Journal of Education and Educational Research
ISSN: 2957-9465 | Vol. 7, No. 3, 2024

Experimental Study on Attention Blink of Male Sanda Athletes of Different Sports Levels under Fatigue State

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Abstract: This article uses literature methods, experimental methods, mathematical statistics and other research methods to pay attention to instantaneous detection of male Sanda athletes of different sports levels under fatigue conditions. The results showed that male Sanda athletes' attentional blink phenomenon will be aggravated under fatigue state, but the position of the lowest point will not change. At the same time, excellent Sanda athletes will break away from the attention blinking phenomenon faster.

Keywords: Athletes; Fatigue Status; Attention Blink.

1. Introduction

In a real environment, when we see a series of different stimuli appearing in rapid succession, in most cases we can clearly identify the first stimulus that appears, but when the second and third stimuli appear in succession, even if Consciously identify the stimulus, which is difficult to identify in most cases. In order to study it, the researchers designed a rapid sequence of visually presented stimuli with different attributes. Under this experimental condition, the subjects had to identify the "first sight" target stimulus (T1) and at the same time the "second sight" target stimulus. The stimulus (T2) will appear randomly within 200-500ms after the "first eye" target stimulus (T1). The experimental results found that the subject's accuracy in identifying the "second eye" target stimulus will be significantly reduced, so this type of stimulus is defined. attentional blink [1].

About 80% of the various types of information we obtain from the outside world are completed through visual channels. According to existing research, athletes' victory in the game is composed of 10% to 20% physiological factors and 80% to 90% psychological factors. Sanda is an environmentally active attention-based event, and the ability of athletes to pay attention has an important impact on the results of the competition. The level of attention of athletes determines the level of processing of different stimuli, and also determines whether important stimuli can be effectively processed. Usually time and space are used as two dimensions to express the psychological phenomenon of "attention". Most studies on the attention of Sanda athletes focus on the spatial dimension. However, whether in competition or training, Sanda athletes must to make accurate judgments and reactions to various types of stimuli from opponents or partners in quick succession, during this process the Sanda athlete's body will often enter Fatigue may lead to inattention, slow reaction, and errors in judgment. This study takes the attentional blink in the time dimension as the entry point, and male Sanda athletes of different levels as the research subjects. Combined with the treadmill motion model, it explores the attentional blink characteristics of male Sanda athletes of different sports levels under fatigue conditions.

2. Documentation Method

Through Web of Science, multiple searches were conducted with the keywords attentional blink, athlete, Sanda, and athlete, At the same time, I consulted books on sports training, which provided a certain theoretical basis and reference for formulating relevant sports intervention plans and test indicators, as well as conducting later experiments and data collection.

2.1. Expert Interview Method

Based on the purpose and needs of the experiment in this study, interviews were conducted with national Sanda team coaches, experts in sports training and applied psychology around the research theme to obtain corresponding information to provide assistance for the design of the research plan and the conduct of the experiment.

2.2. Experimental Method

2.2.1. Experimental Subjects

The experimental subjects were randomly selected active Sanda athletes. Based on the grouping opinions of relevant experts, 8 masters or first-level athletes and 8 second-level athletes were selected. They were all male, aged between 18-22 years old, and weighed between 58-80kg. Among them, masters or first-level Sanda athletes are in the excellent group, and second-level Sanda athletes are in the general group, with a total of 16 people.

2.2.2. Experimental Materials and Equipment

The experimental materials are written using E-prime2.0 software, the running environment is Windows 7, and presented on a 24-inch flat-screen monitor (120HZ). A certain reference design is made based on Li Yongrui's and others' attention to blinking-related research. A rapid sequence visual presentation (RSVP) stimulus stream consisting of 60 strings of black English capital letters. The presentation speed of each stimulus is 140ms/each stimulus. The duration of each stimulus presentation is 15ms. The time interval between adjacent stimuli is 125ms. Each stimulus stream in the 160 strings is in the stream, a target stimulus (a randomly generated English letter, color white) will appear, and a probe stimulus (black X) will also appear randomly. In each

stimulus stream, 7-15 English letters are randomly presented before the target stimulus (white English letters), followed by 8 English letters, and the black P1-P8) each appears randomly (50% chance) 10 times, a total of 80 times.

The exercise intervention equipment is a circle treadmill, Polar Team 2 system computer and telemetry heart rate belt, and FSP-I electronic reaction time tester.

2.2.3. Exercise Intervention

The subjects performed physical activities on the treadmill with a starting speed of 4 km/h (no additional slope). After adapting for 3 minutes, the speed increased to 1.6 km/h per minute, and after 5 minutes it increased to 12 km/h. Maintain a speed of 12 kilometers/hour and continue to exercise until fatigue.

2.2.4. Experimental Process

Record the subject's resting heart rate, subjective fatigue scale magnitude, comprehensive reaction time (average of 3 times) and other data. After the recording is completed, ask the subject to perform the attention blink test. After the end, save and sort the attention blink test. Remove data.

In order to conduct an experimental study on the subject's attentional blink in the fatigue state, the subject was first asked about his physical condition and filled out a questionnaire. After confirming that he could perform physical activities, he wore a heart rate belt and the subject performed physical activities on a treadmill. During this process, the subjective fatigue scale was asked every 2 minutes and the magnitude was recorded. Observe and question the subjects until they are in a trance, their bodies are sweating profusely, their breathing is irregular, their steps are chaotic and swaying, and their heart rate remains above 180 beats/minute. With repeated encouragement from the experimenter, the athletes are depressed and can no longer continue to exercise. Go down, enter the fatigue state, and end the exercise. Immediately after the end, the subjects were asked to perform three reaction time tests on the FSP-I electronic reaction time tester. Record their heart rate, subjective fatigue scale magnitude, comprehensive reaction time (average of 3 times) and other data. It is determined that athletes have entered a fatigue state through changes in subjective fatigue scale magnitude, comprehensive reaction time prolongation, heart rate range and other indicators. After the body data recording is completed, perform the attention blink test. After the completion of the attention blink test, save and sort the attention blink data in order.

2.2.5. Test Indicators

Indicators include heart rate, comprehensive reaction time, reporting accuracy rate of attention blink T and P1-P8 positions, the location of the lowest point, and duration.

2.3. Mathematical Statistics

Movement data such as heart rate and reaction time were obtained through the Polar Team 2 system and electronic reaction time tester, and behavioral data were obtained through the E-prime2.0 software, which was standardized and imported into the SPSS28 software system for statistical analysis of each value.

3. Experimental Results

3.1. Both Groups of Sanda Athletes Experienced the Phenomenon of Attentional Blink, and at the Same Time, The Change Trend of the Correct Rate of Identifying Each Position was Consistent Between the Two Groups

Table 1. Statistics of subjects' recognition accuracy of probe stimuli at positions T and P1-P8

State	Group		T	P1	P2	P3	P4	P5	P6	P7	P8
Quiet	Excellent	M	93.13	66.25	60.00	75.00	81.25	81.25	87.50	90.00	91.25
		SD	2.64	11.88	14.14	11.95	11.26	11.26	7.07	5.34	8.34
	Generally	M	91.38	60.00	57.50	71.25	75.00	82.50	85.00	85.00	87.50
		SD	3.99	16.90	19.82	12.46	11.95	4.62	5.34	7.56	4.62
Fatigue	Excellent	M	89.75	57.50	51.25	67.50	75.00	78.75	81.25	82.50	86.25
		SD	3.37	14.88	12.46	10.35	13.09	11.26	9.91	13.89	9.16
	Generally	M	87.00	53.75	48.78	62.50	66.25	75.00	76.25	77.50	82.50
		SD	2.93	10.61	13.56	10.35	9.16	10.69	7.44	7.07	10.35

Note: "*" means there is a statistical difference $p<0.05$, "**" means there is a significant difference $p<0.01$

It can be seen from Table 1 that in the quiet and fatigue states, both the excellent group and the average group were affected to varying degrees in the recognition of the detection stimuli at the 8 positions after the target stimulus T, and the accuracy of the recognition of the detection stimuli at the 8 positions was low. Regarding the accuracy of recognition of target stimulus T, the accuracy of recognition of target stimulus T by both groups of subjects interfered with the recognition of subsequent detection position P. It can be seen that the classic attentional blink phenomenon occurred in both subject groups under different physical conditions, among which the fatigue state aggravated the attentional blink phenomenon in Sanda athletes.

It can be seen from Figure 2 that the accuracy of recognition of each position by excellent Sanda athletes under fatigue is higher than that of ordinary Sanda athletes, but the difference between the two is not obvious. At the same time, the change trend of the accuracy of recognition of each position by the two is consistent.

3.2. Sanda Athletes Note That the Position of The Lowest Point of the Instant has not Changed, and There is no Significant Difference in the Accuracy of Identifying its Position

It can be seen from Table 2 that in the quiet state, the two groups of subjects paid attention to the accuracy of recognition of the P2 position at the lowest point of the blink ($p>0.05$). There was no statistical difference in the recognition of P2 between the two groups in silence. In the fatigue state, the two groups of subjects paid attention to the recognition accuracy of the P2 position, the lowest point of the blink ($p>0.05$). There was no statistical difference in the

recognition of P2 when the two groups were fatigued. It can be seen that the position of the lowest point of the attention blink does not change with the physical state, nor does it change due to differences in exercise levels.

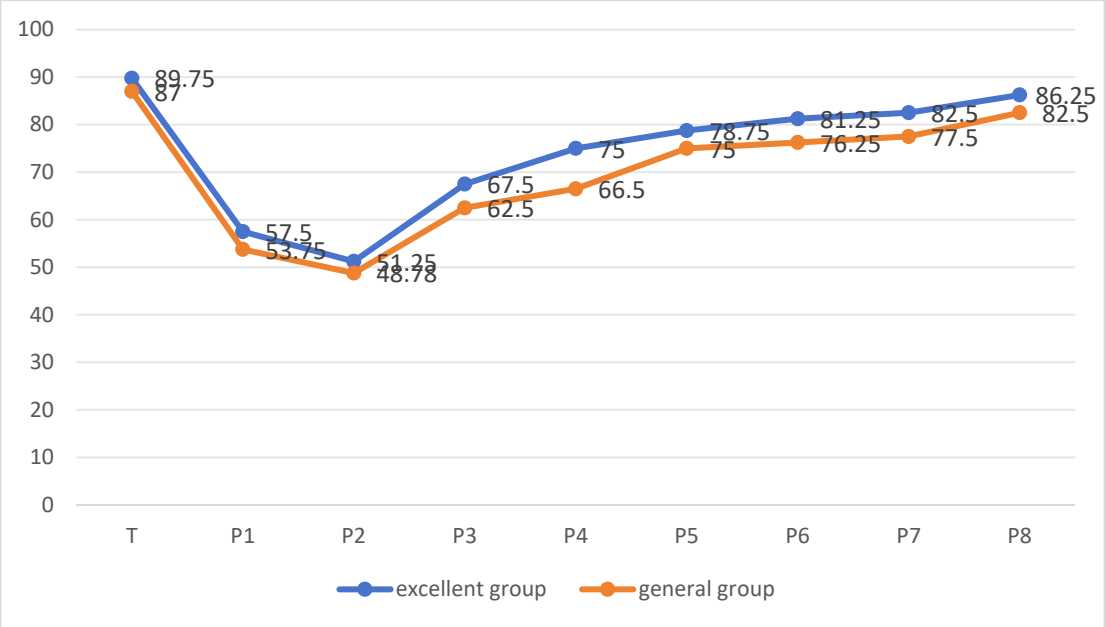

Figure 1. Statistical chart of subjects' recognition accuracy of detection stimuli at positions T and P1-P8 under fatigue state

Table 2. Independent sample t test on the accuracy of recognition of the detection stimulus at the P2 position by two groups of subjects under different physical states

State	Group	N	M	SD	T	P
Quiet	**Excellent**	8	60.00	14.14	0.29	0.776
	Generally	8	57.50	19.82		
Fatigue	**Excellent**	8	51.25	14.63	-1.22	0.244
	Generally	8	48.75	17.26		

Note: "*" means there is a statistical difference $p<0.05$, "**" means there is a significant difference $p<0.01$

3.3. Sanda Athletes should Pay Attention to the Extension of the Instantaneous Duration under Fatigue Conditions. Generally, Sanda Athletes Will Extend the Duration Even More

Table 3. Paired t test on the recognition accuracy of detection stimuli P in different body states T and P1-P8 positions of the excellent group

State		M	SD	T	DF	P
Quiet	**T-P1**	26.88	13.88	5.47	7	0.001**
	T-P2	33.13	15.72	5.96	7	0.001**
	T-P3	18.13	13.93	3.67	7	0.008**
	T-P4	14.38	12.76	3.63	7	0.034*
	T-P5	11.88	12.76	2.63	7	0.034*
	T-P6	5.63	9.37	1.69	7	0.133
	T-P7	3.13	7.26	1.21	7	0.263
	T-P8	1.88	9.85	0.53	7	0.607
Fatigue	**T-P1**	31.00	13.37	6.55	7	0.000**
	T-P2	33.50	14.94	6.34	7	0.000**
	T-P3	21.00	15.55	3.82	7	0.007**
	T-P4	14.75	6.54	6.37	7	0.000**
	T-P5	9.75	6.96	3.96	7	0.005**
	T-P6	4.75	8.28	1.62	7	0.149
	T-P7	3.50	6.35	1.56	7	0.163
	T-P8	2.25	5.85	1.08	7	0.313

Note: "*" means there is a statistical difference $p<0.05$, "**" means there is a significant difference $p<0.01$

As can be seen from Table 3, there is a significant difference ($p<0.01$) between the recognition accuracy of the target stimulus and the detection stimulus at the P1-P3 position in the excellent group in the quiet state. At the same

time, the recognition accuracy of the target stimulus and the detection stimulus at the P1-P5 position There is a statistical difference between the correct rates ($p<0.05$), so in a quiet state, excellent Sanda athletes should pay attention to the blink duration of about 5x140ms=700ms.

There is a significant difference ($p<0.01$) between the recognition accuracy of the target stimulus and the detection stimulus at the P1-P4 position in the excellent group under the fatigue state. At the same time, there is a significant difference between the recognition accuracy of the target stimulus and the detection stimulus at the P1-P6 position (p p <0.05) has a statistical difference, so when fatigued, excellent Sanda athletes should note that the duration of the instant is about 6x140ms=840ms.

Table 4. Paired t test on the recognition accuracy of different body states T and detection stimuli P at positions P1-P8 in the general group

State		M	SD	T	DF	P
Quiet	**T-P1**	31.38	15.18	5.84	7	0.001**
	T-P2	33.88	16.68	5.74	7	0.001**
	T-P3	20.13	9.76	5.83	7	0.001**
	T-P4	16.38	10.70	4.32	7	0.003**
	T-P5	8.88	5.57	4.51	7	0.003**
	T-P6	6.38	4.81	3.75	7	0.007**
	T-P7	6.38	7.76	2.32	7	0.053
	T-P8	3.88	5.44	2.01	7	0.084
Fatigue	**T-P1**	33.25	11.63	8.08	7	0.000**
	T-P2	38.25	13.56	7.97	7	0.000**
	T-P3	24.50	11.77	5.88	7	0.001**
	T-P4	20.75	10.05	5.83	7	0.001**
	T-P5	12.00	10.69	3.17	7	0.016*
	T-P6	10.75	7.82	3.89	7	0.006**
	T-P7	9.50	5.98	4.49	7	0.003**
	T-P8	4.50	10.49	1.21	7	0.264

Note: "*" means there is a statistical difference $p<0.05$, "**" means there is a significant difference $p<0.01$

As can be seen from Table 4, there is a significant difference ($p<0.01$) between the recognition accuracy of the target stimulus and the P1-P6 position detection stimulus of the general group in the quiet state. Therefore, in the quiet state, the general Sanda athletes should pay attention to the blink duration. 6x140ms =840ms.

Under the fatigue state, there is a significant difference ($p<0.01$) between the recognition accuracy of the target stimulus T and the detection stimulus X at the P1-P4 and P6-P7 points in the general group. There is a statistical difference ($p<0.05$) between the recognition accuracy of detection stimuli. Therefore, under fatigue, generally Sanda athletes should pay attention to the blink duration of about 7x140ms=980ms.

3.4. Excellent Sanda Athletes Experience Less Complete Instants and Less Minor Instants than Ordinary Sanda Athletes

Table 5. List of attention blinking degrees of the two groups under different exercise states

	quietstate		fatiguestate	
	Excellent group	**Generally group**	**Excellent group**	**Generally group**
Complete	0	0	1	2
Severe	1	2	1	1
Moderate	2	2	2	1
Mild	2	3	3	4
Slight	3	3	1	0

Li Yongrui divided the degree of attentional blink into the following 6 levels: when the accuracy of recognition of detection stimuli at the P1-P8 position is greater than 95%, it is classified as no blink of attention; when it is between 85% and 95%, it is classified as slight blink of attention; 75% to 85% is classified as a mild attention blink; 65% to 75% is classified as a moderate attention blink; 55% to 65% is classified as a severe attention blink; less than 55% is classified as a complete attention blink. Take off. When the accuracy of identifying a specific detection position is greater than 80%, it is considered that the individual attentional blink phenomenon is not obvious [2].

In a quiet state, excellent Sanda athletes start at the P4 position (560ms), and the blink phenomenon is not obvious, while ordinary Sanda athletes start at the P5 position (700ms), and the blink phenomenon is not obvious. In a quiet state, Sanda athletes of different levels note that the blink phenomenon is not obvious. In terms of the degree of blinking, the p4 position is the dividing point for Sanda athletes of different levels in the quiet state to pay attention to the degree of blinking.

In the fatigue state, from the perspective of the degree of attentional blinks experienced, elite Sanda athletes experience less complete blinks and less minor blinks than ordinary Sanda athletes. Specifically, when fatigued, excellent Sanda athletes start at the P6 position (840ms), and the blink

phenomenon is not obvious, while ordinary Sanda athletes start at the P8 position (1120ms), and the blink phenomenon is not obvious. It can be seen that under the fatigue state, excellent Sanda athletes break away from the attentional blink phenomenon 280ms earlier than ordinary Sanda athletes. The p6 position is the dividing point of the attentional blinking degree of Sanda athletes of different sports levels under the fatigue state.

4. Conclusion

Both groups of Sanda athletes had obvious attentional blinks in both quiet and fatigued exercise conditions. At the same time, the attentional blinking phenomenon was most obvious in the fatigued state. Changes in physical condition will not affect the location of the lowest point of the Sanda athletes' attention. Both groups of Sanda athletes noticed that the lowest point of the instant appeared at the position of detection stimulus P2 (at 280ms), and the recognition at this position was correct. There is no significant difference in rate. Excellent Sanda athletes break away from the attentional blink earlier than ordinary Sanda athletes. In a quiet state, excellent Sanda athletes break away from the attentional blink 140ms earlier. In a fatigue state, excellent Sanda athletes break away from the attentional blink 280ms earlier. Compared with the fatigue state of the two groups of Sanda athletes in the quiet state, please note that the flash occurs longer, lasts longer, and is severe.

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