

RUNNING HEAD: MULTITASKING EFFECT

Situational Factors Competing for Attention:

The Interaction Effect of Multitasking and Sexually Explicit Content on TV Recognition

Weiyu Zhang\*

Assistant Professor

Communications and New Media

National University of Singapore

Se-Hoon Jeong

Assistant Professor

School of Journalism and Mass Communication

Korea University

Martin Fishbein

Professor

Annenberg School for Communication

University of Pennsylvania

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## Abstract

The purpose of this study is to investigate how multitasking interacts with levels of sexually explicit content to influence an individual's ability to recognize TV content. A 2 (multitasking vs. non-multitasking) by 3 (low, medium and high sexual content) between-subjects experiment was conducted. The analyses revealed that multitasking not only impaired task performance but also decreased TV recognition. An inverted-U relationship between degree of sexually explicit content and recognition of TV content was found, but only when subjects were multitasking. In addition, multitasking interfered with subjects' ability to recognize audio information more than their ability to recognize visual information.

Key words: multitasking, sexual explicit content, arousal, TV, mode, sequence, recognition

Multitasking with media (heretofore multitasking), that is, using media while engaging in one or more other non-media activity, is found to be popular among youth. The Middletown Media Studies (2005a, 2005b) suggest that, based on observational data, media were often used with other life activities: 32.0% of newspaper reading, 39.7% of magazine time, 46.2% of TV watching, 58.6% of web surfing, and 75.6% of radio listening were accompanied by other non-media activity. Similarly, Foehr (2006) reported that among American youth, 45% of TV watching, 58% of music listening and 63% of websites use occurred during multitasking. A recent diary study of 14- to 22-year-olds (Jeong et al., 2005) found that 76% of the time respondents were using media they were also involved in one or more other activities (i.e., they were multitasking).

Very few studies have explored multitasking's influence on attention paid to media. One exception was a study by Pezdek and Hartman (1983) who found that audience behaviors such as playing with a toy while watching TV reduced the recognition of TV content. Ignoring the situational factors that are present during media use raises important questions about the estimation of media effects, such as the effects of sexually explicit content. Researchers have found an increasing amount of sexual materials in media (Kunkel, Cope, Biely, & Donnerstein, 2001). Sex in the media was often portrayed in ways that are inaccurate and misleading (Lowry & Shidler, 1993; Sapolsky & Tabarlet, 1991). Safe sex messages, including depictions of sexual risk and responsibility topics, were rarely addressed (Eyal, Kunkel, Biely, & Finnerty, 2007). Given the widely held belief that the sexual messages conveyed in the media are shaping adolescents and young adults' beliefs, attitudes, norms and intentions to have sex (Hennessy, Bleakley, Busse, & Fishbein, 2008), we can understand why sex in the media has been a concern of both parents and educators. Findings regarding the effects of exposure to sexual content suggested that exposure may influence a number of outcome variables, such as attitudes toward premarital sex and endorsements of traditional gender norms (Zhang, Miller, & Harrison, 2008), on the

one hand. On the other hand, safe sex messages presented along with sexual intercourse lead to positive attitudes about condom use among women (Farrar, 2006).

Whereas plenty of empirical evidence supports the effects of sexually explicit content on young audiences, the situation in which such information is consumed is often ignored. Multitasking may function as such an important situational factor that challenges our understanding of the effects of sexually explicit content. Audiences who are involved in multitasking may be distracted and thus cannot catch all the messages conveyed in the sexually explicit content, such as safe sex messages. Rather, they watch the content superficially, paying attention only to stimulating cues such as images with nudity. There thus stands a risk that audiences cannot interpret the sexually explicit content accurately and only sexual stereotypes, not the nuances included in the TV content, would be recognized and reinforced.

The purpose of this study is to investigate whether multitasking, as a common situational factor during media exposure, interacts with sexually explicit content to affect audiences' ability to recognize sexual TV content. In this study, we define sexually explicit content on TV as a message feature, referring to the intensity of sex-related verbal and nonverbal cues presented in either the visual or the audio channel. We examine a relatively popular media usage pattern, watching TV and doing homework, because adolescents reported significant amounts of using media while studying—a quarter of those aged 10 and over said they did school homework while watching TV (Wober, 1992). Previous studies have investigated the effect of background TV or radio on task performance (e.g., Armstrong & Chung, 2000; Pool, Koolstra, & van der Voort, 2003). In contrast, this paper examines the interaction between sexually explicit content and a homework-type task on TV recognition. Although it seems quite likely that multitasking will reduce recognition of sexual TV content, the main question asked in this paper is whether the magnitude of this effect will depend upon the sexual explicitness of that content. How exactly do multiple tasks compete with each other at various levels to gain attention?

This paper begins with a review of previous theories that provide important insights into the mechanisms underlying the influence of multitasking on recognition of TV content. The limited capacity approach is discussed in detail and treated as the fundamental mechanism by which sexually explicit content, modality, and sequence are assumed to be differentially influenced by multitasking. After proposing hypotheses and research questions based on these theoretical perspectives, we introduce a two by three between-subjects experimental design to clarify the complex effect of multitasking on recognition of TV content.

### Theory

Because our focus is on attention and recognition, the Model of Limited Capacity is used as the theoretical framework in this study (Kahneman, 1973; Lang, 1995). According to this model (Lang, Borse, Wise, & David, 2002), allocating cognitive resources to TV content is both a controlled and an automatic process. It is assumed that an individual has a finite amount of controlled processing resources that can be allocated among all the task(s) he/she is working on, depending upon his/her goals, interests, and motives. In contrast, structural and content features of both the medium and the message can elicit the automatic allocation of resources, such as orienting behavior and arousal. Resources can be used for different cognitive subprocesses, including encoding, retrieval and storage. Therefore, multiple tasks (e.g., watching TV and doing homework), message features (e.g., pace and emotion), sensory channels (e.g., visual and audio) and cognitive subprocesses (i.e., encoding, storage, and retrieval) all compete for resources. When there are insufficient resources available to be allocated to all the tasks, features, channels and subprocesses, some aspect(s) of processing will be performed less well.

The limited-capacity approach suggests that different tasks compete for cognitive resources: On the one hand, as has been consistently demonstrated in previous studies (e.g., Armstrong, Boiarsky &

Mares, 1991; Pool, van der Voort, Beentjes, & Koolstra, 2000), TV can be a distracter when students do homework. On the other hand, although not fully investigated, working on homework should negatively influence the attention paid to TV programs. Although common sense tells us that multitasking will significantly reduce both task performance and the recognition of TV content, it is unclear how multitasking will interact with media/message features to influence TV recognition. The sexual explicitness of TV content is considered as one message feature, whose effects on TV recognition have to be re-evaluated when a simultaneous task is present.

#### *Multitasking and the Effect of Sexually Explicit Content*

Various physiological measures have supported the assumption that sexual media materials are arousing (e.g., Abramson, Perry, Seeley, Seeley, & Rothblatt, 1981). According to Zillmann's (1982) theory of arousal, if media content produces emotional and physical arousal, processing resources are directed toward such arousing material. This would suggest that the more sexually explicit the media content, the better should be the content recognition. However, findings concerning the effects of arousing media content on recall and recognition of that content are controversial. While some studies have found memory enhancement for arousing material (Bock & Klinger, 1986; Bolls, Lang, & Potter, 2001; Brosius, 1993), other studies have found memory deficit (Christianson, 1986; Newell, Henderson, & Wu, 2001; Pavelchak, Antil, & Munch, 1988). There are also studies indicating no differences in memory as a function of degree of arousal (Christianson & Mjorndal, 1985) as well as studies finding support for an inverted-U relationship between degree of arousal and recognition of arousing content (Lang, Bolls, Potter, & Kawahara, 1999).

Attig and Cappella (1995) suggested that these inconsistencies might be due to an interaction between the intensity of stimulus materials (e.g., arousing content) and the cognitive load imposed on individuals who view these materials. In other words, whether the memory of arousing materials is

enhanced or inhibited by a high level of arousal will depend on the difficulty level of tasks which are performed during exposure to these materials.

When people are multitasking and cannot pay full attention to TV content, they are more likely to respond to message cues that elicit automatic attention. Arousing material such as emotional or sexually explicit content is treated as one of those cues (e.g., Lang, 1990). Arousing material speeds up the rate with which mental and response operations occur (Eysenck, 1982), or calls for more cognitive resources to be invested in the arousing content (Easterbrook, 1959). Both of these processes are assumed to lead to greater attention to the arousing material at higher levels of arousal, as long as cognitive resources are not exhausted. For example, Kern, Libkuman, Otani and Holmes (2005) showed neutral vs. negative emotional slides to subjects in both divided and non-divided attention conditions. In the divided attention condition, subjects worked on a digit-tracking task during the slide viewing; in the non-divided attention condition, participants simply viewed the slides. As expected, there was better recall of the emotional (i.e., arousing), than of the neutral slides. More important, the superiority of the arousing material in terms of facilitating memory of the material was more obvious in the dual task condition than in the single task condition. This finding supports the notion that multitasking makes it more difficult for people to control their allocation of attention and thus, the effect of arousal on eliciting automatic attention to that arousing material becomes more explicit.

However, the combination of concurrent tasks and the arousing material can also push the system into cognitive overload. In other words, there is an upper limit for the positive effect of arousal on recognition when multitasking. Lang, Chung, Lee, Schwartz and Shin (2005) found that when the arousing material was accompanied by fast-paced content, the arousing material was less well recognized than was the calm material. This implies that if the combination of the arousing material and the fast pace of that material is so demanding that it exhausts subjects' cognitive capacity, the positive

effect of arousing material on recognition might be eliminated because there would be no cognitive resources available for activation. Based on these findings, we hypothesize that an inverted-U relationship between recognition and degree of sexually explicit content is most likely to be found when an attention distracter (e.g., a simultaneous task or another message feature such as fast pace) is present during exposure to the sexually explicit material.

H1: When people are multitasking, there will be an inverted-U shape relationship between the degree of sexual explicitness in TV content and recognition of that content.

### *Multitasking and the Mode Effect*

Sensory channels (i.e., mode) also differ in the manner that they address attentional capacity. The visual dominance theory suggests that in many situations, visual input tends to dominate other modalities in perceptual and memorial reports and in speeded responses (Cooper, 1998; Chan & Chan, 2006). Visual dominance appears to be related to the relatively weak capacity of visual inputs to alert the organism to their occurrence. In response to this reduced alerting, subjects tend to keep their attention tuned to the visual modality. Research on audiovisual redundancy varies the comparability of visual and audio stimuli and finds that as audio-video redundancy decreased, recognition for information presented in the audio track decreased substantially while recognition of visual information was hardly impaired (Drew & Grimes, 1987; Zhou, 2004). In other words, recognition of audio stimuli in a situation in which the audio and the visual content are not comparable is much lower than the audio recognition in a highly comparable situation. The difference in visual recognition, in contrast, is very small. Lang, Potter and Bolls (1999) made a further argument that visual encoding is a relatively automatic task and not severely resource-limited, whereas audio encoding appears to be a more controlled or resource-limited process.

How multitasking interferes with the mode effect is hypothesized based on the above argument. First, multitasking burdens cognitive load and leaves little resource for people to control. Second, audio



encoding is more subject to resource limit than is visual encoding. Therefore, multitasking should have a larger influence on audio encoding than on visual encoding. We hypothesize that when people are multitasking and resources are obviously limited, we will see a larger decrease in audio recognition than in visual recognition.

H2: Irrespective of the degree of sexual explicitness in TV content, multitasking will lead to a larger decrease in audio recognition than in visual recognition.

### *Multitasking and the Sequence Effect*

As Lang and Friestad (1993) suggested, TV-viewing is a time-based activity. Thus it is theoretically meaningful to examine how sexually explicit content influences recognition of TV content in sequence and how that influence manifests differently in multitasking situations. Excitation transfer theory is relevant here because it also addresses arousal that is elicited by media stimuli and provides predictions regarding responses to stimuli that follow the arousing material. Specifically, the theory states that residual arousal elicited from one stimulus could intensify the affective reactions to subsequent stimuli (Zillmann, 1996). Because arousal takes a relatively long time to disappear, some degree of residual excitation may be present even when the audience is no longer exposed to the stimulus. The theory has been supported in a wide range of contexts (e.g., advertisements, films, and websites) (Perry, 2001; Sparks, 1991; Sundar & Wagner, 2002). Based on this theory, we can hypothesize an interaction between sequence and the degree of sexually explicit content. Sexually explicit materials should not only influence recognition of the sexually explicit material itself but also that of content following the sexually explicit material. Since we expect an inverted-U shape relation between sexually explicit content and recognition to emerge with respect to the arousing content, we expect the same pattern to be seen with respect to recognition of content that appears after the arousing material.

H3: When people are multitasking, there will be an inverted-U shape relationship between the degree of sexual explicitness in TV content and recognition of content following the sexual content.

Arousing material may also affect recognition of TV content prior to the arousing material. Although recognition is often considered as a measure of the encoding process, as some scholars suggested (Leigh, Zinkhan, & Swaminathan, 2006), recognition tests might involve a low degree of retrieval and storage. According to Lang et al. (2002), storage refers to the establishment of an association between current and previous information and retrieval means the rehearsal of previously stored information. Lang and Newhagen (1996) explained that the arousing material affects recognition of content prior to that material because the resources are shifted from the process of storing the previously encoded information to the process of encoding and storing the incoming arousing material. Two studies on negative TV videos (Newhagen & Reeve, 1992; Lang & Newhagen, 1996) show that negative videos, which comprise both arousal and negative emotion, result in retroactive inhibition, namely, subjects had very poor memory for information presented before the negative video. When subjects are multitasking, we will see little available resources to be allocated. Therefore, we expect that the retroactive inhibition will be evident in the multitasking condition.

H4: When people are multitasking, recognition of content prior to the sexually more explicit content will be poorer than recognition of content prior to the sexually less explicit content.

## Method

### *Subjects*

One hundred and twenty-one undergraduates and graduate students participated in the six conditions comprising the two by three between-subjects design, and 119 of them successfully completed the experiment. Another 20 subjects successfully finished a task-only control condition. The

subjects were compensated 10 dollars for their participation. The average age of these 139 subjects is 20.25 ( $SD = 2.32$ ) and 54% of them are female. About 61% of subjects are white, 14% black, 12% Asian, 7% more than one race and 6% others.

### *Experimental Procedure*

After filling out consent forms, subjects were randomly assigned to conditions and were tested in small groups (one to seven people). Participants in the non-multitasking conditions were instructed to pay close attention to the TV programs because they were going to answer questions about them<sup>1</sup>. Those in the multitasking conditions were required to pay equal attention to both TV and the homework task. Those in the task-only control group were told that the study was concerned with testing task performance and were given 10 minutes to work on the tasks.

The experimental setting was a medium-size and quiet meeting room. Participants were seated around a large square table. Each participant had a laptop computer to be used for completing the post-exposure questionnaire. A TV monitor and a laptop were placed on a TV stand which was at one end of the table. Thus the TV was at about a 45-degree angle to subjects' right or left depending upon the side of the table at which he/she sat. The experimenter sat in a chair besides the TV stand, mainly to be available in case the TV or the laptops did not work appropriately but also to provide procedural information when requested by the subjects.

After all participants finished reading the instructions, the TV set was turned on and the subjects were instructed to start working on the tasks. When the TV clip ended, subjects were asked to stop working and to turn their answers in to the experimenters whether they had or had not finished. After the TV show, participants were given the post-test questionnaire. Subjects were allowed to answer the questionnaire without a time limit but were not allowed to go back to change answers. After subjects had completed the questionnaire, they were debriefed and compensated.

*Sexual Messages*

The sexual messages were carefully selected in order to make sure that their main difference lies in the sexual explicitness but not other aspects. A set of measurement categories that are often employed in content analysis of sexual media content (Amy Jordan, personal communication, August 18, 2006)<sup>2</sup> were used to differentiate levels of TV sexual content. A variety of TV programs (Girlfriends, My Wife and Kids, One Tree Hill, Will & Grace, etc) were scrutinized using the coding criteria and clips from Desperate Housewives manifest a good range of sexual explicitness.

Clips from a prime-time TV show, Desperate Housewives (DH), were used in the experiment as the sexual messages. The sexual clips involve Gabrielle, a housewife and John, a teenage gardener, who are having a secret affair. All three levels of sexual content (heretofore Part 2) involve substantial visual and audio information: The low sexual content clip first shows Gabrielle and John having a conversation about John's plan of gardening fulltime instead of going to college and it then depicts John's proposal to Gabrielle, with a ring in his hand. The medium sexual content clip involves the same characters, talking about having had sex a moment ago and then John, who is partially nude throughout the whole part, presents Gabrielle with a single red rose. The high sexual content clip depicts Gabrielle and John talking about where they are going to have sex and then being engaged in sexual intercourse, with both characters in some state of nudity.

The sexual clips are short, running approximately two minutes. The homework-type task we used requires a longer time period, at least five to six minutes. Therefore, we add non-sexual content immediately before and after the sexual content. Both the before- and after-content are held constant across the three levels of sexual content. In all three levels of sexually explicit content, the before-sex content is a two-minute clip, which depicts Bree, another character from the same show, having a conversation with her son while the family is having a dinner (heretofore Part 1). In the after-sex content,

Lynette, a housewife with three kids and also a character from *Desperate Housewives*, talks about her troubled kids with a neighbor (heretofore Part 3). Because the length of Part 2 is slightly different in the three conditions, the length of the three TV clips ranges from 7:13 to 7:57 minutes.

### *Manipulation Check*

A pilot test of the sexual clips was conducted with 19 graduate students in order to make sure that the clips varied in sexually explicit content and arousal. More specifically, immediately after viewing either the high, medium or low sexual content clip (i.e., Part 2 only), the participants in the pilot study were asked to indicate the degree of sexuality in the clip as well as the extent to which they found the clip to be arousing. The amount of sexual content was evaluated by a 4-point scale, with 1 indicating *no sexual content* and 4 indicating *a lot of sexual content*. A 7-point scale was used to assess perceived level of arousal, with 1 meaning *not at all arousing* and 7 meaning *extremely arousing*. Consistent with expectation, the clips varied in perceived sexuality ( $F(2, 54) = 57.59, p < .001; \eta_p^2 = .69$ ) and perceived level of arousal ( $F(2, 54) = 19.48, p < .001; \eta_p^2 = .42$ ). Post-hoc Tukey's HSD tests indicated that the differences between low, medium and high sexual content in perceived sexuality (Low vs. Medium:  $\Delta M = -1.53, SE = .21, p < .001$ ; Medium vs. High:  $\Delta M = -.72, SE = .21, p < .01$ ) and perceived level of arousal (Low vs. Medium:  $\Delta M = -1.26, SE = .47, p < .05$ ; Medium vs. High:  $\Delta M = -1.68, SE = .47, p < .01$ ) were in the right direction and significant<sup>3</sup>. Previous studies show that the perceived level of arousal provides a good estimate of the actual arousal. In particular, ratings of self-reported arousal have been shown to correlate quite highly with physiological measures of arousal (like skin conductance) (e.g., Greenwald, Cook, & Lang, 1989).

### *Task Manipulation*

Respondents in the multi-tasking or task only conditions were asked to work on two tasks: The first task required reading a paper concerning world climate change and the second task involved

reading a news article about health and genes. Both reading and writing tasks are quite often seen in the homework context. Reading tasks were chosen because they are not as resource overwhelming as writing tasks. We can expect to see at least some attention to be spent on TV. The evaluation of the first task involved a comprehension test that was selected from the Graduate Record Examination (GRE). Subjects were asked to answer multiple choice questions about the topic, the main idea, and some details regarding the GRE paper. They were also instructed to read the news article and the comprehension of the second article was tested. Once again, the comprehension test included questions about the topic, the main idea and some simple facts presented in the news story.

### *Dependent Measures*

The dependent variables include both task performance and recognition of TV content. Task performance is assessed by counting the number of correct answers out of 10 questions to both the GRE and the news comprehension test. The recognition of TV content is divided into two parts – visual and audio. The visual recognition test is comprised of nine multiple choice questions (Each question has four alternatives, which means the chance level to be correct is 25%), which ask subjects to identify the images that have appeared in the TV excerpts: Three images from Part 1, three from Part 2 and three from Part 3. With respect to each part, two questions involve pictures of close-ups of two different characters and the third question involves a long-distance scene. By matching types of pictures from each part, we attempted to control the degree of difficulty of the visual recognition questions across three parts. The foils are also screenshot images from the same TV show. They either include the same characters (e.g., Gabrielle) or a similar long-distance scene (e.g., a car on the street) as shown in the target image (correct answer). A similar test is used to measure the recognition of audio materials. Subjects are asked to identify quotes of audio material which are from the TV content. Here too, the material comes from the content before, during and after the sexual clips. We again attempted to control

the degree of difficulty by asking two monologue questions (the length of the quotes is no longer than 20 words) and one conversation question (the length of the quotes is no longer than 40 words) for each part. Again, the foils are quotes from the same TV show. They match the target answer in terms of both formats (i.e., monologue or conversation) and length (variances range +/- 5 words). No pretest of these recognition questions was conducted although the attempted control was enforced as vigorously as we can. We chose to use recognition tests not recall tests because aided recognitions are often easier than free recalls. In the multitasking condition, we expect attention division to be very difficult for subjects therefore an easier test such as recognition is able to catch more variances than free recalls.

### *Control Variables*

A number of variables could conceivably enter into plausible rival hypotheses explaining experimental findings. First, familiarity with the TV program can strongly influence subjects' recognition of TV content. We checked prior experience with the TV show by asking subjects whether they had seen *Desperate Housewives* before and if yes, how often they watched the show (54.6% of respondents never saw *Desperate Housewives* before, 22.7% rarely, 10.1% sometimes, and 12.6% often did so). Second, subjects' prior experience with multitasking could also influence any findings and thus participants were asked: "when you are doing homework, how often do you watch TV at the same time?" 37.8% of respondents said never, 34.5% rarely, 20.2% sometimes, and 7.5% said they often or always did so.

Third, sensation seeking represents people's likelihood of engaging in activities that overwhelm their sensory ability. Sensation seeking was measured using a reduced form of the Brief Sensation Seeking Scale (Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002). Respondents were asked to rate their agreement on a 7-point agree/disagree scale with each of the following statements: I would like to explore strange places; I like to do frightening things; I like new and exciting experiences, even if I

have to break the rules; I prefer friends who are exciting and unpredictable (Cronbach's  $\alpha = .68$ ,  $M = 19.82$ ,  $SD = 3.85$ ).

In addition, as an estimate of subjects' cognitive abilities, academic achievement was measured by self-reported Grade Point Average (GPA) and Scholastic Assessment Test (SAT, a standardized test for college admissions in the United States) scores (GPA: 61.3% of respondents said they got most As; SAT:  $M = 1393.71$ ,  $SD = 111.29$ ). Finally, a general TV exposure measure (i.e., How much time do you usually spend watching TV on a school day) was assessed. We found that 48.7% of respondents watched TV less than one hour every day.

A series of two-way ANOVAs (including the main effects of degree of sexually explicit content and multitasking and their interaction) were conducted in order to identify differences among subjects that might be confounded with subjects' assignment to conditions. Among the 9 potential confounders we examined (i.e., age, gender, race, SAT score, average grade, sensation seeking scale, prior experience with multitasking, prior experience with *Desperate Housewives*, and time spent with TV per day), only prior experience with DH ( $F(1,113) = 4.94$ ,  $p < .05$ ;  $\eta_p^2 = .04$ ) and gender ( $F(1,113) = 6.36$ ,  $p < .05$ ;  $\eta_p^2 = .05$ ) were significantly different for subjects who participated in the multitasking and non-multitasking conditions. Therefore, we entered prior experience with DH and being male as covariates in models which examine TV content recognition measures.

## Results

### *The Multitasking Effect*

An ANCOVA repeated measures analysis was performed with level of TV sexually explicit content and multitasking entered as the between-subjects factors while sequence (i.e., Part 1 vs. Part 2 vs. Part 3) and mode (i.e., visual vs. audio) were entered as within-subjects factors. Prior experience with



the TV clips and gender were treated as covariates. The significant results revealed a main effect of multitasking on recognition of TV content ( $F(1, 111) = 68.17, p < .001; \eta_p^2 = .38$ ), which suggests that multitasking decreased TV recognition<sup>4</sup>. Prior experience showed a significant main effect ( $F(1, 111) = 38.37, p < .001; \eta_p^2 = .26$ ), meaning that the more prior experience with the show, the better the recognitions. No significant main effects were found for either level of sexual explicitness or gender. The four interactions between the two covariates and the two main factors (i.e., prior experience\*multitasking, prior experience\*sexual explicitness, gender\*multitasking, and gender\*sexual explicitness) were all not significant. Neither were any higher level interactions (e.g., the four-way interaction between prior experience, gender, multitasking, and sexual explicitness).

#### *Multitasking and the Effect of Sexually Explicit Content*

As expected, the three-way interaction between sequence, TV sexually explicit content and multitasking was significant ( $F(4, 222) = 2.33, p < .10^5; \eta_p^2 = .04$ ). When people were multitasking, an inverted-U relation between degree of sexually explicit content and recognition of that content was obtained (See Figure 1, MT part2, MT means multitasking), supporting H1. Post-hoc tests showed that when multitasking, medium sexual content was significantly better recognized than both low sexual content (Medium vs. Low:  $\Delta M = .19, SE = .07, p < .01$ ) and high sexual content (Medium vs. High:  $\Delta M = .31, SE = .07, p < .001$ ). In contrast, when people were only watching TV, the level of sexual content did not significantly influence recognition of that content (See Figure 1, Non-MT part2, Non-MT means non-multitasking).

#### *Multitasking and the Mode Effect*

There is a significant main effect of mode ( $F(1, 111) = 31.05, p < .001; \eta_p^2 = .22$ ), which means that audio recognition is generally better than visual recognition. However, our focus is on the finding that recognition of information presented in different modes was contingent on multitasking. Consistent

with expectations, there was a significant interaction effect between mode and multitasking ( $F(1, 111) = 10.81, p < .01; \eta_p^2 = .09$ ), indicating that multitasking led to a significantly greater decrease in audio recognition than in visual recognition (see Figure 2). H2 is thus supported.

### *Multitasking and the Sequence Effect*

There is a significant main effect of sequence ( $F(1, 111) = 19.77, p < .001; \eta_p^2 = .15$ ), showing that content from different sections of the video clips received different amount of attention. Again, our focus is rather on the interaction between sequence, multitasking, and sexual explicitness (see above for the statistics). Specifically, the excitation transfer theory suggests that whatever variance we found in recognition of sexual content (i.e., Part 2) should be observed in recognition of the content following the sexually explicit material (i.e., Part 3). In contrast to expectations, however, there were no differences found in Part 3 recognition as a function of sexually explicit content in Part 2 (see Figure 1, MT part3) when people were multitasking. Thus H3 is rejected.

In addition, TV sexual content in Part 2 did make a difference in the recognition of Part 1 content but only when subjects were multitasking (See Figure 1, MT Part1). Post-hoc tests showed that content that occurs prior to high sexual material was recognized significantly less well than content that occurs prior to low sexual material (Low vs. High:  $\Delta M = .17, SE = .07, p < .05$ ). Although the differences between medium vs. high and medium vs. low sexual content were not significant, the trend is the same (Medium vs. High:  $\Delta M = .13, SE = .07, ns$ ; High: Medium vs. Low:  $\Delta M = -.04, SE = .07, ns$ ). When subjects were not multitasking, degree of sexually explicit content in Part 2 did not lead to differences in recognition of Part 1 (See Figure 1, Non-MT part1). H4 is thus supported.

## Discussion

The most important contribution of this paper is to reveal the effects of multitasking on the recognition of sexually explicit TV content. We found that multitasking significantly decreased subjects' recognition of TV content. In addition, the degree of sexually explicit content influenced recognition, but only when a concurrent task was present. There were no significant differences in recognition between three levels of sexually explicit content when subjects only watched TV. They were able to pay full attention to TV and thus they remembered most of the content. Another explanation may be our recognition tests were not very difficult. In contrast, an inverted-U shaped relation between sexually explicit content and recognition was found in the multitasking condition. This finding provides further evidence for Attig and Cappella's (1995) hypothesis that the effect of arousing material on recognition of that material depends upon the cognitive load imposed on subjects.

Clearly, it is possible that even the highest level of sexual content in this study is not highly arousing, which could explain why we did not find an effect of sexually explicit material in the non-multitasking condition. However, regular TV programs do not contain pornography and the high sexual content we chose most likely represents the most arousing level of sexual content that can be seen in prime-time on network TV channels. The existence of an effect of sexually explicit content in the multitasking condition actually points out the importance of studying sexual content on TV even though its arousing level may be relatively low.

The mode findings suggest that multitasking interfered with subjects' ability to recognize audio information more than their ability to recognize visual information. We found a steeper decrease in audio than in visual recognition as a result of multitasking. These findings generally support the conclusions from visual-audio redundancy studies (Drew & Grimes, 1987; Lang, 1992; Zhou, 2004): Because audio encoding is more resource-demanding than visual encoding, it follows from the model of

limited capacity that multitasking will inhibit recognition of audio information more than that of visual information

The excitation transfer effect was not found in TV recognition when multitasking. The significant differences in the recognition of sexual content in Part 2 were not transferred to the recognition of Part 3. These findings might be explained as follows: First, the relatively short duration (about 2 minutes) of even the most sexually explicit material may not have been all that arousing. Thus the amount of the elicited excitation might be too small to be transferred. Second, it is possible that excitation transfer theory is primarily applicable over transitions between discrete activities, such as watching arousing TV first and then doing homework, rather than over two adjacent portions of media contents. The excitation that was elicited by sexual TV content might be transferred to the homework task rather than to attention to Part 3. Third, it's worth noting that most previous studies found significant excitation transfer effects using affective (e.g., perceived enjoyment, Mattes & Cantor, 1982) or behavioral measures (e.g., web browsing activity, Sundar & Wagner, 2002). The possibility that this theory is less applicable to cognitive measures such as recognition is worth examining. Finally, recency effects generally suggest better recognition or shorter response times on the last items on a memory list than on items in the middle of the list (Zhang et al., 2003). The recency effect may be strong enough to compensate the differences we expect to be caused by excitation transfer. Because Part 3 is recent to subjects' memory, they recognize them equally well in spite of the different amount of excitation transferred to them.

Consistent with previous research, we found that, when people are multitasking, level of sexually explicit content can influence the recognition of content presented before the sexual content (i.e., Part 1). Specifically, multitasking subjects who watched low or medium sexual content recognized significantly more information from Part 1 than subjects who watched high sexual content. A plausible explanation

is that although level of sexually explicit content does not influence the encoding of Part 1, it might influence subjects' storage and retrieval of Part 1 because the TV recognition test occurs after exposure to the entire TV clip. Although recognition measures are often considered as mainly testing the encoding process (Diao & Sundar, 2004), researchers acknowledge that recognition might also require at least some storage and retrieval (Leigh et al., 2006). The effect of sexually explicit content on recognition of Part 1 content during multitasking suggests that the retrieval and the storage of Part 1 content is inhibited by pairing sexually explicit material with a concurrent task. Although several researchers (Meyer & Kieras, 1997; Pashler, 2000) have argued that the bottleneck in multitasking processing is at the retrieval stage, there are very few studies testing the effects of multitasking with TV sexual content on the encoding vs. retrieval process. There is a recent study showing that "while the subjects' memories were fine during multitasking, it appeared to be more difficult for them to retrieve the memories later on" (Leong, 2006). Our finding suggests that this mechanism is worth exploring in the future.

While we are generalizing the findings, a limitation of such generalization is that we only had one example of sexually explicit content in each condition. There is a possibility that our findings might be due to the specific messages rather than the manipulation of the degree of sexual explicitness. This possibility was reduced by a rigorous manipulation check, including both self-reported measures such as perceived levels of sexuality and experimenters' control on structural features such as cuts and edits.. We agree that multiple message designs will further improve the generalizability of our findings but considering the already complicated analytical model (ANCOVA repeated measures with 2 between-subject factors and 2 within-subject factors), single messages are the most efficient way in the current case. Another limitation is the type of task we used in this study. Reading tasks, although common in the homework context, do not cover all possible types of homework. Whether such findings hold for other types of homework such as writing tasks needs to be verified in future research. Third, the audio

recognition test could have been better if we used audio files rather than quotes as our tests. The generally better recognition of audio information compared to visual information may be due to this reason – the relatively easier test to recognize quotes compared to screenshots. It could also be a methodological artifact that audio questions were asked after visual questions. The information transported by the images was made accessible in subjects' memory and thus triggered audio recognition. We acknowledge the limitations but want to point out that the nature of our hypotheses is about the interaction effects between multitasking and sexually explicit TV content, not the main effects of sexual explicitness, nor mode of information, nor type of homework tasks. These limitations should not seriously affect our major findings.

The above observations point out that multitasking is an important situational factor that interacts with media content to affect the amount of attention paid to the media and this in turn influences the amount of content that will be recognized. Moreover, multitasking can influence the likelihood of finding traditional media effects such as excitation transfer and the inverted U-shaped curve associating arousing content with recognition. Future research studying media effects needs to put more efforts into developing theories that consider both the social and the physical locus of media reception (e.g., Situational Theory, See Katz, 2001 for a brief review). TV as the sole focus of attention and TV watched while engaging in other tasks should not be treated as having the same effect. More importantly, the mechanisms working under the two situations should be differentiated.

## References

- Abramson, P. R., Perry, L., Seeley, T., Seeley, D., & Rothblatt, A. (1981). Thermographic measurement of sexual arousal: A discriminant validity analysis. *Archives of Sexual Behavior, 10*(2), 175-176.
- Armstrong, G. B., Boiarsky, G. A., & Mares, M. (1991). Background television and reading performance. *Communication Monographs, 58*, 235-253.
- Armstrong, G. B. & Chung, L. (2000). Background television and reading memory in context: Assessing TV interference and facilitate context effects on encoding versus retrieval processes. *Communication Research, 27*(3), 327-352.
- Attig, R. B. & Cappella, J. N. (1995). *Using visuals to teach health information: The influence of emotional intensity and encoding instructions on learning from televised public service messages about AIDS*. Paper presented at the annual conference of International Communication Association, Albuquerque, USA.
- Bock, M., & Klinger, E. (1986). Interaction of emotion and cognition in word recall. *Psychological Research, 48*(2), 99-106.
- Bolls, P. D., Lang, A., & Potter, R. F. (2001). The effects of message valence and listener arousal on attention, memory, and facial muscular responses to radio advertisements. *Communication Research, 28*(5), 627-651.
- Brosius, H. (1993). The effects of emotional pictures in television news. *Communication Research, 20*(1), 105-124.
- Chan, A. H. S., & Chan, K. W. L. (2006). Synchronous and asynchronous presentations of auditory and visual signals: Implications for control console design. *Applied Ergonomics, 37*(2), 131–140.

- Christianson, S. (1986). Effects of positive emotional events on memory. *Scandinavian Journal of Psychology*, 27, 287-299.
- Christianson, S., & Mjorndal, T. (1985). Adrenalin, emotional arousal and memory. *Scandinavian Journal of Psychology*, 26, 237-248.
- Cooper, R. (1998). *Visual dominance and the control of action*. Paper presented at the 20th Annual Meeting of the Cognitive Science Society, Madison, WI, USA.
- Diao, F. & Sundar, S. S. (2004). Orienting response and memory for web advertisements: Exploring effects of pop-up window and animation. *Communication Research*, 31(5), 537-567.
- Drew, D. G., & Grimes, T. (1987). Audio-visual redundancy and TV news recall. *Communication Research*, 14(4), 452-461.
- Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological Review*, 66, 183-201.
- Eyal, K., Kunkel, D., Biely, E. N., & Finnerty, K. L. (2007). Sexual socialization messages on television programs most popular among teens. *Journal of Broadcasting & Electronic Media*, 51(2), 316-336.
- Eysenck, M.W. (1982). *Attention and arousal: Cognition and performance*. Berlin: Springer.
- Farrar, K. M. (2006). Sexual intercourse on television: Do safe sex messages matter? *Journal of Broadcasting & Electronic Media*, 50(4), 635-650.
- Foehr, U. G. (2006). *Media multitasking among American youth: Prevalence, predictors, and pairings*. The Henry J. Kaiser Family Foundation.
- Greenwald, M., Cook, E., & Lang, P.J. (1989). Affective judgment and psychophysiological response: Dimensional covariation in the evaluation of pictorial stimuli. *Journal of Psychophysiology*, 3, 51-64.



- Hennessy, M., Bleakley, A., Busse, P., & Fishbein, M. (2008). What is the appropriate regulatory response to wardrobe malfunctions? Fining stations for television sex and violence. *Journal of Broadcasting & Electronic Media*, 52(3), 387-407.
- Hoyle, R. H., Stephenson, M. T., Palmgreen, P., Lorch, E. P., & Donohew, L. (2002). Reliability and validity of a brief measure of sensation seeking. *Personality and Individual Differences*, 32, 401–414.
- Jeong, S. H., Zhang, W., Davis, E., Jordan, A. B., Fishbein, M., Hennessy, M., & Martin S. (2005). *Multiple media use and multitasking with media among high school and college students*. Paper presented at the annual conference of International Communication Association, New York City, USA.
- Kahneman, D. (1973). *Attention and effort*. Englewood Cliffs, NJ: Prentice Hall.
- Katz, E. (2001). Media Effects. In N. J. Smelser & P. B. Baltes (Eds.), *International encyclopedia of the social & behavioral sciences* (pp. 9472-9479). Amsterdam, New York: Elsevier.
- Kern, R. P., Libkuman, T. M., Otani, H., & Holmes, K. (2005). Emotional stimuli, divided attention, and memory. *Emotion*, 5(4), 408-417.
- Kunkel, D., Cope, K. M., Biely E., & Donnerstein E. (2001). *Sex on TV2: A Biennial Report to the Kaiser Family Foundation*. Menlo Park, CA: The Kaiser Family Foundation.
- Lang, A. (1990). Involuntary attention and physiological arousal evoked by structural features and emotional content in TV commercials. *Communication Research*, 17(3), 275-299.
- Lang, A. (1995). Defining audio/video redundancy from a limited-capacity information processing perspective. *Communication Research*, 22, 86-115.

- Lang, A., Bolls, P., Potter, R. F., & Kawahara, K. (1999). The effect of production pacing and arousing content on the information processing of television messages. *Journal of Broadcasting & Electronic Media*, 43(4), 451-475.
- Lang, A., Borse, J., Wise, K., & David, P. (2002). Captured by the World Wide Web: Orienting to structural and content features of computer-presented information. *Communication Research*, 29(3), 215-245.
- Lang, A., Chung, Y., Lee, S., Schwartz, N., & Shin, M. (2005). It's an arousing, fast-paced kind of world: The effects of age and sensation seeking on the information processing of substance-abuse PSAs. *Media Psychology*, 7, 421-454.
- Lang, A., & Friestad, M. (1993). Emotion, hemispheric specialization, and visual and verbal memory for television messages. *Communication Research*, 20(5), 647-670.
- Lang, A., & Newhagen, J. (1996). Negative video as structure: Emotion, attention, capacity, and memory. *Journal of Broadcasting & Electronic Media*, 40(4), 460-477.
- Lang, A., Potter, R. F., & Bolls, P. D. (1999). Something for nothing: Is visual encoding automatic? *Media Psychology*, 1, 145-163.
- Leigh, J. H., Zinkhan, G. M., & Swaminathan, V. (2006). Dimensional relationships of recall and recognition measures with selected cognitive and affective aspects of print ads. *Journal of Advertising*, 35(1), 105-122.
- Leong, E. (2006). *Recent Studies Show Multitasking may Hurt a Person's Memory*. Retrieved on October, 25, 2004 from <http://www.elitestv.com/pub/2006/Aug/EEN44e1lead11447.html>.
- Lowry, D. T., & Shilder, J. A. (1993). Prime time television portrayals of sex, "safe sex" and AIDS: A longitudinal analysis. *Journalism Quarterly*. Vol 70, 628-637.

- Mattes, J., & Cantor, J. (1982). Enhancing responses to television advertisements via the transfer of residual arousal from prior programming. *Journal of Broadcasting & Electronic Media*, 26, 553–556.
- Meyer, D. E., & Kieras, D. E. (1997). A computational theory of executive cognitive processes and multiple-task performance. Part 1. Basic mechanisms. *Psychological Review*, 104(1), 3–65.
- Middletown Media Studies. (2005a). *Engaging the ad-supported media*. Muncie, IN: the Center for Media Design, Ball State University.
- Middletown Media Studies. (2005b). *Concurrent Media Exposure: Some key findings*. Muncie, IN: the Center for Media Design, Ball State University.
- Newell, S. J., Henderson, K. V., & Wu, B. T. (2001). The effects of pleasure and arousal on recall of advertisements during the Super Bowl. *Psychology & Marketing*, 18(11), 1135-1153.
- Newhagen, J., & Reeves, B. (1992). This evening's bad news: Effects of compelling negative television news images on memory. *Journal of Communication*, 42, 25-41.
- Palmgreen, P., Stephenson, M., Everett, M., Baseheart, J., & Francies, R. (2002). Perceived message sensation value (PMSV) and the dimensions and validation of a PMSV scale. *Health Communication*, 4(4), 403-428.
- Pashler, H. (2000). Task switching and multitask performance. In S. Monsell & J. Driver (Eds.), *Control of Cognitive Processes: Attention and Performance XVIII* (pp. 275-423). Cambridge, MA: The MIT Press.
- Pavelchak, M. A., Antil, J. H., & Munch, J. M. (1988). The super bowl: An investigation into the relationship among program context, emotional experience, and ad recall. *The Journal of Consumer Research*, 15(3), 360-367.

- Perry, S. D. (2001). Commercial humor enhancement of program enjoyment: Gender and program appeal as mitigating factors. *Mass Communication & Society*, 4(1), 103-116.
- Pezdek, K., & Hartman, E. F. (1983). Children's television viewing: Attention and comprehension of auditory versus visual information. *Child Development*, 54, 1015-1023.
- Pool, M. M., Koolstra, C. M., & van der Voort, T. H. A. (2003). The impact of background radio and television on high school students' homework performance. *Journal of Communication*, 53(1), 74-87.
- Pool, M. M., van der Voort, T. H. A., Beentjes, J. W., & Koolstra, C. M. (2000). Background television as an inhibitor of performance on easy and difficult homework assignments. *Communication Research*, 27(3), 293-326.
- Sapolsky, B. S., & Tabarlet, J. O. (1991). Sex in primetime television: 1979 versus 1989. *Journal of Broadcasting & Electronic Media*, 35, 505-516.
- Sparks, G. G. (1991). The relationship between distress and delight in males' and females' reactions to frightening films. *Human Communication Research*, 17(4), 625-637.
- Sundar, S. S. & Wagner, C. B. (2002). The World Wide Wait: Exploring physiological and behavioral effects of download speed. *Media Psychology*, 4, 173-206.
- Wober, J. M. (1992). Text in a texture of television: Children's homework experience. *Journal of Educational Television*, 18(1), 23-34.
- Zillmann, D. (1982). Transfer of excitation in emotional behavior. In: J. T. Cacioppo & R. E. Petty (Eds.), *Social Psychophysiology*. New York: Guilford.
- Zillmann, D. (1996). Sequential dependencies in emotional experience and behavior. In R. D. Kavanaugh, B. Zimmerberg, & S. Fein (Eds.), *Emotion: Interdisciplinary perspectives* (pp. 243-272). Mahwah, NJ: Erlbaum.

- Zhang D. R., Li. Z. H., Chen, X. C., Wang, Z. X., Zhang, X. C., Meng, X. M., He, S., & Hu, X. P. (2003). Functional comparison of primacy, middle, and recency retrieval in human auditory short-term memory: An event-related fMRI study. *Cognitive Brain Research, 16*, 91-98.
- Zhang, Y., Miller, L. E., & Harrison, K. (2008). The relationship between exposure to sexual music videos and young adults' sexual attitudes. *Journal of Broadcasting & Electronic Media, 52*(3), 368-386.
- Zhou, S. (2004). Effects of visual intensity and audiovisual redundancy in bad news. *Media Psychology, 6*, 237-256.

## Footnotes

<sup>1</sup> This is an unusual situation because most of time, audiences do not pay full attention to content on TV even they are not doing anything else. The instruction was made in order to equalize the level of motivation among multitasking and non-multitasking subjects. Multitasking subjects were instructed to pay close attention to both TV and their homework. Thus a laid-back and casual viewing of TV among non-multitasking subjects may make their motivation levels, therefore recognition results, incomparable to multitasking subjects. The possible consequence of this instruction is that the recognition scores obtained from our non-multitasking subjects are higher than what we would actually observe in real situations. Another consequence we have seen is that the level of sexually explicitness did not make any differences in recognition scores of non-multitasking subjects because they were motivated to pay close attention no matter how sexual the content is. We may see some differences among low, medium, and high sexual content if non-multitasking subjects were viewing these contents in an unmotivated mode.

<sup>2</sup> The coding schema separates talk and behavior. Under each category, TV content is evaluated by checking whether the following is present: sexual innuendo, unspecified sex talk, sexual sound effects, suggestive gesturing, sexual actions, hooking up, flirting, sexy appearance, exaggerated body parts, nudity, partial nudity, private part, casual touching, passionate kissing, intimate touching, intimate touching of 'private' parts, masturbation, orgasm, anal sex, oral sex, sexual intercourse interrupted, and sexual intercourse.

<sup>3</sup> Valence and humor of the sexual clips were also measured using 5-point scales: 1 refers to *sad* or *not funny at all* while 5 refers to *happy* or *funny*. As expected, the three clips did not differ in either valence or funniness. In addition, Perceived Message Sensation Value (PMSV, the 17-item scale developed by Palmgreen et al., 2002) was rated by the pilot subjects. The three DH clips did not differ in the aggregated measure of PMSV.

<sup>4</sup>The effect of multitasking on task performance was not the focus of this study, but the findings generally replicate previous research. The effects of multitasking were tested with four groups: Task-only, and multitasking with low, medium, and high explicit sexual TV content. An ANOVA with condition as a between-subject factor and type of task (i.e., GRE comprehension vs. news story comprehension) as a within-subject factor was conducted. The effect of multitasking was significant ( $F(3, 76) = 6.99, p < .001; \eta_p^2 = .22$ ) while the effect of type of task was not. Post-hoc Tukey's HSD test suggests that subjects in the task-only condition performed significantly better than those who multitasked with either low ( $\Delta M = 1.95, SE = .66, p < .05$ ), medium ( $\Delta M = 2.45, SE = .66, p < .005$ ) or high sexual TV content ( $\Delta M = 2.78, SE = .66, p < .001$ ). Although task performance systematically decreased with increasing levels of sexually explicit content, the differences among the three levels of sexually explicit content were not statistically significant.

<sup>5</sup>The significance level of .10 is accepted here because different statistics yielded slightly different results. Whereas Pillai's Trace indicates a p value of .08, Roy's Largest Root suggests that the p value is as low as .02. We think that this result is worth reporting but decided to report the more conservative statistics in order to remind readers to read the significant effect with caution.

## Figure Captions

*FIGURE 1.* Recognition as a function of multitasking, level of sexual content, and sequence (MT means multitasking and Non-MT refers to non-multitasking).

*FIGURE 2.* Recognition as a function of multitasking and mode (MT means multitasking and Non-MT refers to non-multitasking).



Figure 1.

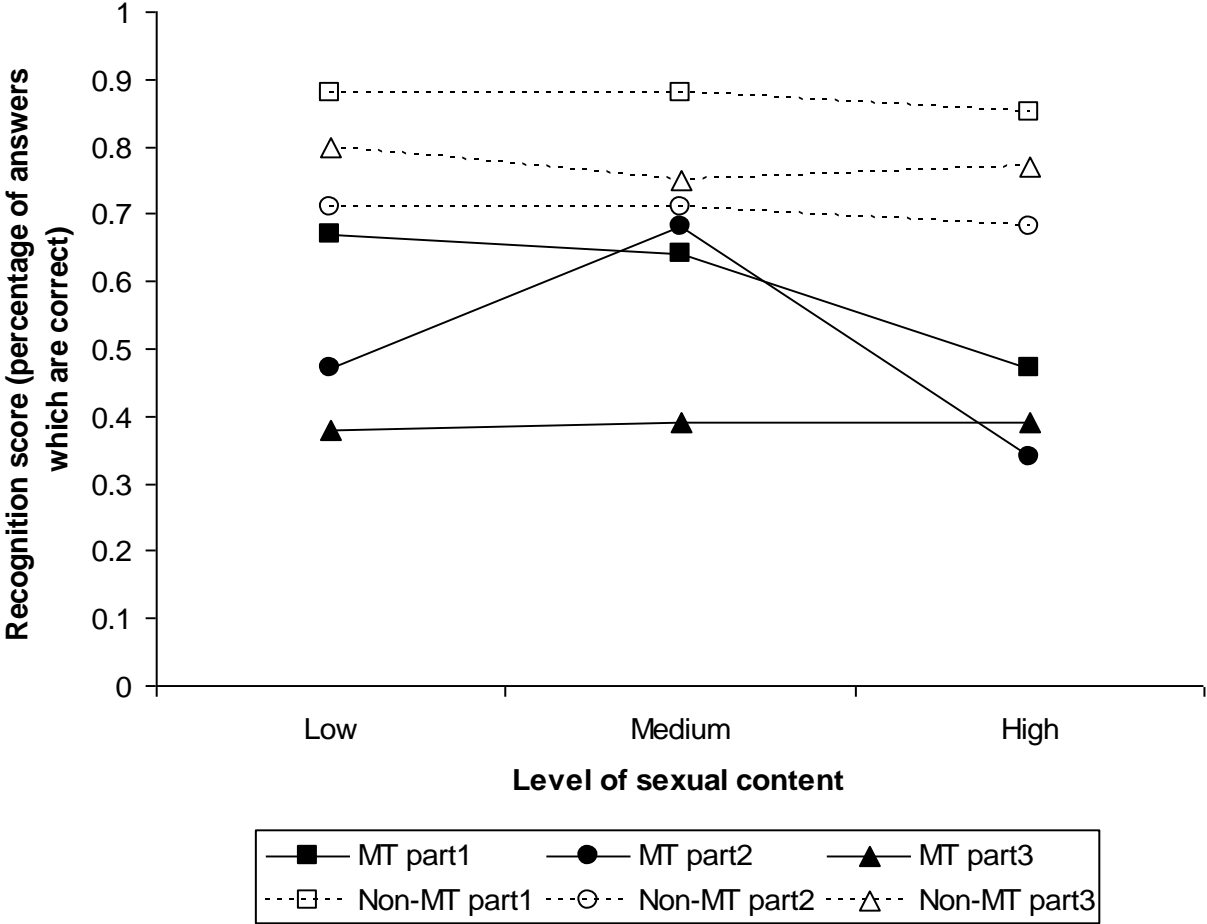


Figure 2.

