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Analysis of answer times in recognition of facial features

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Introduction

Two parameters are important for memorizing and recognizing face images: observation time and the dimensions of the facial images. These are all controlled conditions for observing facial images. However, the question is how well we remember these faces and how well we recognize them. In our research, memory and recognition tests were performed according to the well-established method of memory tests (YES / NO tests). These were essentially tests that consisted of two parts: an observation test and a recognition test. The observation tests contained a series of facial images that participants viewed under controlled conditions (the display time of the facial images was fixed). In the recognition test, new facial images were added to the facial images and the observation test, the number of which must be equal to that of the observation test. Thus, in the recognition there were twice as many images as in the observation. In the recognition process, participants had free control over the recognition responses. The success of facial image recognition was measured by the correctness of the participants' answers to the question whether the face they saw in the recognition test was also shown in the observation test (i.e. answers YES / NO).

Problem Description

We were interested in the time of the answers and whether we could establish a relationship between the times of the answers and their correctness (basically incorrect answers). We assumed that a participant who was sure of his answer, he gave it quickly. If a participant took longer for his answer, it meant that he was not sure of his correctness and therefore made more incorrect recognitions. This would be useful in identifying criminals in various crimes (robberies, burglaries, murders, traffic accidents).
Since we wanted to find out the influence of the two above-mentioned parameters on the recognition success, we determined four different presentation times of facial images (1 second, 2 seconds, 4 seconds, 8 seconds) and three different dimensions of the images ("small", "medium" and "large"). Thus, we obtained 12 different tests. So, we measured the percentage of incorrect answers for all 12 tests.

Methods

Every test was done for 6 participants, so all together we recruited 72 participants (26 male and 46 female). They were our students and had normal vision. Average age was 20,6 years (SD = 1,02).
We took the images from the Minear and Park Face Database We prepared them in three different dimensions ("small" (320 px × 240 px), "medium" (640 px × 480 px), and "large" (1280 px × 960 px)).
The procedure observation test is shown in Figure 1.

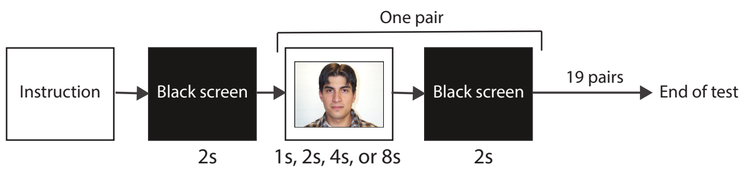

Figure 1

Procedure of the observation test

The observation test included 20 facial images (10 male and 10 female). According to the procedure in Figure 1, the tests lasted 1 minute (Test1s), 1 minute 20 seconds (Test2s), 2 minutes (Test4s), and 3 minutes 20 seconds (Test8s). The observation test was followed by the recognition test (Figure 2).

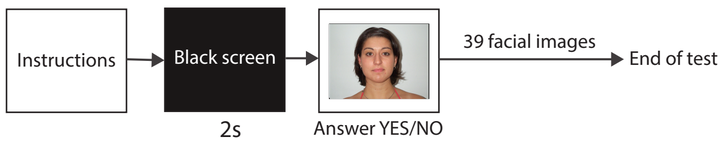

Figure 2

Procedure of the recognition test

The first part of the study provided us with the results of the average time of correct answers (CA) and incorrect answers (IA) answers for each of the 12 tests.
In the second part of the study, we were interested in the percentage of incorrect answers in relation to the duration of the answer. To determine the time limit for the responses, we first distributed all answers according to their time duration. Figure 3 shows the time intervals, the number of responses in each time interval.

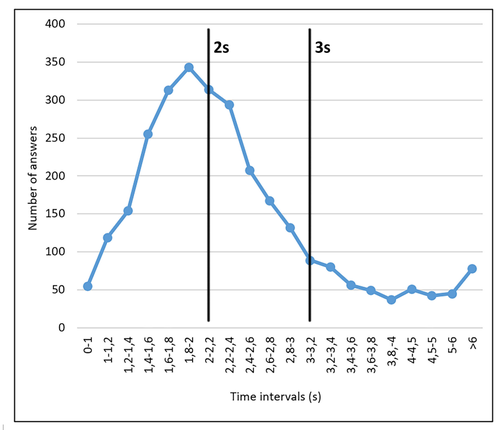

Figure 3

Distribution of the number of responses

In total, there were 2880 answers (72 participants, each had 40 answers). Based on this distribution, we set two time limits (two and three seconds). For each test, we were interested in the percentage of incorrect answers if they lasted longer than two seconds or longer than three seconds.

Results

The results of the first part of our research are shown in Table 1. The average times of correct and incorrect answers for all 12 tests are given.

Table 1

Time of correct answers (CA) and incorrect answers (IA)

Average time of answers [s]			Time of observation tests			
			1s	2s	4s	8s
Dimensions of facial images	small	CA	2,27	2,49	2,56	2,35
		IA	2,54	3,09	3,06	4,02
	medium	CA	2,66	2,39	2,29	2,02
		IA	3,38	3,38	4,16	3,14
	large	CA	1,93	2,29	2,59	2,19
		IA	2,52	3,79	4,42	3,90

Figure 4 shows the percentage of incorrect answers for three categories: all answers, answers longer than 2 seconds, and answers longer than 3 seconds. The graphs are shown for different presentation times of the facial image in the observation test (1s, 2s, 4s, and 8s).

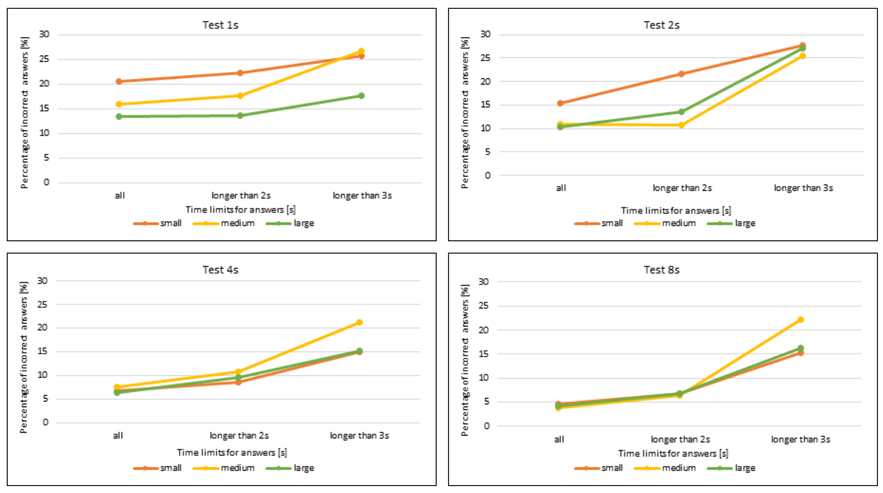

Figure 4

Incorrect recognition for different observation tests

Discussion / Conclusion

The difference between the times for correct and incorrect answers is greatest for the 4s and 8s tests. Thus, the times for correct answers were very short (2.02 to 2.59 seconds) when participants had enough time to look at the facial image in the observation test and consequently remembered it better, whereas for incorrect answers they usually hesitated a lot and the times were much longer (3.06 to 4.42 seconds).
In all the different time tests, we find that the percentage of incorrect answers is higher for longer answer times. The differences between the percentages of incorrect answers as a function of answer time are largest for the 8-second test, where the percentage of incorrect answers among all answers is very low, regardless of the dimension of the facial images. It is also relatively low for all answers longer than two seconds. However, it increases rapidly for answers longer than three seconds (for medium-sized images, there are as many as 22.2% incorrect responses for responses longer than three seconds answers compared to 3.8% incorrect answers among all answers). The smallest increase in this trend is, of course, in the 1-second observation test, where the percentage of incorrect answers among all answers is quite high regardless of the size of the face images. All these numbers support the assumption that a longer answer time significantly increases the probability of incorrect facial recognition. The reason for this, in our opinion, is the uncertainty of the participants about the correctness of the answer.
Results of all tests indicating very clearly that participants answered incorrectly in the recognition test much more often when they hesitated than when they answered quickly.

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