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Armel Quentin Tchanou
HEC Montréal, armel-quentin.tchanou@hec.ca

Félix Giroux
HEC Montréal, felix.giroux@hec.ca

Pierre-Majorique Léger
HEC Montréal, pierre-majorique.leger@hec.ca

Sylvain Senecal
HEC Montréal, sylvain.senecal@hec.ca

Jean-François Ménard
D-BOX Technologies inc., jfmenard@d-box.com

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Impact of Information Technology Multitasking on Hedonic Experience

[Complete Research]

Armel Quentin Tchanou
HEC Montréal, Montréal, Canada
armel-quentin.tchanou@hec.ca

Félix Giroux
HEC Montréal, Montréal, Canada
felix.giroux@hec.ca

Pierre-Majorique Léger
HEC Montréal, Montréal, Canada
pierre-majorique.leger@hec.ca

Sylvain Senecal
HEC Montréal, Montréal, Canada
sylvain.senecal@hec.ca

Jean-François Ménard
D-BOX Technologies inc., Longueuil, Canada
jfmenard@d-box.com

ABSTRACT

This study investigates the impact of information technology (IT) multitasking on multisensory hedonic experience. Existing literature extensively studies the impact of IT multitasking on user experience in a professional context but still lacks insight regarding this influence in a hedonic context. This study contributes to the literature by examining how technology can alter pleasure induced by hedonic activities. In a context of engaged IT interaction along with multisensory music listening, we hypothesize that the multisensory factor positively influences emotional reaction. We also hypothesize that IT interaction will degrade the hedonic experience. We conducted a multi-method experiment using both explicit (questionnaires) and implicit (automatic facial analysis, and electrodermal activity) measures of emotional reactions. Results support our hypotheses and highlight the importance of avoiding multitasking with technology during passive hedonic activities for better experience. Future research may examine IT multitasking's influence on active hedonic activities.

Keywords

IT Multitasking, Multisensory, Hedonic Experience, Music listening, Vibro-kinetic movements.

INTRODUCTION

The objective of this research is to investigate the role information technologies (IT) can play during hedonic activities in the context of a multitasking and multisensory experience. With the proliferation of technology today, several IT have taken an important place in people's life. More notably, mobile technologies, which are accessible everywhere and at all time, have been widely adopted especially by younger generations (Combes, 2006;). The impact of IT in a multitasking context has been extensively studied in the extant literature. Several past studies concluded that technology multitasking has a deteriorating effect on performance and attention (Gazzaley & Rosen, 2016; Strayer & Watson, 2016), suggesting that the human brain is made to be most efficient while doing a single task at a time as compared to operating in a polychronicity context.

However, studies in the extant literature on IT multitasking are mainly focused on "functional" or professional contexts in which users perform some productive tasks along with IT interactions. Despite considerable past efforts, little is known about the role IT multitasking could play in hedonic settings in relationship with the actual pleasure and enjoyment experience, which is the purpose hedonic activities. An important topic is to examine how technology multitasking may influence a consumer's engagement in such activities. In this study, we contribute to knowledge about this question, specifically in the context of a multisensory hedonic experience, that is, hedonic activities in which the user uses different senses to benefit from the activity (for example, the user may not only touch an object of pleasure, but also can feel an object's actions and reactions). In this regard, we investigate the following research question.

RQ: *To what extent does IT multitasking influences hedonic experience*?

In the following sections of this paper, we will first provide some theoretical background by conceptualizing the study's constructs, then present the research model and the methodology we used to test our model, followed by our study's results and discussions.

THEORETICAL DEVELOPMENT

This section explains the choice of constructs for the study and provide their conceptual definition.

IT interaction

We situate our conceptualization of IT interaction in the specific context of hedonic activities. Entertainment with technology, clearly, generally involves multiple interactions with the said technology; in the present study we make a distinction between hedonic activities in which IT interactions are central to the activity (e.g., using a phone to play a game) and those in which IT interactions are peripherical to the hedonic activity (e.g., occasionally looking at incoming text messages (peripheral) while watching a movie (central)). Hence in the case of entertainment through technology, the said technology would be the object of entertainment and the "IT interaction" construct would be related to a separate technology that is peripherical to the central activity. An illustration of IT as central to the hedonic activity is the use of a social media platform on a mobile phone in the purpose of pleasure and enjoyment. In this study, we conceptualize the "IT interaction" construct as related with the set of interactions with technology as a separate and parallel operation to the main hedonic activity. As a result, we define IT interaction as whether a user is engaged in parallel technology tasks while he or she is performing a hedonic activity.

Multisensory hedonic experience

Hedonic experience is materialized by people's emotional responses generated by the stimuli they are exposed to during a hedonic activity. The dimensional perspective for understanding emotions suggests that an emotional response is made of at least three core dimensions: *emotional valence* (the positive affect), *emotional arousal* (the degree of excitation), and *dominance* (how much control of the situation a subject has) (Bradley & Lang, 1994). Because the present study focusses on passive hedonic activities (aiming at relaxing), we do not focus on the dominance dimension of emotional response. In this perspective, an enhanced multisensory hedonic experience will correspond to higher emotional valence, since the purpose is to bring pleasure to the user. Likewise, an enhanced multisensory hedonic experience will correspond to greater calm (lower arousal) in activities that aim at relaxing, and to higher arousal in activities that aim at physiological activation.

CONSTRUCT OPERATIONALIZATION AND HYPOTHESIS DEVELOPMENT

Past studies suggest that the multisensory characteristic of a hedonic activity enhances the hedonic experience (Donley, Ritz, & Shujau, 2014). Hence, we make the following hypotheses.

H1: The multisensory characteristic of the hedonic activity will be associated with more positive emotional valence compared to a unisensory activity.

H2: The multisensory characteristic of the hedonic activity will be associated with lower emotional arousal compared to a unisensory activity.

Impact of technology multitasking

As mentioned, IT multitasking has a deteriorating effect on attention and performance (Gazzaley & Rosen, 2016; Strayer & Watson, 2016; Rosen, 2008). During a multisensory hedonic activity aiming at relaxing, actively multitasking with technology generates interruptions and attention switching (Gazzaley & Rosen, 2016). Because of the switching effort imposed by the need to perform technology operations while at the same time benefiting from the hedonic activity, we can logically hypothesize that IT interactions will have an adverse effect on the emotional reaction induced by the multisensory characteristic of the hedonic experience.

H3: The effect of the multisensory characteristic of the hedonic activity on emotional valence is negatively moderated by IT interaction, so that emotional valence will be lower with parallel IT interactions than without IT interactions.

H4: The effect of the multisensory characteristic of the hedonic activity on emotional arousal is positively moderated by IT interaction, so that emotional arousal will be higher with IT interactions than without IT interactions.

The research model is depicted in figure 1.

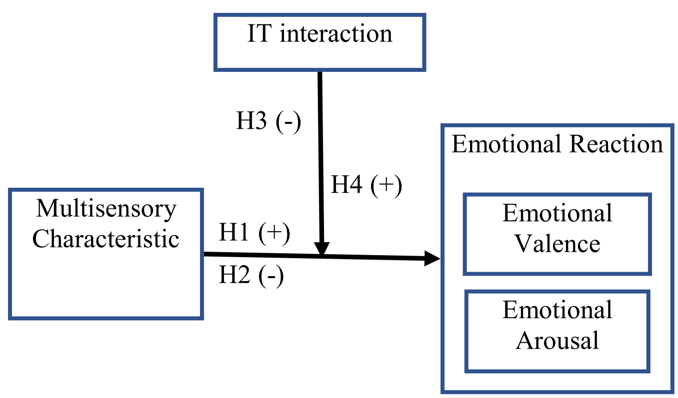

Figure 1. The research model

METHODOLOGY

We conducted an experiment in a laboratory in a northeastern business school in North America. The experiment typically involved participants multitasking with technology while immersed in a relaxing activity. They listened to music while comfortably sitting on a vibro-kinetic chair producing for each song played some movements and vibrations that are artistically developed to be perfectly synchronized with the song.

Participants

Our sample was composed of 24 participants: 11 males and 13 females, with an average age of 24-year old (5 years standard deviation). Participants were recruited through the business school's community panel, which is mostly composed of millennial students (between 20 and 30-year old).

Experimental design

A two-factor experiment with repeated measures was performed (Table 1). The first factor is "vibro-kinetic movement": depending on the condition, the chair produced vibro-kinetic movements perfectly synchronized with the songs. This factor represents the "multisensory characteristic" of the hedonic activity in this study. The second factor is "IT interaction": depending on the condition, participants actively interacted or not with the mobile application during music listening.

To improve internal validity of the experiment, we planned to control for four variables, namely, participant's age, sex, previous experience with the song and appreciation of the song.

	With IT	No IT
With Movement	X	Y
No Movement	Z	C (Control)

Table 1. Experimental conditions.

A total of fifteen songs were used[1]. Each participant listened to different songs in the four conditions. For each subject, three songs were randomly chosen (e.g. Song No 7, Song No 4, and Song No 13), among which one was randomly chosen to be assigned to the control condition (e.g. Song No 13); then the three randomly chosen songs were again randomly assigned to the other three treatment conditions (e.g. Song No 4, Song No 13, and Song No 7, respectively assigned to conditions X, Y, and Z).

The randomness of the song choice helped mitigate possible error term due to song choice. Moreover, the order of the treatment conditions was randomized for every participant, in order to minimize possible carryover effect, as is recommended in the literature (Keppel & Wickens, 2004).

To reduce the error term that could be linked to manual playing of the playlists, we automated the playlist for each participant using Python programming language: one Python program was developed for every subject's playlist, for a total of twenty-four playlist programs. Hence, the playlists were semi-automatic, with minimal human intervention.

[1] The set of fifteen songs was made of mostly popular music with different styles from slower to more animated.

Explicit measures

We performed a double translation for all questionnaires. After each song listening, the participants had to answer a 13-item questionnaire assessing the following emotions they experienced during the task[2]: sadness (adopted from Stuijfzand, et al., 2016), arousal (adopted from De Guinea, Titah, & Léger, 2013), valence, and boredom (adopted from Tilburg & Igou, 2012). We developed the valence scale and performed its validation in a pretest with twenty-two participants, getting Cohen's Kappa of 0.735. Clearly, our valence construct's content validity was confirmed.

To assess the reliability of the constructs (arousal and valence), another pretest was done during which four participants listened to three songs each in the multisensory condition, providing a total sample of twelve answers to the questionnaire. For emotional valence, the Cronbach α was 0.723, and for emotional arousal, the Cronbach α was 0.879, all greater than 0.60, a reference value at early stages of a study (Moore & Benbasat, 1991). Hence, reliability is satisfactory.

At the end of the experiment, a 5 minutes semi-structured interview was conducted to learn about the participant's impressions on their multi-sensory hedonic experience.

Experimental stimuli

The technology interactions aiming at adding up to the multisensory hedonic experience were done through a mobile web-based application we developed. The application simulated a well-known music listening mobile platform. The main goal of the informative application was to make sure the participants actively interacts with each song's informational interfaces for the full duration of the corresponding song listening.

Material and apparatus[3]

A vibro-kinetic chair (D-BOX Technologies Inc., Canada) was used that was able to generate artistically developed movements and vibrations perfectly synchronized with the different songs.

We used the sensors for electrodermal activity (EDA), which varies with the state of sweat glands. We used the EDA signal amplitude related to the electrical conductivity level of the skin as an indicator of excitement and involvement at different moments of the experiment.

We also used a fixed camera to record the participant's facial expressions, which were analyzed using

[2] In this study, we investigated only two of these emotions, namely, valence and arousal.

[3] Electroencephalography (EEG) data were collected in addition to the other presented data collection methods, but these data have not been used for the analysis.

FaceReader (Noldus, Wageningen, Netherlands) a software which can detect up to 7 positive, negative or neutral states from micro facial expressions.

Analysis

We ran statistical analyses using linear regression with mixed model for physiological data. We used a 2-tailed p-value, adjusted for multitest using Holm-Sidak method. To analyze main effects with questionnaire data, we ran an analysis of covariance (ANCOVA) for each dependent variable, with the four control variables as covariates. With a sample size of 24 and a medium effect size of interest $\omega = 0.06$, the statistical power of our test was 64% at $\alpha = 0.10$. This choice was justified, according to the small sample size and the low risk associated with a Type I error in our context. The effects were measured with electrodermal activation adjusted for baseline values.

RESULTS

The condition with vibro-kinetic movement and without any IT interaction (Y) generated more emotional valence than the control condition, ($p = 0.057$). In both conditions, no IT multitasking was done by the subjects, suggesting a main effect of the multisensory hedonic activity. Besides, the questionnaire data showed a statistically significant main effect of the multisensory hedonic activity on emotional valence ($p = 0.058$). Clearly the hypothesis H1 was supported. Besides, the condition with vibro-kinetic movement and without any IT interaction recorded less electrodermal activation than the control condition (both without IT), and condition X's value was lower than condition Z's, which is in line with hypothesis H2; but the differences were not statistically significant, which may be related to the statistical power of our test. However, the questionnaire data showed a statistically significant main effect of the multisensory hedonic activity on emotional arousal ($p = 0.041$), with a confidence interval [0.19; 1.37] not containing the value zero. So H2 was supported.

Moreover, as depicted in the marginal means plot in Figure 3, the effect of IT interactions on emotional valence was not the same (and was opposite) for each value of the multisensory characteristic. Lower valence was recorded in conditions with vibro-kinetic movements when IT interactions were present. Consequently, the Hypothesis H3 was supported. Likewise, as depicted in the marginal means plot in figure 4, the effect of IT interactions on emotional arousal was not the same (and was opposite) for each value of the multisensory characteristic. In conditions with vibro-kinetic movements, arousal was higher with engaged IT interactions. Consequently, the Hypothesis H4 was supported. These two findings (H3 and H4) were illustrated in participants answers to interviews. Following is an excerpt of a typical participant comment regarding the parallel engaged use of the mobile application:

« *… Also there is the fact that you ask me to use this (the Mobile App), so I could not really focus on the chair, I totally forget that it exists, I am more interested in the App…*".

Hence, the IT interaction often completely switched the participant's attention to the hedonic activity and hampered his or her engagement in the multisensorial music listening.

Finally, none of the control variable's main effect was significant.

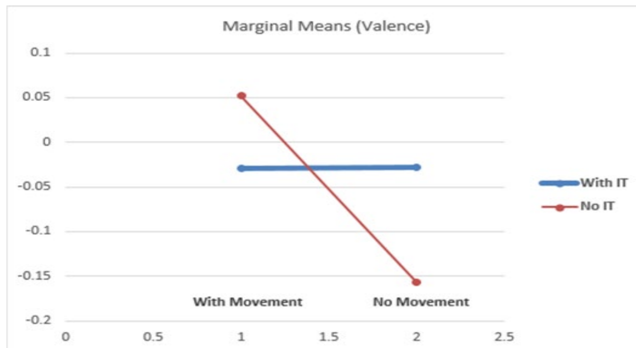

Figure 3. Interaction effect on Valence (Movement * IT)

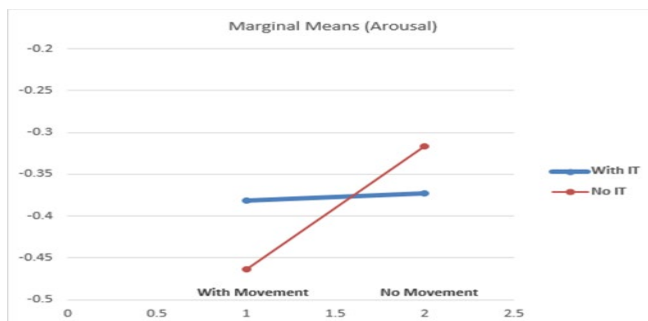

Figure 4. Interaction effect on Arousal (Movement * IT)

DISCUSSION

In line with Hypotheses H1 and H2, results show that the multisensory hedonic experience generates more emotional valence and less emotional arousal, hence enhancing participant's music listening experience.

Besides, the fact that almost no difference was observed between the conditions with IT interaction suggests that technology deteriorated the hedonic experience such that the effect of the perfectly synchronized vibro-kinetic movements of the chair was negligible. This denoted a significant switch of attention to the IT in expense of the multisensory hedonic experience, an observation that was confirmed by the qualitative data collected during the interview at the end of the experiment.

This finding is in line with existing literature suggesting that multitasking with technology does degrade people's attention and performance (D'Arcy, Gupta, Tarafdar, & Turel, 2014). This adverse effect can be explained by fact that in our experiment, technology intervenes as an interruption as per Gazzaley & Rosen (2016), and in addition, there is a cost of attention switching between the multisensory music listening and the IT.

Our study was conducted in the context of passive hedonic activities; participant used several senses to benefit from the activity (auditory, touching, visual) but did not have to actively perform any action. A legitimate question would be whether similar results would be observed if the participants had to perform active actions to benefit from the experience (e.g. tasting a dish, throwing a ball, or playing a video game). Would IT interaction have the same impact? Future research may investigate this question in the context of active hedonic activities.

Implication for practice

In line with our findings, a straightforward recommendation regarding technology use can be made in the context of multisensory hedonic activities. People will benefit a better hedonic experience when they avoid multitasking with technology at the same time (with IT not being central to the hedonic activity).

CONCLUSION

After significant past work on multitasking, little is known about the influence of IT multitasking in a multisensory hedonic context. This study makes a contribution by investigating this topic based on existing literature. Through an experiment consisting on music listening on a vibro-kinetic chair with parallel use of a mobile technology, our results suggest a deteriorating effect of technology interaction on the hedonic experience, suggesting that a passive multisensory hedonic experience would be more benefic to participants without any engagement in parallel technology tasks.

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