A Preliminary Study of Distance Between Examination Seats for Preventing Cheat With Speed-Accuracy Tradeoff

Krongkarn Wiwatwisawakorn and Phairoat Ladavichitkul

Abstract— Speed-Accuracy Tradeoff is a study of human perceptions and reactions which can be applied in a variety of design. An examination seat can be considered as a workstation operated by an examiner which is essential in the education process. Unlike common workstations which are designed to improve the working accuracy, the examination seats are designed to minimize the copy accuracy. A major propose of examination management is to protect the academic dishonesty. A common way to reduce cheating is the seat arrangement by increasing the distance between the examination seats. However the cheating problems may occur when the large number of examiners is set in a relative small room. The arrangement of exam seats are limited by room space then the relative close distance between seats may encourage examination cheating. Based on speed-accuracy tradeoff, the distance between seats and the copying time period can be set as the speed factors or the index of difficulties which affect the copying accuracy. The results show the relationship between the copy accuracy and index of difficulties such as the examination seat distance and the looking time periods.

Index Terms—**Academic dishonesty, Exam seat arrangement, Cognitive Engineering, Speed-accuracy tradeoff, Space design.**

I. Introduction

Education is very essential for country developing, and then an important process of the education is the examination in order to evaluate the successive level of the education. The examination is always used as an indicator to classify the student classes or levels and also identify the quality of education. Cristina et al., 2009 [1] classifies cheating on tests into three domains: (1) cheating by taking, giving, or receiving information from others; (2) cheating through the use of for bidden materials or information; (3) cheating by circumventing the process of assessment. Officer of the Commission for Basic Education of Thailand, 2009 [2] controlled the physical examination conditions by setting the seat arrangement at 35 seats per room with 2 observers. However the distance between exam tables was not identified, the examination committees used their own subjective arrangement. The arrangement of exams tables are always varied by room space which varies upon the floor plan of building. The uncertain room space causes the variation of the distance between seats. Therefore, the variation of the seat arrangement may cause the cheating opportunity and the standard level of examination management.

Cristina et al, 2009 [1] proposes exam seat arrangements to find the minimum distance between the seat within the visual range. The minimum visual range was 8.1 ft. then the proposed seat arrangements were calculated and designed in order to maximize the number of students whom can be set in the examination room space.

Since Schmidt's Law has stated the relationship between the hand movement error and the hand movement speed: the movement amplitude and time [3], Speed-Accuracy tradeoff was applied in variety user interface design. The examination seat can be considered as a workstation which has to eliminate all cheating opportunities. A simple method is to separate the examination seat with a proper distance. Another method is using the observers to watch the dishonest examiners. Increasing the number of observer or the observing frequency can reduce the cheating opportunities.

Based on speed accuracy tradeoff, the distance between examination seats was implied as the movement distance while the looking time period at the original answer sheet was implied as the movement time. Both distance and time period factors would influence the copying accuracy. The copying accuracy was calculated by comparing the participant answer sheet to the original answer sheet. The numbers of correct answer were used as the indicator of the working accuracy.

II Method

A. Participants

Five students from Chulalongkorn University (age between 18-27 years) were recruited. The participants consisted of three females and two males who had good sight and have had experiences on using the computer answer sheet of Chulalongkorn University.

B. Apparatus

Simple equipments in the experiment are Snellen chart for visual acuity test, the computer answer sheets of Chulalongkorn University that have size 21.6 x 28.0 cm. (Fig 1), a long examination table (Fig 2) and a rhythmic

Manuscript received on January 2, 2011

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ISBN: 978-988-19251-2-1
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

sound generating program. The examination tasks were simulated in Ergonomics Laboratory of Industrial engineering department, Chulalongkorn University.

The environment in experiment room was set as the following: the light intensity was at 300 Lux [5] on the examination table by fluorescent lamp (warm white color) and the temperature was at 27°C.

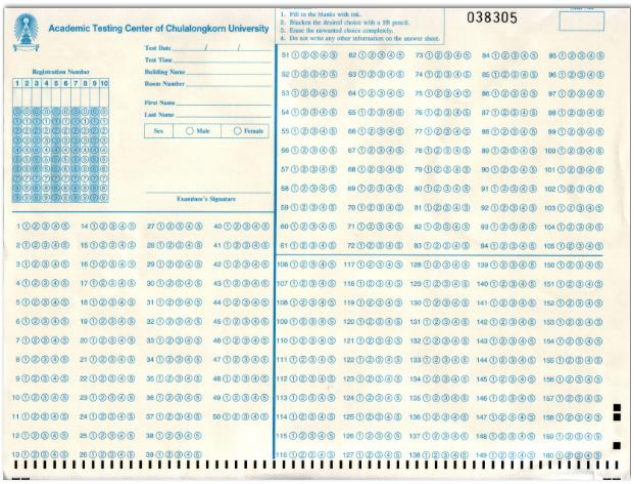

Fig 1: Computer answer sheet

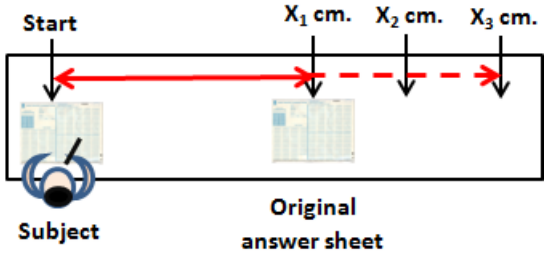

Fig 2: Layout on the examination table
(X_i is distance between the centers of both answer sheets)

C. Procedure

Before the experiment, use a Snellen chart to test each participant's visual acuity. Only those participants with 20/20 vision or better were selected to join the experiment [6]. The examination seat was set by placing the target/original answer sheet on the right side of the subject as shown in Figure 2. The original answer sheet is a computer multiple choices (five choices, A-E) which selected by painting with 2B pencil. Forty patterns of the original answer sheets were prepared by painting 30 topics randomly.

The factors of this experiment are the target distances (X_i) and looking time periods. The target distances have 10 distance levels (80, 100, 120, 140, 160 180, 200, 220, 240 and 260 cm.). The looking time periods were varied as 1, 2, 4 and 6 seconds for looking at one topic. Subjects repeated the experiment twice in each condition. The patterns of original answer sheet were changed in each condition and replication.

Subjects did the copying tasks under each condition. The copy tasks were separated into two subtasks. The 1st subtask called "Looking task" is turning the head and looking the original answer sheet. The 2nd subtask called "Marking task" is turning back the head and mark the expected answer on the subject answer sheet (Fig 3). In order to reduce the decision process and use only the short-term memory of the subject [7], the marking task was limited in 1 second then the subject did only mark the expected choice without hesitation. One copy task can do only one topic. Therefore at each condition, subjects did the copying task for 30 cycles (30 topics on each answer sheet). To control the subject movement speed, the sound "BEEP" was generated from the computer program to signal the subjects for turning their heads or changing the subtasks.

The subject answer sheets were compared to the original answer sheet to calculate the number of correct answer which represented the accuracy of copy task

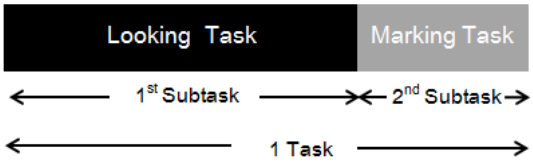

Fig 3: Steps for looking the answer sheet

II. Results

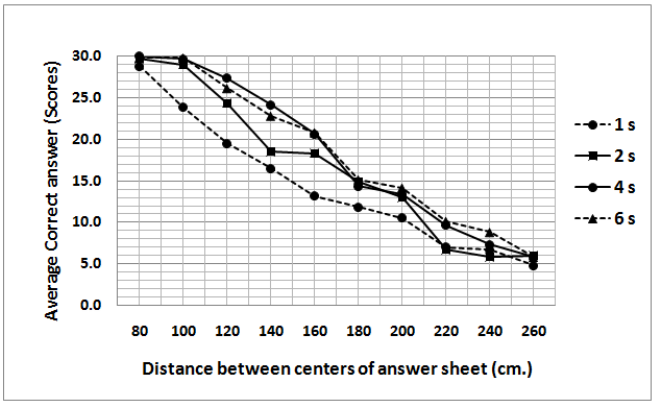

Fig 4: Target distances and average correct answers of 4 looking time periods

Figure 4 shows the relationship between target distances and average correct answers of four looking time periods. The average correct answers were averaged from five subjects and 2 replications. The average correct answers decrease along the distances but increase along the looking time periods. By observation, there were no differences between the average correct answers at 4 and 6 sec., then the looking time period for 4 sec. is sufficient for looking at the answer of 1 topic on original answer sheet at any target distances. In addition, the rate of changing of the average correct answers initially decreases at 220 cm.

At the maximum target distance (260 cm.), all subjects can get the correct answer about 5-6 scores or 20% of total scores which is equal to the probability of guess at one-fifth. It can be explained that subjects could not perceive the right answer on the original answer sheet because the minimum visual range was 243 cm. (Cristina et al, 2009).

ISBN: 978-988-19251-2-1
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

III. Conclusion

This study showed the relationship between the copy accuracy and the speed of copying. It can be explain the opportunities of cheating in any situations of seat arrangement. Based on this study, the results can be stated that the proper distance between the examination seats should be 220 cm. Beyond this distance, the copy accuracy was not decrease while trading with the distance expansion. The looking time period can be applied in the case that a close circuit monitoring system will be used instead of human observation in order to identify the frequency of monitoring.

Moreover, this study revealed the new area research of speed-accuracy tradeoff. Unlike Fitts' law and Schmidt's Law which explained the behavior of physical movement, this study explained the behavior of visual perception and decision and applied this knowledge to the real workstation, the examination seat arrangement.

For the future study, the number of subjects will be increased to 40 subjects in order to create the mathematical relationships between the copy accuracy and the copy speed factors, the target distances and the looking time periods.

Acknowledgment

I would like to thank Mr. Poom Luangjamekorn for his valuable time to help in creating the rhythmic sound generating program. And also I would like to thank all subjects who joined in the experiment.

References

[1] Cristina Pomales-Garcia, Hector J. Carlo *, Tanya M. Ramos-Ortiz, Iza M. Figueroa-Santiago, Sharlyn Garcia-Ortiz, "Non-traditional exam seat arrangements," in Computers & Industrial Engineering 57 2009, pp. 188–195.

[2] Office of the Basic Education Commission. (2010, August 28) Regulation for arrangement exam seats and evaluation quality of education[Online].Available: http://www.pbn2.obec.go.th/mooICT/.../nawpatibatsob%20p.6.doc

[3] Richard J. Jagacinski. John M. and Flach., "Schmidt's Law (Control Theory for Humans)," New York: McGraw-Hill., 2003, pp. 74-75.

[4] Richard J. Jagacinski. John M. and Flach., "Information Theory and Fitt's Law (Control Theory for Humans)" New York: McGraw-Hill., 2003, pp. 21-22.

[5] Ministerial Regulation No. 39 (B.E. 2537), issued Parliament, Act of control building B.E 2522 (2010, October 25) [Online]. Available: http://203.155.220.239/yota/acrobat/yota39_37.pdf

[6] Naphaporn Tananuwat. (2010, October 25). Visual Acuity and Ophthalmoscop [Online]. Available: http://www.medicine.cmu.ac.th/dept/eye/lecture301.pdf

[7] Andris Freivalds, Benjamin W. Niebel., "Design of Cognitive Work (Niebel's Methods, Standard, and Work Design)," New York: McGraw-Hill., 2009, pp. 273-286.