

The Relationship between Risk Perception, Driving Experience, Attitude Toward Safety, and Driving Behavior on a Simulator

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Thirty subjects continuously rated subjective (perceived) risk with a joystick, while watching seven video clips of driving scenes. Afterwards their actual driving behavior in the same scenes was recorded in a driving simulator. Finally, they filled in the SAS 592, a self-rating scale of driving attitude developed by the National Research Institute of Police Science, Japan. Risk evaluation and “vehicle speed” at various hazardous objects and events were compared between subjects classified by driving experience and by scores on attitude toward safety. The result showed that driving speed was significantly higher in subjects whose “Anti-social behavior” score in the SAS is higher. “Egocentric behavior”, on the other hand, has a different influence on subjective risk depending on whether the hazard is overt or covert. We will discuss individual differences in perceived risk and speed chosen at various hazard sources, as well as the interaction between perceived risk and speed.

1. INTRODUCTION

How a driver perceives risk affects how he/she drives, and is related to the occurrence of traffic accidents. If the characteristics of risk perception are different according to the individual, assessment of such characteristics should help driver education and training.

However, there are few studies investigating whether individual difference in attitude toward safety are associated with risk perception or not, and how risk perception affects driving behavior (except for Kokubun et al., 2003b).

To obtain basic data to answer these questions, we carried out a laboratory experiment using a PC-based driving simulator (Kokubun et al., 2003a).

2. METHOD

Thirty subjects, aged 19 to 26 years, 16 males and 14 females, participated in the experiment. At the first stage of the experimental session, the subject watched video clips of driving scenes on a computer screen while continuously evaluating the level of risk.

Then, at the second stage, the subject “drove” by him/herself, controlling apparent speed with only “gas” and “brake” pedals connected to the computer, and driving behavior, such as velocity (virtual running speed of the automobile), braking, and accelerating were recorded. However, in the later analysis, only velocity was used

among the measures of driving behavior.

At the final stage of the session, the subject filled in the SAS 592, self-rating scale of driving attitude developed by the National Research Institute of Police Science, Japan (Otsuka et al., 1992). The SAS592 is used in police stations on the occasion of driver license renewal, and is constructed of two subscales: “Egocentric behavior” and “Anti-social behavior”: the scores are thought to reveal tendencies towards dangerous driving behavior. The “Egocentric behavior” subscale is subdivided into measures of “desire to show off” and “impulsiveness”. The “Anti-social behavior” subscale is subdivided into measures of “aggressiveness” and “lack of cooperativeness”. The subjects answered about their driving experience as well.

3. RESULTS

3-1. Classification of data

We classified the subjective risk and velocity data based upon two categories of driving phase: the risky phase and the safe phase. The risky phase refers to a 3- to 4-second fragment of video clip in which an overt hazard exists. On the other hand, in the safe phase, there is no overt hazard.

3-2. Relationship between subjective risk and velocity

First, we examined the relationship between subjective risk evaluation and velocity averaged for each subject over the risky phase, but no correlation was found at all.

Then we calculated correlation coefficients for each subject between subjective risk and velocity at individual risky phases. As a result, as shown in Figure 1, significant negative correlations were found for 9 out of 30 subjects ($r = -0.69$, $p < .01$; for subject O.R., see Figure 1).

3-3. The effects of sex and driving experience

The subjects were classified into a no-license group, a novice group, and an experienced group according to their driving experience. Two-way ANOVAs (sex by experience) were carried out taking mean subjective risk and mean velocity as dependent variables. Results showed no significant main effect of either sex or experience for either dependent variable. No significant interaction was seen either.

We also conducted an ANOVA separately for every phase, using subjective risk and velocity as dependent variables, and found a significant main effect of driving experience on velocity in some phases (e.g. Figure 2).

3-4. The influence of attitude toward safety

The subjects were classified into "Group P" and "Group G" according to their score on "Egocentric behavior" and "Anti-social behavior" as measured by SAS592. On the "Egocentric behavior" and "Anti-social behavior" subscales, subjects were divided into those who scored high, Group P (i.e. those who were more "Egocentric" or more "Anti-social"), and those who showed less of these characteristics, Group G.

We compared mean subjective risk and velocity between Group P and Group G for both traits of attitude toward safety. An ANOVA showed that the effect of "Anti-social behavior" on velocity was significant ($F(1,28) = 4.25$, $p < .05$; see Figure 3).

A one-way ANOVA was carried out again separately for each risky phase of driving, and detected a significant effect of "Anti-social behavior" on velocity for 4 out of 20 phases (e.g. Figure 4).

Effects of "Egocentric behavior" on subjective risk were significant for some phases. The fact that subjects in Group P were higher in subjective risk (e.g. Figure 5) was,

however, contrary to our prediction. We assumed that those rated lower in attitude toward safety would rate risk lower and therefore drive at higher speed. In fact, in the risky phases as shown in Figure 6, Group G in the "Egocentric behavior" group evaluates subjective risk significantly higher.

This tendency was only seen in the risky phase, not in the safe phases.

4. DISCUSSION

4-1. Relationship between subjective risk and driving behavior

Although significant correlations were seen only in 9 subjects, there was a tendency for drivers to select their driving behavior (i.e. velocity) in response to perceived risk (see 3-2).

4-2. The effects of sex and driving experience

Little effect of driving experience on subjective risk was seen (3-3). This result was thought to be due to the small differences in driving experience among participants in this experiment; 5-years driving experience was the longest. The effect of driving experience on velocity was significant in some risky phases; the no-license group drove at a higher speed than the other two groups. This fact can be explained as a consequence of their lack of ability to properly control accelerator and brakes.

4-3. The effect of attitude toward safety

The result 3-4 shows that subjects in Group P in the "Anti-social behavior" group tend to choose a higher speed than those in Group G, in the risky phase. This fact suggests that driving behavior is affected by driver's attitude toward safety.

Moreover, on subjective risk, the effect of "Egocentric behavior" changed in the opposite direction according to the kinds of risky phase. Risky phases such as Figure 6, where higher risk was perceived by Group G, might require prediction of other road users' behavior and finding *potential* hazard in a traffic situation. In contrast, in the risky phases such as Figure 5, where higher risk was perceived by Group P, there was another road user disturbing the subject's own behavior.

It was suggested that drivers, who are diagnosed as

problematic in the “Egocentric behavior” subscale of SAS592, tend to underestimate hazard with a covert risk while they regard other road user’s behavior obstructing their way as a hazardous event.

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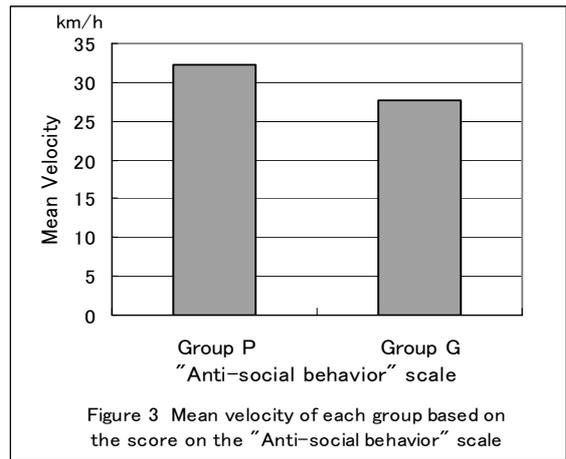


Figure 4 Risky phase No.20



Figure 5 Risky phase No.14



Figure 6 Risky phase No.12

