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Analysis of Physiological Signals Variation in Listening to Music

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Abstract

The use of music for relaxing and relieving anxiety has become increasing popular in recent years; a lot of relevant researches have shown that music has both a mental and physiological effect which is quantifiable. This research measures the brain wave and heart rate variability (HRV) change during the course of experiments in listening to music. Furthermore, we attempted to distinguish the relation between the music¡BEEG and HRV.

The following points have been discovered. First, it is found that alpha power under no music, listening to soft music and listening to rock music are different significantly. The biggest alpha power occurred under the situation of no music, and listening to rock music induced the least alpha power. On the other hand, we found no matter which kind of music is listened to, the gamma powers are greater comparing with that under no music. This result is similar to the finding of the past research. According to relevant research, stimulus to the perception and selective attention caused individual's gamma power to rise. Our study also verifies such a viewpoint. Meanwhile, the music probably makes the change on experimenter's mood to cause gamma power to rise. We also find that there are greater alpha power on the people who like rock music than people who don't like when listening to rock music.

Finally, the relationship between EEG and HRV were analyzed. Alpha power of EEG was positively correlated to HFnu and SDRR, and negatively correlated to LF/HF and LFnu of HRV. Therefore, the autonomic nervous system and cerebral cortex may have interplay in response to music.

Keywords: **Music Therapy, EEG, HRV, Time Frequency Analysis**

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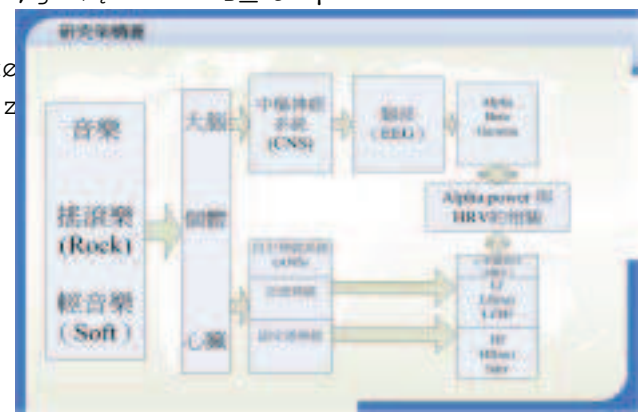
¡]HRV¡^¡A⁄ †v¯ †S' °⁄⁄"" LF¡BLFnu¡BLF/HF



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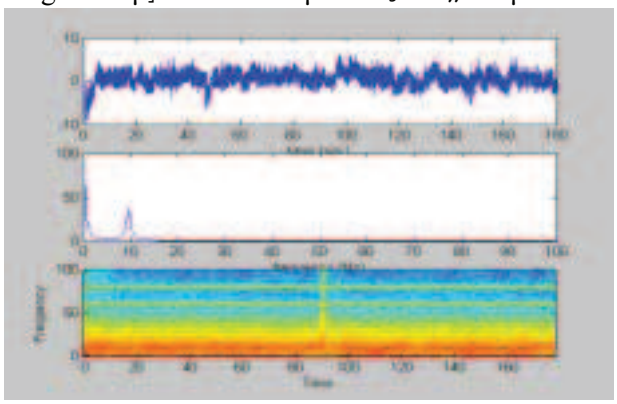
¥ "⁄"‹ W†v¡A„˘⁄⁄ Œ "⁄"† `†LSY‹ © fl ¶q]power¡^

" " – j fi z ¡ C „ ˇ/ alpha power ¡]8-13Hz ¡ ^H fi ¶ ƒ Ÿ"– ¡ Š ¸ ¡ A Š ›ƒ ¥ i ¥ HC / @ ˜ ` Š@.. "" – ¡„ / U‹ O/ p' ¥ i– ¤ • ƒ u.. † "" (z=-2.209, p<.05) ¡ C alpha power "" ¥ Š ¡ ¡ A Š Y ¥ i– ¤ C / @ "" ¥ › $£ \ -power ›¨¡ Œ ƒ „/ @ ¥ Š ¡ alpha power ›¨Š Y ¥ i ¥ ¸ ¤ † ¸ › ₽B¡ "Œ Š › /] • | ₣ … ¸ beta ¡]13Hz~30Hz ¡ ^ 'Mgamma ¡]30Hz~50Hz ¡ ^ ‹ ƒ P "" „ ¤ ¡ C



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ƒ b/ « ¯ † Š ° "" / "R/ £ – ¡ A « h Š ¢ {, ß "" fit † Š ¡ C †"G o † { Soft ƒ b LF/HF / W O/ ƒ Rock "" ¡]Z=-2.068,P<.05 ¡ ^ ¡ F ƒ soft ƒ b LFnu / W/]‹ O/ ƒ Baseline "" ¡]Z=-2.327,P<.05 ¡ ^ ¡ C

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		¥ ", £		¥ k, £	
		mean	SD	mean	SD
alpha power	BL	9468*	10909	8151*#	9140
	Rock	8841*$	15507	7080*	13598
	Soft	9641$	16023	7672#	14601
beta power	BL	1505	1271	1396	831
	Rock	1681$	1367	1375	1200
	Soft	1268$	1049	1268	1049
gamma power	BL	188*#	391	134*#	142
	Rock	7202*	17097	5212*	7864
	Soft	4820#	6306	4464#	5457

*" ¥ BL » P ROCK ¶ ¡ ƒ † ¯ ª fit † Š
#" ¥ BL » P SOFT ¶ ¡ ƒ † ¯ ª fit † Š
$" ¥ SOFT » P ROCK ¶ ¡ ƒ † ¯ ª fit † Š

" / G ¡ B / « † Š ° » P, £ i alpha power / Š ¶ ¡ " ‹ ^ « Y …¡ C

Correlation coefficient		Alpha power of EEG		
		BL	Rock	Soft
HRV	LF/HF	-0.597*	-0.594*	-0.371
	LFnu	-0.526*	-0.588*	-0.368
	HFun	0.509*	0.485	0.491
	SDRR	0.568*	0.171	0.344

*" ¥ p<0.05

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¤ ^ ⁄ £ • | ƒ † › S CJ.¥{»″„ Œ‟G¡C‟ ″ ¤, ‟[5] ‹ŒLorch CA, Lorch V, Diefendorf AO and Earl PW (1994) Effect of stimulative and sedative Music on systolic blood pressure, heart rate, and respiratory rate in premature infants. *Journal of Music Therapy*, 32: 105-118.

† B ' J … { ‟ ″ ⁄ † z ‟ ‹ Æ¡Æ › ≈ ‟—¥X†{ ,
‟ ‟ ™ ‟Klimesch ‟″‹ ªs ¶G« ¥ X ¡ Æ ›•Œ
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HF¡BHFnu 'MSDRR ¥ ℕ ¥ •Pfl ‹g‟″¿ †˜‟ ″A
[6,13]¡Æ› ¯Øƒb' âP‟ ″ ‟AU¡Æ¤ ˇ•Pfl ‹g ⊧
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‹ ªs[16]⁄] o†{ delta power 'MLF/HF ƒ†›t‹ ^ ¡C
S › –·⁄Q v ¯ †Sƒ ¶ « …˜¡]LF/HF¡BLF¡BHF¡B
LFnu¡BHFnu¡BSDRR¡^'Malpha power ‟″‹ ^ ¡Æ‹
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