The Effect of Music on Consumer Behavior: A neuromarketing Approach

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Abstract:

The physical environment where services are delivered affects individuals within it. Servicescapes or atmospherics refer to the subfield of marketing which applies environmental psychology to marketing research and studies the effect of environment to individuals within it.

Environmental stimuli can trigger emotions, such as pleasure and arousal, and behaviors, such us approach and avoidance to individuals exposed to them; the level of arousal / non-arousal and the pleasure-displeasure experienced by individuals will determine their approach-avoidance responses. The two emotional states also interact with each other in a way that arousal intensifies both pleasant and unpleasant reactions.

The paper describes the objectives and methodology of a study aiming to investigate the effect of background music stimulation on binary consumer choices. Specifically, by manipulating the tempo and BPM (Bits per Minute) of a musical piece, three different conditions will be made: a slow tempo, a medium tempo music and a fast tempo music condition. While music is manipulated, participants will be asked to choose between products presented in a computer screen. Consumer's arousal, pleasure, attention and approach/avoidance tendencies will be measured, using Electroencephalogram (EEG), Electrodermal Activity (EDA) and surveys.

The results are expected to contribute to both for the servicescapes and the consumer neuroscience research streams of literature. Managerial implications are also expected to come out of the study enabling store managers to better utilize servicescapes and music for their purposes.

Keywords: Neuromarketing, Electroencephalogram (EEG), Electrodermal Activity (EDA)

Introduction

The physical environment where a product or a service is being delivered affects individuals within it. Servicescapes or Atmospherics is a subfield of marketing which applies environmental psychology to marketing research and studies the effect of environment to individuals within it (Kotler, 1973; Bitner, 1992). The shopping environment affects consumers physiologically, cognitively, emotionally and those responses in turn influence consumer behavior (Wakefield and Baker, 1998; Mattila and Wirtz, 2001).

Based on the Stimulus-Organism-Response (SOR) paradigm of environmental psychology, Mehrabian and Russell (1974) proposed their much-cited M-R model. According to their model, the organism's emotional state (pleasure-displeasure, dominance-passivity and arousal-nonarousal), is seen to mediate the relationship between the environmental stimuli and the organism's behavioral response: approach or avoidance. The level of arousal and the pleasure/displeasure experienced by an individual are expected to determine his/her approach/avoidance behavior towards the environment (Russell and Pratt, 1980; Donovan and Rossiter, 1982; Donovan, Rossiter, Marcoolyn and Nesdale, 1994; Turley and Milliman, 2000; Mari and Pogessi, 2013).

The topic on the influence of the external environment and environmental stimuli has been extensively studied in the marketing literature and practice using traditional market research approaches such as observation, surveys, focus groups and experiments. Little is however known about the mental processes that underpin certain consumer behaviors and the buying process. In this study we will investigate the effects of environmental stimuli on consumer behavior using tools from the Neuroscience domain namely Electroencephalography (EEG), Electrodermal Activity (EDA) in combination with classic questionnaires.

Literature Review

Arousal is induced from the environmental stimuli. Borrowing from information theory, Mehrabian and Russell (1974) proposed a general measure of environmental stimulation applicable across many and various physical and social

settings: the information rate or load. Environmental Load or Information Rate is defined as the amount of environmental novelty (i.e., how well an individual knows an environment and can predict what will happen) and complexity (i.e., the number of elements, features, and changes in an environment) (Mehrabian, 1976). Kaplan (1987) argues that load is concerned with information and depends also on the mystery, coherence and legibility of the physical environments.

There are various dimensions of the environment that can affect consumers (Ali, Kim and Ryu, 2016). The components of the physical store environment are: (i) external factors such as the size of the building, exterior walls, surrounding area, surrounding stores, exterior display windows, congestion and traffic, parking availability, lawns and gardens, entrances, architectural style, color of building, height of building, exterior signs, address and location; (ii) ambient factors, such as the air quality, temperature, humidity, ventilation, noise, music, scent, lighting, tobacco smoke, cleanliness; (iii) design factors such as architecture, color, style, materials, décor, scale shape, texture, pattern, layout, comfort, signage, flooring and carpeting, wall composition and accessories, signs, symbols, artifacts, usage instructions, point-of-purchase displays, degrees and certificates, product displays, pictures and price displays; (iv) social factors, such as crowding, privacy, employee characteristics, customer characteristics and employee uniforms; (v) other factors such as spatial layout and functionality of the store (Baker, 1987; Bitner, 1992; Berman and Evans, 1995; Baker, Grewal, and Parasuraman, 1994; Wakefield and Blodgett, 1996; Wakefield and Blodgett, 1999; Lucas, 2003; Kottasz, 2006; Ryu and Jang, 2007; Kim and Moon, 2009; Han and Ryu, 2009, Han, 2013; Wu, Li, and Li, 2014; Wang and Mattila, 2015)

These dimensions used as stimuli are able to affect the overall perception independently and/or through its interactions with the other dimensions (Berman and Evans, 1995). People perceive discrete stimuli, but it is the total configuration of stimuli that determines their responses to the environment (Holahan, 1982). Research in environmental psychology postulates that people respond to their environments holistically. This holistic perspective is called Gestalt (Schiffman, 2001).

Furthermore, great care is needed to ensure that the effects of different environmental dimensions that act as stimuli match. When a scene is coherent (its elements complement each other and hang together), the individual can understand the environment better (Rosen and Purinton, 2004). Based on the information-

processing theory of Kaplan (1987), Nasar (1987) proposed that a more organized and harmonic servicescape creates positive affective responses from consumers, leading to preference.

Different levels of arousal are needed in different servicescapes. There are two types of Servicecapes: utilitarian and hedonic. Consumers in hedonic service contexts actively seek arousal and pleasure aspects or affective gratification (Kempf, 1999), as compared to utilitarian service contexts, where they look for more instrumental utility, and hence, rational approach predominates (Jiang and Wang, 2006). This distinction between hedonic and utilitarian services therefore point to the differential impacts of visual servicescape aesthetics on a consumer's affective responses and preferences. For instance, the consumer's evaluation of a hedonic service context will be based on how much affective gratification they gain, which is an aspect that may be absent from their evaluation of the utilitarian context (Kumar, Purani and Sahadev, 2017).

The perceived servicescape does not directly cause people to behave in certain ways. As with all behavioral relationships, however, the strength and direction of the relation between variables is moderated by various factors known as moderators (Bitner, 1992). Personality traits, such as arousal-seeking tendencies and ability to screen environmental stimuli have the strongest effect. The situational factors, such as expectations, momentary mood: pleasure and arousal, plans and purposes for being in the servicescape, familiarity with the environment and shopping motives also moderate the relationship between the perceived servicescape and internal responses (Bitner, 1992). Other traits that also have an effect are the big five personality traits also known as the five-factor model (FFM) or CANOE model or OCEAN model: Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to experience (Goldberg, 1993).

Music:

Music has long been considered an efficient and effective means for triggering moods and communicating nonverbally (Bruner, 1990). It is capable of evoking complex and affective behavioral responses in consumers. Specifically, music affects consumer behavior in retail environments (Milliman, 1982, Milliman, 1986; Yalch and Spangenberg, 1990) and influences their desire to affiliate in buyer-seller interactions (Dube´, Chebat and Morin, 1995). Appropriately structured music acts on the nervous system as a key on a lock, activating the brain with corresponding

emotional reactions (Clynes and Netheim, 1982) and also plays an important role among higher brain functions (Bhattacharya, Petsche and Pereda, 2001). It is therefore not surprising that music has become a major component of consumer marketing, both at the point of purchase and in advertising (Bruner, 1990).

Bruner (1990) states that music is not simply a generic sonic mass; it is a complex chemistry of controllable elements. According to Dowling and Harwood (1986), music is composed of multiple time-related, pitch-related and texture-related variables, while according to Bruner (1990), there are three primary dimensions of music regarding servicescapes: a physical dimension (volume, pitch, tempo, and rhythm), an emotional tone and a preferential dimension (the degree to which a shopper likes the music).

There are experiments in the scientific domains of servicescapes and atmospherics where researchers manipulate music's elements such as tempo. Some researchers have found that slow tempo music reduced anxiety (Jacobson, 1956), whereas faster tempo music was associated with increased worry and emotionality (Smith and Morris, 1976). However, Bruner (1990) reviewed literature that suggested faster tempo music was associated with positive affective states (such as happy and exciting), whereas slow tempo music was associated with feelings of sadness. Milliman conducted experiments where he manipulated music tempo. He proposed that shoppers spent more time and money in a slow tempo retail environment and customers in the slow music condition took more time to eat their meals compared to those in the fast-music condition. Beverage revenue was also higher in the slow-music condition (Milliman, 1982; Milliman, 1986). Following Milliman, Vanderark and Ely (1993) reported that high tempo and high rhythmic content in the music led to an increase in physiological arousal among consumers (Mattila and Wirtz, 2001). Dube´ et al., (1995) proposed that music-induced pleasure and arousal might have independent effects on consumers' desire to affiliate in a buyer-seller interaction, with more desire to affiliate associated with more pleasure and more arousal. Following those experiments, the purpose of this study is to manipulate Beats Per Minute (BPM) of music and examine how consumer behavior is affected.

Experimental Design:

As mentioned above, music has been chosen as sensory stimuli, because it is considered particularly efficient and effective in triggering moods, increasing arousal,

evoking complex affective and behavioral responses, and affecting cognitive processes in consumers (Bruner, 1990; Vanderark and Ely, 1993; Mattila and Wirtz, 2001; Sweeney and Wyber, 2002).

By manipulating BPM, different servicescapes can be created. In this experiment, there will be four different such conditions. Each condition will be of a different level of environmental load: no music servicescape, slow tempo-low load servicescape, medium tempo-medium load servicescape and high tempo-high load environment. According to the literature, 80 or fewer Beats Per Minute (BPM) is considered as slow tempo music, between 80 and 120 is considered as moderate and 120 or more is considered as fast tempo music (Milliman, 1986; Kellaris and Kent, 1993; Bruner, 1990; Edworthy and Waring, 2006)

Specifically, for the low environmental load condition, a 70 BPM non-vocal song will be used as a low-arousing music. For the medium environmental load, a 120 BPM non-vocal song will be used as a medium-arousing music. For the high environmental load, a 170 BPM non-vocal song will be used as a high-arousing music. Non vocal music is chosen, because we want to focus on the effect of music on consumer behavior and not on the effect of linguistics.

Participants will be asked to perform a task while being exposed to the four different servicescapes conditions in a random order. They will have to make a binary choice: choose between two bottles of wine, one presented in the right side of the computer screen and one presented in the left and their time-responses will be measured. The side that each bottle will be presented will be random.

This task is chosen, because we want to replicate a hedonic service task. Hedonic services are those that provide consumers with values such as excitement, playfulness and entertainment and according to the literature, arousal has a bigger effect on pleasure and satisfaction in hedonic servicescapes than in utilitarian servicescapes (Babin, Darden and Griffin, 1994).

Great effort will be made to keep all other conditions such as temperature, air quality, humidity, crowding and cleanliness, similar in the four different servicescapes conditions in all participants. As suggested by the literature, 30 participants are enough for the purposes of this study.

Pre-experiment Tests:

Before subjects participate in the experiment, they will be asked to do some pre-experiment tests. Firstly, they will have to do a handedness test, in order to see their hand preferences, because it is important for EEG analysis (Annet, 1970). The test includes questions such as: “Which hand you use to write a readable letter?”, “Which hand you use to throw a ball to reach a goal?”, ”Which hand you use when you want to use scissors?”

Secondly, the participants will have to do an acuity test to find out if they can see effectively the optical stimuli that will be presented. In order to so, the Freiburg Visual Acuity & Contrast Test is chosen, which is a widely-used computer program that can provide automated, self-paced measurement of the visual acuity and contrast sensitivity (Bach, 1996).

A pretest will also be conducted to adjust the volume of the music. In addition, feedback from the pretest sample is expected to help with the wording of the questions and the questionnaire layout.

Lastly, the participants will be asked to complete a questionnaire prior to entering the experiment in order to measure individual differences that influence the role that the environment plays on individuals such as: demographics, momentary mood state, arousal seeking tendency, openness to experience, and stimulus screening. The following measurements will be made using items and scales from previous studies:

1. Pleasure: (Mehrabian and Russel, 1974), (8 items, 7-point likert scale)
    - Contented-Depressed
    - Happy-Unhappy
    - Satisfied-Unsatisfied
    - Pleased-Annoyed
    - Relaxed-Bored
    - Important-Insignificant
    - Free-Restricted
    - Hopeful-Despairing

2. Arousal: (Mehrabian and Russel, 1974), (8 items, 7-point likert scale)
    - Stimulated-Relaxed

- Excited-Calm
- Jittery-Dull
- Aroused-Unaroused
- Frenzied-Sluggish
- Overcrowded-Uncrowded
- Wideawake-Sleepy
- Controlling-Controlled

3. Stimulus screening (Mehrabian, 1977), (8 items, 7-point likert scale)
    - Rapid habituation: strong emotions have a lasting effect on me.
    - Low general arousability: things usually don't get me excited.
    - Low arousability in novel or changing settings: I am strongly moved when many things are happening at once.
    - Low arousability in multi-component or complex settings: my moods are quickly affected when I enter new places.
    - Thermal screening: extremes in temperature don't affect me a great deal.
    - Auditory screening: I don't react much to sudden loud sounds.
    - Tactile and kinaesthetic screening: I am affected much by the feel of the texture of the clothes I wear.
    - Olfactory screening: I am not one to be strongly moved by an unusual odor.

4. Arousal Seeking Tendency (AST): (Mehrabian and Russell, 1973), (40 items, 7-point likert scale)

    Arousal from Change: 12 items, e.g.:
    - I like to experience novelty and change in my daily routine (+)
    - I like to go somewhere different nearly every day (+)
    - My ideal home would be peaceful and quiet (-)

    Arousal from Unusual Stimuli: 11 items, e.g.:
    - I like to look at pictures which are puzzling in some way (+)
    - It’s unpleasant seeing people in strange, weird clothes (-)

- Designs or patterns should be bold and exciting (+)

Arousal from Risk: 9 items, e.g.:

- I wouldn't enjoy dangerous sports such as mountain climbing, airplane flying, or sky diving (-)
- I sometimes like to do things that are a little frightening (+)
- I prefer friends who are reliable and predictable to those who are excitingly unpredictable (-)

Arousal from Sensuality: 5 items, examples:

- I never notice textures (-)
- I like to run through heaps of fallen leaves (+)
- I don't pay much attention to my surroundings (-)

Arousal from New Environments: 3 items, example:

- I would be content to live in the same town for the rest of my life (-)

5. Openness to Experience: (John and Srivastava, 1999) (7 items, 7-point likert scale)
   - I have excellent ideas.
   - I am quick to understand things.
   - I use difficult words.
   - I am full of ideas.
   - I am not interested in abstractions. (reversed)
   - I do not have a good imagination. (reversed)
   - I have difficulty understanding abstract ideas. (reversed)

EEG and EOG Measurements:

Electroencephalography (EEG) is a non-invasive medical imaging technique that records the extracellular electrical activity of the brain, generated by the action potentials of neurons (Abhang, Gawali, and Mehrotra, 2016; Alix, Ponnusamy, Pilling and Hart, 2017) and it is a widely used in consumer neuroscience.

EEG is chosen as a research method, because it has advantages such high-temporal-resolution (Abhang et al., 2016; Cohen, 2014; Lakshmi, Prasad, and Prakash, 2014; Michel and Murray, 2012; Ramsøy, 2014), it can capture these fast, dynamic, time sequenced cognitive events cognitive events (Cohen, 2014) and it is also a considerably cheap neuromarketing technique. Furthermore, EEG is capable of measuring visual attention, which is one of the purposes of this study. More specifically, special focus will be paid to the Posterior-Contralateral Negativity (PCN), which is an Event-Related-Potential (ERP). Evoked potentials (EPs) and event-related potentials (ERPs) are components of the EEG that arise in response to different kinds of stimuli, such as auditory, gustatory, olfactory, somatosensory and visual input (Ramsøy, 2014).

Parameters of the Posterior-Contralateral Negativity (PCN), also known as the N2-posterior contralateral (N2pc), will be analyzed in order to assess if a certain bottle of wine caught participants' visual attention. The PCN expresses an increased negativity in the visual area (posterior electrodes) contralateral to the stimulus position in a time window of approximately 175 and 300 ms (or even less) after the stimulus presentation. (Tollner et al., 2011a,b; Vossel et al., 2015; Zehetleitner and Muller, 2010). The hypothesis is that individual visual attention for a specific label are reflected by EEG lateralization in the parieto-occipital area (PO8/PO7 electrode pair and that participants' preference for a bottle of wine would be indicated by a more negative-going deflection (PCN).

H1a: A negative-going deflection (PCN) is indicative of participants' preferences regarding a bottle of wine.

It is also hypothesized that increasing music's BPM is related to participant's pressure while preparing a response. Falkenstein et al., (1994) examined the influence of time pressure on ERP components such as P3 latency in a choice-reaction task with visual and auditory stimuli in which time pressure was manipulated. In this study pressure to the participants will be induced by manipulating music's BPM.

H1b: An increase in music's BPM will lead to an increase in participants' reported stress and a decrease in time needed to finish the task. P3 latency is also expected to be affected by time pressure.

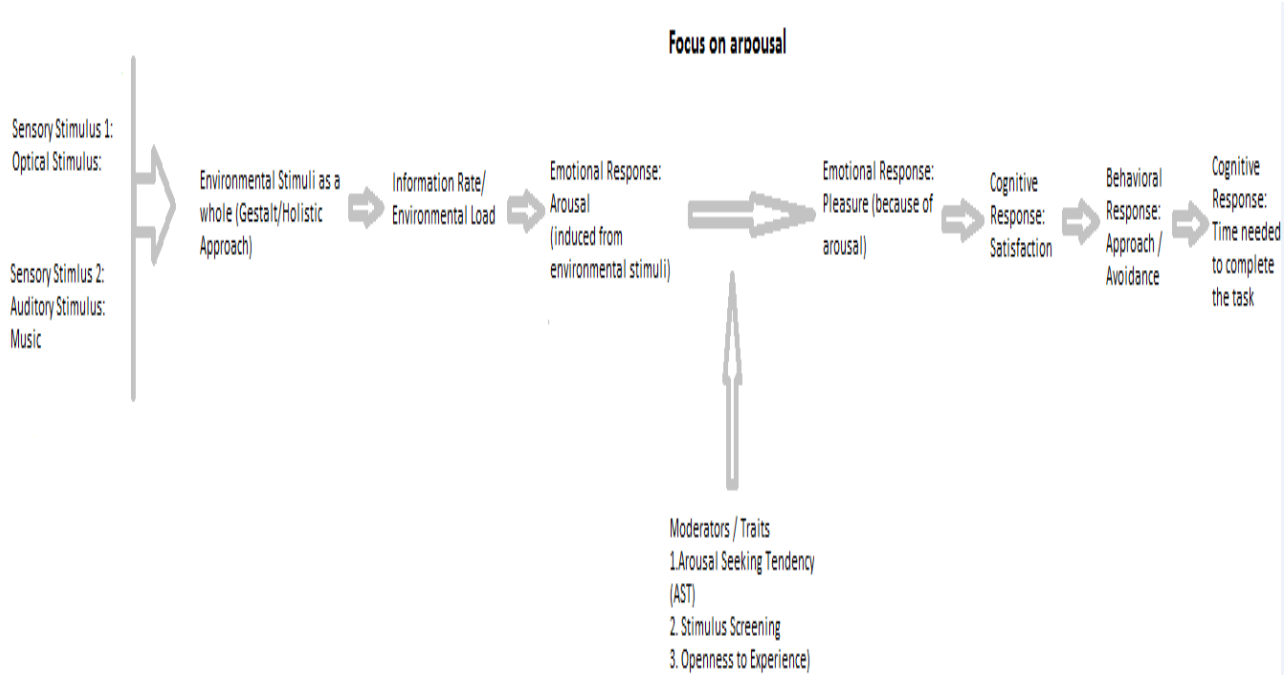
In order to do the EEG and EOG, there will be two computers, a presentation one and a recording one, both of them connected with the ActiPower amplifier from BrainVision. BrainVision Recorder and BrainVision Analyzer will be used in order to

collect the data and analyze them. Participants will be sited in a comfortable chair 60 cm away from the presentation computer. The EEG will be recorded continuously from 32 active Ag/AgCl electrode sites: AFz, AF3, AF4, AF7, AF8, F1, F2, F5, F6, FCz, FC3, FC4, FT7, FT8, C3, C4, C5, C6, CPz, CP3, CP4, TP7, TP8, P1, P2, P5, P6, POz, PO3, PO4, PO7, and PO8 using an EasyCap-62 channel cap (standard international 10–20 system layout). The EOG will be recorded continuously from 5 electrodes connected to the same amplifier. A pair of electrodes will be placed above and below the left eye, in order to measure horizontal eye movements (hEOG); a pair of electrodes will be placed near the left side of the left eye and right side of the right eye, in order to measure vertical eye movements (vEOG).

EDA and Heart Rate Measurements:

Electrodermal Activity (EDA), also known as Skin conductance (SC) is based on the analysis of subtle changes in Galvanic Skin Responses (GSR) when the Autonomic Nervous System (ANS) is activated (Ohme, Reykowska, Wiener and Choromanska, 2010). It uses two electrodes in the finger tips filled with conductive gel and measures EDA. It will be recorded continuously from these electrodes, which are connected to the same amplifier with the EEG and EOG. The results will be synchronized producing no noise.

According to LaBarbera and Tucciarone (1995) who made an overview of EDA use in neuromarketing research, it is often used in neuromarketing research to measure the degree of arousal and to predicting market preferences. EDA is chosen as research technique, because it is considered one of the best methods of measuring arousal and our experiment focuses on the effect of arousal on consumer behavioral, emotional and cognitive responses, as it presented in the following graph.



In this study, it is expected that arousal induced from music is increasing while the BPM are increasing. We hypothesize that different servicescapes will affect participants' arousal level differently and that extreme level of arousal is not preferred.

H2a: Electrodermal activity of the participant will be increased because of music's BPM increase.

Heart rate will be measured as well. It is expected an increase in heart's BPM, while the BPM of music are increasing.

H2b: An increase in music's BPM will lead to an increase in heart's BPM.

Behavioral Measurements (In-room Questionnaire):

In order to measure what the participant thought of each servicescape, after the completion of the task and before leaving the room, the participant will be asked to fill in a questionnaire. The hypotheses that will be tested are the following:

H3a: Moderate arousal level induced from manipulating ambient music's BPM is more pleasant than extreme high or extreme low arousal level induced from manipulating ambient music's BPM

H3b: Moderate arousal level induced from manipulating ambient music's BPM is more satisfying than extreme high or extreme low arousal level induced from manipulating ambient music's BPM.

H3c: Moderate arousal level induced from manipulating ambient music's BPM leads approach behavior towards the environment. Extreme high or extreme low arousal level induced from manipulating ambient music's BPM leads to avoidance behavior towards the environment.

For example, questions of the questionnaire may be: "Please let us know which of the four different environmental conditions you preferred…", "which are more satisgying…", "which is more arousing…", "which is more pleasant…"etc. The following measurements will be done using the items and scales presented above:

1. Store Environment: (Donovan and Rossiter, 1982): (14 items, 7-point likert scale measuring information rate and its dimensions: Novelty, Variety, Irregularity, Density, Size.

Novelty: average of:

- Usual - Surprising
- Common - Rare
- Familiar - Novel

Variety: average of:

- Homogeneous - Heterogeneous
- Redundant - Varied

Irregularity: average of:

- Symmetrical - Asymmetrical
- Patterned - Random

Density: average of:

- Sparse - Dense
- Intermittent - Continuous

Size:

- Small scale - Large scale

2. Store Environment: (Fisher, 1974), (7 items, 7-point likert scale)
    - Unattractive - Attractive
    - Uninteresting - Interesting
    - Bad - Good

- Depressing - Cheerful
- Dull - Bright
- Uncomfortable - Comfortable
- Pleasant – Unpleasant

3. Music: (Lin, 2010), (1 item, 7-point likert scale)
    - Tranquil – Dynamic

4. Pleasure: (Mehrabian and Russel, 1974), (8 items, 7-point likert scale)
    - Contented-Depressed
    - Happy-Unhappy
    - Satisfied-Unsatisfied
    - Pleased-Annoyed
    - Relaxed-Bored
    - Important-Insignificant
    - Free-Restricted
    - Hopeful-Despairing

5. Arousal: (Mehrabian and Russel, 1974), (8 items, 7-point likert scale)
    - Stimulated-Relaxed
    - Excited-Calm
    - Jittery-Dull
    - Aroused-Unaroused
    - Frenzied-Sluggish
    - Overcrowded-Uncrowded
    - Wideawake-Sleepy
    - Controlling-Controlled

6. Approach / Avoidance: (Donovan and Rossiter, 1982), (8 items, 7-point likert scale)
    - Do you like the environment?
    - Would you enjoy shopping in the store?
    - Would you avoid returning? (reverse scored)

- Feel friendly to a stranger?
- Avoid other people? (reverse scored)
- Spend more than you set out to?
- How much time browsing?
- Avoid exploring (reverse scored)

Comparison of the two studies:

At the end of the study, the EEG, EOG, EDA and Heart Rate results will be compared and contrasted with the emotional, behavioral and task-related results. The relative advantages and disadvantages of the conventional marketing and neuromarketing research methods and their potential complementarity will be showcased. A final conclusion will be drawn based on all of the results.

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