ICCST 2020

Proceedings of the 1st International Conference on

Culture-oriented Science & Technology

Revised Selected Papers

30 - 31 October 2020
Beijing, China

Wei Jiang
Shuwu Zhang
Editors

IEEE

Wei Jiang
Shuwu Zhang
Editors

Proceedings of the 1st International Conference on

Culture-oriented Science &Technology

(ICCST 2020)

Revised Selected Papers

IEEE

ISBN: 978-1-7281-8138-7

主编

蒋　伟

张树武

第一届国际文化科技学术会议论文集

(ICCST 2020)

IEEE

ISBN: 978-1-7281-8138-7

Editors

Wei Jiang
School of Information and
Communication Engineering,
Communication University of China
Beijing, China

Shuwu Zhang
Institute of Automation,
Chinese Academy of Sciences
Beijing, China

ISBN-13: 978-1-7281-8138-7

2020 International Conference on Culture-oriented Science & Technology (ICCST)

ICCST 2020

Table of Contents

Message from the General Chairs .... **xvi**
Message from the Program Chairs .... **xvii**
Organizing Committee .... **xviii**
Reviewers .... **xix**
Sponsors and Supporters .... **xxi**

A Study on the Relationship Between Timbre Perception Features and Emotion in Musical Sounds 22
Jiying Guo (Communication University of China), Jingyu Liu (Communication University of China), Zijin Li (Musicology Department China Conservatory of Music), Jiaxing Zhu (Musicology Department China Conservatory of Music), and Wei Jiang (Communication University of China)

STAW: An Audio Watermarking in Short Time DCT for Copyright Protection 28
Shiqiang Wu (Institute of Automation, Chinese Academy of Sciences), Hu Guan (Institute of Automation, Chinese Academy of Sciences), Ying Huang (Institute of Automation, Chinese Academy of Sciences), and Shuwu Zhang (Institute of Automation, Chinese Academy of Sciences)

Research on Traditional Chinese Cultural Material Identification and Database Construction Technology based on Mask R-CNN 34
Hanqing Hu (Beijing Information Science and Technology University)

Piano Playing Simulation System Based on Human Posture Recognition 39
Jucheng Qiu (Communication University of China), Xiaoyu Wu (Communication University of China), Shuyu Chen (Communication University of China), and Yifan Zhang (Communication University of China)

RSF: A Novel Saliency Fusion Framework for Image Saliency Detection 45
Yunhe Wu (Northeastern University), Tong Jia (Northeastern University), Wenhao Li (Northeastern University), and Dongyue Chen (Northeastern University)

Technical Analysis of Multi-Text Video Standardization Based on Tag System 50
Yuan Zhang (Communication University of China) and Shufeng Li (Communication University of China)

Garbage Object Recognition and Classification based on Mask Scoring RCNN 54
Shuijing Li (Communication University of China), Ming Yan (Communication University of China), and Jie Xu (Academy of Broadcasting Science)

Features of Brainwave Induced by 3D Auditory Stimulation 250
Yi Qin (Shanghai Conservatory of Music), Mei Mao (Shanghai Conservatory of Music), Huayu Zhang (Shanghai Artsbang Culture Communication Co., Ltd), Yuni Wang (Shanghai Artsbang Culture Communication Co., Ltd.), and Fuguo Chen (Shanghai Jiao Tong University)

Research on Object Tracking Algorithm Based on KCF 255
Shilei Bai (Communication University of China), Xiujun Tang (Communication University of China), and Jiaxin Zhang (Communication University of China)

Simulation and Analysis of Moving-coil Loudspeakers 260
Zixin Feng (Shanghai Aircraft Design and Research Institute), Jun Gu (Nanjing University), Junlong Ren (Nanjing University), Xuelei Feng (Nanjing University), and Yong Shen (Nanjing University)

Text Classification Using a Bidirectional Recurrent Neural Network with an Attention Mechanism 265
Bingyuan Wang (Communication University of China), Fang Miao (Communication University of China), Xueting Wang (Communication University of China), and Libiao Jin (Communication University of China)

Exhibition Design of the Thematic Science Popularization Space Based on Scientific Visualization 269
Chen Yansong (Tsinghua University), Wang Zhigang (Tsinghua University), Xu Hantian (Communication University of China), Liu Xiaoxi (Communication University of China), Wang Luhan (Communication University of China), and Gao Fei (Beijing Normal University)

Utilizing Gated Convolutional Picker to Enhance Relation Extraction 274
Qian Yi (Chinese Academy of Sciences, University of Chinese Academy of Sciences), Guixuan Zhang (Key Lab of Digital Rights Services), and Shuwu Zhang (Beijing Digital Content Research Center)

A Community Discovery and TrustRank based Approach for Spammer Ranking 279
Yuejun Li (Chinese Academy of Sciences) and Shuwu Zhang (Chinese Academy of Sciences)

Real-time Rendering of 3D Animal Models in Chinese Ink Painting Style 284
Fengjiao Li (Communication University of China) and Shaobin Li (Communication University of China)

Research of Media Product's Changes and Cultivation of Applied Professional Talents in Broadcasting and Hosting 288
Mengxin Zhao (Wuhan Qingchuan University), Li Ding (Wuhan Qingchuan University), Guowei Li (Wuhan Qingchuan University), and Zhixiang Fang (Wuhan Qingchuan University)

Joint Depth Estimation and Semantic Segmentation with Adversarial Multi-task Network 293
Hui Ren (Communication University of China), Nan Gao (Communication University of China), and Jia Li (Communication University of China)

Research on Double Watermarking Algorithm Based on PDF Document Structure 298
Weijuan Zhao (Communication University of China), Hu Guan (Chinese Academy of Sciences), Ying Huang (Chinese Academy of Sciences), and Shuwu Zhang (Chinese Academy of Sciences)

Word Semantic Similarity Based on CiLin and Word2vec 304
Yushang Mao (University of Chinese Academy of Sciences), Guixuan Zhang (Beijing Digital Content Research Center), and Shuwu Zhang (Beijing Digital Content Research Center)

Features of brainwave induced by 3D auditory stimulation

Yi Qin, Mei Mao
Shanghai Conservatory of Music
Shanghai, China
yuan001_us@hotmail.com, mm4141@sina.com

Huayu Zhang, Yuni Wang
Shanghai Artsbang Culture Communication Co.,Ltd
Shanghai, China
artsbang@163.com, may_wyn@126.com

Fuguo Chen
Shanghai Jiao Tong University
Shanghai, China
fuguoc@126.com

Abstract—**Previous studies have shown that music has a certain calming effect, which cause an increase in alpha-band activity (8-12 Hz) in electroencephalography (EEG), and different types of music can increase or inhibit the activity of the cerebral cortex and induce some features of brainwave. With the development of virtual reality technology and binaural technology, the presentation of music and sound works is extended from two-dimensional to three-dimensional, but there is hardly any research on three-dimensional audio (3D audio) and its effect. This study looked for EEG features by collecting EEG signals before and after listening to 3D audio. Persistent 3D audio at a specific frequency of a specific location was used as the stimulation material, and the silence stage and the listening stage of the same group of people (without the control group) were used for the study. The analysis of the changes of alpha, beta and theta band power from the brain area and channel shows that the 3D audio sound stimulation has a significant effect on the EEG power of the general population, and the brain has reached a state of relaxation; after listening to 3D audio, the alpha wave rises obviously, theta wave drops obviously; the brain is more sensitive to 3D audio in the parietal lobe and occipital lobe, and the alpha wave changes more obviously in the right hemisphere, which is almost same as the position of the sonic stimulation point.**

Keywords-EEG power; sound and EEG; digital audio; auditory stimulation

I. INTRODUCTION

Listening to music is an effective means of reducing stress and anxiety and relaxing properly. Studies have shown that music and sound is closely related to people's emotions and body reactions, and different types of concerts evoke different emotional reactions, induce different EEG features. Listening to music is considered an effective way to reduce stress and anxiety [1] . Music can relieve stress and create a sense of well-being from the inside out [2], music therapy has a positive effect on emotions, and reduces fatigue and increases concentration of attention [3]. At the same time, studies have shown that different music can induce different EEG features. For example, Fried (1990) found that music can strengthen the low-metabolism and the opposite state of awakening , that is, the alpha wave increases; in the study, Lu Yingjun found that Chinese classical music made the subjects most relaxed, brain activity weakened significantly, and music processing had the advantage of the right hemisphere.

With the development of virtual reality technology and computer technology, as well as people's constant seek of sound quality and effect, mono and stereo audio can no longer meet people's demand for high-quality sound, 3D audio has become the development direction of today's social audio. As a new way of music and sound presentation, 3D sound localization technology creates a 360-degree listening environment. How this three-dimensional sound effect affects the brain is worthy of further study and discussion. Therefore, the relationship between them can be observed through the study of EEG signals. The main stimuli in human brain science research, from static visual images and dynamic visual images to music and sound, are effective ways to induce physiological and psychological activities, and some studies have proved that the cognitive law is excavated through music [4]. It is very reasonable and effective, and it has broad application prospects, but there are not many brain science research related to 3D audio. Therefore, this article will focus on 3D audio, using spatial 3D audio stimuli to observe the brain's response to continuous three-dimensional sound intervention, and to find a connection between the two.

II. GENERATING METHODS OF 3D AUDITORY STIMULATION

The core principle of virtual 3D audio based on 3D sound localization technology is HRTF (Head Related Transfer Function), which contains the information of sound

978-1-7281-8138-7/20/$31.00 ©2020 IEEE
DOI 10.1109/ICCST50977.2020.00054

source points in 3D sound field. Using HRTF function, 3D sound field can be accurately reproduced [5]. In the case of free field, the HRTF of the left and right ears is defined as：

$$H_L = H_L(r,\theta,\varphi,f) = P_L(r,\theta,\varphi,f)/P_0(r,f)$$
$$H_R = H_R(r,\theta,\varphi,f) = P_R(r,\theta,\varphi,f)/P_0(r,f) \quad (1)$$

The P_L, P_R represents the sound pressure of the left and right ears of the listener and P_0 is the sound pressure when the listener is not in the position. From formula (1), we can see that H_L and H_R are the functions of the horizontal angle θ, elevation angle φ, distance from the sound source to the center of the head r and the frequency f of the sound wave [6]. Since HRTF changes with the position of human head and varies from person to person, the virtual 3D audio generated in this study takes into account the head shape of most people and the basic environment. A more moderate HRTF is selected from IRCAM Listen Database for signal processing to avoid causing errors.

Virtual 3D audio with HRTF information is mainly generated and processed by interactive graphical programming software MaxMSP. The program in this study is mainly divided into two parts: signal generation and localization. In the first part, the software module is used to generate the sine wave of 333Hz. The sine wave is recorded and divided into 20 audio points in 1 second. In the second part, in order to generate more realistic virtual localization, the virtual 3D sound environment is constructed in software, and the horizontal angle, elevation angle and the distance to the head of the sound source are adjusted by using HRTF algorithm. All materials are generated in headset monitor to ensure the accuracy of positioning and matching with the subsequent experimental process.

III. EXPERIMENT MATERIALS AND METHODS

A. Experiment Materials

In this experiment, the 3D audio described above was used as the stimulus material, which is a sine wave signal with a frequency of 333Hz and processed by the HRTF algorithm, which had a certain sense of space and a clear orientation. The auditory stimulus lasted 5 minutes. The playback volume is adjusted to a clear and comfortable degree (about 60dB). The EEG is recorded using 8 Greentek noninvasive EEG electrode with the control scalp impedance below 100 Ω .

B. Participants

The experiment was conducted at the Shanghai Science and Technology Museum during the Shanghai Science Festival in May 2018. Visitors to the Shanghai Science and Technology Museum lined up at the door of the laboratory and entered the laboratory in turn to participate in the experiment. 29 subjects who are different from gender,age and occupation participate in the experiments.

C. Experiment Methods

The subjects were tested individually in five steps (as shown in Fig.1): (1) The subject enters the field, sits down comfortably, puts on headphones, and wears the EEG cap; (2) The experimenter introduces the experiment task, and the subject stays silence, at the same time fills out the basic information table, including gender, age, occupation and other information and the experimenter begins to collect the EEG data of the subjects for 4minutes; (3) The subjects begin to listen to the 3D audio material for 4minutes; (4) At the end of the test, the subject is asked to fill out a questionnaire about their feelings of the test.

In order to control the variables, we keep the duration of the silence and listening stage consistent.The total duration of the test is 18 hours, the scene is set to a semi-enclosed area, the light is soft, and the ambient noise is controlled as much as possible.

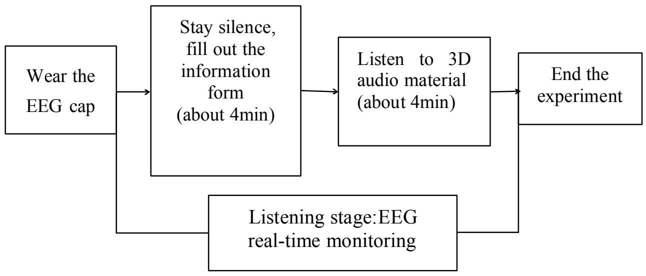

Figure 1. Schematic diagram of experimental steps.

D. EEG processing and analysis

The following EEG processing steps were performed using Matlab and EEGLAB.

1) EEG preprocessing: In order to eliminate all frequencies outside the range of interest, data was high pass filtered with a 0.3 Hz FIR filter,and was filtered with 50Hz FIR notch filter to filter out baseline drift and power frequency interference. The amplitude envelope of the different frequency bands were obtained for ‘Silence’, ‘Listening’ conditions for a total of 8 electrodes which are F3, F4, C3, C4,T7,T8, P3, P4.

2) Feature frequency extraction: The data is divided into two sections according to the beginning marker. The first section is the data of 4 minutes in silence stage and the second section is the data of 4 minutes in listening stage. The amplitude envelope of the delta(1-4Hz), theta(4-8Hz), alpha(8-13Hz), beta(13-30Hz) frequency ranges were obtained using FFT(fast Fourier transform).The method used to convert temporal domains to frequency domain is called Digital Signal Processing. In addition, the transformation is also been known as Fourier Transform which generates Fourier coefficient for each frequency present in the temporal signal [7].

3) Invalid data elimination: Check if the amplitude range of the whole data is concentrated in $\pm$ 100μv^2, and judge the invalid channel beyond $\pm$ 100μv^2 as invalid data, and delete the invalid data artificially. After deletion, the EEG data is relatively clean, which can be used as valid data in statistical analysis.

4) Calculation of evaluation parameters: After the above steps have been completed, the average power of alpha, beta, delta, theta bands before and during the listening stage is selected as the main processing object. According to the formula, the two corresponding evaluation parameters of all frequency bands are calculated: the mean of EEG power measured in silence stage, and the ratio of EEG power to total power (hereinafter referred to as relative power). Total power is the sum of absolute power in all frequency bands, and the relative power is the ratio of absolute power to total power in each frequency band. As shown in formula (2), the P_i is the absolute power of the corresponding band and the p_i is the relative power. P_i (i=1,2,3) represents the average power of the three bands alpha, beta, theta, p_i is its relative power.

$$p_i=P_i/(P_1+P_2+P_3) \quad (2)$$

5) Statistical analysis of evaluation parameters: The collected data were recorded into the SPSS24.0 statistical software, and the relative power changes were analyzed by using the paired t-test. P<0.05 means the difference is statistically significant.

IV. EXPERIMENT RESULTS

Through data collation and statistical analysis, this study contrast the silence stage (4mins) when the subject does not listen to 3D audio and the listening stage (4mins) when listening to 3D audio, and the results are obtained from the following two aspects:

A. Comparison of the mean relative power of EEG in silence and listening stage

In order to observe the changes of alpha, beta and theta waves in silence and listening stage (as shown in the map, the delta band does not change significantly before and after listening, so it is not included in the subsequent statistical test), the relative power of each target band (calculated by formula (1)) is used to do the paired t-test. The statistical level of p<0.05 was used to observe the difference of each channel before and during the listening stage.

TABLE I. PAIRED T-TEST RESULTS OF ALPHA BAND MEAN RELATIVE POWER IN SILENCE AND LISTENING STAGE

Paired T-test results (Marked * represents significant difference)				
Electrode position	Silence	Listeni -ng	T	Sig.
F3	0.2798	0.3007	-1.884	0.070
F4*	0.2742	0.2983	-2.308	0.029
C3	0.3131	0.3566	-1.846	0.076
C4*	0.3077	0.3591	-2.666	0.013
T7*	0.2742	0.3647	-4.153	0.000
T8*	0.2794	0.3493	-3.737	0.001
P3*	0.2994	0.4072	-3.97	0.001
P4*	0.2921	0.3966	-3.983	0.000

TABLE II. PAIRED T-TEST RESULTS OF BETA BAND MEAN RELATIVE POWER IN SILENCE AND LISTENING STAGE

Paired T-test results (Marked * represents significant difference)				
Electrode position	Silence	Listeni -ng	T	Sig.
F3*	0.1508	0.1668	-2.115	0.044
F4	0.1519	0.1624	-1.31	0.201
C3*	0.1349	0.1520	-2.168	0.039
C4	0.1393	0.1537	-1.839	0.077
T7	0.1410	0.1408	0.011	0.991
T8	0.1433	0.1431	0.023	0.982
P3	0.1314	0.1419	-0.839	0.409
P4	0.1213	0.1191	0.291	0.773

TABLE III. PAIRED T-TEST RESULTS OF THETA BAND MEAN RELATIVE POWER IN SILENCE AND LISTENING STAGE

Paired T-test results (Marked * represents significant difference)				
Electrode position	Silence	Listeni -ng	T	Sig.
F3*	0.5694	0.5325	2.504	0.019
F4*	0.5739	0.5393	2.417	0.022
C3*	0.5519	0.4914	2.57	0.016
C4*	0.5530	0.4872	3.45	0.002
T7*	0.5848	0.4945	4.389	0.000
T8*	0.5772	0.5076	4.36	0.000
P3*	0.5691	0.4509	4.596	0.000
P4*	0.5866	0.4843	4.58	0.000

As shown in table 1&2&3, it is observed from the frequency band that, compared with the silence stage and the listening stage of the same group, the alpha wave increases obviously in all the channels, while the theta wave decreases obviously, and the difference is statistically significant, but there is no obvious regularity in the beta wave.

From the changes in the brain area, the alpha wave and the theta wave have obvious changes in all the channels of the occipital region, and there are left and right brain asymmetry from the position of the frontal lobe and the parietal lobe. The EEG asymmetry of the frontal and top regions is determined by comparing the relative power of the alpha waves from the right electrode with the relative power of the alpha waves at the left electrode. The alpha wave increases obviously in the F4/C4 electrode position (right frontal lobe and parietal lobe), and the beta wave increases significantly in the F3/C3 electrode position (left frontal lobe and parietal lobe), and the difference are statistically significant. It is indicated that the left and right brain asymmetry exists in the front and top regions.

B. *Comparison of the mean of EEG power in silence and listening stage*

In order to observe the energy changes of alpha, beta, delta, theta bands in different lobes of the cerebral cortex, the corresponding power spectral density of the electrodes was mapped to the scalp model to form a brain topographic map with different colors. The closer the color is to the red, the greater the energy of the position.

By comparing the brain topographic maps before and during the listening stage, it can be found from figure 2&3 that, the alpha wave increases obviously in the top and occipital lobes, and increases slightly in the frontal lobe, when the theta wave decreases significantly in the parietal and occipital lobes. Meanwhile, the beta wave increases slightly in the occipital and frontal lobes, and the delta wave decreases slightly in the occipital lobe. The results show that the change of alpha and theta waves is more obvious in 3D audio, and the brain is more sensitive to 3D audio in the

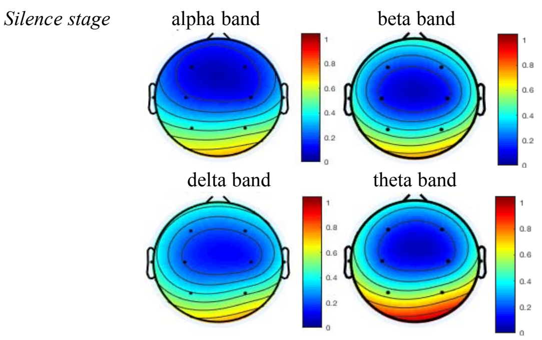

Figure 2. Brain Topographic Map in Silence stage in four bands.

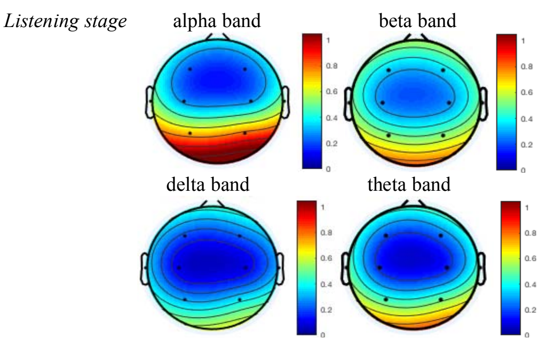

Figure 3. Brain Topographic Map in Listening stage in four bands.

parietal and occipital lobes. At the same time, compared to the other three bands, the response of beta in frontal area is more obvious.

V. Discussion

This study examined the features of brain waves induced by 3D audio, and whether it is conducive to stress management. Results show that participants showed significant positive changes after listening to 3D audio compared to the silence stage. Analysis of brainwave power changes shows a sharp contrast between the silence stage and the listening stage. The following conclusions can be drawn:

1) By comparing the results of the same group of people in the silence stage and the listening stage, the alpha band power is obviously increased, and the theta band power is significantly decreased. It can be seen that the alpha band power is induced after listening to the 3D audio, and the theta band power is suppressed. As far as we know, there is no previous report on 3D audio for relieving stress and relieving emotions. However, there are many discoveries support our observations. Studies show that the rise of alpha waves proves that adults are gradually entering a state of quiet, comfort, relax but awakening, accompanied by a state of thinking [8]. Therefore, in this study, after listening to 3D audio, the EEG signal mainly recorded alpha wave, this is similar to the EEG feature induced by ordinary two-channel stereo audio.

2) The main findings of the brain area are mainly that in the comparison between silence and listening stage, both the frontal, parietal and occipital lobes show changes. The results show that in the frontal area and the parietal lobes, the alpha band power changes more obviously on the right side, and the beta band power changes more obviously on the left side. Subjects who listened to 3D audio exhibited left and right asymmetry of alpha and beta waves. Some previous studies explored the hemisphere characteristics during music listening. For example, one study has shown that lateralization is due to differences in autonomic nervous system input in physiology [9], the right hemisphere mainly receives sympathetic input associated with greater arousal and negative effects, while the left hemisphere primarily receives parasympathetic input associated with less arousal and positive effects. At the same time, Davidson and Fox's theory holds that the frontal lobe differs from positive emotional states and negative emotional states and corresponding motivational behaviors [10], the left frontal area of the brain regulates positive emotional experiences (e.g. happiness) and proximity behavior, as well as the right forehead area of the brain, used to regulate negative emotions (e.g. fear, sadness) and the experience of withdrawal behavior. It can also be noted that the frontal alpha wave, which has increased asymmetry, is associated

with creative thinking [11], more right brain activity at rest is associated with in-depth problem solving [12]. The alpha wave is a common wave in the normal human brain, which is the basic rhythm of EEG. The appearance of alpha wave indicates that the brain is in a state of waking relaxation. During the listening stage, the relative power of the alpha wave in the right frontal region increased significantly compared with the silence stage, which indicates that the audio has a soothing effect on the mood swing in the right frontal region, which may be conducive to regulating negative emotions.

From the above observations, the right brain advantage of the alpha wave may be the characteristic of negative emotion regulation and anxiety reduction, and also the embodiment of creative and insightful thinking. This may be related to the virtual 3D position in 3D audio. The virtual position in the sound is located at the junction of the frontal and parietal lobes of the right hemisphere of the brain, which corresponds to the position of the electrode where the alpha wave changes significantly in the experiment, and this change is a energy rise, but it is opposite to the change position of beta wave. This result indicates that the stimulation of a specific position of the brain by sound may induce response in certain bands of EEG, and activate the brain area where the sound waves radiate for relaxation.

VI. Conclusion

This study aims to explain the brain response to 3D auditory stimulation. Studies have shown that when brain processes rhythmic signals, it will produce the resonance of the same frequency with the imagined structure of the bar [13]. It proves that the "virtual" imagination is real in the brain. In this experiment, the 3D audio produces an auditory space, gives a specific position of sound stimulation, and stimulate the listener's imagination of sound location, to induce brain activity. These findings thus bring strong support for that, the imagining of sound localization may also be real in the brain. This may be due to the mental functions in the frontal lobe. This discovery may not be a coincidence, and further research is needed in the future.

In recent years, researchers have focused more on the relationship between brain activity induced by sound or music and emotional factors, but little attention has been paid to sound or music based on virtual reality and binaural technology. However, our study has some limitations. Firstly, the 2D version of 3D audio should be made for comparative research, which may strengthen our research conclusions. And use music with melody as experimental materials to compare with sine wave, and observe the difference in effect. Secondly, our sample size is only 29 people, which will make our research conclusions lack of universality. Therefore, in the future, it is necessary to experiment again in other people and in comparison with 2D audio to verify the conclusions of this experiment. In addition, it is necessary to increase the number of channels and improve the precision of EEG equipment in the future.

This study extends the research direction of brain activity and brain reaction to some extent, and uses 3D audio produced by 3D sound localization technology to explain the characteristics of EEG induced by 3D audio. It also lays the foundation for the research of this new type of music and virtual reality.

Supported by the Project of China National Social Science Fund (Art): Contemporary Chinese Music Research under Perspectives of New Sound Media (No.18BD066)

References

[1] Epstein R. M., “Mindful practice,” JAMA, Vol. 282(9), pp. 833–839, 1999.

[2] Cepeda M. S., Carr D. B., Lau J., and Alvarez H., “Music for pain relief,” The Cochrane Database of Systematic Reviews, Vol. (2), 2006, CD004843.

[3] Lesiuk T., “The Effect of Mindfulness-Based Music Therapy on Attention and Mood in Women Receiving Adjuvant Chemotherapy for Breast Cancer: A Pilot Study,” Oncology Nursing Forum, Vol. 42(3), pp. 276–282, 2015.

[4] Hongwei Li, “EEG Research on the Law of Music Appreciation in the Change of Musical Attributes,” Journal of Fudan University(Natural Science), Vol. 57(3), pp. 385-392, 2018.

[5] ZHANG W., ABHAYAPALA T. D., KENNEDY R. A., and Duraiswami R., “Insights into head-related transfer function: spatial dimensionality and continuous representation,” Journal of Acoustical Society of America, Vol. 127(4), pp. 2347-2357, 2010.

[6] Fu-liang Yin, “Overview of 3D Audio Technology,” Journal on Communications, Vol. 32(2), pp:130-138, 2011.

[7] S. Nag, S. Biswas, S. Sengupta, S. Sanyal, and D.C. Ghosh, “Can Musical Emotion Be Quantified With Neural Jitter Or Shimmer?A Novel EEG Based Study With Hindustani Classical Music,” Jadavpur University Kolkata, India, 2017.

[8] Ming-de Zou, “Exploration of EEG alpha wave biofeedback technique,” Beijing Biomedical Engineering, Vol. 19(1), pp. 39-41, 2000.

[9] Craig A.D., “Forebrain emotional asymmetry: a neuroanatomical basis?,” Trends in Cognitive Sciences,Vol. 9(12), pp. 566 – 571, 2005.

[10] Davidson R.J., Marshall J.R., Tomarken A.J., and Henriques J.B., “While a phobicwaits: Regional Brain electrical and autonomic activity in social phobics during anticipation of public speaking,” Biological Psychiatry, Vol. 47, pp. 85 – 95, 2000.

[11] Jauk E., Benedek M., and Neubauer A.C., “Tackling creativity at its roots: Evidence for different patterns of EEG alpha activity related to convergent and divergent modes of task processing,” International Journal of Psychophysiology, Vol. 84(2), pp. 219 – 225, 2012.

[12] Jung-Beeman, M., Bowden, EM, Haberman, J., Frymiare, JL, Arambel-Liu, S., Greenblatt, R., and Kounios, J., et al., “Neural Activity When People Solve Verbal Problems with Insight,” PLoS Biology, Vol. 2(4), E97, 2004.

[13] Nozaradan S., Peretz I., Missal M., and Mouraux A., “Tagging the neuronal entrainment to beat and meter,” Journal of Neuroscience, Vol. 31(28), pp. 10234-10240,2011.