# An Experimental Study of Speed-Perception of the Car on the Road (II)

TADA HIDEOKI, OHYAMA MASAHIRO, KITAMURA SEIRO, HATAYAMA TOSHITERU

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AN EXPERIMENTAL STUDY OF SPEED-PERCEPTION OF THE CAR ON THE ROAD (II)

By

HIDEOKI TADA (田多英興)  
(Fukushima Medical College, Fukushima)  
MASAHIRO OHYAMA (大山正博)  
(Miyagi-Gakuin Junior College, Sendai)  
SEIRO KITAMURA (北村晴), and TOSHITERU HAYAMA (畑山俊輝)  
(Department of Psychology, Tohoku University, Sendai)

Three modified experiments were conducted, following after the Experiment 1 of standard sample of subjects previously reported. Differences due to cars used and subject drivers were chiefly investigated by these experiments. The results suggest; 1) Professional drivers tend toward over-speeding, 2) Differences in the experimental cars used are not clearly established. 3) The temporary change in the judgement of speed perception is suggested.

INTRODUCTION

Three more experiments followed the previously reported Experiment 1 on speed perception of the car on the road (Tada, et al., 1969). These experiments adopted the method and experimental conditions identical with those in the Experiment 1, except in the following several points. Table 1 summarized the five experiments with respect to the groups, types of the cars used, dates of the experiment, the road and specific areas of study.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Ss (N)</th>
<th>Car</th>
<th>Date</th>
<th>1st series</th>
<th>2nd series</th>
<th>3rd series</th>
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<tr>
<td>Preliminary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1st series</td>
<td>2nd series</td>
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<td>III</td>
<td>University-staff (10)</td>
<td>Prince Gloria ('61 model)</td>
<td>Aug., 1968</td>
<td>Driving-production</td>
<td>Start-production</td>
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Method

The main purpose of Experiment II was to examine the effects of two different samples of subjects on speed perception. One group of subjects (Ss) were from among staff-members of the Tohoku University, who were thought to be amateur drivers, while the other from taxi drivers, who were considered as professional drivers. Although it was difficult to decide what would constitute amateur drivers, the following criterion was tentatively adopted; those of the university staff-members who had commuted to their offices driving their own cars for a period of more than three years. In this manner, 10 subjects were selected. Their age varied from twenties to fifties. The amateur group and the professional group were assumed to differ in terms of their familiarity with cars, attitude toward cars and amount of experiences. In the present experiment, the following estimation series contained in Experiment I was not used. Auditory cues were controlled by keeping the windows closed.

The main purpose of Experiment III was to investigate the differential effects of the experimental vehicles used. It has been expected that different vehicles might five different kinds of cues for the drivers' speed perception. Ss were 12 members of a transportation troop from Japanese Self Defense Force (JSDF). The experimental car used was a 1967-model Prince Gloria, 1900 cc., of a van type. As a measure, the production and the estimation of speed of one car overtaking another took the place of the following-estimation in Experiment I. More specifically, the experimental car with a subject in it followed another car, 1961-model Prince Gloria, which was running according to the same schedule as in the driving-production series* in Experiment I. Then the subject was asked to estimate the speed when he was overtaking the preceding car.

In the previous experiments, Ss and experimental vehicle changed simultaneously, thus making it impossible to study the effects of the change in Ss themselves. Therefore, in Experiment IV, keeping the type of the car constant, differences among the Ss were strictly examined and compared with each other. Here a Prince Gloria of 1961 was used with 10 members of the previously described transportation troop. All the other experimental conditions were identical to those in previous studies.

Results

All the four principal findings already obtained in the preliminary experiment and Experiment I were confirmed in the present series of experiments without exception. Thus, those findings appear to be of very fundamental and general

* This series was named the “driving-production”, because of its specific procedure that a subject driver had always drove his car without stopping throughout the experiment of this session, according to the standard-speed. While in the start-production series, he was asked to stop his car after every speed-production, because his standard-speed is always 0 km/h.
nature in speed perception of the car on the road. In the following section, findings chiefly dealing with differential effects of different subjects and cars will be described.

(1) Differential effects on speed perception deriving from the difference among Ss are suggested in the results from Experiment I, II and III. As shown in Figure 1, taxi drivers, generally speaking, showed the largest discrepancy between task-speed and production-speed. The second largest discrepancy was observed in the members of transportation troop from JSDF. The staff-members of university showed the smallest discrepancy. From the fact that the values for the university staff-members were different in distribution from those for the other two groups which remained close to one another, it can be thought that university staff-members constitute one group, while the others another.

(2) When differential effects on speed perception due to the difference in experimental cars are examined, by comparing the results of Experiment III with those of Experiment IV, a somewhat reverse effect can be found, according to whether the experimental condition was start-production series or driving-production series (Fig. 2). In the case of driving-production series, the curve depicting the discrepancy between task-speed and production-speed is located higher for '67 car than for '61 one, except at the task of 30—60 km/h for the acceleration series.

Especially in the deceleration series the difference between the two cars is larger and more consistent in comparison with that in acceleration. In the case of start-production series, the curve for the '61 model is located higher than that for '67 model.
(3) Figure 3 shows the actual speed and the estimated one during overtaking. In both experiments, Ss overtook the preceding car with their speed about 20 km/h greater than that of the preceding car, but the underestimation of speed was made. Thus Ss seem to underestimate the speed in the case of overtaking as well as in other cases.

(4) Figure 4 shows the time required to arrive at a certain speed. It is apparent that deceleration requires a shorter time than acceleration and the SD value
for deceleration is also smaller than that for acceleration. This difference seems to arise from the difference in the manner of using the brake in both conditions, and also from the relatively quicker recognition of speed-change in deceleration than in acceleration (Torf, A.S. & Duckstein, L., 1966). The required time seems to depend upon the width of speed-change from the standard speed to the task-speed rather than upon the height of speed at which the required change is initiated. This result is consistent with that of Denton (1966). With regard to the change in the required time over the three trials, the third trial requires a relatively shorter time than the first trial. Attention should be paid to this fact of decrement of required time over the progress of the trials as well as to the increment of judgement discrepancy (Fig. 5).

**DISCUSSION**

The difference in speed perception among the different drivers was investigated with three groups; professional, semiprofessional and amateur. These groups differ in the length of driving experiences, estimated time spending in driving a day and
technical skills. Taking these personal factors into consideration, it was originally expected that the JSDF members might yield the results more similar to university-staff-members rather than to taxi drivers. The means for production-speed arrived at by JSDF members, however, was close to that of the professional group of taxi drivers and the groups were roughly divided into two groups, amateur and professional. This fact may permit the interpretation that these differences were originated from the age factor. The age-range of the university staff-members is from twenties to fifties, while JSDF members are in their twenties. It is empirically well known that younger drivers did not tend to suppress the speed. But it should be noticed here that the taxi drivers are in their fifties. Thus the age factor is not the only factor that affects this fact. After all, it may be interpreted in terms of subject's general attitude toward driving (or so-called “courtesy”), including the age factor and the other factors mentioned above. Indeed, Brown, I.D. (1967) suggested that the courtesy for the other road users affects the skills of driving. The similar effects seem to be observed in the perception of speed.

The different speed-production due to the different cars used was examined by utilizing two cars which were different in the model, 1961 model and 1967 model. The result obtained from driving-production series in the present experiment was the same as those of the previous study. In the start-production series, however, the new model of 1967 represented less discrepancy than the old model of 1961, in contrast with the driving-production series. If there were consistently observed less discrepancy in the old model than the new model, it can be thought that the different cues of auditory and kinesthetic perception may yield this difference. However it is difficult to interpret this contrast effect of the model between two series. The only difference in conditions between two series was the standard-speed.

The two results, the time required to produce a certain speed and the estimation of speed during overtaking, seem to be natural. In Denton’s result (1966), the required time to arrive at a task-speed was close to each other in both acceleration and deceleration, but in the present study it was shorter in deceleration than in acceleration. Although there is slight difference in the time between the acceleration and the deceleration, the required time can be thought as a function of the change-width of speed from standard-speed to task-speed. This seems to stem from the time involved in either acceleration or braking operation.

Finally, it is noted that the temporary transition of speed-judgement was observed, as shown in Figure 5. Especially in the acceleration series, the discrepancy of speed-judgement became larger as the trials went on. This temporary transition of speed-judgement might be due to the change of standard point of judgement (or the adaptation level). When a driver drives his car for some time, his standard point of judgement shifted to and his judgement became inaccurate gradually, and the shift seems to be relatively rapid and large. There are some
evidences which support this. One of the evidences is that no Ss were given any information about “objective speed” throughout the experiment. Therefore, they were apt to shift their standard point of judgement especially in the case of acceleration and thus greater discrepancies were observed with the lapse of time. The other is that the clear and consistent data in a sense of showing a linear curve were found in the start-production series which had a condition of distinctive criterion of judgement, no matter how the magnitude of discrepancy in the start-production is not necessarily different from that in the driving-production. Therefore the distinctive standard-speed may play an important role in the perception of speed.

**REFERENCES**


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