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Effect of Background Music and Visual Display on Shopping Website Browsing and Purchasing Process

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Abstract

Recently there are many websites place background music to attract browsers' attention. However, on-line consumer behavior is a complex decision making process. It involves website browsing, product information search, alternatives evaluation and purchase decision making. Background music can play the distractor or the arousal inducer in the decision process. It is important to know the role of the background music in the decision process. Further, website aesthetics and social presence are often used to affect consumers' emotion and approach/avoidance behavior through visual display. The purposes of this study are to investigate the effect of background music and visual display on consumers' browsing and purchasing decision for shopping website. Two types of background music placement modes, 0-2 min fading-in and no music throughout were proposed and undertaken. Higher and lower emotional visual displays were conducted in designing of shopping website. Two decision levels, simple and difficult, were also investigated. Overall, 48 participants are volunteered in this study. Participants are asked to browse an on-line dress store. Participant's brain wave was conducted to extract brain wave data during the browsing and purchasing process by a 32 channel electroencephalogram (EEG) electrodes. Four EEG rhythms are filtered by delta, theta, alpha and beta. Rhythm powers and channel pair coherences are estimated. Results of EEG Power data analysis showed that the background music has no influence in browsing stage but the visual display has. In decision-making stage, background music, visual display, and decision task difficulty all have significant effects on browsers' EEG.

Key words: *Electroencephalography (EEG), shopping website, background music, visual display, browsing, decision making.*
JEL Classification: *c91.*

1. Introduction

Consumer on-line behaviors are more important than ever due to the high growth of on-line shopping. As in brick-and-mortar environments, atmospheric cues have been posited to influence consumers on the web. A variety of stimuli of shopping website will affect consumers react to the shops. However, research on web atmospherics thus far is limited in its theoretical explanation of why web atmospherics influences consumers. Dailey (2004) indicated that web atmospheric researchers should begin to focus on specific web atmospheric cues (that is, color cues, navigation cues, etc.) and theoretical explanations of how and why these cues may influence consumers. As a natural departure from the stimuli present in a traditional retail store, the online retail environment can only be manipulated by visual and auditory cues. In the past, research into online stores focused on the design of website structure and interface from visual stimuli, few carried on the discussion to auditory stimuli. Recently many websites place background music to attract visitors' attention. Some research has recently studied the effect of background music on consumer responses, and this research must assume the existence of background music (Wu et al., 2008). However, this premise is not necessarily tenable as visitors to the website may stop the broadcast. To discuss the effect of background music on an online store it is necessary to allow visitors to first accept the existence of background music. Lai, Chang and Lin (2012) indicated that playing background music with placement point or fade-in period is beneficial for the on-line shopping atmosphere. It is inappropriate to place background music at the start of browsing on a shopping website

On-line consumer behavior is a complex decision making process. It involves website browsing, product information search, alternatives evaluation and purchase decision making. The demand of mental resources for each step is different. The effect of background music on different step could be different. However, few studies defined the difference between the browsing and purchasing decision making. Further, website aesthetics and social presence are often used as visual stimuli to affect consumers' emotion and approach/avoidance behavior (Tractinsky and Lowengart, 2007). The combinative effects of website visual aesthetics and background music on emotions would be different. The performance of multi-attribute decision making has been found to be affected significant by the level of task difficulty. Background music can play the distractor or the arousal inducer in the decision process (Day et al., 2009). It is important to know the role of the background music in the decision process.

To explain the influence of atmospheres on consumers, atmospheric research has focused heavily on the Mehrabian-Russel effect model (Mehrabian and Russel, 1974). Donovan and Rossiter (1982) tested the Stimulus-Organism-Response (S-O-R) framework in a retail store environment and examined Mehrabian and Russell's three-dimensional pleasure, arousal, and

dominance (PAD) emotional experience as the intervening organism state. A number of studies have been conducted using effective response as a measurement of shoppers in a retailer store environment (Dailey, 2004; Eroglu et al., 2001; Donovan and Rossiter, 1982). According to different theoretical perspectives, background music has been focus acting on listeners' cognitive processes (Kellaris et al., 1993). Cognitive responses, such as shoppers' attention and memory, are also critical for the assessment of atmospheric cues.

The relation between music and brain waves is also an attractive issue. Bhattacharya et al. (2001) have explored the relevance of gamma brain waves and music perception between expert musicians and non-musicians. Data show that there is a significant increase in gamma wave power in the expert musician compared to the non-musician, yet there is no difference between the two groups when listening to stories and taking a rest. Koelsch and Mulder (2002) measured the electroencephalogram (EEG) when listening to Haydn, Mozart, Beethoven and Schubert sonatas. There were two versions of Haydn's Piano Sonata (Hoboken XVI: 48), one is the original version and the other is slightly modified with deliberate changes to make it less harmonious. The EEG amplitude on the right temporal lobe at 0.25 s after the unexpected melody is significant different between these two versions. Chien et al. (2005) found that the alpha wave is an important index for pleasure induced by music. Fp1 and F7 are the two main EEG channels for observing the listening response to joyful music.

EEG has also been used to estimate emotional states (Kim et al., 2013). Being able to observe significant change in electroencephalography (EEG) with complex decision making, the EEG could be effectively used to predict behavior and brain function in relevant situations (Qin, Perdoni, and He, 2011). Accordingly, the purposes of this study are to investigate the effect of background music and visual display on consumers' browsing and purchasing decision for shopping website using electroencephalography.

2. Method

2.1 Experimental Design

There are two types of background music placement modes, 0-2 min fading-in and no music throughout were proposed and undertaken. The 0-2 min fade-in method refers to the volume of background music increases linearly from zero to 60 dB in two min. Higher and lower emotional visual displays were conducted in designing of shopping website. Two decision levels, simple and difficult, were also investigated.

To prevent the participants from producing learning effects and experiencing fatigue, varied independent variable levels were used in the between-subject design. The participants were randomly assigned to one of 8 experimental groups. The purchasing processes used in online stores (browsing and purchasing decisions) were also considered, and the experimental process was divided into 2 stages. During the first stage (browsing) the background music

was introduced at 0–2 min faded. At the second stage (purchasing decision), background music was played throughout the entire experiment. The group who did not listen to background music throughout the experiment was used as a control group.

The experimental Website used in this study was an on-line dress store, which was designed specifically for this study. To conform to an actual shopping Website environment, the overall Website presentation comprised 8 dresses and a 3-layer Website link structure. The experimental Website included a main page, 8 product information pages, and a final product purchase page, comprising 10 pages overall (Figure 1).

In this study, Gold Wave music editing software was used to adjust the music volume from low to high during the 0–2 min fade-in duration. The first movement ("Spring") of Vivaldi's The Four Seasons violin concerto was used as the experimental background music. The length of the musical track was 4 min 10 s. To prevent the music from stopping and interrupting the experiment, the single-song repeat setting was used to play the background music continually.

2.2 Participants

A total of forty-eight university students (twenty-four male and twenty-four female) were recruited as participants in the experiment.The average age of the participants was 22.65 years. The time in which each student participated in the experiment was approximately 1 h. The participants were randomly assigned to one of 8 experimental groups and each group included 3 men and 3 women. None of the participants was colour blind or had been diagnosed with other eye diseases. Their post correction vision was 0.9 or above, and they did not have hearing damage. After the experiments were completed, the participants were given NT$200 as a reward for participating in the experiment.

Figure1: Shopping website structure

	High emotional visual display website	Low emotional visual display website
Main page		
Product information page		
Product purchasing page		

2.3 Experimental Operations and Procedures

The participants were tested individually in the experimental setting. This experiment required the participants to browse through all the dresses in the Internet dress store and complete the product purchase process. Before the 2 experimental stages began, the participants were provided with task implementation and action directions. EEG measurement was conducted to extract brain wave data during the browsing process. A consent form was signed by all the participants before the experiment began and they were asked to wear the EEG electrodes. After the experiment started, the participants rested with their eyes closed for 1 min, and then rested for an additional 1 min with their eyes open to ensure that their brain waves were stable. Before browsing the Website, the participants were asked to view the key online directions. After confirming that no errors were present, the participants pressed "confirm" to enter the homepage of the experimental Website and begin browsing the Website. After entering the main page, the participants could browse dresses either randomly or according to dress category based on their personal preferences. However, they were required to browse through all 8 dresses. Once all the dresses had been viewed, the "browsing completed" button could be selected to enter the product purchase page. Before entering the product purchase page, the instruction page informed the participants to select the dresses they wished to purchase for simple purchase decision. For difficult purchase decision, the participant was asked to select the dresses under a limited budget. After confirmation, the participants selected the "begin purchase" button to enter the product purchase page and begin purchasing their desired dresses. Approval for this study was given by the Asia University Medical Research Ethics Committee.

2.4 Equipment and Data Analysis

In this study, the SynAmps system developed by Neuroscan, which uses a 32-channel EEG cap to obtain brain wave signals, was used. The Scan NuAmps Express brain signal amplifier developed by Neuroscan was used to amplify the brain wave signals and conduct analogue-to-digital signal processing. The signals were outputted to Neuroscan 4.3 brain-wave extraction software, which had a low-frequency system filter setting of 0.05 Hz, a high-frequency filter setting of 50 Hz, and a sampling frequency of 1000 Hz. Useable brain waves were intercepted and outputted into data files to conduct follow-up data analysis. After the browsing and purchasing were finished, participants' emotional state and electroencephalogram (EEG) were collected for the analysis. EEG was recorded from the beginning of eye close at rest to the end of purchase completed. Analysis of variance (ANOVA) was conducted in the data analysis.

3. Results and Discussion

Table1 showed that there was no significant difference for the background music

placement mode except the Theta rhythm on the TP7 channel during the browsing stage. However, the visual emotional display had significant effect in the Theta rhythm on the T3, TP7, T5, and O1 channels, Alpha rhythm on the FP2 channel, and Beta rhythm on the F7, FC3, C3, and P3 channels. The low visual emotional visual display had greater EEG power than for the high emotional display. During the decision-making stage, the background music placement mode had significant effect in the Delta rhythm on the FP1, F3, FZ, FCZ, and FC4 channels, and Beta rhythm on the CP3 and TP8 channel. The visual emotional display had significant effect in the Delta rhythm on the F8 channel, Theta rhythm on the T5 channel, Alpha rhythm on the F7, FT7, FT8, T3 and T6 channels, and Beta rhythm on the F7, C3, T4, CP3 and P3 channels.

Data analysis of EEG power showed that there are many significant electrodes sites of Theta, Alpha and Beta rhythms in the browsing process for the level of visual emotional display. There were less significant differences for the background music placement mode. It indicated that visual emotional stimuli may have more influence than background music.

Table1: Results of EEG power difference for the background music placement mode and visual emotional display

Stage	Rhythm	0-2min fad-in vs. no music throughout	Low vs. high visual emotional display
Browsing	Delta	N.S	N.S
	Theta	TP7*	T3*、TP7***、T5*、O1*
	Alpha	N.S.	FP2*
	Beta	N.S	F7*、FC3*、C3*、P3*
Decision	Delta	FP1**、F3*、FZ*、FCZ*、FC4*	F8*
	Theta	N.S.	T5*
	Alpha	N.S.	F7*、FT7*、FT8*、T3*、T6*
	Beta	CP3*、TP8**	FT7*、C3*、T4**、CP3**、P3**

Table2 showed that the EEG power difference for the decision level during the decision stage. There were significant effects in the Delta rhythm on the FP1, F3, FZ, F4, FCZ, FC4, T6, and O1 channels, Alpha rhythm on the FP1, F4, and F, and Beta rhythm on the F7, F8, T3, CP3, TP8, and P3 channels. The results showed that Delta waves occurred at the highest number of significant electrode positions. The power values for difficult purchase decision were greater than for simple purchase decision.

Table2: Results of EEG power difference for the decision level during the decision stage

Rhythm	Simple decision vs. difficult decision
Delta	FP1*、F3*、FZ*、F4*、FCZ**、FC4*、T6*、O1*
Theta	N.S.
Alpha	FP1*、F4*、F8**
Beta	F7*、F8**、T3*、CP3*、TP8*、P3*

4. Conclusions and Recommendations

The results showed that the background music has no influence during browsing stage but the visual display has. During decision-making stage, background music, visual display and decision task difficulty all have significant effects on browsers' EEG. In this study, the browsing and decision-making stages were effectively distinguished. The marketer must be careful in manipulating the placement methods of background music for a web store. However, this study was an initial study. The EEG data can provide physiological evidence rather than the traditional subjective measures. Though the relationships between the measures have not been examined clearly in the present study, it can be a good model for further studies. Numerous factors influence purchasing behavior, such as the time that music is introduce, the music type, volume, and the relationship of the music and the product type. These factors also require further study.

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