

Listening to Music and Idea Generation

Wen-Chih Chang^(✉) and Chi-Meng Liao

National Taiwan University of Science and Technology, Taipei, Taiwan
wchang@mail.ntust.edu.tw, jameslgm88@yahoo.com.tw

Abstract. This study explores the effects of music tempo on designer's idea generation, and compares the features of the subjects' ideas evoked through design behaviors and emotional feelings under without-music, fast-tempo, and slow-tempo music situations. Three experienced designers and design teachers were invited to evaluate their sketches. The experimental results showed that, (1) when listening to fast-tempo music, the subjects generated remarkably more sketches, and achieved significantly higher scores of idea fluency and flexibility, in contrast to listening to slow-music and non-music situations. (2) Under the slow-tempo music situation, the subjects' originality and feasibility of idea sketches were significantly higher than those under fast-tempo music and without-music. (3) The idea elaboration was enhanced when listening to slow-music and non-music situations. The study suggests that when require lots of ideas may listening to fast-tempo music, while listening slow-tempo music if need novelty ideas.

Keywords: Music tempo · Idea generation · Emotion · Activation

1 Introduction

People listen to music a lot in their daily life, and there are many studies regarding the effectiveness of music. For example, music can enhance the customer purchase rate [1], playing suitable music can influence product choice when consumers do not have a clear existing preference [2]. Some studies have found the influence of music on cognitive ability; for example, playing music that children are familiar with can help improve the creativity and vividness of their drawing ability [3], and improves students' speed and performance of picture drawing tasks [4]. Recently, Liao and Chang investigated more than 500 designers, and indicated that most designers get used to listening to music during design. The survey also indicated that listening to music during design has positive effect [5]. These studies showed that music does indeed have multiple influences. This study intends to investigate whether design concepts can be triggered through music stimulation, or whether design effectiveness can be further improved through mood regulation of music. The main purpose of this study is to investigate the influence of listening to fast-tempo music, slow-tempo music, and without-music on design idea generation, as well as to compare the characteristics of design concepts under different music situations through two aspects – design behavior and induced emotional feelings, as triggered by different music tempo.

2 Literature Review

2.1 Influence of Music Tempo on Behaviors and Emotions

Tempo refers to the speed of a beat, and is one of the fundamental elements of music. Music with a fast tempo makes a person feel aggressive, energetic, and excited; while music with a slow tempo can express solemn, lyrical, and calm feelings [6]. It shows music tempo will interconnect with people's perceptions, and further affect their behavioral responses. Therefore, listening to fast-tempo music activates perception improves athletes' motor response performance [7], and strengthen the performance of graphic pattern recognition tasks after paper is folded [8]. However, some studies suggest that slow-tempo music is beneficial to cognitive activities. The study of two weeks on students' writing ability by McKnight showed that, listening to slow-tempo music is beneficial to elementary school students' writing ability [9]. Hallam and Price also indicated that, listening to calm background music can improve students' emotions, reduce the rule-breaking, and improve their mathematical ability [10].

In addition, previous studies showed that, music tempo affects people's emotional feelings. Relevant studies showed that, tempo is positively correlated with happy or sad feelings [11]. Fast-tempo music makes people perceive happy and positive emotions, while slow-tempo music makes them perceive opposite feelings [12]. Moreover, music tempo may affect people activation [13]. Holbrook and Anand pointed out that, there is a logarithm relationship between people's energetic feeling and music tempo, at a faster tempo people feel more activation [14]. Yamamoto and his colleagues performed a cross-comparison on the subjects' physiological response and self-report scale under fast/slow-music tempo, and the results showed that, listening to slow-tempo music significantly decreases heartbeat and disperses pressure, which is beneficial to tasks with pressure [15]. These studies demonstrated that, musical tempo affects human behavioral and emotion perception, which further affects the performance of cognition.

2.2 Emotions and Design Creativity

Emotion refers to a physical and mental activation state triggered by external stimuli that induces physiological changes and behaviors responses. Physiologist Russell systematically arranged emotional qualities, and proposed the Circumplex Model of Affect, where the X-axis is an affective valence, Y-axis is activation. He suggested that, most emotional responses can be explained through two dimensions – activation and pleasant emotion [16]. According to the Circumplex Model of Affect, Russell and Carroll suggested that, the emotional state of people generally reflect the following 6 types: high activation of positive emotions (e.g., excitement and passion), moderate activation (e.g., happiness and satisfaction), low activation (e.g., calmness and relaxation, corresponding low activation of negative emotions (e.g., depression and boredom), moderate activation (e.g., unhappiness and dissatisfaction), and high activation (e.g., tension and anxiety) [17]. They are opposite to one another in the Circumplex Model of Affect, as shown in Fig. 1.

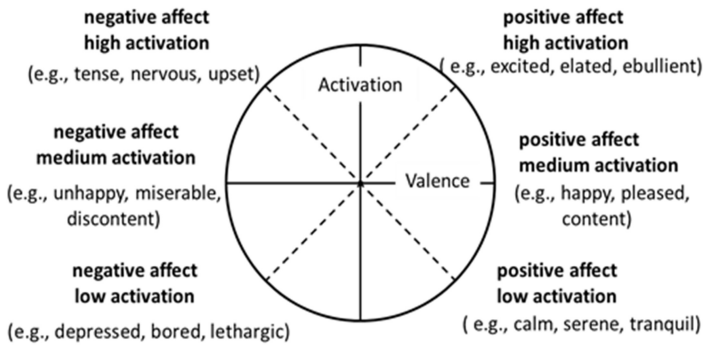


Fig. 1. Six clusters of affect items, as quoted from Russel and Carroll (1999)

For the relationship between emotions and design creativity, some studies indicated that under positive emotions, people can propose more creative solutions to problems, which improves the smoothness of thinking divergence [18]. Fast thinking, which involves many thoughts per unit time, generally produces positive affect, and generated significantly more ideas [19]. Moreover, some studies showed that, under positive emotions, people can associate with more diversified vocabularies and terms, and the content is more positive. The reason may be that positive emotions make people feel more comfortable, relaxed, and less stubborn, which allows them to smoothly develop creative solutions to problems [20]. Moreover, people under positive emotions can deal with things more flexibly and accept different solutions than they can under negative emotions [21]. Therefore, the diversity and flexibility of problem-solving may be one of the qualities of positive emotions.

Although most studies found that positive emotions are beneficial to design creativity, some studies showed that negative emotions are positively correlated with creativity performance. The study by Kaufmann proposed that, negative and neutral moods may be more helpful finding insightful and highly creative solutions to problems [22]. Vosburg also suggested that negative emotions are beneficial to the development of the best strategy and attach more importance to conception quality [18]. The reason may be that, people under negative emotions will try to get rid of emotions or difficulties at the moment, and adopt analytic thinking strategies to deal with problem, which activates knowledge and makes knowledge more useful [23]. Therefore, negative emotions more likely to develop novel ideas.

2.3 Design Creativity and Assessment

Design is a part of human imagination, every stage of the design process requires creativity. Therefore, the success/failure of design works is closely related to creativity. Guilford suggested that creativity thinking abilities have their properties, involving originality, fluency, flexibility, and elaboration abilities, these so called divergent-thinking [24]. Amabile proposed that the creative concept must be novel, appropriate, useful, and valuable to the task undertaken [25]. Therefore, in addition to

attaching importance to the creativity of the concepts, studies regarding design creativity must also consider the feasibility and appropriateness of conception fulfillment. At the early conceptual stage of design process, designers applied pictorial representation and embody concepts in their mind using idea sketches, which have long been an important part of the design process [26]. Therefore, drawing idea sketches in studies regarding the design creative is a more direct method.

As the theories of creativity are diversified, there are many different methods for evaluating creativity. Hocevar and Bachelor analyzed more than 100 creative evaluation examples, and summarized eight major types of evaluations of design creativity, including: (1) test of divergent thinking: Torrance's test of creative thinking (TTCT) can be taken as representative, which test the fluency, flexibility, originality, and elaboration of subjects as the evaluation items of creativity; (2) attitude & interest inventories; (3) personality inventories; (4) biographical inventories; (5) ratings by teacher, peers & supervisors; (6) judgment of products; (7) eminence; and (8) self-reported creative activities & achievements [27]. Although Torrance's TTCT is used more frequently, Sternburg suggested that an experimental design apply practical design task may be the best, that can propose more reasonable explanations of the cause-and-effect relationship among various creative behaviors [28]. Therefore, this study requested the subjects to actually draw idea sketches in order to investigate the influence of music on design idea generation.

3 Research Methods

This study applied within-subjects design, requested the subjects to conduct design tasks under without-music, listening to fast-tempo music, and slow-tempo music, by drawing idea sketches in order to investigate the influence of music tempo on design creativity. The experiment including conducted design task, fill in music perception assessment, and evaluating design ideas by expertise.

3.1 Music on Experiment

In the researches we have discussed, the music was presented in be manipulated for laboratory settings. This kinds of music is unusual, it makes very hard to applied the research findings in the real world [13]. In order to improve ecological validity, we adopted the music original tempo was presented, so that is close to the real music listening experience people used to. The instrumental music was used in the experiment, which can avoid the interference from lyrics or singing style [29], the music was mainly played by piano. The music selected pianist Omar Akram who won a Grammy Award. We picked 3 fast-tempo songs, Downpour (126/bpm), Dancing with the wind (134/bpm), Last Dance (126/bpm); and 3 slow-tempo songs, Daytime Dreamer (72/bpm), The Promise (66/bpm), and My desire (84/pbm), in his album of Daytime Dreamer. The music was randomly played through a pair of 40 W speakers meanwhile music played continue until design task completed.

3.2 Experimental Assignments and Equipment

This study recruited 40 undergraduate students of the Department of Industrial Design of two universities in northern Taiwan to participate. The subjects were divided into groups A and B, with each group consisting of half males and half females. First, each group designed seasoning containers (powdered or liquid seasonings container were accepted) by free hand sketching under the condition of without listening to music. Then, Group A listened to fast-tempo music to first design powdered seasoning containers, and then, designed liquid seasoning containers under the condition of slow-tempo music 1 week later. Group B listened to slow-tempo music first to design powdered seasoning containers, and then, they designed liquid seasoning containers under the condition of listening to fast-tempo music 1 week later. The subjects had 5 min to warm up before they conducted the design task, and then, executed the design task for 40 min. When the design task was complete, the subjects filled in their basic information, music-induced design behaviors, and emotional feeling scale. This experiment was conducted in a school classroom, which only had a whiteboard on the wall, thus, reducing the interference of environmental factors. The subjects used black or blue pen or pencil to draw sketches of their own choices.

3.3 Measurement of Music Perception

According to the literature review, music tempo affects people's actions and thinking paces [e.g., 6, 7, 15]; therefore, this study hypothesized that music tempo (fast vs. slow) may also affect design behaviors. This study evaluated the potential influence of music tempo (fast vs. slow) on design thinking speed (slow vs. fast), concentration of design thinking (careful vs. careless), action of drawing sketches (slow vs. fast), and concentration of drawing (careful vs. careless), as the evaluation items of the influence of music on design behaviors. Previous studies also showed that, music tempo affects emotional feelings [e.g., 11, 12], and emotions affect design creativity performance [e.g., 21, 22]. Regarding music emotion assessment, this study selected Russell and Carroll, which suggested 6 representative emotional adjectives to test the subjects' emotional feelings [17]. These adjectives were: depressed vs. excited; unhappy vs. happy; tense vs. calm, for a total of 6 mutually opposite adjectives of emotions. The measurement scale is divided into 7 levels, as shown in the partial examples of the design behavior and emotional feeling scales in Table 1.

3.4 Expert Assessment of Design Concept

Three design experts, an associate professor, a design director, and a creative director, with experience totaling more than 10 years, were invited to evaluate the sketches. The experts agreed with the use of fluency, originality, flexibility, and elaboration of divergent thinking, as proposed by Guilford [24], as well as feasibility and appropriateness, as proposed in this study, as the test items of creative idea sketches in the experiment. They also agreed with the use of Torrance's TTCT as the evaluation criteria for judging creative performance. In addition, the experts suggested using a

Table 1. The examples of design behavior and emotional perception measurement

Measurement items	Measurement scale						
	1	2	3	4	5	6	7
The music you are listening makes your thinking pace tend to	slower	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	faster
The music you are listening makes your emotional perception tend to	calm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	tense

10-point scale to rate evaluation items, where the worst score was 1 point, while the best score was 10 points. The evaluation criteria of idea sketches are as shown in Table 2. Prior to performing the assessment, the experts selected the idea sketches for each evaluation item (higher and lower), according to the spirit of the evaluation criteria, in order to establish a consensus of assessment, as shown in the comparison of originality in Fig. 2, and the comparison of elaboration in Fig. 3.

Table 2. The principle of idea creativity measurement

Items	Evaluation criteria measurement	
Fluency	Judgement according to the quantities of idea sketches	By quantity
Originality	It is to provide novel, or clever idea, in form or operation methods in respect to condiment container design	1–10 scales
Flexibility	Have difference between one’s own idea, or types of idea are divergent	1–10 scales
Elaboration	The contents of an idea are well considered, and the explanation is in detail both in text or drawing	1–10 scales
Feasibility	It refers to the idea can be practiced, especially in mass production	1–10 scales
Appropriateness	It refers to the product form or operation methods fulfillment people expectation	1–10 scales

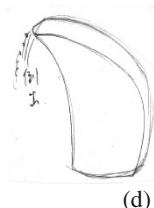
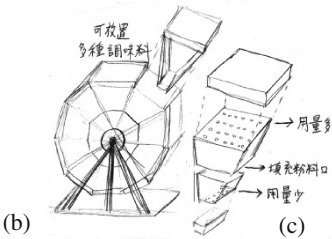
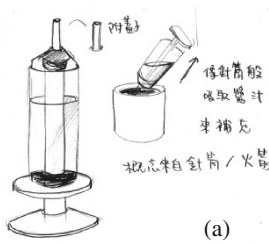


Fig. 2. Comparison of originality: (a) high originality, (b) low originality.

Fig. 3. Comparison of elaboration: (c) high elaboration, (d) low elaboration.

4 Experimental Results and Analysis

4.1 Music Tempo and Idea Creativity

The experimental results showed that, when listening to fast-tempo music, the subjects generated larger quantities of sketches (350 sketches; Mean = 8.70) than under slow-tempo music (298 sketches; Mean = 7.45), and without-music situations (282 sketches; Mean = 7.15). One-way repeated measures ANOVA was conducted to examine whether there is significant difference in the subjects' idea generation when listening to fast-tempo, slow-tempo, and without-music conditions. The verification results are as shown in Table 3. The idea sketch fluency, originality, flexibility, elaboration, and feasibility had p values of $0.00 < 0.05$, and there were significant differences under these three music situations. However, idea appropriateness had a p value of $0.42 > 0.05$, meaning there was no significant difference of idea appropriateness among these three music conditions.

Table 3. The feature of creative ideas, as examined by One-way repeated measures ANOVA

Variable	Fast-tempo		Slow-tempo		Without-music		F	fd	p	Post Hoc
	Mean	SD	Mean	SD	Mean	SD				
Fluency	8.70	3.09	7.45	2.56	7.15	2.11	21.83	2	0.00*	Ft > St; Ft > Wm
Originality	5.18	0.96	5.63	1.02	5.07	1.03	6.23	2	0.00*	St > Ft; St > Wm
Flexibility	5.62	0.84	5.10	1.11	4.85	0.94	9.89	2	0.00*	Ft > St; Ft > Wm
Elaboration	5.00	0.88	5.67	1.01	5.53	0.96	10.74	2	0.00*	St > Ft; Wm > Ft
Feasibility	4.53	0.98	5.15	0.89	5.01	0.94	8.78	2	0.00*	St > Ft; St > Wm
Appropriateness	4.78	0.89	4.95	1.06	5.06	1.23	0.83	2	0.42	No significant

$\alpha = 0.05$, * $p < 0.05$, Fast-tempo = Ft, Slow-tempo = St, Without-music = Wm

The results of Post Hoc testing showed that, under the fast-tempo music situation, the fluency and flexibility of subjects' idea sketches were significantly higher than those under slow-tempo music and without-music conditions. On the other hand, the originality and feasibility of subjects' idea sketches were significantly higher than under fast-tempo music and without-music situations. In addition, the idea elaboration of subjects had better performance when listening to slow music and without-music conditions than under fast-tempo music conditions.

4.2 Music Tempo, Design Behavior and Emotional Feelings

The results of the subjects' design behavior assessment and emotional perceptions under fast-tempo music, slow-tempo music, and without-music conditions, as examined by One-way repeated measures ANOVA, shows that there were significant differences under the three music conditions, as shown in Table 4. According to the

results of Post Hoc testing, the subjects' demonstrated thought pace and drawing speed under fast-tempo music (mean = 5.73; 5.94) > without-music (mean = 3.58; 4.35) > slow-tempo music (mean = 2.27; 2.35), meaning the subjects felt their thought pace and drawing speed accelerated when listening to fast-tempo music. In addition, the subjects' concentration of design thinking and drawing when listening to slow-tempo music (mean = 5.52; 5.21) > without-music (mean = 3.98; 4.73) > fast-tempo music (mean = 2.81; 2.83). It shows that the subjects felt their design concentration tended to be more careful when listening to slow-tempo music. The results of the subjects' design behavior under these three music conditions are as shown in Fig. 4.

Table 4. Design behavior and emotion perception, as examined by One-way repeated measures ANOVA.

Variable	Fast-tempo		Slow-tempo		Without-music		F	fd	p	Post Hoc
	Mean	SD	Mean	SD	Mean	SD				
Thinking pace	5.73	1.03	2.27	0.96	3.58	0.89	177.66	2	0.00*	Ft > Wm > St
Thinking concentration	2.81	0.79	5.52	0.77	3.97	0.93	120.97	2	0.00*	St > Wm > Ft
Drawing pace	5.94	0.86	2.35	1.12	4.35	0.98	206.53	2	0.00*	Ft > Wm > St
Drawing concentration	2.83	0.18	5.21	0.19	4.73	0.12	117.51	2	0.00*	St > Wm > Ft
Excitement	5.71	0.77	3.73	0.57	3.50	0.79	154.26	2	0.00*	Ft > St; Ft > Wm
Happiness	5.50	0.88	3.78	1.04	3.75	1.08	61.11	2	0.00*	Ft > St; Ft > Wm
Tense	5.36	0.87	1.75	0.86	4.08	0.85	201.04	2	0.00*	Ft > Wm > St

$\alpha = 0.05$, * $p < 0.05$, Fast-tempo = Ft, Slow-tempo = St, Without-music = Wm

In terms of emotional perceptions, referring to the results of Post Hoc testing shows that, the subjects felt emotional excitement and happiness under the fast-tempo music condition (mean = 5.71; 5.50) > without-music (mean = 3.50; 3.75), and slow-tempo music (mean = 3.73; 3.78). It means that, during the design task under fast-tempo music, the subjects significantly perceived the emotion of excitement, with positive affect and high activation, but felt moderate excitement of medium affect and activation when listening to slow-tempo music and without-music situations. Regarding the emotional tension of idea generation when listening to fast-tempo music (mean = 5.36) > under without-music listening (mean = 4.08 > listening to slow-tempo music (mean = 1.75). It shows that during the conducted design task, the subjects perceived that listening to fast-tempo music promoted the emotional tension of negative affect and high activation. In the without-music situation, their emotions tended to calm positive affect and low activation. Furthermore, the subjects obviously felt the calm emotion of positive affect and low activation when listening to slow-tempo music. The results of the subjects emotional feeling under these three music situations are as shown in Fig. 5.

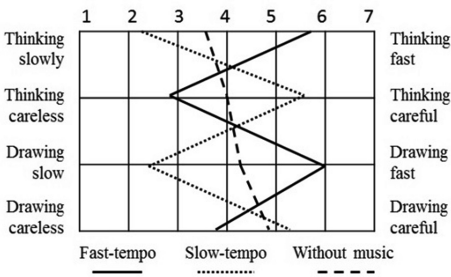


Fig. 4. Music tempo and design behavior

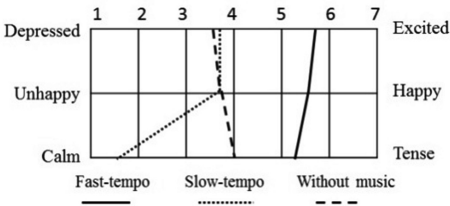


Fig. 5. Music tempo and emotion perception

5 Discussion

During design seasoning containers, the participants perceived design behavioral and emotional feelings were influenced by listening to fast-tempo music, slow-tempo music, and without-music listening. The possible reasons descriptive as below.

5.1 Influence of Music Tempo Affects Design Behavior on Design Creativity

The experiment results showed that, when listening to fast-tempo music, the subjects generated more seasoning container ideas, and demonstrated better fluency of their idea sketches. Such phenomenon may be caused by the interconnection between the music tempo and people’s perceptions, and thus, influence behavioral reaction [6]. In addition, the design behavior assessment showed listening to fast-tempo music can speed up subjects’ thinking pace and drawing speed (Fig. 4), meaning that more times of design thinking and drawing behaviors being performed in the same unit time [19], thus, more ideas will be generated and enhanced the fluency of creative ideas. Since more ideas were generated, that may result in more types of creative ideas as well as indirect improve the flexibility of ideas.

The subjects under slow-tempo music showed that, their design thinking and drawing speed tended to be slower and higher concentration (Fig. 4), which might help them to carefully consider how to overcome the problems of seasoning containers, and further generate ideas from the existing product framework. Therefore, the condition of slow-tempo music prompted subjects to generate creative ideas with originality and feasibility, which encouraged the elaboration of idea sketches.

Under the without-music situation, subject’s idea sketch elaboration obtained high scores, which were the same as slow-tempo music listening; however, the reasons may be not the same. Since a lack of music stimulates the non-music listening condition, the subjects perceived neutral design thinking and drawing pace. This study speculates that idea elaboration obtained better performance under the without-music condition, which may be unrelated to design behavior perception, and may be attributed to the small amount of generated idea sketches. Therefore, they had extra time to detail their drawing sketches or note idea features, and this result indirectly improved the

elaboration of idea sketches with better performance. However, the exact reasons for this phenomenon require further investigation in the future.

5.2 Influence of Music Tempo Affects Emotional Feelings on Design Creativity

In the perspective of emotion perception, under fast-tempo music, the subjects' feelings were inclined to the emotion of excitement with the positive affect of low activation, and the emotion of happiness with positive affect medium activation (Fig. 5). This result verified that, fast-tempo music can induce positive emotions, as proposed in previous relevant studies [11], and the fact that people can develop more solutions and proposals under positive emotions [18]. Therefore, the fluency of design concepts can be improved by transforming them into positive affect. Moreover, under fast-tempo music, the flexibility of creative ideas is better. The reason may be that people are more relaxed and carefree under positive emotions, and thus, deal with things more flexibly and willing to accept different proposals [20, 21]. Therefore, the positive emotions, as induced under fast-tempo music, may help to improving the flexibility of creative ideas.

The subjects' originality, elaboration, and feasibility of creative ideas obtained better performance when listening to slow-tempo music. The reason might be that, during idea generation, the subjects perceived the calm emotion of lower activation under slow-tempo music (Fig. 5), which could help cool down their mind and concentrate on design problems. As indicated by Yamamoto, slow-tempo music can decrease heartbeat, reduce pressure, and relieve the tense atmosphere of an experimental task, which is beneficial to fulfillment of the design task [15]. Therefore, listening to slow-tempo music induces the perception of emotions of lower activation, which may help designers propose ideas with better originality, elaboration, and feasibility.

Under the without-music situation, the subjects perceived neutral affect and moderate activation of emotion. This study speculates that idea elaboration obtained better performance, which may not be concerned with emotion perception, but instead, be attributed to the small amount of generated idea sketches. The actual reason this study was unable to provide a specific explanation, meaning the same as the without-music situation effect on design behavior, requires further investigation in the future.

6 Conclusions and Suggestions

This study used the subjects' actual designs of seasoning containers to investigate the influence of music tempo on idea generation. The results showed that, music tempo will interact with people's behavioral reaction and emotion feelings, which further affect design creativity. The subjects listening to fast-tempo music developed more creative ideas and exhibited higher fluency and flexibility of ideas, while the subjects listening to slow-tempo music, the originality, elaboration, and feasibility of their ideas were better. However, the idea elaboration was enhanced when listening to slow-music and non-music situations.

The study suggests that designers could listen to fast-tempo music when they require lots of ideas in a short period of time, while slow-tempo music is a good choice when they are looking to break through a thinking barrier. Although this study applied the practical design of seasoning containers to investigate the relationship between music tempo and idea creativity, as compared with a real design project, the design of a seasoning container in 40-min was too short to achieve deep insight into the relationship between music tempo and idea generation. Future studies are advised to introduce music into a design project to perform long term observation, which may help to clearly identify the relationships between music and design creativity.

References

1. North, A.C., Shilcock, A., Hargreaves, D.J.: The effect of musical style on restaurant customers' spending. *Environ. Behav.* **35**(5), 712–718 (2003)
2. Yeoh, J.P.S., North, A.C.: The effect of musical fit on consumers' preferences between competing alternate petrols. *Psychol. Music* **40**(6), 709–719 (2012)
3. Schellenberg, E.G., Nakata, T., Hunter, P.G., Tamoto, S.: Exposure to music and cognitive performance: tests of children and adults. *Psychol. Music* **35**(1), 5–19 (2007)
4. Nittono, H., Tsuda, A., Akai, S., Nakajima, Y.: Tempo of background sound and performance speed. *Percept. Mot. Skills* **90**(3), 1122 (2000)
5. Liao, C.-M., Chang, W.-C.: A survey on effects of music on design association. *Bull. Jpn. Soc. Sci. Des.* **61**(5), 47–56 (2015)
6. Kamien, R.: *Music: An Appreciation*. McGraw-Hill, Boston (2000)
7. Bishop, D.T., Wright, M.J., Karageorghis, C.I.: Tempo and intensity of pre-task music modulate neural activity during reactive task performance. *Psychol. Music* **42**(5), 714–727 (2014)
8. Husain, G., Thompson, W.F., Schellenberg, E.G.: Effects of musical tempo and mode on arousal, mood and spatial abilities. *Music Percept.* **20**(2), 151–171 (2002)
9. McKnight, R.: Does listening to slow tempo classical music during independent writing affect children's on-task performance. Education Resources Information Center, ED 430 898 (1998)
10. Hallam, S., Price, J.: Can the use of background music improve the behaviour and academic performance of children with emotional and behavioural difficulties? *Br. J. Spec. Educ.* **25**(2), 88–91 (1998)
11. Webster, G.D., Weir, C.G.: Emotional responses to music: interactive effects of mode, texture, and tempo. *Motiv. Emot.* **29**(1), 19–39 (2005)
12. Hunter, P.G., Schellenberg, E.G., Schimmack, U.: Feelings and perceptions of happiness and sadness induced by music: similarities, differences, and mixed emotions. *Psychol. Aesthet. Creativity Arts* **4**(1), 47–56 (2010)
13. van der Zwaag, M.D., Westerink, J.H.D.M., van den Broek, E.L.: Emotional and psychophysiological responses to tempo, mode, and percussiveness. *Musicae Scientiae* **15**(2), 250–269 (2011)
14. Holbrook, M.B., Anand, P.: Effects of tempo and situational arousal on the listener's perceptual and affective responses to music. *Psychol. Music* **18**(2), 150–162 (1990)
15. Yamamoto, M., Naga, S., Shimizu, J.: Positive musical effects on two types of negative stressful conditions. *Psychol. Music* **35**(2), 249–275 (2007)
16. Russell, J.A.: A circumplex model of affect. *J. Pers. Soc. Psychol.* **39**, 1161–1178 (1980)

17. Russell, J.A., Carroll, J.M.: On the bipolarity of positive and negative affect. *Psychol. Bull.* **125**(1), 3–30 (1999)
18. Vosburg, S.K.: The effect of positive and negative mood on divergent-thinking performance. *Creativity Res. J.* **11**(2), 165–172 (1998)
19. Pronin, E., Jacobs, E.: Thought speed, mood, and the experience of mental motion. *Perspect. Psychol. Sci.* **3**(6), 461–485 (2008)
20. Abele-Brehm, A.: Positive and negative mood influences on creativity: evidence for asymmetrical effects. *Pol. Psychol. Bull.* **23**(3), 203–221 (1992)
21. Murray, N., Sujan, H., Hirt, E.R., Sujan, M.: The influence of mood on categorization: a cognitive flexibility interpretation. *J. Pers. Soc. Psychol.* **59**(3), 411–425 (1990)
22. Kaufmann, G.: The Effect of Mood On Creativity in the Innovation Process. In: Shavinina, L.V. (ed.) *The International Handbook on Innovation*, pp. 191–203. Elsevier Science Ltd., Oxford (2003)
23. Schwarz, N.: Feelings as information: informational and motivational functions of affective states. In: Higgins, E.T., Sorrentino, R.M. (eds.) *Handbook of Motivation and Cognition: Function of Social Behavior*. Guilford Press, New York (1990)
24. Guilford, J.P.: *The Nature of Human Intelligence*. McGraw-Hill, New York (1967)
25. Amabile, T.M.: *Creativity in Context*. Westview Press, Colorado (1996)
26. Purcell, A.T., Gero, J.S.: Drawings and the design process: a review of protocol studies in design and other disciplines and related research in cognitive psychology. *Des. Stud.* **19**(4), 389–430 (1998)
27. Hocevar, D., Bachelor, P.: A taxonomy and critique of measurements used in the study of creativity. In: Glover, H.A., Ronning, R.R.C., Reynolds, R. (eds.) *Handbook of Creativity*, pp. 53–59. Plenum Press, New York (1989)
28. Sternberg, R.J.: *Handbook of Creativity*. Cambridge University Press, New York (1999)
29. Ali, S.O., Peynircioğlu, Z.F.: Songs and emotions: are lyrics and melodies equal partners? *Psychol. Music* **34**(4), 511–534 (2006)