

The Effect of Anxiety State on the Visual Search Efficiency of Athletes

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Abstract

High-efficient visual search ability is the key for the athletes to win their games. Visual search is an important way for the athletes to catch effective information on site within complicated environment as well as the manifestation of their regulating and controlling their mental status and skill abilities within complicated environment. Maintaining an appropriate level of anxiety during exercises and contests could ensure higher visual search efficiency and is helpful for better bringing the skills of the athletes into play. Excessive anxiety will have larger interferences on the visual search efficiency of the athletes and the visual research efficiency will be reduced, resulting in the abnormal performance of the skill levels of the athletes. To optimize and regulate the visual search efficiency of the athletes could ensure the athletes to bring their competitive skills into best play.

Keywords

Anxiety, Athletes, Visual Search

1. Introduction

Anxiety is the negative emotional status of an individual that is incurred by the upcoming or potentially existing threats, such as worrying, nervousness, and agitation, etc. [1]. Anxiety has been divided into two forms, that is, status anxiety and trait anxiety. Status anxiety is a temporary subjective feeling, while trait anxiety is a kind of individual distinction lasting longer as well as a stable personality trait [2]. Anxiety could lead to both active and negative effects, but the specific functions thus incurred depend on the characters of the interactive functions of the subjective status of the person and the positive environment. According to the analysis made from the perspective of active function, anxiety may trigger the sense of urgency for people to change the current status of them and urge them to try hard to pursue the achievement of a certain goal. If analyzed from a pessimistic view,

excessive anxiety will also reduce the processing efficiency of an individual and prohibit the playing of their normal actions. Usually different anxiety statuses will accompany the athletes during their contests and there would be even the interaction among the various kinds of anxieties (trait anxiety and status anxiety). Whether athletes with different levels of anxiety could quickly search effective information and respond correctly and in time has always been an important difficult question that needs to be solved during exercise and contests.

2. Theories Related to Anxieties in Sports

The relationship between waking, anxiety, and the performances in sports is one of the favorite researches of athletic psychologists. The theories generated within this area could promote researches on athletic psychology, and what is more important lies in that these theories and hypotheses usually have direct practical instruction effect on the emotional preparation before the contests.

2.1. The Drive Theory

The drive theory has basically considered that the relationship between performance and the waking level is a line relationship. However, some scholars have pointed out that this kind of simple linear relationship between the waking level and the sports performance within the drive theory is only applicable to the action skills that have been completely learnt and mastered proficiently as well as the actions of pure strength type, which could only explain the relationship between waking level and sports performances in the sports activities in need of extremely high degree of stamina, effort and perseverance instead of that in those sports activities in need of mutual cooperation as well as extremely high degree of control ability and harmony.

2.2. The Theory of Inverted U

The Theory of inverted U predicts that during the process of the waking level from sleepiness to the status of wakefulness, the performance achievements will also grow continuously. However, when the wakefulness continues to rise after exceeding a certain level, the performance results will decline with the rising of the waking level [3]. In short, it believes that the relationship between the waking level and performance is a curve and shows an inverted U shape instead of a line. **Figure 1** below shows the comparisons among the best waking levels of the various kinds of athletic skills.

2.3. The Multi-Dimensional Anxiety Theory of Morris

The multi-dimensional theory has mainly made the following assumption: there is a negative linear relationship between the cognition status anxiety and the motor behavior and an inverted U relationship between the somatic anxiety and behavior.

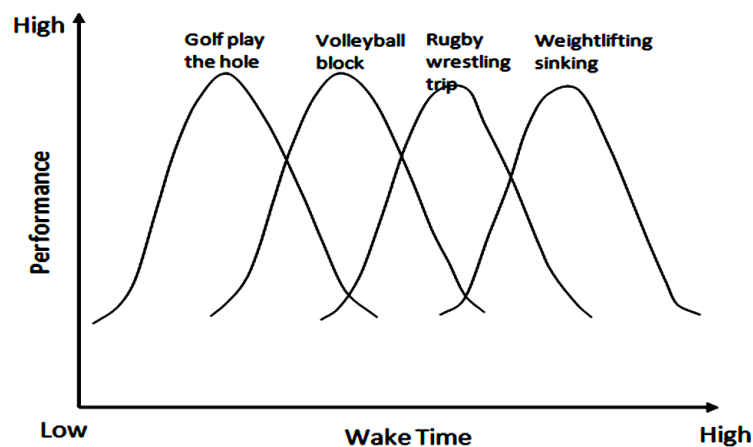


Figure 1. Comparison of the best waking levels of athletes with different levels of technical skills.

2.4. The Jones Orientation Theory

One of the opinions of anxiety orientation theory is that the explanation of direction made by the athletes on anxiety experience should be stressed, that is to say, whether the athletes regard the contest anxiety experience as a positive one and having a promotional function on the performance of the sports or as a negative one and having a hindering effect on the performance of the sports. Another idea is that the occurrence frequency of the anxiety experience of the athletes should be stressed, that is, whether an anxiety experience of some strength occurs frequently or not.

3. The Relationship between the Anxiety Status and Visual Search of Athletes

Visual search is a kind of complicated process of cognition as well as an important method for human being to obtain and process exterior information. Visual search can be affected by a lot of factors like personal experience, status and ability [4], the difficulty of the visual search task [5], and the physical features of the stimulant [6], etc. Now the effect of anxiety on the visual search of athletes has gradually drawn the attention of scholars. As to the sports scene, that the athletes have high-efficient visual search ability is the key for victory and under the status of anxiety the athletes could quickly find the visual information that they need in complicated race course so as to make quick decision and determination. It is even the manifestation of the capability of the athletes in regulating and controlling their mental status and skills.

The anxiety status at appropriate degree could stimulate the urgent feeling of the athletes to change their own statuses so as to achieve a kind of new goals. The waking level at extremely low degree will render a too wide scope of attention so that a lot of information not related to the current task also enters into the level of consciousness without anything to be left, which could enhance the working strength of the brain in dealing with information and reduces the ability for the brain to differentiate and choose the key information of the brain so as to influence the speed of the action and response as well as the high-degreed implementation of techniques and tactics [7], while the excessive anxiety status will render the attention scope of the athletes to be narrower and the athletes will also be liable to care less about the contest environment or their opponents.

Take a research on volleyball athletes as the example. Successful receiving and serving a ball requires the athletes to have to utilize effective visual search strategies, which also could determine the quality of the process of consequential information and the results of on-the-spot decisions and is the basis for ensuring the athletes to finish the expectation and themotion action. Under the appropriate anxiety status, excellent volleyball athletes could always correctly predict the coming direction and the falling point of the balls so as to make reasonable counterattack. This is not only due to that excellent athletes process by the central nervous system at a quicker speed but also in that they have manifested the advantages in the process of moving information during the process of visual search and extraction of visual information. **Table 1** shows the accuracy and reaction time results of the volleyball athletes at different levels in determining the falling point of the serving ball [8].

The influence of anxiety status on the visual search efficiency of athletes is also shown on some eye movement indexes. For example, during a research on the effect of anxiety on visual search behavior, the testees are required to finish a task of climbing a rock of 7 meters. When the testees are climbing a high height, the time of gaze is significantly increased compared to that during climbing a low height in addition that both the operational gaze and exploratory gaze during climbing a high height are longer than those during climbing a low height.

Table 1. Index of accuracy and response time in volleyball athletes' landing point Pre-judgment ($X \pm SD$).

Behavioral indicators	Serve type	Master sportsman	First-class athletes	Second-class athletes
Correct rate (%)	Jump serve	93.13 \pm 8.41	92.92 \pm 7.34	90.12 \pm 8.76
	Fluttering ball	95.83 \pm 9.06	95.41 \pm 7.28	93.14 \pm 8.37
	Place floating ball	97.21 \pm 8.94	96.32 \pm 8.91	94.31 \pm 7.98
Reaction time (ms)	Jump serve	2631 \pm 469.41	2876 \pm 503.71	3019 \pm 439.14
	Fluttering ball	2573 \pm 493.17	2731 \pm 497.46	2864 \pm 519.64
	Place floating ball	2421 \pm 429.97	2593 \pm 387.54	2701 \pm 407.56

As to the times of the gaze, it is more in climbing a high height than in climbing a low one, while the times of exploratory gaze has significantly increased from low height to high height [9].

4. The Influences of High Anxiety Status on the Visual Search of Athletes

Under fierce contest environment, the athletes usually bear tremendous psychological pressure, and this kind of pressure could usually induce high level of anxiety emotion so as to affect the sports performance during the contest. Many athletes expressed that “it is more difficult to conquer oneself than defeat the opponent”. High level of anxiety will interfere with the personal manipulating behavior and under the status of high level of anxiety, the personal gaze behavior will turn to be of low efficiency and just lead to ineffective searching strategies. There are also researches that have shown high level of anxiety will increase the reaction time and the searching ratio during contest has increased to some degree, showing that the processing efficiency has decreased. During competitive sports and especially at the key moment of some contests or under the circumstances of some important contests, the automated action skills of the athletes will decay during the process of implementation, resulting in the plummet of the performance level of the sports. This is called the “Choking” phenomena under pressure, mainly manifested as that the athletes have some faults that should have not occurred under the status of increasing pressure [10]. Nideffer and Sagal revised the “Choking” interference theory model and they think that during a contest, when the athletes realize the importance of the contests (towards introspection) and the status anxiety of the athletes will increase, thus leading to physiological stress responses like quicker beating of the heart, elevation of blood pressure, and muscular tensions, so the phenomenon of “Choking” will thus occur [11].

There are some researchers that further prove through experiment that there is no direct relationship between pressure and performance. It is just through a pressure environment that the anxiety levels of the athletes have been increased and thus indirectly increased the possibility for the generation of “Choking”. It has been proved by the empirical study on “Choking” of free combat athletes under pressure that pressure will render the individual status anxiety level of the free combat athletes to be increased and the reaction time will be increased with a decreasing accuracy when finishing the task of visual search on the pictures of free combat moves, both of which have reached a significant statistical level [12].

There are also some other people who have conducted researches on how to control the damage of the gaze behavior and increased anxiety to perception and action relationship when an individual is implementing a task of remote sighting (Behan, *et al.*, 2008). The testee is required to finish a stimuli task of shooting an arrow, that is, to aim with a joystick and shoot an arrow to the target, then take part in a contest under two kinds of balanced experimental conditions so as to carry out and control their anxiety experiences. The continuous time length during the static eye movement period is taken as the index for measurement. Just as what have been predicted, the continuous time of the static eye movement period could affect the accuracy. The longer the static eye movement period is, the performance of the operation will be better. If the implementation and control of the anxiety will reduce the continuous time of the static eye movement, it means that the static eye movement period is sensitive to the increase of anxiety, which could be used as the indexes for the effectiveness of visual orientation within the aiming the task. During the period of static eye movement, the athletes should confirm the final patterns of the implementing actions, which are related to the amount of the cognitive programming required by successful operation, and the complexity of the tasks will render the static eye movement period longer.

5. The Regulating Strategy of the Visual Search Efficiency of the Athletes under Anxiety

A great deal of analyses had proved that an individual could improve the visual search strategy through long term of adaptive exercise and accumulation of experience so as to reduce the visual attention burden. Training on psychological skills could also relieve the contest anxiety of athletes so as to realize the goal of improve the visual search efficiencies of the athletes.

The visual search of athletes has some rules, and there are many tasks about visual attention and perception within the scene during sports. After long time exercises of repetitive watching of and analysis on a great deal of game videos, high level individuals could occupy less or even no resources of visual attention under the high degree limitation of visual tasks and at the same time deal with many complicated visual information, efficiently distribute the attention resources within different information and conduct transitions in priorities so as to better

finish the tasks of visual attention. For example, through observing the game videos under the same scenes the athletes could form a fixed and effective visual search model and make correct prediction and reaction through extracting less characteristic values.

Of course to regulate the anxiety emotions of the athletes is also an important method to improve the efficiency of visual search. Here are three exercises on psychological skills related to sports anxiety to be introduced below: relaxation training, representation skills training and attention skills training.

1) Relaxation training: Relaxation training is a psychological skill training that has been most widely utilized and able to directly affect physiological activation. It is the process that uses hints to concentrate, regulate respiratory rates, and make muscles relax sufficiently so as to regulate the excitability of central nervous system. The relaxation training consists of simple respiratory training, progressive relaxation, and meditation, etc.

2) Representation skills training: Representation skills training is a most common psychological skill training in the field of PE and sports and regarded as the core of psychological skill training. Representation is also called as image or imago, which means the perceptual images formed on the basis of perception and mainly manifested in memory and imagination activities. A lot of researches have shown that the representation exercise is helpful for the athletes to build and consolidate the dynamic stereotype of correct actions as well as to speedup the skilled movements and deepen memories. It could also strengthen the confidence of the athletes before the contests so that they could reach the optimal competitive status more easily [13].

3) Attention skills training: Attention skills training is a vital psychological skill for successfully finishing the skill actions and enjoying the contests, which is a process of enhancing the stability of attention, anti-interference or the degree of concentration through various kinds of methods. Best performance in contest will not appear until the athletes are in the area with best functions. One of the characters within this area is that all the attention is on the process of finishing the action instead of any other things like the weather conditions, the number of the audiences in the competition terrain, the emotions of the audiences, the atmosphere of the competition terrain, or the fatigue degree of the athletes, etc. Therefore, during the exercise and contest the ability to overcome interference and the level of attention must be enhanced. The adaptive ability of the athletes will be improved through exercising the attention of the athletes under different environment.

6. Conclusion

Visual search manifests different specific characters under various specific sports area, but the visual search model of experts (excellent) athletes tends to be centralized and economized with quicker processing rate and higher efficiency. The anxiety at appropriate level is helpful for the enhancement of visual search efficiency as well as the precondition for athletes to obtain excellent goals in contest. High anxiety status could exert large interference to the visual search efficiency of athletes so that the gaze behavior of an individual will become of low efficiency and lead to invalid searching strategy.

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