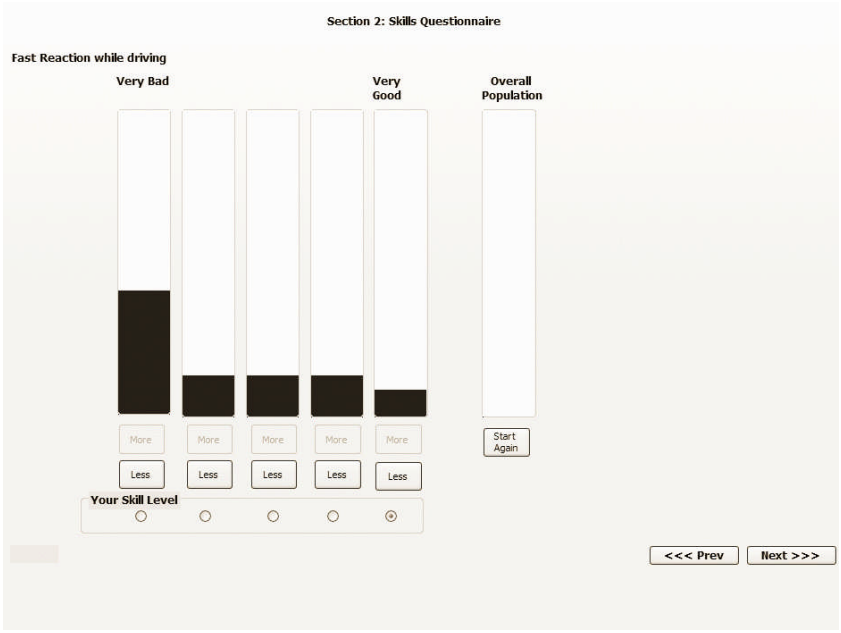

Figure 2 A snapshot of the new method used for assessing perceived skill

Actual skill - Driving simulator

After gaining information on drivers' level of perceived skill, participants level of "actual skill" will be measured in order to assess their level of OC. In the expanded version of this research a variety of methods will be used for assessing participants' level of actual skill, however this current study has used "Reaction time while driving".

Reaction time is an important factor in driving safety. Hazardous situations frequently require a quick response: for example: a one second reaction delay at the speed of 113 kilometre per hour (70 mph) will take the vehicle more than thirty metres further down the road. Reaction time is one of the main questions in most driving skill related questionnaires. The Driver Skill Inventory (Lajunen and Summala 1995) asks participants to assess their reaction time on a scale from one to five. The study described in this paper will assess participants' brake reaction times.

STUDY DESIGN

A portable driving simulator for assessing drivers' actual skill is used. Research has shown that findings from a driving simulator can be applied to real world situations (Chan, Pradhan et al. 2010). It has also been proven that portable simulator findings are valid and produce results that are comparable to those from large simulators (Jamson and Jamson 2010). For this evaluation, complex scenarios related to safe driving have been chosen.

In order to assess the proposed new method a pilot study was conducted in which participants' OC were assessed based on their braking reaction time and their perception of their braking reaction time.

In the second stage participants were asked to drive the simulator as they would drive normally and follow their leading vehicle. The only task they were asked to do was to brake as soon as the leading vehicle brakes, when the braking lights turned on. This provides the reaction time made up of the sum of the participants' accelerator release time and accelerator to brake movement.

This study uses a low-cost, small, driving simulator for assessing drivers' actual skill. Studies have proven that findings of driving simulator can be applied to real world situations. For example Chan et al. (2010) in a study on novices' hazard perception found that the findings of driving simulator are applicable to real world. Based on the skills asked in questionnaire, driving simulator scenarios will be designed. Some studies have also proven that small simulators' findings are valid and similar to the big ones. For example, Jamson and Jamson (2010) did a recent study on the outcomes of low-cost, small, and big simulator. The outcome of the study for speeding in both simulators was similar, whereas the results of headway were different. Even though in their study some differences were found between both simulator findings, Jamson and Jamson (2010) concluded that considering the benefits of low-cost simulator it still can be used in studies.

SAMPLE GROUP

Table 1 shows the demography of the sample group. There were total of seventeen participants in ten male and seven female. The youngest participant was twenty-two and the oldest participant was forty three years old. The mean age of all participants is 28.8 years old. The mean age of male participants' age is 32.2 years old while this value for female participants was 24 years old. Average of driving licence duration is 9.4 years for all participants. Male participants had had their driving licence for 13.1 years in average. In average female participants received their driving licence 4.1 years ago.

The average annual driven mileage for thirteen of the participants was 5080; this data was not available for four participants. Average annual driven mileage for female participants was 5667; one participant's annual mileage was not available. Average annual driving mileage for male drivers was 4570 and this value is for seven participants, data for three male participants were not available.

Table 1 Participants demography

ID	Gender	Age	Duration	Mileage
1	M	43	17	4000
2	F	27	8	6000
3	F	23	4	3000
4	M	29	6	NA
5	M	25	7	8000
6	M	23	6	NA
7	M	39	20	NA
8	F	19	1	NA
9	F	22	3	10000
10	M	38	20	12000
11	F	25	7	6000
12	M	23	6	3000
13	F	27	6	2000
14	M	37	19	1000
15	M	23	5	2000
16	F	27	1	8000
17	M	42	25	2000

RESULTS

Twelve *brake reaction* times were provided to participants and their *reaction time* results are used in the analysis section, actual performance column in Table 2.

Table 2Actual Performance

ID	Actual perform.	Actual point
1	887.5008	3.97
2	806.945	4.54
3	1212.501	1.71
4	1123.611	2.33
5	941.6667	3.6
6	824.9992	4.41
7	766.6667	4.82
8	1244.443	1.48
9	943.0558	3.59
10	894.4458	3.92
11	740.2783	5
12	856.945	4.19
13	1313.889	1
14	951.3908	3.53
15	1072.223	2.69
16	1091.668	2.55
17	1015.278	3.08

In the analysis section the quickest *reaction time* was rated five (5) and the slowest *reaction time* was rated one. Following this assumption the rest of participants got a point, based on their performance, between one to five, relatively. Table 2 shows the results for simulator drive, "actual skill".

The rate for perceived skill was found using the percentage and distribution of drivers in the questionnaire. The percentage of drivers in the categories higher than the participant's category that was chosen by the participants themselves was deducted from 100. This provides us with the drivers' perception of their own position among all drivers, and the rate they would give to themselves compared to all drivers in the society, from 5 (Very good) to 1 (Very bad). The next step was to divide the value by 20 in order to provide a rate between one (1) and five (5), similar to actual skill, for further comparison. The results of questionnaire are provided in the table 3.

Table 3 Perceived Performance

ID	1 (Very good)	2	3	4	5 (Very bad)	Self choice	Perceived point
1	10	10	40	30	10	3	3
2	5	25	40	25	5	3	3.5
3	10	30	30	25	5	4	3.5
4	10	20	35	25	10	3	3.25
5	20	30	35	10	5	4	4.75
6	45	25	15	10	5	3	4.25
7	10	20	40	20	10	3	3.5
8	10	20	55	10	5	3	4.25
9	25	30	35	5	5	3	4.5
10	15	20	40	20	5	3	3.75
11	10	10	45	20	15	3	3.25
12	15	10	25	25	25	4	3.75
13	20	15	25	25	15	3	4.25
14	10	20	25	30	15	4	4.25
15	10	15	30	30	15	4	4.25
16	0	5	30	65	0	4	5
17	10	10	45	20	15	3	4.25

The next stage is to compare the actual skill ratings with the perceived skill ratings. Drivers with higher ratings for perceived skill compared to their actual skill are overconfident, positive value in the “Confidence” column: Participants with lower value of perceived skill compared to their actual skill are under confident, negative values in the “Confidence” column.
Following is Table 4 which includes the results:

Table 4 Table of Results

ID	Gender	Actual point	Perceived point	Confidence
1	M	3.97	3	-0.97
2	F	4.54	3.5	-1.04
3	F	1.71	3.5	1.79
4	M	2.33	3.25	0.92
5	M	3.6	4.75	1.15
6	M	4.41	4.25	-0.16
7	M	4.82	3.5	-1.32
8	F	1.48	4.25	2.77
9	F	3.59	4.5	0.91
10	M	3.92	3.75	-0.17
11	F	5	3.25	-1.75
12	M	4.19	3.75	-0.44
13	F	1	4.25	3.25
14	M	3.53	4.25	0.72
15	M	2.69	4.25	1.56
16	F	2.55	5	2.45
17	M	3.08	4.25	1.17

Following the analysis it was found that 10 drivers are overconfident and seven participants found to be under confident. Among females there were two under confidence and five overconfident. Among males there were five overconfident drivers, out of ten participants. A T-test analysis showed 0.00 significance between actual skill and perceived skill, showed that both set of data are significantly different.

For further analysis independent-samples T test was run. It was found that there is no difference between male and female participants, in terms of level of OC. It also was found that in terms of both level of “perceived skill” and “actual skill” there were no significant difference between both male and female drivers.

CONCLUSION AND FURTHER STEPS

By using this method three issues regarding assessment of OC are considered, first is assessment of OC based on the difference between "perceived skill" and "actual skill". Second benefit is overcoming the issue of baseline driver by providing a visual method in which participants tell us what they think without the need to use any "vague" terms. Finally in OC is found not only based on drivers perception of their own level of skill but also by finding their perception of other drivers' level of skill and their level of skill in relation to all drivers.

Some modifications are needs to be done in the design of the questionnaire. Since this was the first time this study was conducted some improvement can be done to further the study. Participants were asked about the ease of filling the questionnaire and it was founded that the questionnaire should be more users friendly, easier fill out. Another improvement is to change the names of both end sides columns of the questionnaire. These will be chosen based on the type of the skill, for example for fast reaction participants will be asked to select between very fast and very slow.

Whilst this study evaluated brake reaction time, in the larger research project various scenarios will be used. The following is an introduction to some of the scenarios that will be called on in the larger study; they are grouped under different skills related to safe driving.

Hazard perception

Hazard perception is an important skill related to safe driving. Some researchers (Pelz and Krupat 1974; McKenna, Stanier et al. 1991; Horswill and McKenna 2004) argue that beyond basic vehicle control skills, hazard perception is the primary skill that correlates with road accidents. For assessing this skill, particular scenarios have been designed. For example, in one scenario, a car parked at the side of the road will suddenly move in front of the participant's vehicle.

Curve Driving

One of the important road safety problems among young British drivers is loss of control on curves (Clarke, Ward et al. 2006). Managing curves is a complicated task which consists of different tasks and subtasks. Drivers should be able to adapt their speed adequately while they are steering. Researchers have provided different methods for assessing driver's steering, for example steering entropy, i.e. jerkiness (Boer, Rakauskas et al. 2005). An experienced driver is expected to slow down and steer smoothly during the whole curve while a novice driver may not slow down soon enough and/or control the vehicle with a high lateral deviation, which will be measured by Standard Deviation of Lateral Positioning (SDLP) and/or jerkiness. In the simulator drivers will be provided with a range of curves of different radius and angles.

Overtaking

Overtaking is the cause of many road accidents (e.g. Clarke, Ward et al. 1998). Based on the provided models this skill can be divided into different stages or levels. Overtaking is a complex task which consists of many components: for instance McKnight and Adams (1970) found 214 sub-tasks for overtaking. It is related to both the control and manoeuvring level, since it is a combination of the skills needed for controlling the vehicle such as steering and the skills in manoeuvring level such as interaction with other drivers. The simulator will replicate situations in which participants will face a lead vehicle which drives rather slowly thus encouraging the participants to overtake it. Participants will randomly be provided with safe and unsafe situations for overtaking that, according to the maximum speed of the participant's vehicle and the speed of other vehicles in the simulation, could be easy, difficult and impossible for overtaking.

Car Following

Most of the times during driving, vehicles are following a leading vehicle in front of them. Studies have proven that car following is an important skill required for safe driving (e.g. Brookhuis, De Waard et al. 1994). In this simulator scenario participants will approach a leading vehicle that alternates its speed and will be required to follow behind whilst maintaining a constant safe distance from the leading vehicle. It is crucial for drivers to be able to follow lead vehicles while keeping a safe speed and distance from them.

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