Emotional and cognitive response to placement method of background music in shopping website

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Consumer on-line behaviors are more important than ever due to the high growth of on-line shopping. The main purposes of this study is to design placement methods for background music for shopping websites and examine the effects of these methods on on-line shoppers’ emotional and cognitive responses. Two placement methods of background music, that is, placement point and fade-in period for shopping websites were proposed and undertaken in a laboratory experiment. Participants’ emotional state, approach-avoidance behavior intention, recalling accuracy, action to adjust music volume and electroencephalogram (EEG); were collected. The results indicate 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; thus the marketer must be careful in manipulating the placement methods of background music for a web store. The combination of EEG and subjective measure for background music effect analysis used in this research is a novel approach and the EEG involved data that 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.

Key words: Background music, shopping website, placement, fade-in, electroencephalogram (EEG).

INTRODUCTION

The impacts of atmospherics on the nature and outcomes of shopping in brick-and-mortar environments have been examined by researchers for some time. Online retailing has attracted a great deal of attention in recent years due to the rapid developing of the Internet and research into consumer on-line behavior which has become more important than ever. Dailey (2004) defined web atmospherics as “the conscious designing of web environments to create positive effects (for example, positive effect, positive cognitions, etc.) in users in order to increase favorable consumer responses (for example, site revisiting, browsing, etc.). Eroglu et al. (2001) proposed a typology that classifies web atmospheric cues into high task-relevant cues (for example, descriptions of the merchandise, the price, navigation cues, etc.) and low task-relevant cues (for example, the colors, borders and background patterns, typestyles and fonts, music and sounds, etc.). These cues form the atmosphere of a web site. Empirical work in the area has examined specific atmospheric cues and their effects on shopper response. Some researchers have already begun to call for more systematic research into the nature of this format by using established retailing and consumer behavior theories. Bitner (1992) argued that music is a critical ambient condition of the servicescape and that music influences people’s emotions, physiological feelings and mood. Various structural characteristics of music, such as
time (rhythm, tempo and phrasing), pitch (melody, keys, mode and harmony), and texture (timbre, orchestration and volume), influence consumer response and behavior (Bruner II, 1990). There have been a number of studies that investigate the effect of background music on the physical environment in the interest of various research fields, for example, advertising, retail/manufacturing and ergonomics (Herrington and Capella, 1994; Oakes, 2000).

As in brick-and-mortar environments, atmospheric cues have been posited to influence consumers on the web. However, research on web atmospheres 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. The present study initially addresses this issue by focusing specifically on the design of placement methods of music cues on a website.

To explain the influence of atmospheres on consumers, atmospheric research has focused heavily on the Mehrabian-Russel effect model (Mehrabian and Russell, 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 measure 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.

A possible general explanation for the effect of background music can be based on the mediating factor of attention (Jones, 1999; Kahneman, 1973). Background music can play at least two different roles in the operation of attention, that is, the distractor versus the arousal inducer. From the distractor perspective, both browsing a website and processing background music are basically assumed to be cognitive activities demanding the attention resource (Jones, 1999). On the other hand, from the arousal inducer perspective, background music may affect the arousal level of listeners, increasing the total amount of momentary mental resource available for browsing the website and thus, impacting the recalling of memory. According to the distractor perspective, the performance of a task is impaired by the interruption of background music. While from the arousal inducer perspective, it is improved by the supplement of resource stimulated by the background music. This contradiction makes the prediction of the background music effect problematic.

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. Lin's study revealed that five EEG channels: Cz, T4, T3, F7, and F3 are very sensitive to music (Lin, 2005). 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.

In summary, the main purposes of this study is to design a placement method for background music for the duration of web browsing and examine the effects of these placements on visitors’ emotional and cognitive responses. The measures of pleasure and aroused emotional state, approach-avoidance behavior intention, recalling accuracy of website commodity, and action to adjust music volume were collected. EEG records were also measured to explore the relation between emotional and cognitive responses.

**METHODOLOGY**

This study proposed two placement methods of background music for shopping websites. The first method considered the placement point of background music during the browsing. Three entry points from the start of browsing: 2 min. (PL2), 4 min. (PL4), and 6 min. (PL6) were considered. Background music was played from the entry point with 60 dB intensity. The second method was the fade-in period of background music. The fade-in period of background
music refers to the time interval of music volume increasing linearly from zero to 60 dB. 2 min. (FA₂), 4 min. (FA₄), and 6 min. (FA₆) of fade-in period was considered in the experiment. Both browsing without music (None) and browsing with constant music volume (Full) for the whole experiment session were treated as control groups. In total, the experiment consisted of eight treatment levels. Figure 1 shows the conceptual framework of the placement methods. A between-subject experiment was performed to explore the effects of these placement methods on visitors’ response.

**Simulated book store website**

An online book store was designed and served as the context of this experiment. There was a home page, a merchandise page and a purchase merchandise page on the website. The home page consisted of twenty books with five categories, which were introduced for participants to browse. The merchandise page provided detailed information such as author, price, publisher and abstracts for each book. The configuration of the book website is shown in Figure 2. The simulated shopping website was developed via a PHP program and combined with MySQL database system.

**Background music**

Tempo has been considered representative of an essential dimension of music and has received wide attention in previous research (Bruner II, 1990; Kellaris and Rice, 1993). Because the faster music can induce a more pleasant effective response than slower music, we conducted the classical work Vivaldi’s “The Four Seasons, Concerto No. 1, Spring” as background music. It is an allegro with a tempo of 120 BPM. The length time of the music in the experiment was 4 min and 10 s. It was played repeatedly. The maximum volume was set at 60db, which was considered to be a comfortable level for shopping (Kellaris and Rice, 1993). The music was edited by Gold Wave software. Music volume was from zero to maximum in 0 min, 2 min, 4 min and 6 min.

**Participants**

A total of forty-eight university students (twenty-four male and twenty-four female) who were between nineteen and thirty years old (M= 22.6, SD = 2.6) were recruited as participants in the experiment. There were six participants (three male and three female) involved in each level. Each participant has surfing experience on the internet for one year at least. More than 90% of participants have online shopping experience. They were paid a cash reward of NT$ 150 for their participation.

**Tasks and procedures**

The participants were tested individually in the experimental setting. Participants were asked to browse the website and then complete a purchase task. A variable amount of time to browse was allowed for as long as the participants required. A shopping description was introduced before the experiment. Before browsing, participants were asked to close their eyes for one minute, then open their eyes for one minute, and then start to browse the website. Background music was played according to the experimental treatments. After the browsing and purchasing were finished, participants’ emotional state, approach-avoidance behavior intention, recognition memory of online store contents was collected for the analysis. An EEG was recorded from the beginning of eye close at rest to the end of purchase completed.

**Dependent measures and data analysis**

The dependent measures collected in this experiment consisted of emotional state, approach-avoidance behavior intention, recognition memory of online store and EEG record as follows:

(1) **Emotional state:** Mehrabian and Russell’s 12-item semantic differential scale with 7-point Likert scale was employed as the emotional response measure (Mehrabian and Russel, 1974). Pleasure and arousal were considered for the analysis. Pleasure is the degree to which individual’s feel good, happy, joyful and satisfied. Surveys are inclusive of the following adjectival terms: unhappy-happy, trouble-joyful, blue-satisfactory, desperate-hopeful, and boring-easy. Arousal is the degree to which individuals feel excitement, stimulation, alertness and activeness in a specific situation. Surveys are inclusive of relax-crazy, acanthiexcitement, stress-calm, sluggish-sleepy, dull-tense.

(2) **Approach-avoidance behavior intention:** The level of agreement with four statements on a 7-point Likert scale was collected to indicate participants’ approach-avoidance behavior intention. The actions for a participant to adjust music volume or to turn music off were also observed and recorded.

(3) **Memory recalling:** A test consisting of twenty-five questions about the book information described on the merchandise page of the experimental website was used to measure the recognition memory of online store content. Recalling accuracy of website commodity was 100 times the number of correct responses divided by 25.

(4) **EEG record:** A Neuro Scan system was used to record EEG data with a sampling frequency of 1,000 Hz. EEG channels Fp1, Fp2, F7, F8, T3, T4, Cz, Pz, P3 and P4 were chosen for further analysis. EEG data was analyzed by software Scan4.3.1 with window size 1 min for baseline and 2 min for experiment session. Alpha rhythm powers (8 to 12 Hz) were extracted.

The mean and standard derivations of participant’s response were estimated. Analysis of variance (ANOVA) was used to examine the statistical difference for experiment levels. Paired t-test was used to test EEG power variation before and after background music placement.

**RESULTS**

Table 1 shows the means and standard deviations of
Figure 2. The configuration of the book website (a) Home Page (b) Merchandise Page (c) Purchasing Page.
emotional response and approach-avoidance behavior intention under each level of placement method. Descriptive statistics demonstrated that participants had higher levels of pleasure and arousal for all placement points (PL2, PL4, PL6) and fade-in periods (FA2, FA4, FA6) than for none music (None) and full music (Full). For the pleasure, all eight levels are greater than average pleasure mood (scale=4). For the arousal, all eight levels are greater than average arousal mood. The lowest average arousal mood is 2.92 for non-music (None) and full music (Full). For the approach, all eight levels showed there were no statistical differences.

The frequencies of adjusting music volume or of turning music off are also summarized in Table 1. It was found that most of the participants (83.3%, 5/6) for Full level adjusted the volume of background music. Only 16.7% (3/18) of participants for placement point and 44.4% (8/18) for fade-in period adjusted the volume.

Background EEG wave with eyes closed is often dominated by alpha waves of (8 to 12 Hz), and alpha power is depressed when the eyes are open. The one minute alpha power of EEG for eyes closed, eyes open while browsing the website are listed in Table 2. As expected, there is significant difference between first minute eyes closed resting and eyes open resting. An interesting phenomena is that the alpha power of eyes open while browsing the website is slightly different on P2, P3 and P4 channels (p<0.05*). These channels are vision related areas, and are affected by visual stimulation on the website.

Further examination of alpha wave power scalp mapping patterns before and after two minutes of each placement point (Figure 3) showed there is stronger...
alpha power in the right frontal channels. Detail alpha power variation is organized in Table 3. Paired t-test showed there were significant differences due to placed background music on channel Fp1 (p<0.01**) at 4 min placement point (PL₄), and on channels F8 (p<0.05*), T4 (p<0.01**) at 6 min placement point (PL₆) respectively. This result showed that EEG alpha power was definitely affected by placement of background music. However, there was no significant difference among different placement points (PL₂, PL₄, PL₆) by ANOVA analysis.

### DISCUSSION

The purpose of this study was to investigate suitable placement point or fade-in period of background music, which can affect website visitors’ behavior. The results showed that participants experienced greater pleasure when they were exposed to Vivaldi’s “The Four Seasons, Concerto No. 1, Spring” which was conducted in the experiment as fast-tempo music. The results are consistent with the conclusions of Bruner II (1990). He summarized that faster music can induce a more pleasant effective response than slower music. However, the results found that all placement points (PL₂, PL₄, PL₆) and fade-in periods (FA₂, FA₄, FA₆) had higher levels of pleasure than for none music (None) and full music (Full). It was also found that most of the participants (83.3%) adjusted the volume of full background music. Full music that is, browsing with constant music volume in this study could be treated as a distractor while visiting an online shopping store. One possible reason for the observed tendency is the increased information load (Day et al., 2009; Payne, 1976). When participants were under the full music condition, their information load increased due to the fact that they need to process more pieces of auditory information. The processing of music will consume the mental resources from the beginning of browsing, the overloading of mental resources will lead to impaired browsing task.

Hui et al. (1997) indicated that people in a positively valenced music condition produce more positive emotional response than people in a negatively valenced music or no music condition. Full music in this study could be regard as a negatively valenced music. In contrast to the full music, playing background music after browsing for a certain period (placement point) or increasing music volume linearly (fade-in) could induce higher pleasure, arousal and approach behavior intention. The results suggest that it is inappropriate to place background music at the start of browsing a shopping website. The marketer must carefully manipulate placement methods of background music for a web store.

For the arousal measure, however, all levels of background music placement methods are less than average arousal mood (scale=4). These results are not consistent with the findings of previous researches (Bruner II, 1990; Garlin and Owen, 2006; Wu et al., 2008). Their study indicated that participants felt more aroused and experienced greater pleasure when they were exposed to fast-tempo music. A possible explanation is the participants’ task in the experiment. In this study, participants were asked to browse the website and then complete a purchase task with a variable amount of time as long as the participants required. This
Table 3. Statistics and paired t-test result of EEG alpha wave power at before and after two minutes of each placement point.

<table>
<thead>
<tr>
<th>Channel</th>
<th>PL&lt;sub&gt;2&lt;/sub&gt; Mean(S.D.)</th>
<th>P value</th>
<th>PL&lt;sub&gt;4&lt;/sub&gt; Mean(S.D.)</th>
<th>P value</th>
<th>PL&lt;sub&gt;6&lt;/sub&gt; Mean(S.D.)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fp&lt;sub&gt;1&lt;/sub&gt; Before</td>
<td>3.068(1.258)</td>
<td>2.853(1.266)</td>
<td>3.117(1.720)</td>
<td>0.090</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>3.041(0.966)</td>
<td>2.684(1.268)</td>
<td>2.568(1.212)</td>
<td>0.005*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fp&lt;sub&gt;2&lt;/sub&gt; Before</td>
<td>3.241(1.137)</td>
<td>2.940(1.371)</td>
<td>3.355(1.637)</td>
<td>0.090</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>3.345(1.158)</td>
<td>2.648(1.135)</td>
<td>2.689(1.071)</td>
<td>0.090</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F&lt;sub&gt;7&lt;/sub&gt; Before</td>
<td>2.461(0.990)</td>
<td>2.212(1.014)</td>
<td>2.378(0.915)</td>
<td>0.124</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>2.510(0.807)</td>
<td>2.186(1.088)</td>
<td>2.074(0.613)</td>
<td>0.158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F&lt;sub&gt;8&lt;/sub&gt; Before</td>
<td>2.667(1.366)</td>
<td>2.351(1.444)</td>
<td>2.517(0.864)</td>
<td>0.050*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>2.691(1.418)</td>
<td>2.109(0.800)</td>
<td>2.023(0.594)</td>
<td>0.320</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T&lt;sub&gt;3&lt;/sub&gt; Before</td>
<td>1.989(1.340)</td>
<td>1.733(1.418)</td>
<td>1.687(0.656)</td>
<td>0.050*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>1.856(1.241)</td>
<td>1.692(1.382)</td>
<td>1.505(0.376)</td>
<td>0.320</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cz Before</td>
<td>3.927(1.624)</td>
<td>3.042(1.819)</td>
<td>3.525(1.497)</td>
<td>0.050*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>3.398(0.926)</td>
<td>2.701(1.100)</td>
<td>2.967(1.090)</td>
<td>0.101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T&lt;sub&gt;4&lt;/sub&gt; Before</td>
<td>2.125(1.503)</td>
<td>1.972(1.125)</td>
<td>1.705(0.377)</td>
<td>0.006*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>2.171(1.410)</td>
<td>1.921(1.095)</td>
<td>1.372(0.275)</td>
<td>0.704</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P&lt;sub&gt;3&lt;/sub&gt; Before</td>
<td>2.453(1.027)</td>
<td>2.169(1.349)</td>
<td>2.226(0.732)</td>
<td>0.434</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>2.496(0.764)</td>
<td>2.045(1.065)</td>
<td>2.140(0.804)</td>
<td>0.405</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P&lt;sub&gt;5&lt;/sub&gt; Before</td>
<td>3.695(1.421)</td>
<td>3.019(1.786)</td>
<td>3.167(1.749)</td>
<td>0.050*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>3.789(1.172)</td>
<td>2.667(1.141)</td>
<td>2.817(1.249)</td>
<td>0.445</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P&lt;sub&gt;4&lt;/sub&gt; Before</td>
<td>3.402(1.468)</td>
<td>2.832(1.581)</td>
<td>2.642(1.338)</td>
<td>0.006*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After</td>
<td>3.684(1.343)</td>
<td>2.408(1.141)</td>
<td>2.469(1.051)</td>
<td>0.445</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05

task only needs simple decision-making. Faster tempo music was found to improve the accuracy of harder decision-making only, not that of easier decision-making (Day et al., 2009). Kellaris and Kent (1994) also indicated that the empirical supports for the effects of background music would seem to be mixed. It has been further suggested that the effect of background music is moderated mainly by the multidimensional nature of both task (Furnham and Bradley, 1997) and music (BrunerII, 1990; Kellaris and Kent, 1994). Browsing task difficulty should be administrated in the future research to explore the effects of background music in shopping website.

A combination of EEG and subjective measures for background music effect analysis is a novel approach, although there are already some articles investigating consumer behaviors by EEG. This article reveals that there is correlation between EEG alpha wave power and participants’ pleasure when browsing a website with music stimulation. There is no significant finding of EEG between different music placement points/fade-in period levels, which may be due to complex brain activity involvement. Three major stages are involved, the first brain stage is visual browsing, the second is decision, and the third is music stimulation. When background music is turned on the participant’s brain stage may be in a visual browsing stage or in a decision stage. The interaction between both stages with music is still an unknown effect. The time scale of the three stages is not known due to dynamic stage transition from one brain stage to another. Therefore, the average EEG power difference before and after background music placement is not significant statistically.

The EEG data can provide physiological evidence rather than a traditional subjective questionnaire result. In addition, there are still many factors influencing consumer decisions with background music, such as music styles, consumer appetite for music, shopping website goods, etc. Further investigation for each factor and their
interactions is still an attractive issue. The preliminary results of this article provide a good template for future study.

Limitation and future research

When interpreting our results, the reader should be aware of certain limitations. First, our research only conducted fast-tempo music to examine the effect of music placement method in one experimental website. Future researches should attempt to explore the effects of the other component, such as slow-tempo music and merchandise website. Second, 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. The current study did not explore the difference between the browsing and purchasing decision making. It is important to know the role of the background music in the decision process in the future.

Conclusions

The results of this study support the belief that a website visitor’s behavior is affected by a retail environment factor, such as background music. Playing background music with a placement point or fade-in period is a benefit for an on-line shopping atmosphere. Corresponding brain activity data can support physiological evidence in addition to a traditional subjective questionnaire. Though the relationship between the measures has not been examined in the present study, they can be a good model for further related studies.

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