

Musical program context effects:
The effect of music-induced arousal on memory and evaluation.

Marit Ruitenber

Master Thesis Psychology

Faculty of Behavioural Sciences – University of Twente

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Student number: 0181463

Supervisor: Dr. A. Heuvelman

Co reader: Dr. R. Verleur

Department: Media, Communication and Organisation

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ABSTRACT

In this study we investigated the effect of music-induced arousal on the evaluation of a subsequently presented informative program, as well as memory for the program. We conducted an experiment in which participants listened to either medium or high arousing music and then watched an informative video. Results showed that participants in the medium arousal condition reported more positive evaluations of the video. Furthermore, their memory for the video was better when compared to memory of participants in the high arousal condition. In the discussion section implications of the findings are discussed.

1. INTRODUCTION

1.1 Program context effects

Research has shown that emotional aspects of a program can have effect on evaluation of and memory for a subsequent program. This is known as the program context effect. The majority of the studies examining this effect have used two distinct dimensions of emotions as independent variables: valence and arousal. Mehrabian and Russell (1974) formulated this distinction in the pleasure-arousal-dominance theory, which was later termed the pleasure-arousal theory by Russell (1980). Several researchers have since proposed that all emotions consist of two dimensions (Russell, 1980; Russell & Barrett, 1999). Valence refers to the extent to which an emotion is positive or negative and thus indicates the direction of an emotion. Arousal, on the other hand, refers to the intensity of an emotion (from calm and drowsy to excited and energized). It has been found that the distinction between valence and arousal is important since each dimension can affect behavior in a different way (Gorn, Pham & Sin, 2001; Raghunathan & Pham, 1999; Shapiro, MacInnis & Whan Park, 2002).

Previous studies have provided strong support for program context effects in various domains, such as learning (Drew & Reeves, 1978), evaluations of personalities and brands (Zander, 2006) and effectiveness of advertising (e.g., Goldberg & Gorn, 1987; Newell, Henderson & Wu, 2001). These effects have been demonstrated with respect to several media contexts, such as print contexts (Yi, 1990) and audio contexts (Norris & Colman, 1996). However, most research on program context effects has focused on television contexts and has investigated the effect of program context on recall and evaluation of subsequently presented stimuli.

Research conducted in television contexts in general found that the valence and arousal of a context can affect both memory for and evaluation of a subsequently presented stimulus. For example, Goldberg and Gorn (1987) found that compared to participants who watched a sad program, participants who watched a happy program reported higher ratings of commercial effectiveness. Furthermore, watching a happy program resulted in more positive responses and better recall of the commercials. In another study of television program context effects Kamins, Marks and Skinner (1991) investigated the role of the affective tone of commercials. Results showed that happy commercials were evaluated more positively in a happy context than in a sad context. As for sad commercials, reverse effects were found. That is, these commercials were evaluated more positively in a sad context. Commercials thus were more effective when they matched the affective tone of the program context. Other evidence for program context effects in the television domain was provided by Newell et al. (2001), who examined the effects of pleasure and arousal levels

accompanying a sports program on advertisement recall. They found that strong emotional reactions associated with such a program – in their study the Super Bowl – had a negative effect on recall of advertisements and brands.

Evidence for the program context effect in the audio domain was provided by Norris and Colman (1996). In their study, participants listened to one of three radio shows in which four advertisements were embedded. Memory for the advertisements was measured, as well as participants' evaluation of the advertised products. Results indicated that memory was best when a program was perceived as being entertaining, enjoyable, interesting, and not boring and humorous. In addition, it was found that radio program context affected participants' evaluations. The more positive participants rated a program, the more positive evaluations the products received.

It is thus clear from the Norris and Colman (1996) study that audio – in the form of a radio show – can serve as program context. In addition, Norris and Colman's (1996) findings show that audio context influences memory and evaluation. What is yet unclear is whether another form of audio, i.e., music, as program context will affect memory for and evaluation of subsequently presented stimuli in a similar way. Several effects of music have been studied, as will be discussed in the next section. However, none of these studies addressed the impact of a musical program context (e.g., a music clip) on the processing of a subsequent informative video. This might be a realistic situation however, for example when using the Internet or watching informative messages preceding a movie in the cinema (such as the SIRE commercials in the Netherlands). The present study aims to elaborate on the existing knowledge about audio context effects by investigating the effect that a musical context has on the processing of subsequent stimuli. More specifically, the effect of music-induced arousal level on memory for and evaluation of a subsequent informative video is investigated.

1.2 Effects of music

Various effects of music have been demonstrated in previous studies. First of all, research has shown that music can affect mood, and in addition that it can be used to induce a certain mood (e.g., Alpert & Alpert, 1990; McCraty, Barrios-Choplin, Atkinson, & Tomasino, 1998). For example, McCraty et al. (1998) found that grunge rock music increases feelings of hostility, sadness, tension, and fatigue. Designer music (i.e., music that is designed to have a specific effect on the listener) was found to increase feelings of caring, relaxation, mental clarity, and vigor.

Another effect of music has been investigated by Vitouch (2001). He found that music, accompanying a video, affects people's interpretation and judgment of a visually neutral stimulus. In his study, Vitouch (2001) showed participants a video starting with a full angle shot of New York and then slowly zooming in on an apartment. The music accompanying this video was manipulated,

creating two conditions in which participants listened to either a rather positive or a more melodramatic piece of music. Results showed that participants in the positive music condition described they had noticed lovely weather, whereas participants in the melodramatic music condition mentioned gray and desperate circumstances.

Furthermore, there is evidence that music-induced mood influences people's evaluations. Gorn, Goldberg and Basu (1993) studied the effect of mood and awareness on product evaluations. They found that when participants were not aware of mood-inducing music, the music influenced their evaluations. Participants in a good mood, induced by music, rated products as more positive than participants in a music-induced bad mood. When participants were made aware of the fact that the music was a source of their mood, the effect disappeared. The valence of people's affective states can thus affect their evaluations in a valence-congruent direction (e.g., Goldberg & Gorn, 1987; Gorn et al., 1993). Gorn et al. (2001) described two explanations that have been offered for this finding. A first explanation is that affective states – pleasant or unpleasant – cue similarly valenced materials in memory, making the valence more salient. As a result, people's evaluations of a stimulus are biased in the direction of their affective state. Another explanation is that people rely on their feelings when making judgments. That is, the pleasant or unpleasant feelings that one has are attributed to the stimulus that has to be evaluated. This explanation is known as the affect-as-information explanation (Schwarz & Clore, 1988).

A study conducted by Alpert and Alpert (1990) showed another effect of music-induced mood, i.e., the effect on purchase intentions. It was found that compared to listening to happy music, listening to sad music was associated with higher purchase intentions. This result can be explained by the mood-repair theory (e.g., Josephson, Singer & Salovey, 1996), which states that when people are in a negative mood they will try to restore their mood to a more positive level. In another study, Park & Young (1986) found that music can have a facilitating or distracting effect on brand attitude formation, depending on level of involvement. When involvement was low, participants' attitude formation was facilitated by background music. However, when cognitive involvement was high, music had a distracting effect on formation of brand evaluations. In line with the Elaboration Likelihood Model (Petty & Cacioppo, 1986), the music served as a peripheral cue for attitude formation under low involvement conditions but not under high involvement conditions.

Gorn et al. (2001) investigated under which circumstances valence influences evaluation and arousal does not, and vice versa. In a first study, the valence of participants' mood was manipulated by means of music, inducing either a pleasant or unpleasant mood. Results showed that valence affected advertisement evaluation in a mood-congruent direction. That is, participants in a pleasant mood reported more positive evaluations than participants in an unpleasant mood. A second study showed that when an advertisement had a clear positive or negative affective tone, participants'

arousal level influenced evaluations. Thus, the arousal dimension, but not the valence dimension affected evaluation. It should be noted, however, that effects of valence and arousal may interact (Gorn et al., 2001) and the specific roles of both dimensions are not necessarily restricted to either evaluations or memory.

Taken together, research on music effects has shown that music can affect mood and that music-induced mood in turn can influence evaluations and behavior (i.e., purchase intentions). Both the valence and arousal dimension of music-induced mood seem to account for the effects on evaluation, albeit to different extents (Gorn et al., 2001). Furthermore, the valence of music has been found to affect purchase intentions (Alpert & Alpert, 1990). Although these studies provide insight in the effects of music on evaluation, they do not address effects on memory. Additionally, in both studies, products were used as stimuli, whereas in the present study an informative video is presented. Since it has been found that the specific effects of valence and arousal appear to be stronger for emotional messages than for informational messages (Goldberg & Gorn, 1987), the distinction of valence and arousal effects is likely to be less explicit for stimuli with an informational content. That is, the two emotional dimensions each can affect both memory for and evaluation of an informative video.

1.3 Music-induced arousal

In the majority of studies on context effects, both valence and arousal have been manipulated. There is significant consent that music and musically induced emotions, like emotions in general, can be measured in terms of valence and arousal as well (Hevner, 1936; Ritossa & Rickard, 2004; Thayer & Faith, 2001). While effects of valence of music have been extensively studied, the role of musical arousal has received relatively little attention – with the exception of Gorn et al.'s (2001) study. The present study therefore manipulated arousal while controlling for valence, in order to gain insight on the specific effects of arousal on memory and evaluation in a musical context.

There are several theories that offer explanations for effects of arousal, such as the excitation transfer theory (Zillmann, 1971) and the intensity theory (e.g., Newell et al., 2001). Zillmann (1971) proposed that elicited arousal decays relatively slowly and that residue elements of this excitation are transferred to a subsequent stimulus. The arousal elicited by the first stimulus thus integrates with that of a subsequent stimulus and intensifies the experienced excitatory responses to the second stimulus. Processing of the second stimulus, for example a commercial, is affected by arousal of the preceding stimulus, for example a television program or music. Results of the Gorn et al. (2001) study, as described in the previous section, support the excitation transfer theory.

The intensity theory states that increased arousal is negatively related to memory, because intensity narrows the attention towards a stimulus and thereby inhibits recall. Newell et al. (2001)

found that when intensity, and thus the arousal level, of a television program is high, individuals focus on the source of the arousal and not on subsequent stimuli such as commercials. As a result, recall decreases when arousal levels increase. Tavassoli, Shultz and Fitzsimons (1995) found that the relationship between arousal and memory for commercials was an inverted-U relationship. These results suggest that after watching a medium arousing program, memory for commercials is best. Memory for commercials shown after either a low or highly arousing program was less optimal. Furthermore, Tavassoli et al. (1995) found a similar inverted-U relationship between arousal and advertisement evaluations. Participants reported the most positive evaluations after watching a medium arousing program. These findings offer partial support for the intensity theory.

Another explanation for arousal effects is that it influences the level of processing. A study of Shapiro et al. (2002) indicated that arousal levels (induced by video) affected the level of processing so that, compared to moderate arousal level, processing under high arousal was more shallow. Shapiro et al. (2002) suggested that heightened arousal distracts people from processing, resulting in more difficulty with respect to retrieval of presented information. This has consequences for memory, as deeper processing has been found to be related to better recall (Brock & Green, 2005). This is in line with findings of Craik and Lockhart (1972), that the level of processing is an important determinant for memory: deeper processing and a higher degree of stimulus elaboration result in better memory.

Since research has shown that there is an inverted-U relationship between arousal and memory and evaluation, and studies in which arousal levels were high versus low often resulted in contradicting findings (see Tavassoli et al., 1995), the arousal levels used in this study were either high or medium. Overall, medium arousing musical contexts were expected to provide the most optimal condition for memory and evaluation. A first expectation, regarding memory for an informative video, was that medium musical context arousal would have more beneficial effects on memory than high musical context arousal. The inverted-U relationship found by Tavassoli et al. (1995) showed that medium context arousal is related to better memory than low or high context arousal. In addition, Newell et al. (2001) found that compared to high context arousal, medium context arousal is more favorable for memory. The effect of arousal on memory can be explained by the finding of Shapiro et al. (2002), that high arousal levels lead to more shallow processing than moderate arousal levels. Since deeper processing is related to better recall (Brock & Green, 2005; Craik & Lockhart, 1972), moderate musical context arousal was expected to result in better memory.

H1: Compared to high levels of musical context arousal, moderate context arousal levels will result in better memory for an informative video.

Furthermore, the expectation was that evaluations of an informative video would be more favorable in a medium arousal musical context than a high arousal musical context. This expectation follows findings of Tavassoli et al. (1995), that evaluations of commercials were most positive when program context was moderately arousing, and less positive when it was either low or highly arousing. Storbeck and Clore (2008) explain the effects of arousal on evaluation by the finding that high arousal is associated with negative feelings, which guide evaluations in a negative direction as well. Since it is likely that the same processes are involved in evaluation of a commercial and evaluation of an informative video, it was expected that moderate musical context arousal would result in more positive evaluations.

H2: Compared to high levels of musical context arousal, moderate context arousal levels will result in more positive evaluations of an informative video.

2. METHOD

2.1 Participants

The participants in this study were fifty-nine students (29 male and 30 female) at the Faculty of Behavioural Sciences, University of Twente. Participants were aged 18 to 35 years, with a mean age of 22.4 ($SD = 3.3$). They participated on a voluntary basis.

2.2 Design

The study had a uni-factorial (music induced arousal level: high vs. medium) between-subject design. Participants were assigned to either the high arousal condition or the medium arousal condition. The first dependent variable was participants' evaluations of the informative video, which was measured by using ten semantic differentials. The second dependent variable was the participants' memory for the informative clips. Memory was measured by free recall, true false questions and forced choice questions.

2.3 Measures and materials

Manipulation check. In order to check whether the intended arousal levels were elicited by the music, participants completed the Self-Assessment Manikin (SAM), a non-verbal pictorial questionnaire that asks participants to make three simple judgments regarding emotions (Bradley & Lang, 1994). The SAM measures the dimensions arousal, valence and dominance by using graphic characters arranged along a linear nine-point scale. The arousal scale ranges from a sleeping character with eyes closed to an excited character with eyes wide open. The pleasure scale contains characters ranging from frowning and unhappy to smiling and happy. The dominance scale ranges from a small submissive character to a large powerful one. The SAM has been found to be a valid measure of emotion (Bradley & Lang, 1994) and the scales of arousal and valence have been found to correlate highly with psycho-physiological and physiological measures of arousal and valence (Greenwald, Cook & Lang, 1989). Although the dominance dimension was not used in this study, it was presented to the participants and measured to follow the instrument's protocol.

Music. To determine which music is associated with high and medium arousal, a pretest was conducted. Eight musical pieces that have been used in previous studies regarding valence and arousal levels of music (North & Hargreaves, 1997; Ritossa & Rickard, 2004) were subjected to the pretest. These pieces have been found to induce medium to high arousal levels, but exact evaluations of some of the pieces were unclear. The arousal that is induced by the musical pieces was measured by means of the Self-Assessment Manikin. In addition, valence ratings of the musical

pieces were measured so that this could be controlled for. The dominance dimension of the SAM was measured as well to follow the protocol of the instrument.

Twenty-three participants (5 male, 18 female) rated the musical pieces on the three dimensions. The mean age of the participants was 18.7 years, ranging from 17 to 26 years. The musical piece that was rated highest on the arousal dimension was Cup of Life, by Ricky Martin ($M = 6.05$, $SD = 2.18$). Two musical pieces were rated as being medium arousing. However, the valence rating of one of the pieces strongly differed from the valence rating of the music that was rated as being highly arousing. Therefore, it was chosen to use the song Head over Feet, by Alanis Morissette, in the medium arousing condition. It was rated medium on the arousal scale ($M = 4.59$, $SD = 1.82$). Furthermore, the valence rating of the highly arousing musical piece ($M = 6.95$, $SD = 2.57$) was comparable to the rating that Head over Feet received ($M = 6.18$, $SD = 2.01$).

Informative video. The video that participants watched after listening to the music was very rich in information. It was a video about the Dutch painter Rembrandt van Rijn and it was spoken in Dutch. The duration of the video was approximately five minutes. The information presented in the video was well distributed across the video, i.e., the first half and the latter half of the video contained equal amounts of information.

Memory. Participants' memory for the informative video was measured in three different ways. First of all, free recall was measured. Participants were asked to write down as many facts regarding the video as they could remember. For each fact that was correct they received one point. In addition, memory was measured by using eighteen true/false questions containing information that was presented in the video. One point was given for every correctly answered question. Finally, participants answered ten forced choice questions. Again, one point was given for each question that is answered correctly. Besides determining separate scores for each measure, the three measures were combined into an overall memory score as well by adding the received points.

Memory of information presented in the first few minutes might be affected more by musical context than that of information presented later on in the video. In order to study such a decay effect, half of the true/false and forced choice questions were related to information presented in the first half of the video, whereas the other half of the questions were related to information presented in the latter half of the video.

Evaluation. Participants' evaluations of the informative video were measured by using ten semantic differentials. Six of these were adapted from Goldberg and Gorn (1987). Participants rated the video as being ineffective to effective, sad to happy, unsatisfactory to satisfactory, unpleasant to pleasant, bad to good and disliked to liked. These items mainly measured how much participants liked the video. In addition, four other items were used to measure the degree to which the video was clear and understandable. Participants rated the video as being incomprehensible to

comprehensible, difficult to simple, boring to exciting and uninteresting to interesting. All items were measured on a 9-point scale, with higher scores indicating more positive evaluations. Both in the original study (Goldberg & Gorn, 1987) as well as in another study using the same scales (Kamins et al., 1991) have these measures been proven to be effective and reliable.

2.4 Procedure

Participants in this experiment were students attending one of two lectures. Students in one lecture were assigned to the high arousal condition, while students in the other lecture were assigned to the medium arousal condition. All students were told they were participating in an experiment that studied the perception of music and video. They were asked to fill out some questions regarding demographic variables, so that potential arousal resulting from previous activities could fade. The duration of brief oral instructions and filling out of the questions was approximately three minutes. Depending on the experimental condition they were assigned to, participants then listened to either high or medium arousing music while watching an abstract animation that was generated by Windows Media Player. However, the music accompanying this animation differed across the two conditions. Thus, participants in the high arousal condition listened to music that induced high arousal, whereas participants in the medium arousal condition listened to music that induced medium arousal. In order to be able to check whether the manipulation was successful, participants completed the SAM directly after watching the abstract animation. Upon completing the SAM, participants watched an informative video. Then, participants answered ten questions that measured their evaluation of the informative video. After completing the evaluation, free recall of the information presented in the video was measured, followed by eighteen true/false questions and finally ten forced choice questions. Lastly, all students were thanked for their participation and dismissed.

3. RESULTS

Three participants (two in the high arousal condition, one in the medium arousal condition) did not properly follow the instructions they were given. Therefore, they were excluded from the analyses below. Furthermore, the gender of participants did not produce any significant effects and thus was discarded from the analyses.

3.1 Manipulation check

In order to be able to determine whether the medium and high arousing music indeed induced the different levels of arousal that were intended, participants completed the SAM. Scores on the arousal dimension were compared across conditions and a t-test for independent samples showed that participants in the high arousal condition reported feeling more aroused ($M = 5.61$, $SD = 1.71$) than participants in the medium arousal condition ($M = 4.61$, $SD = 1.85$), $t(54) = 2.07$, $p < .05$. Participants' scores on the valence dimension were also compared across conditions. Valence scores of participants in the high arousal condition ($M = 6.15$, $SD = 1.42$) and the medium arousal condition ($M = 5.96$, $SD = 1.69$) did not differ significantly ($p = .64$, *ns*).

3.2 Memory

With respect to the measures of memory, a t-test for independent samples showed that the overall memory score of participants in the medium arousal condition was higher ($M = 10.38$, $SD = 1.73$) than that of participants in the high arousal condition ($M = 9.40$, $SD = 1.59$), $t(54) = 2.17$, $p < .05$.

The various memory measures were also analyzed separately. A t-test for independent samples showed that the free recall score differed across conditions, $t(54) = 2.37$, $p < .05$. Participants in the medium arousal conditions recalled more correct facts ($M = 7.30$, $SD = 2.70$) than participants in the high arousal condition did ($M = 5.76$, $SD = 2.17$). There were no significant effects in the true/false and the forced choice measure. However, with respect to the true/false questions, there was a tendency for the medium arousal condition to produce better memory scores ($M = 15.09$, $SD = 2.09$) when compared to the high arousal condition ($M = 13.88$, $SD = 2.40$), $t(54) = 2.37$, $p = .056$. Mean scores of participants on the various memory measures can be found in Table 1.

Table 1. Means of the different memory measures by Music

Music	Memory measure					
	Free recall		True/false		Forced choice	
	M	SD	M	SD	M	SD
Medium arousal	7.30	2.70	15.09	2.09	8.74	1.21
High arousal	5.76	2.17	13.88	2.40	8.58	1.56
p	< .05		ns		ns	

When looking at memory for information that was presented in the first half of the video versus information that was presented in the latter half, differences between conditions were found. With respect to free recall, analysis of the results showed that participants in the medium arousal condition recalled more correct facts that were related to information presented in the first half of the video ($M = 3.26$, $SD = 2.14$) than participants in the high arousal condition ($M = 1.88$, $SD = 1.54$), $t(54) = 2.82$, $p < .01$. No difference was found for information presented in the latter half of the video. As for the true/false measure of memory, a similar result was found. The number of correctly answered questions regarding information presented in the first half of the video was higher for participants in the medium arousal condition ($M = 6.83$, $SD = 1.44$) than for participants in the high arousal condition ($M = 5.76$, $SD = 1.71$), $t(54) = 2.45$, $p < .05$. Again, no difference was found for information that was presented in the latter half of the video. There was no difference between the conditions with respect to the forced choice questions.

3.3 Evaluation

Analysis of the results showed that the reliability of the items that were used to determine how participants evaluated the video, as indicated by Cronbach's alpha, was high ($\alpha = .87$). One participant failed to complete all ten items and was therefore discarded from the analysis below. Results from twenty-five participants in the high arousal condition and twenty-three participants in the medium-arousal condition were analyzed. A t-test for independent samples showed that there was a significant difference in participants' evaluation of the video between conditions, $t(53) = 2.05$, $p < .05$. Evaluations of participants in the medium arousal condition were more positive ($M = 6.40$, $SD = .91$) than those of participants in the high arousal condition ($M = 5.78$, $SD = 1.22$).

4. DISCUSSION

This study investigated the role of music in program context effects. More specifically, the effect of music-induced arousal on the memory for and evaluation of a subsequently presented informative video was investigated. Our first hypothesis was that memory for an informative video would be better in a medium arousing musical context than in a high arousing musical context. Results supported this hypothesis and in addition supported earlier findings of both Tavassoli et al. (1995) and Newell et al. (2001). Since processing of information under high arousal might be more shallow than under medium arousal conditions (Shapiro et al., 2002) and deeper processing is related to better memory (Craik & Lockhart, 1972), this might account for the found effect of arousal context on memory. Although Shapiro et al. (2002) studied the memory for advertisements, it is likely that the same process is involved when it concerns an informative program.

We found that not all memory measures resulted in significant differences between high and medium arousing musical contexts. Free recall of information presented in the video was better in a medium arousing context. There was a tendency for significance with respect to the true / false questions, and a similar pattern – however, not significant – was found for the forced choice questions. The absence of a significant effect with respect to the forced choice questions can be explained by the scores that participants obtained on this task. Both participants in the medium and high arousal condition scored very high – means were 8.74 and 8.58, respectively, where a maximum score of 10 could be obtained – due to which a ceiling effect may have arisen. The results suggest that when information has to be recalled without the use of any cues, the music-induced arousal context is of particular influence. Whereas true / false questions and forced choice questions provide cues which facilitate answering based on recognition, free recall requires retrieval of information from memory. It therefore seems that free recall is a good indicator for the level at which information is processed.

An interesting finding of our study was that memory for information presented in the first half of the video was better in a medium arousing context than in a high arousing context. This pattern was found for both the free recall and the true / false measures for memory, but not for the forced choice memory measure. No such differences were found with respect to information that was presented in the latter half of the video. These results suggest that high arousal has negatively affected memory, but that this effect faded after a relatively short period (here, two and a half minutes). So, after this period, arousal in both conditions had decreased to similar levels. There thus seems to be a decay effect of music-induced arousal on memory for an informative program.

Our findings regarding the effect of music-induced arousal on memory support the excitation transfer theory (Zillmann, 1971). Processing of the informative video was affected by the arousal

associated with preceding presented music. The arousal that was induced by the music may have transferred to the informative video. Furthermore, results show that when arousal increases (presumably beyond an optimum point), memory for the informative video decreases. This negative relationship supports the intensity theory of Newell et al. (2001). When compared to medium arousal that is induced by music, high music-induced arousal is more intense and most likely narrows attention and consequently inhibits memory for a subsequent stimulus.

In addition to effects on memory, we investigated the effect of arousal on evaluation. It was expected that, compared to a high arousing musical context, evaluations of an informative video would be more positive in a medium arousing musical context. This hypothesis was supported and earlier findings of Tavassoli et al. (1995) thus were supported as well. Here, too, support was found for both the excitation transfer theory and the intensity theory. It is possible that residual arousal from the presented music was transferred to the subsequently presented informative video, thus adding to the arousal induced by that stimulus. As a result, and in line with the inverted-U relationship between arousal and evaluations (Tavassoli et al., 1995), evaluations were more negative when context arousal was high. In addition, the high arousing context may have caused attention for the subsequently presented video to be narrowed (cf. Newell et al., 2001) and program involvement to be low (Tavassoli et al., 1995), resulting in more negative evaluations when compared to the medium arousing context.

In all, this study provided insight in the effects of music-induced arousal and demonstrated the musical program context effect. Our results indicate that it is most beneficial to present information on television in a medium arousing context, since memory for the content of a program will be most optimal. For messages of the government (the *Postbus 51* clips in The Netherlands) and other television programs that strive to inform the audience, it is of great importance that information is remembered. In order for such information to be evaluated positively, a medium arousing context will be most effective as well.

There are several effects of music-induced arousal that yet remain to be studied. First of all, mechanisms that account for the musical program context effect should be studied. It is clear that music-induced arousal affects memory and evaluation, however we do not yet know which underlying processes are involved. Perhaps arousal narrows attention, as suggested by Newell et al. (2001), but level of processing might play a role as well. Another suggestion for future research is to include a low arousal level in order to investigate whether the inverted U-shape of the effect of arousal on memory and evaluation (as found by Tavassoli et al., 1995) can be replicated. Our results show that medium arousal is favorable over high arousal when it comes to memory and evaluation, but they do not provide insight in the effect of low arousal. Furthermore, other effects of music-induced arousal can be studied, e.g., the effect on program involvement. Other examples include

effects of arousal on the degree to which people are interested in a program and on the credibility of an informative program. Finally, both arousal and valence of a musical context could be manipulated in future research. In doing so, the joined effect of these two dimensions can be investigated. We now know that music can induce various arousal levels and that this has effect on memory and evaluation of an informative program, but what role does the valence of music play? When the valence of music is positive, this might indicate that all is well. As a result, information might be processed less accurately and recall decreases. As our results suggest, this effect might be strongest when context arousal is high. In contrast, when music has a negative valence, this might indicate that something is wrong and information should be processed thoroughly, resulting in better recall (cf. Shapiro et al., 2002). Since our results show that medium context arousal results in better recall than high arousal, the proposed effect of valence might be strongest under medium context arousal. With respect to evaluations, the affect-as-information explanation (Schwarz & Clore, 1988) suggests that people will use the valence of music to make a judgment. On the other hand, the finding of Gorn et al. (2001), that advertisement evaluation was affected by the arousal but not the valence dimension, suggests that the valence of music will not have any effects. These suggestions for future research show that there is more to explore in the field of musical program context effects.

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