The Exploration of Neural Mechanism of Long-term and Short-term Memory through Dance Memory and Learning

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Keywords: Long-term and Short-term Memory; Neural Mechanism; Dance Memory

Abstract: This study discusses the neural mechanism of dance memory and learning, with special attention to the key role of long-term and short-term memory in this process. Dance, as an art form that needs high skill and expressive force, depends on the dancer's ability to remember complex action sequences, keep the consistency of emotional expression and synchronize with music. We find that long-term memory plays a key role in storing and maintaining skills, action sequences and emotional expression in dance learning. This type of memory allows dancers to permanently embed the learned dance elements into their brains, so that they can extract and perform at any time. On the other hand, short-term memory plays a key role in immediate motion control, spatial perception and immediate correction. This type of memory enables dancers to quickly adapt to the ever-changing environment and situation during the performance, ensuring the fluency and accuracy of the performance. In addition, synaptic plasticity has also been proved to be very important in dance learning. Synaptic plasticity allows the connections between neurons in the brain to change during learning and training, which promotes the improvement of skills and the strengthening of memory.

1. Introduction

Dance is a creative and expressive art form, which requires dancers to achieve a high degree of skill and mastery in physical coordination, rhythm and emotional expression. When learning and performing dance, dancers need to rely on long-term memory and short-term memory to master and practice complex dance action sequences, and at the same time constantly call these memories during the performance [1]. However, the neural mechanism of dance memory and learning is still a relatively unclear research field in the field of neuroscience.

Dance memory refers to the memory system that dancers rely on when learning and executing dance works, which includes action sequences, postures and dance skills stored in a long-term time scale, as well as real-time movement and spatial information stored in a short-term time scale [2-3]. Dancers need to combine these different types of memories to achieve accurate and smooth dance performances. Therefore, it is very important to understand the neural mechanism of dance memory for understanding the essence of dance learning. The purpose of this study is to deeply study the neural mechanism of dance memory and learning, to reveal how the brain processes different types of dance memory, and to provide important insights for improving dancers' skills and performance. This will not only contribute to the theoretical development in the field of dance, but also provide useful reference for memory and learning research in other fields.

2. The distinction between long-term memory and short-term memory

Long-term memory and short-term memory play different roles and requirements in dance learning. These two memory types are responsible for different aspects, which are very important for dancers' skills and performance [4-5].

Long-term memory is a form of memory that can store information permanently. In dance learning, long-term memory plays a key role in storing various action sequences, dance steps and skills. Dancers must store this information in long-term memory so that they can access it at any time when needed [6]. Long-term memory is very important for the acquisition of skills. Dancers turn movements and dance steps into long-term memories through constant practice and repeated

  DOI: 10.25236/icemeet.2023.060

learning. These stored skills form the dancer's "muscle memory", which enables them to perform complex dance movements without thinking too much. Long-term memory also involves the dancer's memory of emotion, expression and artistry. They need to remember how to convey specific emotions or storylines to enrich the artistry of their performances.

Short-term memory is used for immediate motion control in dance learning. Dancers must keep their attention to the current movements, dance steps and music during the performance to ensure accurate and coordinated performance. Short-term memory helps dancers remember the current position, direction and spatial relationship. This is very important for navigating on the stage and avoiding collision or confusion. Short-term memory also allows dancers to make immediate corrections. If they make mistakes in the performance, short-term memory enables them to quickly adjust and continue the performance without interruption.

Long-term memory and short-term memory play complementary roles in dance learning [7-8]. Long-term memory helps dancers build skills and rich artistic expression, while short-term memory supports immediate motion control and flexibility in performance. Successful dance learning needs a balance between these two memory types to ensure a high level of skills and performance. Dancers need to extract movements and skills from long-term memory and use short-term memory to adjust and adapt to the ever-changing performance environment.

3. Neuroplasticity and learning

3.1. The role of synaptic plasticity in the brain in dance learning

Synaptic plasticity in the brain refers to the variability of synaptic connections between neurons, which is the biological basis of learning and memory. Synaptic plasticity plays a key role in dance learning, which affects the dancer's skill improvement, memory storage and performance level [9].

Synaptic plasticity allows the connections between neurons in the brain to change during learning and practice. This is very important for the acquisition of dance skills, because dancers need to constantly improve and adjust their movements to achieve higher accuracy and coordination. Through repeated practice, synaptic plasticity promotes effective signal transmission between motor neurons, thus improving the skill level.

Synaptic plasticity also helps to store dance movements and techniques in long-term memory. When dancers repeat certain dance moves, synaptic connections become stronger, thus ensuring that information can be stored in the brain permanently. This long-term synaptic plasticity helps dancers to accurately retrieve and perform dance movements when needed.

Synaptic plasticity also supports the adaptive learning of dancers in different performance environments. Dancers may need to adapt to new stage, accompaniment music or partners, and synaptic plasticity enables them to quickly adjust and adapt to new situations. This adaptive learning is based on the flexibility of synaptic connections.

Synaptic plasticity also helps dancers to express creatively. By changing and adjusting synaptic connections, dancers can experiment with new movements and expressions, thus creating unique dance works. This creative synaptic plasticity enables dancers to continuously develop and evolve to create new dance works.

Synaptic plasticity in the brain plays many roles in dance learning. It supports skill acquisition, memory storage, adaptive learning and creative expression, and provides the necessary neural basis for dancers to continuously improve their performance level and show their superb skills and artistry on the stage. The understanding of synaptic plasticity is also helpful to develop more effective dance education and training methods to make better use of the potential of the brain.

3.2. Effects of practice, training and repeated learning on brain connection

Practice, training and repeated learning have an important influence on brain connection, especially in the formation and enhancement of dance memory. Synaptic plasticity in the brain refers to the variability of synaptic connections between neurons. Practice and training lead to changes in synaptic connections in the brain, which is called synaptic plasticity. This plasticity

allows communication between neurons to be more efficient and accurate. Repeated practice and training is the key to the acquisition of dance skills. By repeatedly performing specific dance movements and steps, the corresponding neural circuits in the brain become more stable and synaptic connections become more strengthened. This helps to improve the coordination and accuracy of skills.

Practice and training also help to strengthen memory. Repeated study and practice make the brain transfer relevant information from short-term memory to long-term memory, making dance movements and skills easier to remember and extract. This helps dancers to perform dance movements accurately when needed. The brain is highly plastic, which means that even after adulthood, brain connections can still change through practice and training [10]. This is an encouraging fact for dancers, because it means that no matter what age, skills can be improved continuously.

In a word, practice, training and repeated learning have a far-reaching impact on the formation and enhancement of dance memory by strengthening brain connection and synaptic plasticity in dance learning. This emphasizes that dancers need to practice and train persistently in order to achieve higher skill level and excellent performance.

4. Memory types and performances

4.1. Integration of different types of dance memories in performance

The integration of different types of dance memories in performance is one of the keys to the success of dancers. Dance performance requires dancers to organically combine various types of memories (such as action sequence, posture, emotional expression and music timing) to create a smooth and wonderful performance.

(1)Action sequence memory

Action sequence is the basic building block in dance, including specific steps, turns, jumps and combinations. Dancers must remember and execute these sequences accurately in their performances. Memorization of action sequences requires long-term memory in the brain. Through constant practice and repeated learning, dancers can transfer these sequences from short-term memory to long-term memory.

(2)Posture memory

Posture memory involves the dancer's body position, movement, posture and coordination. These elements are crucial to the accuracy and beauty of dance. Posture memory requires dancers to have good body perception and coordination in order to maintain correct posture in performance.

(3)Emotional expression memory

Emotional expression is the core of dance art, and dancers must convey emotions, story lines and emotional elements of performance. The memory of emotional expression involves the dancer's understanding and internalization of the emotional requirements of dance in order to show them in the performance.

(4)Music memory

Music memory is the key to dance performance, and dancers must keep pace with the music rhythm. This requires them to remember the beat, speed and rhythm changes of music. Musical memory involves short-term memory, because dancers must synchronize with the music and adjust their movements during the performance.

(5)Integrate different types of memories

In the performance, dancers need to organically integrate the above-mentioned various types of memories to achieve a smooth and coordinated performance. This requires the brain to quickly access and integrate these different types of memories in the ever-changing performance. Integrating different types of memories requires a high degree of coordination, practice and concentration to ensure that dancers consider multiple aspects at the same time in their performances.

In dance performances, these different types of memories are intertwined with each other to

create complex works of art. Successful dancers need long-term practice and training to build a solid dance memory and be able to integrate them efficiently on the stage to achieve high-level performance and expression. Integrating different types of dance memories is the essence of dancers' skills and performances.

4.2. The influence of memory on dancers' performance skills and creative expression

Memory plays a key role in dancers' performance skills and creative expression. Different types of memory (including action sequence memory, emotional memory and musical memory) have a far-reaching impact on dancers' performance ability.

(1)The influence of action sequence memory on skills

Action sequence memory is necessary for dancers to perform specific steps and actions in performance. It involves long-term memory and requires dancers to remember and perform all parts of the dance accurately. This type of memory directly affects the dancer's skill level. Only when the dancers can remember and execute the dance movements accurately can they show a high level of skill and coordination.

(2)The influence of emotional expression memory on creative expression

Emotional expression memory involves dancers' understanding and conveying the emotions and emotional requirements of dance. This kind of memory requires dancers to truly experience and convey the emotions in the dance, so as to touch the emotional resonance of the audience. Emotional expression memory plays a vital role in creative expression. It allows dancers to give dance deep emotion and expression in their performances and create unforgettable dance works.

(3)The influence of musical memory on the musicality and rhythm of performance

Music memory involves remembering the rhythm, speed and musical elements of music. It helps dancers to keep pace with the music in their performances, and shows musicality and rhythm. Musical memory not only affects the musicality of performance, but also affects the rhythm of dance. Dancers can use musical memory to create performances consistent with musical rhythm and emotion.

(4)Integrating memory types to improve performance

Dancers need to integrate these different types of memories at the same time in order to create a high-level performance. They must organically combine action sequence, emotional expression and musical memory to achieve a smooth and coordinated performance. This memory integration not only improves the skill level, but also enhances the creative expression. Dancers can express themselves more freely in different emotional and musical situations, thus creating unique dance works.

Memory has a significant influence on dancers' performance skills and creative expression. Different types of memories are intertwined with each other, forming a rich and profound performance, which enables dancers to show a high degree of unity of skills and emotions on the stage. The effective use of memory is the key element in dance performance, which enables the audience to experience the real artistic charm in the dancer's performance.

5. Future research direction

Advanced neuroimaging techniques, such as functional magnetic resonance imaging (fMRI) and electroencephalogram (EEG), can be used in future research to study the neural mechanism of dance memory more deeply and accurately. This will allow researchers to track brain activity and understand how different types of memories interact in different time scales. Further research can explore the influence of practice and training on the neuroplasticity of dance memory and learning. Research can focus on the effects of short-term training and long-term training to reveal the changes of brain connections caused by different types of training.

Combining neuroscience with dance science, psychology and cognitive science can provide opportunities for a more comprehensive understanding of the neural mechanism of dance memory. Interdisciplinary research may reveal more information, including how body perception, emotional processing and cognitive control affect dance learning and performance. Combining neuroscience

with dance science, psychology and cognitive science can provide opportunities for a more comprehensive understanding of the neural mechanism of dance memory. Interdisciplinary research may reveal more information, including how body perception, emotional processing and cognitive control affect dance learning and performance. Future research can also explore how to use modern technologies, such as virtual reality (VR) and augmented reality (AR), to provide dancers with intelligent learning and training tools to optimize the cultivation of memory and skills.

In a word, the future research direction can deeply study the neural mechanism of dance memory and learning, which will help to better understand how the brain processes different types of dance memory and how to improve dancers' skills and performance. This is of great significance to the development of dance field and the progress of cognitive science.

6. Conclusions

Generally speaking, dance memory and learning is a complex and multi-level process, involving the complex interaction of long-term memory, short-term memory and synaptic plasticity. These neural mechanisms cooperate with each other to support dancers' skill acquisition, memory storage and performance ability. Understanding these mechanisms is not only of great significance to dancers' performance skills and creative expression, but also helps to promote the development of dance education and training, so that dancers can give full play to their potential and create amazing dance works. Future research will further deepen the understanding of these neural mechanisms, thus providing more inspiration and improvement for the field of dance learning and performance.

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