

Piano training modulates theta oscillations on executive control

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Abstract: Playing the instruments involves the participation of the executive control^[1,2]. Based on previous researches, music training could significantly improve inhibitory control^[3], working memory^[4] and cognitive flexibility^[5]. A research shows that only six months of playing the piano could prominently enhance executive control functions^[6]. Moreover, playing the piano, compared with other training schemes, is found more effective in improving executive control^[7]. However, the neural mechanism especially the neural oscillation of different bands on playing piano is still vague. Therefore, in this study, 20 pianists were recruited as the experimental group. 18 string players and 19 non-musicians were recruited as the control groups. We utilized electroencephalograph (EEG) to detect their neural activities when performing Bimanual Pressing Tasks. Behavioral results show that the accuracy of pianists is significantly higher than both string players and non-musicians (Figure 2. A). The react time of pianists are significantly shorter than string players and non-musicians (Figure 2, B). Through time-frequency analysis of EEG, we found that the theta power of pianists in FC3 and FC4 between 500ms and 800ms after the appearance of stimulus is significantly larger than both string players and non-musicians. These results above show that piano training could lead to a significant difference in neural activities on frontoparietal cortex when compared to string training. This is possibly because of frequent involvement of both hands during playing the piano better modulates executive control system^[8,9]. This research advances the exploration on neural plasticity of different instrument trainings and suggests for the treatment of music therapy.

Keywords: Piano training, Executive control, EEG, Time-frequency analysis

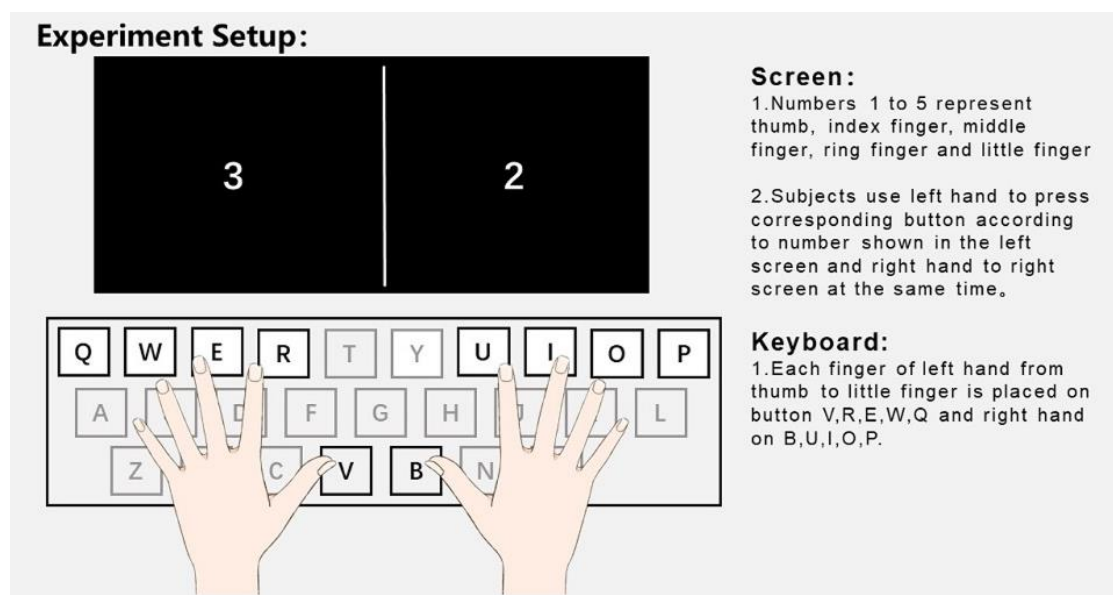


Figure 1. Experiment Protocol

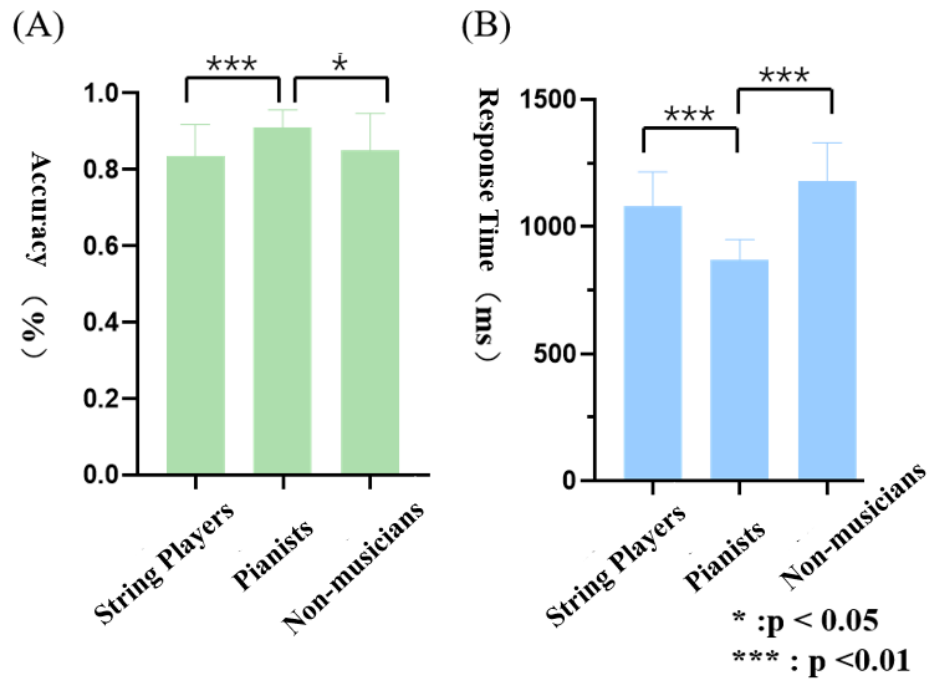


Figure 2. Behavioral Results: Pianists have higher accuracy and shorter response time, implying that piano helps to perform better in Bimanual Pressing Tasks.

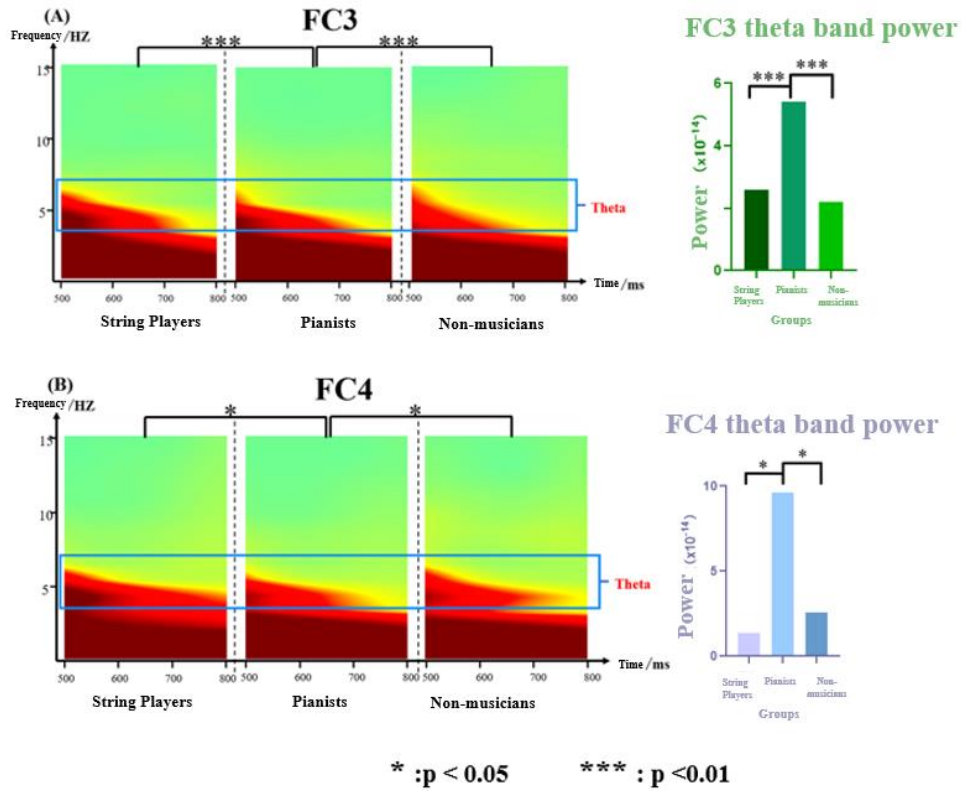


Figure 3. EEG Time-frequency Analysis: The theta band power between 500 to 800ms in pianists is significantly larger the other two groups.

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