

Research on athletes' mental state monitoring of spot athletics based on facial expression analysis

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Abstract. Facing the furious competition of the athletics field at the present times, athletes' physical and psychological qualities have been greatly tested. Meanwhile, athletic mental state has been taken seriously. Athletic mental state is the mental state of the game. It is not only the psychological reaction to the current game environment, but also is the background factors of their game behavior. And it plays an important role in the athletes' performances. This study is supported by the theory of "embodied emotion", and it takes the national team diving team athletes as experimental and intervention objects. It intervenes in the athletes with "embodied" form to influence and change the negative emotions of athletes. In this study, the athlete's emotion can be changed to the acceptable and appropriate situation. Meanwhile, this method can promote athletes to obtain an ideal attitude and mood in the competition thereby achieving an ideal achievement. We analyze the psychological significance behind the facial expression based on sports and athletes own characteristics, and reveal the psychological state of high level athletes on site. Meanwhile, we can better grasp the mental state of athletes, and help coaches and sports psychologists to carry out targeted psychological training of athletes. Moreover, we provide real-time monitoring and guidance for coaches to better guide the game and athletes to achieve the desired athletic performance, so as to promote their competitive level.

Key words. Facial expression, athlete, spot athletics, mental state monitoring.

1. Introduction

Recently, with the rise of embodied cognitive ideas, the subjects' mood based on emotion/posture has aroused the interest of psychology researchers. The view of emotion induced by expression and physical posture can be traced back to Darwin, James and Lange. After years of silence, the researchers put forward the idea of "embodied emotion" based on a series of early studies. They argue that the input of peripheral systems of muscle and visceral (like the facial muscles of happy expression) causes a modal response to the mood-related system (like somatic sensory and motor

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cortex, hypothetical "mirror neuron" system, margin system, orbital frontal cortex). Therefore the individual feels the mood, produces an action that is consistent with the mood, and exhibits activation of the nervous system associated with the mood. The study finds that expression feedback can have a stronger or diminishing effect on individual original emotions. When the individual had no emotion, the expression feedback can directly induce the corresponding emotion. Therefore, we induce the emotion by expression or body feedback and study its impact on cognition and behavior, and this pattern is another hot spot in the research of the emotion.

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2. Introduction

Mental state has the relatively stable level and features of psychological activity, which appeared in a certain situation. Soviet Psychologist H. D. Levitov divides people's mental activity into three forms, including mental process, mental state and personality mental characteristic [1–2]. The mental process is constantly changing and temporary, and the personality mental characteristic is solid. The mental state is temporary and stable, which is situated between the two above. It is a unified performance of mental process and personality mental characteristic. Therefore, athletic mental state has a relatively stable mental activity level and characteristics when athlete participates in the competition.

2.1. *Facial expression overview*

Expression is the external presentation of emotions and it is the explicit form of the movements of the various parts of the body when the emotions and emotions happen. The expression includes body and gesture expression. In different emotional state, the person's physical posture will change. Gestures can express emotions with language, and it can also express emotions alone. The tone is expressed through the voice, rhythm and speed. Facial expression is a combination of changes in the eye, face and mouth muscles. People have more than 20 pairs of muscles on the face, and the combination of these muscles can constitute a different expression mode [3–4].

Facing the furious competition of the athletics field at the present times, athletes' physical and psychological qualities have been greatly tested. Therefore athletic mental state has been taken seriously. Multi-disciplinary multi-field monitoring modes play a role in the field of competitive sports, and it gets a good results. However, the current means of monitoring has a certain hysteresis, because it is completed through pre-match and post-match surveys and interviews, so as to collect the mental state of athletes [5–6]. Moreover, athletic mental state has certain situa-

tion, so the information collected through pre-match and post-match will inevitably has been affected by some other factors, thereby resulting imperfect and inaccurate information.

3. Research methods

3.1. Research objects

HXX, one of the divers on the ten-meter platform of the Chinese national diving team, she is 16 years old, and the gender is female. She has won the top three in the national competitions. The psychological quality of this athlete is ordinary, anxiety and tension motions always appeared on her.

3.2. Research methods

Facial expression adjustment method: the theoretical guidance of this method is "embodied emotion". We use smile imitation and curious facial expressions to intervene in athletes. Mathematical statistics method: we use Excel 2013 and SPSS 21 to analyze the evaluation data of facial expression, so as to provide data support for the study.

3.3. Research process

This research chooses single-case experimental design, and completes the facial expression adjustment intervention in the usual training for five rounds and two months. Meanwhile, we use the facial expression adjustment as the theme to finish the psychological counseling and interview, so that the athletes' spot mood has changed. So we can reduce negative anxiety and tension, so that to facilitate the completion of technical action.

4. Research results and analysis

In this study, we select the facial expressions of the five rounds of intervention to research the emotions and mentality of the athletes' training.

4.1. Research on facial expression adjustment of five rounds intervention

Table 1 is the evaluation results on facial expression adjustment of five rounds intervention. In Table 1, we can see that the athlete's facial expressions are not disgusted and angry in the initial evaluation or five rounds intervention. Although the athlete has made the top three in the national race, there is no sign of facial expression of superiority before diving. The athlete is not very confident, and it may be caused by anxiety and tension. In the facial expression of this athlete, sad mood ratio in the initial evaluation and the first three rounds of the evaluation has

been relatively high. Happiness can be seen in the third round, so the athlete begins to boldly try the facial expression adjustment of the smiling pattern from the third round. There is no fear expression in the fourth round, and there is no pleasure and surprise expression in the initial facial expression.

Table 1. Evaluation results on facial expression adjustment of five rounds intervention

Facial expression	Initial evaluation	First round	Second round	Third round	Fourth round	Fifth round
Delightful expression	0	0	0	5.17±2.01	0	0
Surprised expression	0	8.02±2.34	10.38±2.13	14.34±3.16	16.31±2.71	20.96±4.24
Sad expression	45.36±3.49	37.31±3.41	35.18±2.18	29.31±3.09	24.51±2.61	18.51±4.06
Fear expression	13.13±3.13	9.81±1.74	8.31±2.18	2.24±3.01	0	1.06±2.31
Unaffected expression	39.82±4.31	40.84±3.98	37.31±5.91	46.10±2.98	55.10±2.39	57.01±3.32
Other	16.4±1.09	2.78±0.81	3.34±1.63	2.60±1.08	3.61±0.78	2.44±0.68
<i>N</i>	5	5	5	5	5	5

4.2. Variance analysis of evaluation results on facial expression adjustment of five rounds intervention

Table 2 contains the variance analysis of evaluation results on facial expression adjustment of five rounds intervention. From Table 2, we can see that surprised, sad, fear and unaffected expressions have a very significant difference ($P < 0.001$). In order to facilitate the visual analysis, we draw the curve graphs of mood changes of five rounds intervention of facial expressions. In the horizontal axis, 1 is initial evaluation, and 2–6 are the number of interventions of five rounds. The vertical coordinates presents the proportion of emotions. The results are also depicted in Figs. 1–5 showing the dependence of means of particular expression on the proportion variations.

Table 2. Variance analysis of evaluation results on facial expression adjustment of five rounds intervention

Facial expression	Sum of squares	df	Mean square	F	Sigma
Surprised expression	1345.193	5	269.040	31.376	0.000
Sad expression	2366.331	5	473.266	47.931	0.000
Fear expression	756.423	5	151.309	25.128	0.000
Unaffected expression	1503.381	5	300.817	16.308	0.000
Other	11.291	5	2.259	1.931	0.124

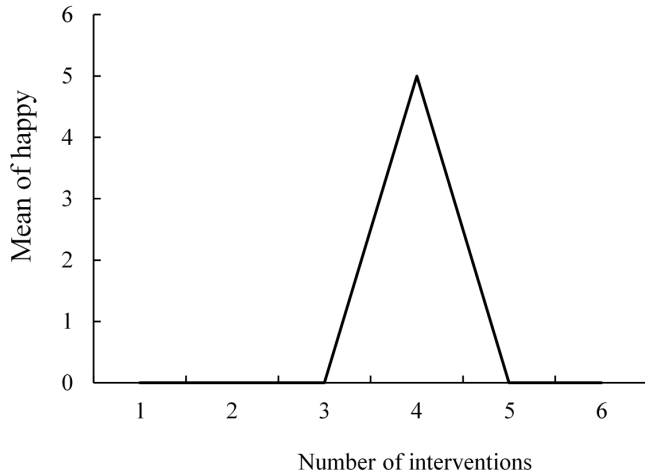


Fig. 1. Proportion variation of delightful emotion of five rounds intervention

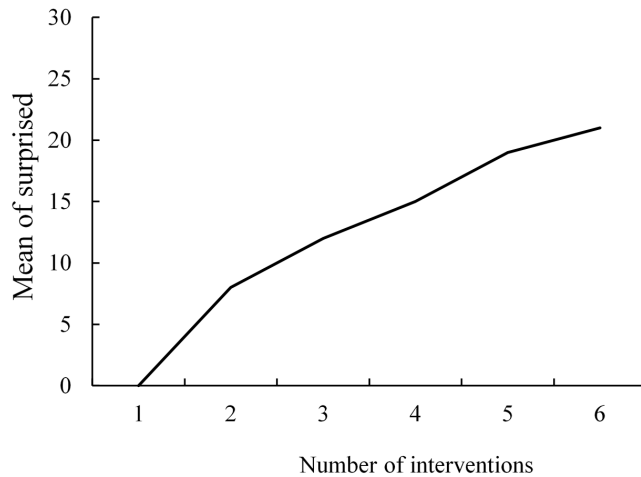


Fig. 2. Proportion variation of surprised emotion of five rounds intervention

5. Conclusion

From Table 2 and Figs. 1–5 we can see that the delightful expression only appeared in the fourth-round and the proportion of the surprised and unaffected expression is increasing with the increases of intervention. In the meantime, the proportion of the sad and fear expression is decreasing with the increases of intervention. The improvement of unaffected expression shows that the mood and mentality of athletes in the spot are more stable. The improvement of surprised expression shows that the attention is more focused. The decrease of sad and fear expression shows that the anxiety and tension mood are decreasing with the increases of intervention.

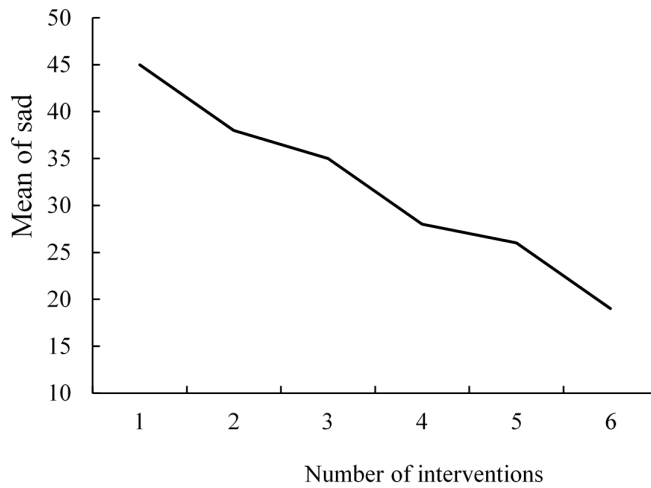


Fig. 3. Proportion variation of sad emotion of five rounds intervention

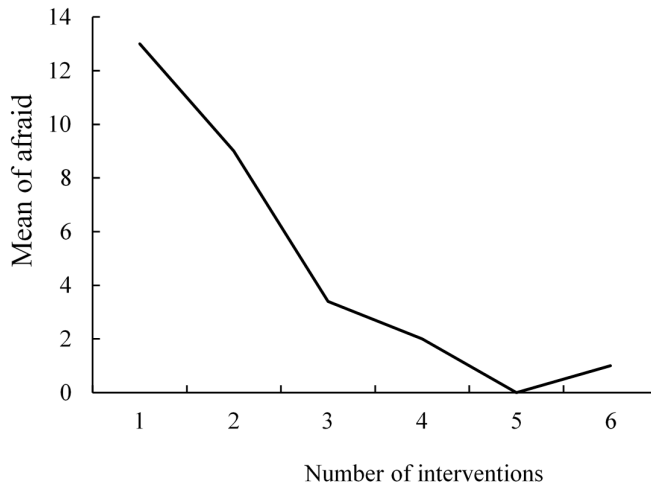


Fig. 4. Proportion variation of fear emotion of five rounds intervention

Coaches are getting more satisfied with the results of the action and scoring based on the interview. Athletes are increasingly interested in facial expression adjustment and they prefer to choose this adjustment method. So, this procedure has become a fixed behavior procedure for the athlete to complete each dive action. Through the above analysis we can know that the facial expression adjustment has the significant effectiveness on the high level diving athletes during the diving training psychological state and real-time emotion. In the next step, we will use the method in the regular game to adjust the facial expression of athletes, so as to improve the anxiety and tension motion during the game. Therefore, we can improve the stability of the

mentality and attention, so as to make it more suitable for sports competitions. Therefore, the athlete can play the normal technical action, thereby achieving the desired results.

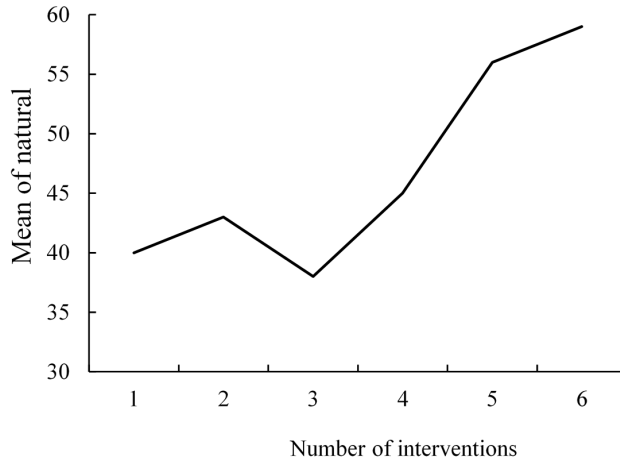


Fig. 5. Proportion variation of unaffected emotion of five rounds intervention

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