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Summary
The Examination of The Relationship Among Driver Behavior, Driver Skills and The Locus of Control by Using Two Measurements

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Locus of control concerns the differences in individuals' attributions regarding the potential causes of the outcomes followed by their actions (Rotter, 1966). Rotter (1966) stated that when the person perceives the outcomes are the result of outside factors such as fate, luck, or powerful others, then this belief signifies an external locus of control. On the other hand, when the person perceives outcomes resulting from his/her own behavior, the belief of that person is termed an internal locus of control (Rotter, 1966).

Examining the general tendency of the person's attribution to the consequences of events has been found important in terms of traffic safety, and there have been studies conducted on this issue. A meta-analytic study examining the factors predicting the involvement in a traffic accident showed that one of the personality factors, locus of control, predicts involvement in a traffic accident and that the internal locus of control-oriented personality trait is associated with being involved in fewer accidents (Arthur, Barret, & Alexander, 1991). Montag and Comrey (1987) developed the Montag Driver Internality - Driver Externality Scale, which aims to measure the internal and external locus of control of drivers, specific to the traffic area, and they compared 200 drivers involved in fatal accidents with 200 regular drivers. They found that drivers involved in fatal accidents had a higher external locus of control than regular drivers whereas regular drivers had a higher internal locus of control than another group, in accordance with the meta-analysis study. There is a similar relationship between a group that was fined for drunk driving and the group that did not (Cavaiola & DeSordi, 2000).

Examining drivers' attitudes rather than events that have the power to change the locus of control, such as accidents or punishments, can be important in understanding the relationship between locus of control and safe driving. Having an internal locus of control has been associated with wearing seat belts (Hoyt, 1973) and being alert while driving which are considered as safe behaviours(Lajunen & Summala, 1995) while Having an external locus of control has been associated with aggressive driving (Lajunen & Summala, 1995). In a study in which Multidimensional Traffic Control Locus (T-LOC) developed by Özkan and Lajunen (2005) was used, it was found that one of the predictive factors of motorcycle riders' unsafe movements with motorcycles for demonstration purposes and speed violations is the fate dimension of the external locus of control. Also,low scores in the fate dimension were found to be associated with using protective equipment (Özkan, Lajunen, Doğruyol, Yıldırım & Çoymak, 2012).

In addition to studies that finding that internal control focus is associated with safe driving and low accident rates, there are also studies that have obtained different results. It is thought that the reason for these opposite findings may be theoretical and methodological differences as well as the use of different scales in studies. Rotter Internal-External Control Scale (e.g. Hoyt, 1973), Levenson's Internality, Powerful Others and Chance Scales (I, P, C Scales) (e.g. Lajunen & Summala, 1995), Montag Comrey Driver Internality- Driver Externality Scale (e.g. Rudin-Brown & Parker, 2004) and T-LOC (e.g. Warner, Özkan, & Lajunen, 2010) have been used in different studies. As it can be seen, both area-specific locus of control and general locus of control scales were used in the studies carried out in the field of traffic. It has been stated by some researchers that it is important to evaluate the locus of control with field-specific measurement tools (Lefcourt, 1991 as cited in Huang & Ford, 2012). It is thought that it will be important to use field-specific scales, especially in a system that includes complex skills and behaviors such as traffic.

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Although there are many studies in the literature about locus of control and driver behavior, some of which has been mentioned above, different results were obtained. Also, the same cannot be said for studies about the association between locus of control and driver skills. Although Rotter (1966) emphasized the skill for internal locus of control while distinguishing internal and external locus of control, a study examining the association of locus of control and driver skills could not be found in the literature by researchers. Therefore, this study, it is aimed to compare two domain-specific scales and examine the relationship between locus of control and driver behavior and skills.

The hypotheses of the study are as follows;

H1: It is expected that the sub-scales measuring the external locus of control of the two scales do not exactly match and their predictiveness will change.

H2: Both the T-LOC's self dimension and the internal locus of control dimension of Montag Driver Internality and Driver Externality Scale predict errors and violations negatively, whereas they predict perceptual-motor skills and safety skills positively.

Method

Participants

A total of 260 drivers, 113 female (43.5%) and 147 male (56.5%), participated in the study. The ages of the participants ranged between 19 and 65 with a mean of 30.94 years (SD = 10.54). The average number of years having a driver's license was 8.63 years (SD = 8.81) and the mean yearly mileage reported by the participants was 9354.95 km (SD = 14090.221).

Instruments

Driver Skills Inventory (DSI)

This scale, which consists of two dimensions (perceptual motor skills and safety skills), was developed by Lajunen and Summala (1995). Twenty items are rated on a 5-point scale. Perceptual motor skills reflect drivers' ability in handling the car (e.g. the driver's control over the vehicle) and rely on information processing and motor skills. Safety skills reflect drivers' ability to drive in a safe manner (Lajunen & Summala, 1995). The Cronbach Alpha was found .87 for the perceptual-motor skills dimension, and .73 for the safety skills dimension in this study.

Driver Behavior Questionnaire (DBQ)

This scale, which consists of two dimensions (errors and violations), was developed by Reason and his colleagues (1990). Twenty-eight items rated on a 6-point scale. Errors were defined as "the failure of planned actions to achieve their intended consequences" while violations were defined as "deliberate deviations from those practices believed necessary to maintain the safe operation of a potentially hazardous system" (Reason, Manstead, Stradling, Baxter ve Campbell, 1990). Turkish adaptation of this scale was completed by Sümer, Lajunen and Özkan (2002). The Cronbach alpha was reported .75 for errors and .77 for violations for Turkish version. In this study, the Cronbach alpha was found .85 for both errors and violations.

Traffic Locus of Control Scale (T-LOC)

This scale was developed by Özkan and Lajunen (2005) and it consists of 17 items rated on a 5-point scale. Four dimensions were identified for this scale; other drivers, self, vehicle/environment, and fate. The Cronbach alpha was found at .80 for other drivers dimension, .82 for self and fate dimensions, and .64 for vehicle/environment in this study. Also, the Cronbach Alpha of the external locus of control, which includes the dimensions of other drivers, vehicle/environment, and fate, was found to be .69.

Montag Driving Internality and Driving Externality Scale

This Scale was developed by Montag and Comrey (1987) and it consists of 30 items rated on a 6-point scale. The scale consists of 2 dimensions: internal locus of control and external locus of control. In this study, the Cronbach Alpha was found at .85 for the internal locus of control dimension and .81 for the external locus of control dimension.

Demographical Information Form

The demographical information of participants; age, gender, years of having a driver's license, the previous year's mileage, and total mileage is gathered.

Process

Participants filled out the questionnaire package composed of demographic information form, Driving Skills Inventory, Driver Behavior Questionnaire, Traffic Locus of Control Scale, and Montag Driving Internality and Driving Externality Scale via https://metupsych.au1.qualtrics.com. The data were analyzed with SPSS 22.0 program.

Data Analysis

SPSS 22.00 package program was used for the analysis of the research data. In this study, Pearson Correlation analysis was performed to examine the concurrent validity of T-LOC and Montag Driver Internality and Driver Externality Scale. The same analysis was also used to examine the relationship between continuous measurements. In addition, hierarchical regression analysis was used to examine the predictive power of locus of control on driver behaviors and driver skills.

Results

The Comparison of T-LOC and Montag Driving Internality and Driving Externality Scale

Pearson Correlation analysis was performed to examine the concurrent validity of the T-LOC and Montag Driver Internality and Driver Externality Scale. It is found that the relationship between the other drivers dimension of T-LOC and both the internal and external locus of control dimensions of the Montag Driver Internality and Driver Externality Scale was non-significant. On the other hand, a significant relationship was found between the self dimension of T-LOC and the internal locus of control dimension of the Montag Driver Internality and Driver Externality Scale (r = .142, p = .02). In addition, it was found that the fate dimension of T-LOC was positively associated with the external locus of control dimension and negatively associated with the internal locus of control dimension of the Montag Driver Internality and Driver Externality Scale (respectively r = 303, r = -.207, p <.01). Besides, a negative relationship was found between the vehicle and environment dimension of the T-LOC and the internal locus of control dimension of the Montag Driver Internality and Driver Externality Scale (r = -.171, p = .006). Finally, it is found that the external locus of control dimension of T-LOC was negatively correlated with the internal locus of control dimension and positively correlated with the external locus of control dimension of the Montag Driver Internality and Driver Externality Scale (respectively r = -.167, r = .214, p <.01).

Locus of Control and Driver Behaviors

Four hierarchical regression analyses were conducted to examine the relationship between driver behaviors and drivers' locus of control. T-LOC dimensions and Montag Driver Internality and Driver Externality Scale were predictors and one DBQ dimensions were the DV in each analysis. Age, gender, and yearly mileage were controlled in the first step.

For the errors, the total variance explained by the control variables in the first step on the errors was found to be 6.9% (R^2=.069, F(3.256) = 6.33, p < .001). Age and gender of the control variables were found to predict errors negatively (β = -.196 p = .002, β = -.143, p = .019, respectively). The locus of control measured with T-LOC added in the second step explains a 4.6% variance on errors in addition to the control variables (ΔR^2=.046, ΔF(4.252) = 3.26, p < .05). In the second step, the total variance explained by T-LOC along with control variables was 11.5% (R^2= .115, F(7.252) = 4.67, p < .001). When the dimensions of the driver locus of control measured by T-LOC were examined, it was observed that only the self-dimension of T-LOC predicted errors positively (β = .208, p = .001).

For the violations, the total variance explained by the control variables in the first step on the errors was found to be 6.7% (R^2=.067, F(3.256) = 6.10, p = .001). Age was found to predict errors negatively (β = -.224 p = .001) while gender and yearly mileage were found to predict errors positively (β = .123 p = .044, β = .142, p = .028, respectively). The locus of control measured with T-LOC added in the second step explains a 4.1% variance on errors in addition to the control variables (ΔR^2=.041, ΔF(4.252) = 2.92, p < .05). In the second step, the total variance explained by T-LOC along with control variables was 10.8% (R^2= .108, F(7.252) = 4.36, p < .001). When the dimensions of the driver locus of control measured by T-LOC were examined, it was observed other drivers predict errors negatively (β = -.147, p = .044) whereas self and fate dimensions predict errors positively (β = .132 p = .037, β = .127, p = .041, respectively).

For the errors, the total variance explained by the control variables on the errors was found to be 6.9% (R^2=.069, F(3.256) = 6.33, p < .001). Age and gender were found to predict violations negatively (β = -.196 p = .002, β = -.143, p = .019, respectively). In addition to control variables, the locus of control measured with the Montag Driver Internality and Driver Externality Scale added in the second step, it explains a 4.8% variance on errors (ΔR^2=.048, ΔF(2.254) = 6.87, p = .001). The total variance explained by the driver locus of control along with the control variables, as measured by the Montag Driver Internality and Driver Externality Scale added in the second step, was found to be 11.7% (R^2=.117, F(5.254) = 6.72, p < .001). It was observed that only the external locus of control dimension predicted errors positively (β = .196, p = .001).

For the violations, the total variance explained by the control variables in the first step on the violations was found to be 6.7% (R^2=.067, F(3.256) = 6.10, p = .001). Age was found to predict violations negatively violations (β = -.236, p = .001) whereas gender and yearly mileage predicted violations positively (β = .123, p = .044, β = .142, p = .028, respectively). In addition to control variables, the locus of control measured with the Montag Driver Internality and Driver Externality Scale added in the second step, it explains a 5.1% variance on violations (ΔR^2=.051, ΔF(2.254) = 7.34, p = .001). The total variance explained by the driver locus of control along with the control variables, as measured by the Montag Driver Internality and Driver Externality Scale added in the second step, was found to be 11.8% (R^2=.118, F(5.254) = 6.78, p < .001). It was observed that only the external locus of control dimension positively predicted violations (β = .206, p = .0001).

Locus of Control and Driver Skills

Two hierarchical regression analyses were conducted to examine the relationship between driver behaviors and drivers' locus of control. T-LOC dimensions were predictors -and one DSI dimensions were the DV in each analysis. Age, gender, and yearly mileage were controlled in the first step. None of the dimensions of T-LOC were found to significantly related to perceptual motor skills and the model in which the relationship between T-LOC and safety skills were tested was nonsignificant.

The same analyses were conducted by using the two dimensions of the Montag Driver Internality and Driver Externality Scale. Moreover, both internal and external locus of control dimensions were non-significantly related to perceptual motor skills and the model in which the relationship between Montag Driver Internality and Driver Externality Scale and safety skills were tested was nonsignificant.

To summarize the results, it was found that the other drivers dimension of T-LOC predicted violations negatively, the self dimension predicted both violations and errors positively, and the fate dimension predicted the violations positively. On the other hand, only the external locus of control dimension of the Montag Driver Internality and Driver Externality Scale was found to positively predict both errors and violations. In addition, it is seen that the dimensions of the driver locus of control measured with two measurement tools do not predict perceptual-motor skills, and the models that test the predictiveness of the driver locus of control dimensions measured with these two scales on safety skills are not significant.

Discussion

In this study, it was examined whether the factor structures of the T-LOC and Montag Driver Internality and Driver Externality Scale were compatible with each other. The results showed that the two scales developed to measure the locus of control, T-LOC, and the Montag Driver Internality and Driver Externality Scale, do not measure the same external locus of control dimensions. A significant relationship was found between the external locus of control dimension of the Montag Driver Internality and Driver Externality Scale and only the fate dimension of the T-LOC. From this point of view, it can be said that the T-LOC includes more components such as other drivers, fate, vehicle, and environment, while the Montag Driver Internality and Driver Externality Scale measures only the fate component among the external locus of control dimensions. In addition, a significant relationship was found between the internal locus of control dimensions of T-LOC and the Montag Driver Internality and Driver Externality Scale. This shows that these two scales are similar in measuring the internal locus of control. In line with these results, it can be said that the first hypothesis of the study is supported. In addition, the relationship between the sub-dimensions of the two scales is quite low (r = .14*). The reason for this low level may be that the two measurement instruments conceptualized the internal locus of control differently.

In this study, also the relationship between driver behaviors and drivers' locus of control, measured with different scales, was examined. The results showed that drivers with the self locus of control are more prone to make mistakes. This finding is consistent with the findings of Özkan and Lajunen (2005). This relationship can be explained by the person's overconfidence and optimistic bias. Self-confident drivers think that their likelihood of being involved in an accident depends on their own skills and behavior rather than external factors (Özkan & Lajunen, 2005). Accordingly, drivers with a high internal locus of control may show risky driver behaviors, thinking they can avoid the accident with their skills and behavior (Özkan & Lajunen, 2005). In this study, it was also found that people with an external locus of control in the Montag Driver Internality and Driver Externality Scale are prone to make both violations and mistakes. In a study conducted with motorcycle drivers, speed violations and risky driver behaviors were found to be associated with the attribution dimension of T-LOC to fate (Özkan, Lajunen, Doğruyol, Yıldırım, & Çoymak, 2012). The relationship between the external locus of control dimension of the Montag Driver Internality and Driver Externality Scale and the fate dimension of T-LOC shows that this result of the study is compatible with the literature.

According to the results of this study, both T-LOC fate and T-LOC self dimension were positively related to unsafe driving in traffic. The results can be interpreted as if the drivers think that they will cause the accident, they may commit a violation because they think that they are in control, but they may violate traffic rules because they think that fate controls the events, regardless of their own behavior. Moreover, the fact that T-LOC other drivers dimension is negatively correlated with violations may indicate that drivers act more cautiously and safely because they think that other drivers may cause an accident and they cannot control the behavior of other drivers.

When the locus of control is examined in the literature, inconsistent findings are found in studies that are using different measures (Bıçaksız, 2021). In this study, the two most used locus of control measures in the literature were compared. The fact that these two locus of control measurements gave different results at some points may be because people focused on different concepts while filling out the measurement tools. Due to the questioning style of the measurement tools, in some items, the person's attribution of the cause of the event to what, and in some items whether the person can control the event or not being questioned. Due to the change in the number and content of the scales focusing on control and causality, conceptual confusion about the locus of control may arise and this may lead to contradictory results. This situation reveals the importance of using context-specific measurement tools in the locus of control studies.

This study has some limitations. First, the data of the study were collected by self-report. Social desirability in self-report studies is a common potential problem known in the literature that participants show themselves in a positive image (Johnson & Fendrich, 2002). In this study, no scale was used to control social desirability. Besides, the data of this study were collected via the internet. The high rate of dropout in studies that collected data via the internet may have led to the loss of possible participants (Birnbaum, 2004). Another limitation of the study is the small sample size. For this reason, the small sample size should be taken into consideration while generalizing the results of the study to drivers. In future studies, a more generalizable result can be achieved by increasing the sample size. In addition, by measuring driver behaviors and skills with driving simulations in future studies, the effect of social desirability in these areas can be reduced.

Conclusion

In this study, the concurrent validity of the two most used locus of control measures in the literature was examined and it was found that the internal locus of control dimension of both locus of control instruments was related to each other whereas the T-LOC in the external locus of control dimension was more comprehensive in terms of driving. In addition, using these two measures, the predictiveness of locus of control on driver behaviors and driver skills was examined. Looking at the results, the internal locus of control dimension of T-LOC predicts both violations and errors, while the external locus of control dimension of the Montag Driver Intrernality and Driver Externality Scale predicts both violations and errors. In addition, other drivers and destiny dimensions of T-LOC also predict violations. When evaluated in general, T-LOC predicts driver behaviors better than Montag Driver Internality and Driver Externality Scale. In terms of driver skills, none of the sub-dimensions predicted perceptual-motor skills for both locus of control measurements, and models that test predictiveness of safety skills were not significant. Although this is the first study in the literature to use these two different measurement tools, the results of the study reveal how important the measurement tool to be used according to the conceptualization method of the locus of control in future studies is and will affect the obtained results. In addition, the fact that the predictive role of locus of control on driver skills in this study was statistically insignificant despite the use of different measures indicates that it is one of the issues to be considered in future research and applications.