Video Gaming Scale Effect on Spatial and Graphical Patterns Recognition on Eye Movement Behavior

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Abstract: The purpose of this study is using eye-tracking technology to explore the relationship between the video gaming scale, and spatial and graphical patterns recognition tasks, focusing on eye movement fixation number analysis. Nineteen sophomore students were recruited to participate in this experiment. The results showed highly negative correlation between the video gaming scale measure and the fixation numbers collected in the process of the advanced spatial recognition and graphical patterns recognition tasks.

Keywords: Fixation numbers, video gaming scale, eye-tracking

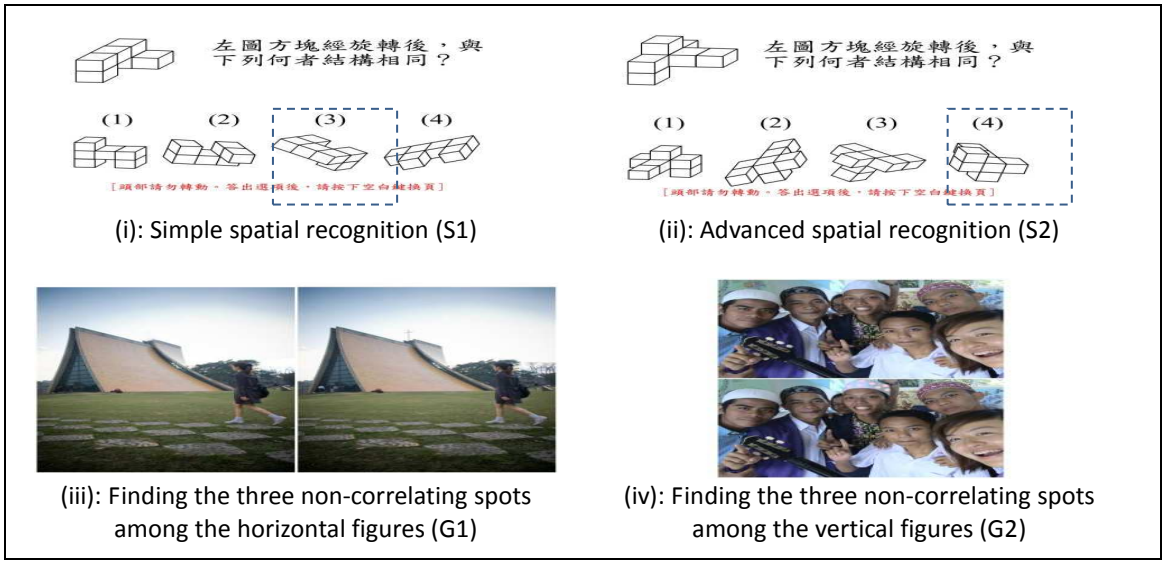
Introduction

Video games offer an attractive outlet in which students are willing to spend an ample amount of time engaging in virtual environments. This phenomenon has caught the attention of many researchers and has sparked a lot of game-related research. However, research exploring the video gaming scale effect on students' physical behavior is still rare, especially focusing on eye movement behavior. Owing to evidence pointing to younger generations spending an ample time on gaming, research into how gaming scale affects reading eye movement behavior will be worth further exploration. The goal of this study is to use a direct physical detection device, an eye-tracking machine, to detect the gaming scale effect on spatial and graphical patterns recognition tasks.

1. Testing Materials

Figure 1 shows the spatial and graphical patterns recognition testing materials which are comprised of four sub-tasks: (i) a simple spatial recognition (identified as S1); (ii) an advanced spatial recognition (identified as S2); (iii) finding the three non-correlating spots among the horizontal figures (identified as G1); (iv) finding the three non-correlating spots among the vertical figures (identified as G2). In S1, the simple spatial recognition testing, the cube should be rotated horizontally 90 degrees, and then be turned 90 degrees counterclockwise to match the answer, choice three. In S2, the advanced spatial recognition testing, the cube should be rotated counterclockwise horizontally 90 degrees, and then be rotated at z-axis 180 degrees to match the answer, choice four. By comparison, the second question (S2) requires more spatial manipulation to complete which deems it the more difficult task. In the G1 and G2 tasks, the experimenters were asked to identify differences

between two nearly identical pictures. There were three differences between the two provided pictures.



(i): Simple spatial recognition (S1)

(ii): Advanced spatial recognition (S2)

(iii): Finding the three non-correlating spots among the horizontal figures (G1)

(iv): Finding the three non-correlating spots among the vertical figures (G2)

Figure 1. Spatial and graphical patterns recognition testing materials.

1.1 Gaming Scale Measurement

A video gaming scale questionnaire revised and translated from an online gaming scale assessment (Kim, Namkoong, Ku, & Kim, 2008) which has a reliability test (α=.90) was applied. The questionnaire is a five-point perception Likert item questionnaire (1 = almost never, 5 = quite often) with twenty questions about video gaming scale behavior. The questionnaire items are about the users' gaming habit self-reflection. Before the testing, all the students were asked to fill out the questionnaire. According to the questionnaire, all the students can be ranked with a number from 20 to 100, which reflects the scale of the gaming. The higher score represents the higher video gaming scale, and vice versa.

2. Experimental Procedure

Nineteen sophomores participated in this experiment. Among them, five were male and fourteen were female. Before the formal experiment, the students were assigned a warm-up exercise to familiarize students with the experiment testing materials. Meanwhile, they were asked the fill out the video gaming scale questionnaire. During the formal experimental phase, the environment was designed as an individual reading space where the testing materials were displayed on the eye-tracking machine. The students' eye movements were logged by the Gazetracker for further analysis.

2.1 Pearson correlation coefficient analysis on overall fixations and video gaming scale

When given a same task, a user who requires more fixations to complete the task correctly has lower encoding performance in comparison to someone who requires fewer fixations. Table 1 lists the statistics of the overall fixation numbers of the involved students on the eleven different types of reading materials. In order to understand the relation between gaming scale and the overall fixation numbers, Person correlation coefficient analysis approach was applied to this study. Only the correct answers which are meaningful when analyzed are counted.

Table 1. Statistics of the fixation and regression numbers.

ID	Gaming scale	Spatial recognition fixation #		Graphical patterns recognition #	
		S1	S2	G1	G2
1	57	48	69	**43**	121
2	64	70	**36**	114	130
3	54	**25**	82	**47**	**42**
4	27	25	34	**75**	**165**
5	25	19	27	**84**	**177**
6	27	**40**	32	**75**	81
7	25	**36**	**58**	24	14
8	60	50	40	**50**	**79**
9	51	**29**	**26**	**41**	**34**
10	35	**21**	21	**46**	37
11	29	**30**	19	24	**90**
12	43	**40**	26	**46**	**78**
13	31	**22**	**68**	**77**	209
14	48	**15**	**41**	**20**	233
15	43	55	**54**	**85**	264
16	27	**47**	42	27	**146**
17	45	43	**45**	185	128
18	33	18	**53**	**47**	**77**
19	46	53	83	**32**	**30**

* The bold and underlined numbers represent the tasks completed without error by each student.

Table 2 lists the Pearson correlation coefficient analysis with video gaming scale and correct answers of the overall reading fixation numbers. The Pearson correlation coefficient analysis results indicated that significantly negative correlation coefficients for spatial recognition (S2) and graphical patterns (G1, G2) were found. When given a task, a user who requires fewer fixations to complete the task correctly is deemed to have higher encoding performance. According to this phenomenon, the statistics result showed that game playing can help students increasing their graphical recognition ability in both in spatial recognition and graphical patterns recognition.

Table 2. Gaming scale and overall fixations of Pearson correlation coefficient analysis.

	Spatial Recognition		Graphical Patterns Recognition	
	S1	S2	G1	G2
Gaming Scale	-0.48	-.803*	-.629*	-.776**

3. Conclusions

This study was devoted to exploring the gaming scale effect on students' visual search behavior. The gaming scale was assessed by a video gaming scale questionnaire, and the overall fixation number index was applied to analyze the eye movement. The study result indicated that the subjects who spent a large amount of time playing game had the less overall fixation numbers for the spatial recognition and graphical matching patterns tests. The results supported by most findings that the video gaming can improve students' spatial and graphic pattern recognition ability.

References

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