CAI-SYSTEM UTILIZATION IN THE RE-EDUCATION OF OLDER DRIVERS' HAZARD PERCEPTION

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1. INTRODUCTION

Several drivers' aptitude tests have been developed in Japan which contribute to driving safety, e.g., The Speed Anticipation Test, developed by Maruyama and Kitamura (1961) and The Discrimination Reaction Test of Multiple Performance Type, by Nagatsuka and Kitamura. (1961). These aptitude tests have been quite successful with regard to the task of identification of safe and unsafe drivers, and in terms of contributing to the scientific understanding of drivers' psychological mechanisms as operative in traffic accidents. However, the tests are not particularly concrete, i.e., situation-specific, as teaching materials. A new trend has recently emerged. Traffic psychologists in Japan are now more interested in advice-oriented testing (e.g. Fukazawa,N. 1985, Nagayama, ,Y. and Renge,K.1989) ; we aim to make diagnostic tests, often using such materials as illustrations, movies and computer graphics which are more situation-specific, directly relating to actual road situations. After testing, the same materials can be used for follow-up teaching purposes; by using small group discussion methods, drivers can attempt to understand typical accident patterns on the road.

These advice-oriented tests focus particularly on external hazard perception on the road However, there is another hazard which is more difficult for drivers to detect. It is the internal danger which drivers themselves have. It is important for drivers to assess their driving abilities objectively, because compensatory behavior can only be expected when drivers understand their own weak points (Simms, B. 1993, Cooper, P.J. et.al. 1993). It is, however, not easy for drivers to make accurate self-evaluation of their driving skills. Drivers usually exhibit an optimistic bias, showing a tendency to over estimate the excellence of their own driving skills (Mackenna, F., Stanier, R. and Lewis,C. 1991, Ota, H. 1996, Keskinen,E. 1997). One important factor determining the road safety of drivers is the degree of adequacy in self-assessment of ability. In particular, an over self-confidence can contribute to unsafe behavior (Keskinen, E. et.al. 1994). Drivers' education should take into account not only external hazard perception but also the internal sort. However we currently lack an educational system which would help drivers achieve accurate self-evaluation.

2. PURPOSE

Accurate self-evaluation is especially important for older drivers. Older drivers must be able to discern which kind of psychological functions relating to driving have deteriorated or are likely to. These drivers can compensate for their weak point by adapting their behavior; if he/she is aware that night-time vision has deteriorated, he/she can try not to drive at night so often. It is also important for older drivers to know when they should give up driving. Older people need

information about their own psychological functions as drivers to determine the appropriate limits of their driving careers. However, there are not yet good diagnostic tests and training systems available, allowing drivers to gain skill in self-evaluation. Considering this present condition, Ota is developing a system which employs the computer in a program for diagnostic testing and education of external hazard perception.

The aim of the study is to assess the effect of the experimental education program which was conducted upon the occasion of older drivers' renewal of their drivers' licenses; the aim of the program is, (1) to offer older drivers an opportunity to re-evaluate their driving skills, especially their hazard-perceptual ability on the road, and (2) to develop a re-education curriculum for older drivers focusing on external hazard perception and the development of the skill of accurate self-evaluation by analyzing the effects of the experimental education conducted by the author.

3. METHOD

Ota (1996) is developing his own advice-oriented tests on hazard perception with Hitachi Co,Ltd., Hitachi Microsoft Co,Ltd. and Kigyokaihatu Center Co,Ltd) using a personal computer with a touch-panel monitor. The system is constructed with a Hitachi personal computer (Hitachi Flora-DM1), MPEG board RM-LT2 (Software Japan Co.LTD), 17" display with touch panel-TD17(Tachimbana Shoukai Co. LTD). After observing a traffic scene from the driver's seat for a few seconds, subjects are shown a still picture of the scene and are asked to point out the dangerous objects and places on the road. The test consists of seven scenes in each of three themes, i.e., intersections, residential streets, and various traffic scenes which drivers might encounter on the way to their offices. After finishing the test, subjects receive an evaluation for three phases of their hazard-perceptual ability:

phase 1: the ability to detect hazardous objects visible from the car

phase 2: anticipation of other traffic participants' behavior

phase 3: the ability to detect dangers hidden on the road

The author devised an experimental re-education program for older drivers in conjunction with the renewal of their driver's license. Prior to involvement in the program, participants were asked to complete a questionnaire in which they were asked to evaluate their own ability in regard to several aspects of hazard perception. The education program itself was carried out with the use of a CAI (Computer Aided Instruction) system, " Yochiro", mentioned above. In this experimental education program, intersection scenes were used in testing and education because older drivers characteristically have problems at intersections. Due to the group education setting, instead of

touching a panel monitor to show the hazardous objects/places, subjects were asked to mark those on illustrations which they had been previously given by the trainer. Seven scenes were shown to the subjects on a wide screen at the front of the room using a projector connected to the computer. Self-diagnostic testing using the CAI system was followed up by discussion among the participants about hazards on the road. The participants were asked to talk about the hazards which they had marked and describe the reasons, referring to the scenes they had been shown. The trainer was required to give attention to all those actively participating in the discussion. The subjects were then given a questionnaire in which they were asked to reevaluate their ability and identify their problem areas in hazard perception.

4. RESULTS

4.1 Participants

73 drivers over 65 years old participated in the experimental education class. The number of participants in a class is between 2 and 10 drivers. Tests were carried out with time limits, i.e., they were given 30 seconds per every 7 scenes for checking and marking hazards on the road in the illustration. Wondering if this might not be enough time after finishing two classes, the trainer tried removing the time limit for the other 53 participants. Analysis was mainly carried out for the 53 participants, except for analysis of the effects of a time limit on the detection of hazards on the road.

4.2. " How often do you drive in a week?"

Three groups were classified by age: (1) 65 - 69 , (2) 70-74, (3) over 75 . The number of participants in each group was respectively 26, 16 and 11 including two female (69 and 70 years old).

More than 60 percent of older drivers who are 65-69 years old drive every day. Even drivers who are over 75 years old tend to drive their cars more than two or three days in a week. It can generally be said that older drivers drive very often and lead active lives.

Fig. 1 "How often do you drive in a week?"

4.3 " Are you afraid that your physical strength is declining?"

2 participants(3.9%) answered "often", 16 participants (30.2%) answered "sometimes, 19 participants (35.8%) answered "seldom" and 14 participants (26.4%) answered "not at all". 65 percent of the participants were not particularly concerned about the deterioration of their physical strength.

Fig.2 "Are you afraid that your physical strength is declining?"

4.4 " Do you have any problems while driving lately?"

Participants who are over 75 years old reported some vision problems while driving at night and on rainy days. 40 percent of them, however, did not report any problems.

Fig. 3 " Do you have any problems while driving lately?"

4.5 "What are your strong and weak areas in hazard perception?" -Comparison of self-assessment before and after testing and teaching-

With regard to most areas of hazard-perceptual ability, participants evaluated themselves higher than average before testing and teaching. However, participants less than 75 years old revised their self-assessment downward on all items toward after testing and teaching. Participants over 75 years old, on the other hand, did not change their self-assessment.

Fig. 4 "What are your strong and weak areas in hazard perception?"
(before testing and teaching)

Fig. 5 "What are your strong and weak areas in hazard perception?"
(after testing and teaching)

4.6 Comparison of test scores by age

Table. 1 shows the average test scores and standard deviation in each of three different ages. The

differences between scores are not significant (F=0.985, p=0.381).

Table 1 Comparison of test scores by age

The author has obtained the test scores of younger drivers (20 - 65 years old, average age; 38.2 years old, SD; 11.4) in the process of developing this CAI system "Yochiro". The average of these younger drivers' scores was 19.4 and the standard deviation was 7.2. It can be said that drivers under 65 have higher scores on hazard perception.

4.7 Comparison of the results of the test between groups who took the test with time limitation and without time limitation, by age.

Tests were carried out with a 30-second time limit for 20 participants and without a time limit for 53 participants. Under the time limit condition drivers over 70 showed lower scores compared with younger drivers aged 65-69 (drivers were regrouped into two groups because it was difficult to analyze the data as the numbers of participants tested with the time limitation were not enough). However, without a time limit, the older older drivers (over 70) achieved the same scores as did the younger older drivers did.

Fig. 6 Comparison of the results with the time limit
and without the time limit

4.8 The relationship between self-assessment and the test scores for hazard perception

The correlation coefficient between the test scores and the average score of five items of self-assessment which was found in the evaluations of 53 participants before testing and education was -0.035. The after-testing correlation coefficient between self-assessment and test scores was -0.139. No relationship between subjective evaluation and objective test scores on hazard perceptual ability could be found.

4.9 " In today's class, what tasks did you learn would improve your driving safety?"

As described above, the participants' self-assessment was higher than average before the class and lower afterwards. At the same time they identified their individual difficulties in regard to

hazard perception on the road. Almost 80 percent of the participants realized a need to be more careful about hidden hazards on the road and 50 percent of them gained insight into other weak areas.

Fig.7 " In today's class, what tasks did you learn would improve your driving safety?"

5. DISCUSSION

The analysis examined the effect of the education program on participants' assessment of their own driving safety, especially in hazard perception.

One of the most interesting results of this study was the lack of a relationship between self-assessment and objective hazard perceptual ability as shown in the result in section 4.8, which offers evidence that drivers do not possess accurate understanding of their own objective abilities as drivers. Previous studies have shown that most drivers usually tend to assess themselves as safer drivers than do others (Mckenna, F., Stanier, R. and Lewis, C. 1991). The drivers who participated in this class exhibited the same tendency despite the fact that their objective hazard perceptual ability had deteriorated compared with younger drivers. In the questionnaire filled out prior to diagnostic testing and teaching, they assessed themselves as better than other drivers with regard to hazard-perceptual ability. However, most participants' self-assessments shifted to lower levels after the subsequent testing and teaching, which can be seen to be the effect of the experimental education. Those drivers older than 75 years old, however, displayed a different tendency. Their self-assessment did not change; their self-assessment after the class was almost the same as before the class, and they still assessed themselves as better than average. Several factors can be considered to possibly contribute to this tendency. Participants under 75 might expect higher test scores before the testing than those they actually achieved. They realized that their objective ability of hazard perception was lower than what they had previously expected, and as a result, their self-assessment shifted to lower levels. On the other hand, participants over 75 might not expect such high scores before the testing. As a result, their self-assessment was unchanged. The problem is that the level of the self-assessment of over 75 is higher than the average level even though they achieved lower scores than the average. This fact suggests that drivers over 75 have difficulties in adjusting their self- assessment even when they have been given objective test results indicating that their safe driving skills have deteriorated. Studies show that older drivers have virtually unbroken self-confidence with respect to their driving ability (OECD 1984). It could be because of the rigidity common among the elderly, which can hinder them in learning from their own mistakes

(OECD 1984).

However, studying the results of the questions asked about their safe driving tasks in the questionnaire, participants over 75 gained awareness of ways of safer driving; 6 of 11 participants mentioned that they understood their own problems in hazard perception and 7 participants identified their problems in the perception of hidden hazard on the road. The method of self-evaluation itself using a 5 scale evaluation method should also be discussed in regard to whether this way of rating is suitable for older drivers.

The time limitation in the diagnostic testing procedure affected older drivers in particular. When there was no time limitation, there were no differences in the scores between younger older drivers (65-69) and older older drivers (over 70). It means that even drivers over 70 years old do not lose hazard-perceptual ability when adequate time is available. However, when they feel pressured to complete tasks in a given time, their hazard-perceptual ability can deteriorate significantly. Studies show that the elderly experience a deterioration of their ability to process information within a short time period (Parasuraman, R. and Nestor, P. 1993). The results of the present study reinforce this, with time limits being a problem for older drivers. However, it is interesting that the results of the study also show that even drivers over 70 years old do not show any deterioration in hazard perception, when the time limitation was removed. It means that when older drivers have enough time to process information or, in another words, if older drivers do not have a time limitation, they can be expected to adequately manage their safety on the road. The time factor is very important for traffic safety. Further studies should be conducted to clarify the effect of the time limitation on hazard perception. Also, further experimental education should be planned to explore the possibility of older drivers improving their driving behavior on the road via re-education in hazard perception by using such teaching materials as CAI systems. It is especially important to understand how the participants' changes in self-assessment can make their driving behavior safer.

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Table 1 Comparison of test scores by age

Total score	average	SD
65-69 years old	14.8	4.6
70-74	12.7	4.3
75-	13.9	5.1

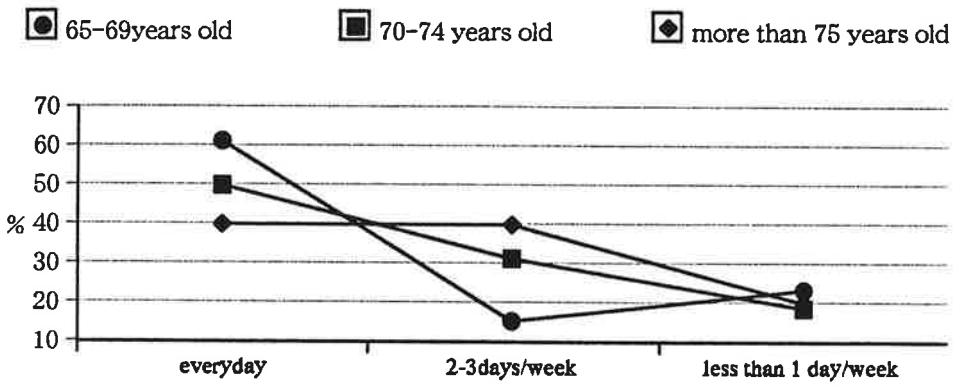


Fig.1 "How often do you drive in a week?"

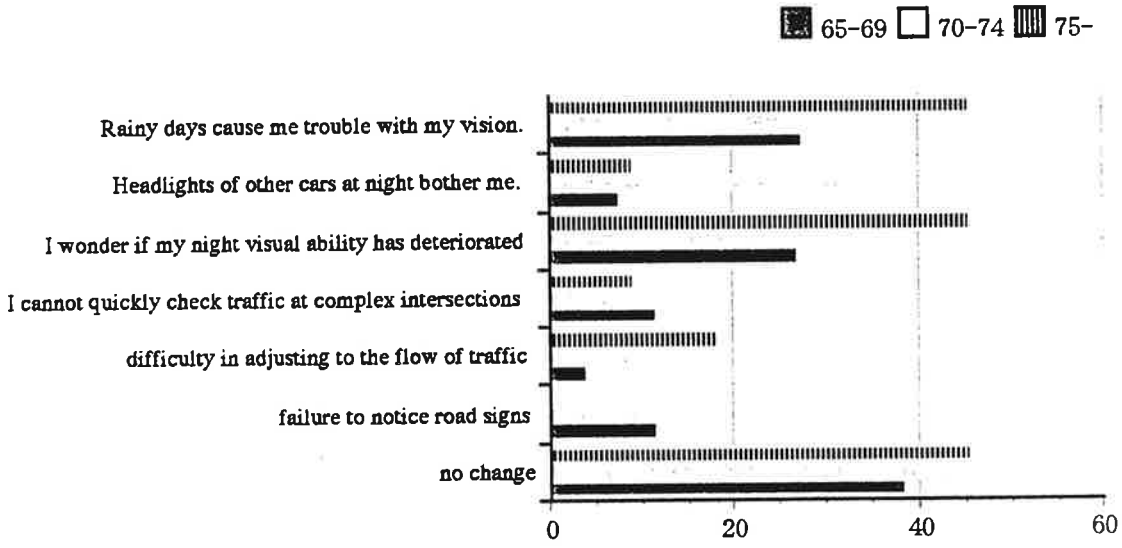


Fig2 "Are you afraid that your physical strength is declining?"

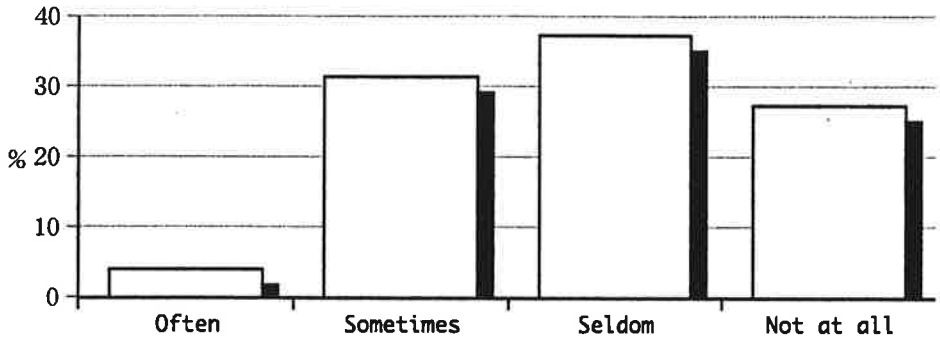


Fig. 3 " Do you have any problems while driving lately?"

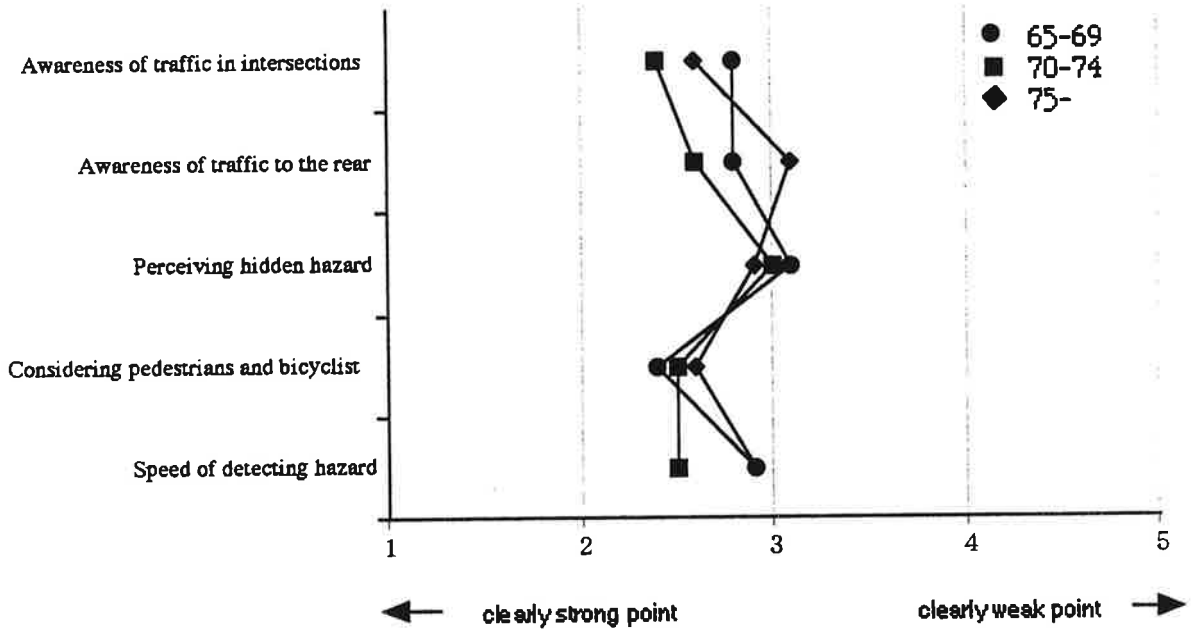


Fig. 4 "What are your strong and weak components in hazard perception?"

(before testing and teaching)

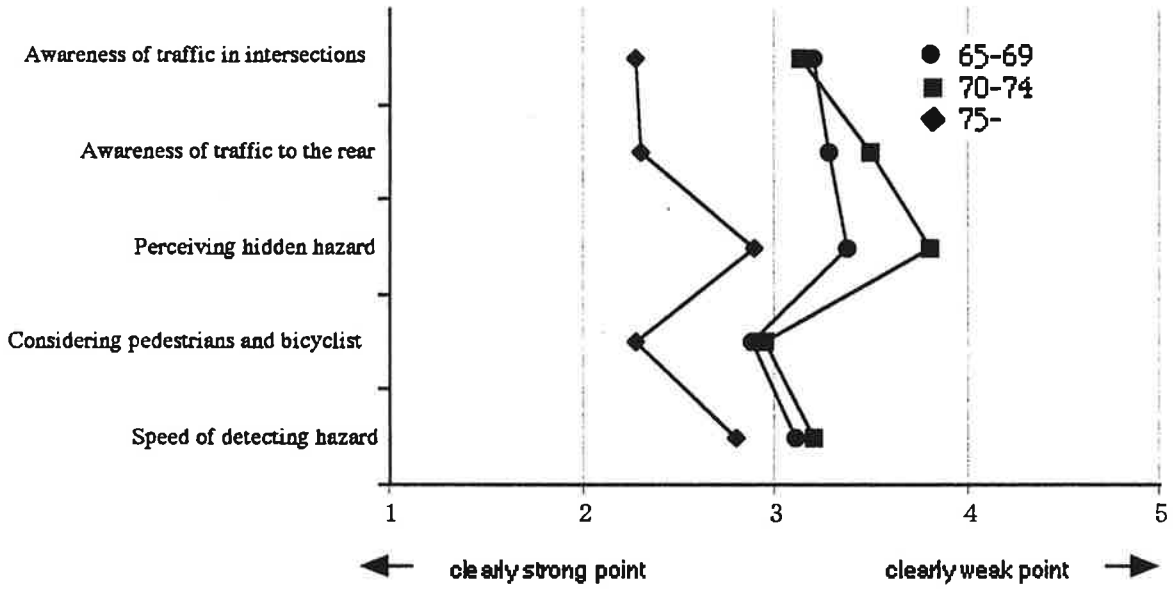
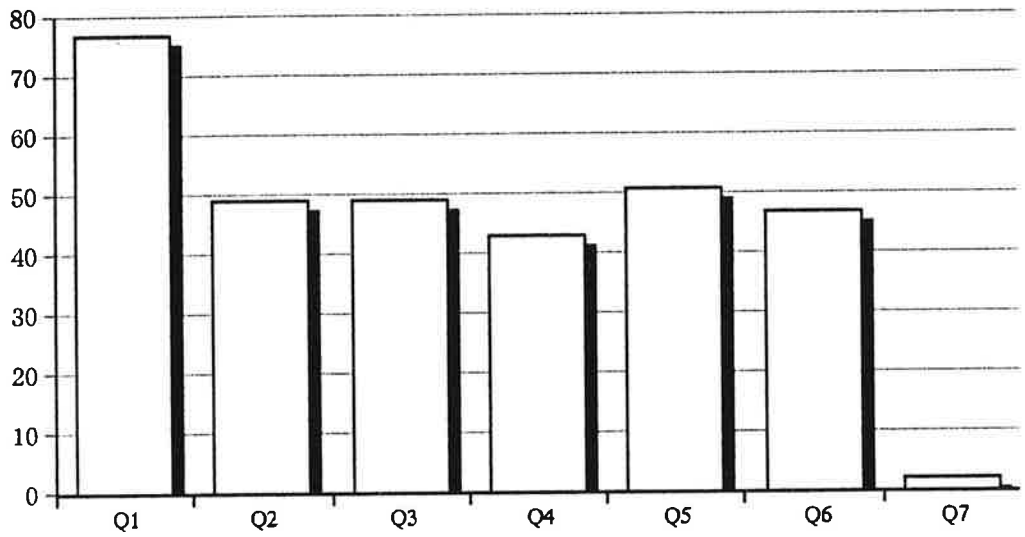


Fig. 5 "What are your strong and weak components in hazard perception?"

(after testing and teaching)



Q1. " I have to be more careful about hidden hazards on the road."
Q2. " I have to check my rearview mirror more often."
Q3. " I learned typical accident patterns on the road"
Q4. " I learned the importance of an active attitude in detecting hazards."
Q5. " I could clearly understand my weak points in hazard perception."
Q6. " I realize that my hazard perception on skills have deteriorated, and I will drive more carefully."
Q7. " I did not get any new information from this class"

Fig6 " In today's class, what tasks did you learn would improve your driving safety?"

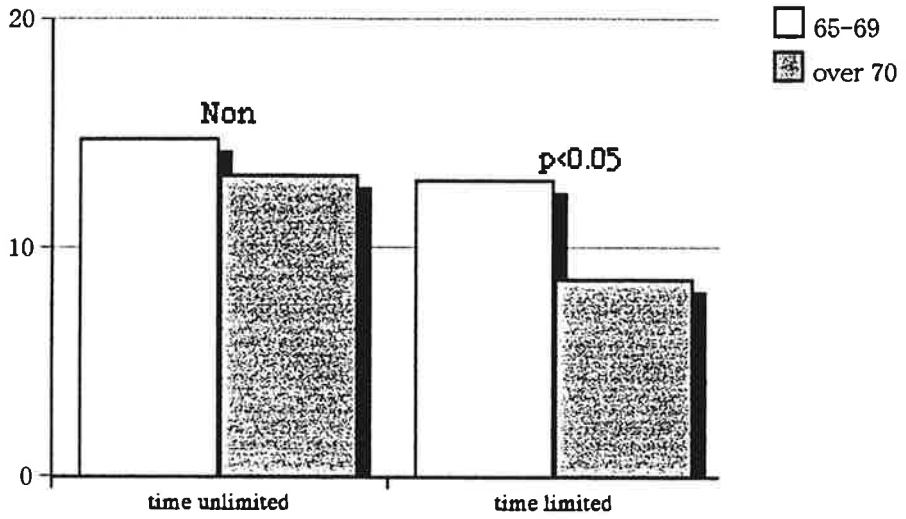


Fig. 7 Comparison of the results with the time limit and without the time limit