

# I Saw It on the Radio: The Allocation of Attention to High-Imagery Radio Advertisements

Paul D. Bolls

Edward R. Murrow School of Communication  
Washington State University

Annie Lang

Department of Telecommunications  
Indiana University

*This study was conducted to explore how the level of imagery in a radio advertisement affects the allocation of cognitive resources to encoding the message into memory. A within-subjects experiment was conducted in which participants listened to 24, 60-second radio advertisements that had been coded as either high- or low-imagery messages. Secondary-task reaction time was obtained during exposure to half of the advertisements, within each level of imagery. Self-reported involvement with the message was also obtained after exposure to each advertisement. Secondary-task reaction time was faster during exposure to the high-imagery advertisements. Self-reported involvement was greater for high-imagery advertisements, compared to low-imagery advertisements. Results of this study indicate that people allocate more controlled cognitive resources to encoding high-imagery radio advertisements than may be required by the message.*

Do radio listeners “see” it on the radio? The Radio Advertising Bureau (RAB) seems to think so. Campaigns, sponsored by the RAB to encourage radio advertising by businesses, highlight the strength of radio to engage the imagination and get listeners to “see” a product in use during exposure to a radio

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Requests for reprints should be addressed to Paul D. Bolls, Edward R. Murrow School of Communication, Washington State University, Pullman, WA 99164–2520. E-mail: [pbolls@wsu.edu](mailto:pbolls@wsu.edu)

advertisement. Although radio practitioners intuitively believe that sensory processes are evoked by engaging a person's imagination, researchers have systematically been investigating the cognitive processes engaged by mental imagery. Some of the resulting research supports the notion that mental imagery engages sensory processes and that listeners may indeed "see" it on the radio (Bolls, 2002; Kosslyn, 1994; Loverock & Modigliani, 1995; MacInnis & Price, 1987). Still, little research has been done that explores the allocation of cognitive resources during on-line processing of high-imagery advertisements. The purpose of this study was to explore how the imagery level of radio advertisements affects the allocation of processing resources to encoding the message in memory.

Definitions of imagery can be somewhat confusing. This is because imagery can be conceptualized as a human cognitive activity but can also be understood as a characteristic of media messages. Advertising researchers who study imagery have dealt with this issue by coming up with separate terminology for each aspect of imagery. They developed the term "imagery processing" to refer to imagery as a human cognitive activity and use the term "imagery" to refer to a characteristic of advertisements. High-imagery advertisements typically engage the target audience in imagery processing of the message. The same terminology, imagery and imagery processing, was used in this study.

Advertising researchers have conceptualized imagery processing as a sensory method of encoding, processing, and evoking information that results in the representation of sensory experience in memory (MacInnis & Price, 1987). Imagery has been conceptualized in terms of the presence of specific production features of advertisements believed to evoke imagery processing (MacInnis & Price, 1987). Bone and Ellen (1992) concluded that production features of advertisements that are capable of evoking imagery processing include direct instructions to imagine, the use of descriptive or concrete language, and sound effects. Advertising researchers have uncovered generally positive effects of imagery and imagery processing on important advertising outcomes such as attitudes toward the advertisement, attention, and memory (Babin & Burns, 1997; Bone & Ellen, 1992; Miller & Marks, 1997; Unnava, Agarwal, & Haugtvedt, 1996). Clearly, high imagery advertisements can be effective at achieving advertising objectives; however, the specific cognitive processes that may underlie the positive effects of high-imagery advertisements are not well understood. Advancing understanding in this area requires a systematic investigation of the nature of imagery processing evoked by high-imagery advertisements.

## THE NATURE OF IMAGERY PROCESSING

A primary characteristic of imagery processing involves the degree to which it is a “sensory” process. If one closes one’s eyes and imagines walking on a white sandy beach, that image can be described in terms of vividness that implies a sensory-like experience. However, this does not necessarily mean that imagery processing engages similar cognitive processes as actually being on the beach, seeing the white sand push up between one’s toes. Indeed, researchers have debated the degree of similarity between imagery processing and visual perception (Kosslyn, 1994).

One theoretical framework to emerge from the debate is the interactive framework. Researchers working under this framework propose that imagery processing and perception share similar cognitive mechanisms and representational structures (Finke, 1985). This is an interesting claim, in that it means that imagining an object is in essence “seeing” the object. In other words, imagining a can of Pepsi uses the same cognitive mechanisms as looking at a Pepsi can. Researchers have tested the interactive framework by conducting experiments using PET and FMRI technology to examine the degree to which imagery processing is based in perceptual processes. PET and FMRI have been used to measure brain activity during imagery processing, allowing researchers to see if areas of the brain believed to be responsible for perception are also activated during imagery processing.

Studies on brain activation during imagery processing have primarily been organized around questions of hemispheric specialization and the involvement of visual cortex in imagery processing (D’esposito, Detre, Aguirre, Stallcup, Alsop, Tippet, et al., 1997). Some researchers have found that the left hemisphere appears to dominate during imagery processing (D’esposito et al. 1997; Goldenberg, Podreka, & Steiner, 1990). Others found either no asymmetry between the hemispheres or larger activation in the right hemisphere (Farah, Hammond, Levine, & Calvinio, 1988; Mellet, Tzourio, Denis, & Mazoyer, 1995). Results indicating no asymmetry between the hemispheres have led researchers to propose that both the left and right hemisphere participate in imagery processing (Richardson, 1991). This makes sense in light of the observation that many tasks involving imagery processing have both a visual and verbal component (Goldenberg, Artner, & Podreka, 1991). Researchers investigating the involvement of visual cortex have concluded that the occipital, temporal, and parietal cortices are selectively activated during imagery processing (Farah, Peronnet, Weisberg, & Monheit, 1989; Goldenberg et al., 1990; Kosslyn, Alpert, Thompson, Maljkovic, Weise, Chabris, et al., 1993; Le Bihan, Turner, Zeffiro, Cue’nod, Jezzard, & Bonnerot, 1993; Roland & Gulyas, 1994). This is significant because these are brain areas that have

been found to subserve visual perception (Loverock & Modigliani, 1995). More recently O'Craven and Kanwisher (2000) found that areas of the brain responsible for the perception of faces and places are also selectively activated during imagery processing involving faces and places.

Data from studies that have measured brain activity support a perception-based conceptualization of imagery processing. Researchers have investigated the underlying mechanisms of imagery processing with a variety of tasks involving different types of environmental stimuli including word lists, maps, faces, and clocks. Researchers have yet to extend this line of research to advertising-evoked imagery processing. Researchers who have explored advertising-evoked imagery processing have primarily been interested in the effects of high-imagery advertisements on a target audience, rather than advancing understanding of the underlying cognitive processes involved in imagery processing. This has led to a conceptualization of advertising-evoked imagery processing that offers a more general, rather than specific, description of the involved cognitive processes.

Researchers have suggested that advertising-evoked imagery processing is a highly involved, personally relevant, sensory mode of information processing (MacInnis & Price, 1987). Advertising-evoked imagery processing leads to greater message involvement (Bolls & Potter, 1998) by engaging relevant long-term memories during exposure to a high-imagery advertisement. The long-term memories activated by high-imagery advertisements are believed to contain sensory information such as sights, sounds, and smells, and are grounded in a person's own experiences, making information processing of this type of advertisement personally relevant. For example, a high-imagery radio advertisement for a restaurant that features "home cooking like Grandma used to do" might engage the target audience in imagery processing that evokes individual long-term memories loaded with the sights, sounds, and smells of eating a meal at Grandma's house. Although there may be some similarities in content of mental images evoked by such an ad, each radio listener who engaged in imagery processing would have somewhat unique memories of their grandmother that could be recalled. The retrieval of unique memories that contain sensory information is what makes advertising-evoked imagery processing a personally relevant, highly involved, sensory mode of information processing.

A slightly more detailed description of the nature of advertising-evoked imagery processing has been advanced by Goossens (1994). Drawing from Paivio's (1986) dual code theory, Goossens proposed that advertising-evoked imagery processing involves a continuous interaction between two cognitive systems, the image system and the verbal system. When an advertisement is being cognitively processed, the verbal system is needed for semantic processing of the words in the

message. When an advertisement evokes imagery processing, the verbal system makes sense of the words in the message, and the image system becomes involved in the activation of long-term visual memories. For instance, an advertisement for Alaska tourism might contain the phrase “come see our snow capped mountain peaks.” When this phrase is encountered by an audience member, the verbal system will contain a representation for each word of the phrase “snow capped mountain peaks,” and if processed at a high enough level, the visual system will activate memories of snow capped mountain peaks.

### IMAGERY, RESOURCE ALLOCATION, AND SECONDARY-TASK REACTION TIMES

Goosens (1994) proposed that advertising-evoked imagery processing occurs when enough cognitive resources are allocated to encode a message in both the verbal and image systems. However, he has not tested his proposition by collecting data during the online processing of high imagery advertisements. Secondary-task reaction time data have the potential to provide insight into how audience members allocate resources during advertising-evoked imagery processing. Secondary-task reaction time is an indicator of the amount of processing resources a participant has allocated to performing a primary task (e.g., watching television, listening to radio advertisements, or looking at pictures). While engaged in the primary task, participants are instructed to be alert for the secondary task signal. This signal is usually a tone, flash, or tactile stimulus. When they detect the secondary-task signal participants are instructed to push a button as fast as possible. Variations in the speed with which the participants respond are interpreted as variations in the amount of processing resources engaged in performing the primary task (Basil, 1994; Lang & Basil, 1998; Reeves, Thorson, Rothschild, McDonald, Hirsch, & Goldstein, 1985).

At first glance, this seems quite straightforward. When participants are highly engaged in the primary task, it will take them longer to respond to the secondary task signal, and, as a result, their secondary-task reaction times will be slower. However, research on media using the secondary task reaction time paradigm has yielded results that are somewhat inexplicable, or at least problematic, when using this straightforward interpretation of secondary-task reaction times.

For example, Reeves et al. (1985) demonstrated that secondary-task reaction times were faster during complex media messages compared to simple media messages. This would suggest that viewers were less engaged or had allocated fewer processing resources to complex stimuli than they had to simple stimuli. This

seems unlikely. Furthermore, this is not an anomalous result; later research has demonstrated the same finding in multiple media, including text.

In a review of the literature reporting secondary-task reaction time during exposure to media, Lang and Basil (1998) examined all of the conceptual and operational definitions used in secondary-task reaction time studies. They proposed that secondary-task reaction times were not simply an indicator of amount of processing resources allocated to the primary task. Lang and Basil suggested secondary-task reaction times indicate the amount of processing resources allocated to encoding information from a stimulus in the environment that are not required to thoroughly encode the stimulus into memory. Lang and Basil termed these leftover processing resources, resources available at encoding.

In this conceptualization, resources are theorized to be allocated separately to various sub-processes of information processing. Specifically, these sub-processes are encoding, storage, and retrieval (Lang, 2000). Resources are assumed to be allocated as a result of both automatic and controlled allocation processes. Resources are limited, and if too many resources are allocated to one sub-process, that may leave insufficient resources to be allocated to another sub-process. When resources are insufficient for the processing task, then performance measurements, such as memory, will decline (Lang, 2000).

Lang and Basil (1998) argue that complex media messages have structural features capable of eliciting orienting responses in audience members. When an orienting response is elicited, processing resources are allocated to the sub-process of encoding (Lang, Geiger, Strickwerda, & Sumner, 1993). These resources are then used to encode the information that elicited the orienting response in memory. However, Lang and Basil (1998) point out that different structural features have different processing requirements. In other words, a structural feature that elicits orienting may or may not contain new information. Some structural features, such as sound effects or cuts from one camera to another in the same visual scene, may introduce very little new information. Thus the additional resources allocated to encoding may not be needed. When this occurs, it is possible that resources allocated to encoding are not being used and are therefore available to encode the secondary task reaction time signal. When this occurs, secondary task reaction times might be very quick, because of the availability of resources already allocated to encoding.

Lang and Basil (1998) suggest that in the case of complex media stimuli, this may often be the case. Many of the structural features in the message may elicit orienting but not introduce a lot of new information. As a result, a great deal of resources are allocated to encoding, resulting in available resources at encoding and, therefore, fast secondary task reaction times, even though participants may show

deficits in other performance measures, particularly those utilizing resources allocated to storage and retrieval. This is because the resources allocated to encoding as a result of orienting are allocated automatically and their allocation reduces the resources available for other sub-processes.

The entire problem becomes more interesting when one considers the processing requirements of visual stimuli. Lang, Potter, and Bolls (1999) have suggested that visual media structural features may be processed virtually automatically. They argue that visual processing is nearly cost-free, but audio processing requires more processing resources. In their study, they increased the complexity of the visual structural features and measured audio and visual recognition. They demonstrated that increasing the complexity of visual structural features had no effect on visual recognition, but severely decreased audio recognition. This supported the notion that, although visual encoding was cost-free, audio encoding required more processing resources.

If this is the case, visual structural features of media that elicit orienting responses result in resource allocation to encoding, but those resources should not be necessary, because a visual feature elicited the resource allocation and visual encoding is relatively cost-free. This would mean that exposure to complex visual stimuli would result in resources being over-allocated to encoding. As a result, storage and retrieval would likely receive fewer resources than required, and encoding would receive more resources than required, resulting in available processing resources at the encoding stage. As a result, complex visual stimuli would have faster secondary task reaction times than simple visual stimuli.

This becomes very interesting when considering the case of imagery processing. If processing mental images is similar to processing visual stimuli, then it should not require additional processing resources allocated to encoding. Therefore, the task of maintaining a visual image ought not to slow secondary task reaction times. Given the earlier conceptualization of imagery processing as a perception based activity, it is proposed that high-imagery radio advertisements are similar to complex visual stimuli and will result in resources being over-allocated to encoding, leaving plenty of resources available to respond to a secondary task reaction time cue. High-imagery radio advertisements are most like complex visual stimuli in that the images evoked are complete objects and actions rather than simple stimuli like line patterns, such as those used in some of the previously cited experiments.

To test the previously discussed proposition, participants in this study listened to high- and low-imagery radio advertisements. During half of the messages, participants also completed a visual task that required them to look at visual images presented on a television screen; during the other half of the messages, they did not

perform this visual task. At the same time, participants were instructed to push a button on a joystick as fast as they could whenever they heard a tone. It should be noted that in the dual-task condition (when participants are listening to a radio advertisement and looking at pictures), the secondary task is actually a tertiary task.

Theoretically, participants in this experiment are carrying out up to four tasks. First, as the primary task, they are listening to an audio message. Audio processing requires the controlled allocation of processing resources to encoding and storage. These audio messages vary in terms of their imagery potential. During high imagery advertisements, participants are also engaging in an imagery task. During the dual-task condition, participants are also encoding visual images. And, when the secondary task signal occurs, participants must encode and respond to that signal. Thus there are four conditions of processing engagement: a) engaged only in audio processing and listening for the secondary task reaction time signal; b) engaged in audio processing, mental imagery, and listening for the secondary task reaction time signal; c) engaged in audio processing, encoding visual images on a television screen, and listening for secondary task reaction time signals; d) engaged in audio processing, mental visual imagery, encoding visual images on a television screen, and listening for a secondary task reaction time signal.

It is interesting to note that encoding the visual images on the television screen and visual mental imagery might be conceptualized as cost-free or relatively cost-free processes (assuming that visual mental imagery is similar to visual processing). Therefore, they might result in the allocation of processing resources to encoding when those resources are not needed. This over allocation of resources to encoding seems likely, given previous research that indicates advertising-evoked imagery processing increases message involvement (Bolls & Potter, 1998) and that features believed to evoke imagery processing, like sound effects, elicit orienting (Potter & Callison, 2000). This means that one would expect imagery processing to increase the resources available at encoding and therefore result in faster secondary-task reaction times during high-imagery ads because, like visual scenes in a television advertisement, the visual mental images evoked by a high-imagery radio advertisement are relatively cost-free to encode. Thus,

**Hypothesis 1:** Secondary-task reaction times will be faster for high-imagery advertisements compared to low-imagery advertisements.

Similarly, what will happen when viewers are engaged in processing mental images and processing visual images? The appearance of the visual images on the television screen should result in an orienting response at the onset of each picture. This orienting response to the visual images will result in processing resources being allo-



cated to encoding the pictures. In this case, processing resources will have to be allocated to encoding the pictures, the radio advertisements and, in the high-imagery condition, mental images. If processing the actual visual image from the pictures on the television screen is relatively cost-free, there should be resources available at encoding. However, the ongoing radio advertisement is the primary task to which controlled processing resources will be allocated and contains structural features that elicit automatic allocation of resources to processing the message. Thus, two simultaneous non-related messages will demand processing resources to encoding. However, once again, one of these messages—the actual visual images from the pictures—should be relatively cost-free. The onset of the pictures should evoke orienting responses, in addition to orienting responses evoked by structural features of the radio advertisements. These orienting responses will lead to resources being automatically allocated to encoding. If encoding the pictures in the dual-task condition is indeed relatively cost-free, then participants should have more processing resources available for encoding the stimuli than they actually need, resulting in secondary-task reaction time being faster during the dual-task condition compared to the single-task condition. The dual-task condition in this study is when the visual task is present. This leads to hypothesis two:

Hypothesis 2: Secondary-task reaction times will be faster during the visual-task condition compared to the no-visual-task condition.

Finally, this study also looked at participants' self-reported involvement with the messages. Previous conceptualizations of secondary-task reaction time have argued that secondary-task reaction times should mirror involvement. That is, when viewers are highly involved with a message, their secondary-task reaction times should be slower than when they are less involved. This conceptualization makes a different argument. In fact, this conceptualization argues that high-imagery advertisements will be more involving than the low-imagery advertisements because imagery processing is a self-involving process. However, this conceptualization also argues that it is relatively cost-free, and therefore, despite the predicted decrease in secondary-task reaction times, there will be an increase in self-reported involvement. Hence,

Hypothesis 3: Self-reported involvement will be greater during high-imagery ads compared to low-imagery ads.

In sum, despite an increase in self-reported involvement, secondary-task reaction times will be faster in the high-imagery and visual-task conditions as pre-

dicted in hypotheses one and two. As listeners over-allocate cognitive resources to encoding high-imagery ads, they will perceive that these ads are more involving but will have plenty of resources to respond to the secondary-task cue.

## METHOD

### Design

This experiment used a mixed model 2 (imagery)  $\times$  2 (visual task)  $\times$  2 (measure)  $\times$  3 (message)  $\times$  3 (order) repeated-measures design. Imagery, visual task, measure, and message were within-subject factors. Imagery had two levels, high and low. Visual task had two levels representing the presence or absence of the visual task. Measure also had two levels representing whether secondary-task reaction time or heart rate was measured during exposure to the advertisement. Heart-rate data were collected during exposure to half of the advertisements and are reported in Bolls (2002). Heart-rate data were collected during exposure to ads for which secondary-task reaction time was not being measured. Message was the repeated factor with three levels representing the three advertisements that were used at each level of Imagery  $\times$  Visual Task  $\times$  Measure. Order was the only between-subjects factor. Participants were randomly assigned to one of three stimulus tape orders.

### Independent Variables

**Imagery.** Imagery was conceptualized as a characteristic of advertisements that elicits imagery processing. Previous research has manipulated imagery through the presence or absence of production features known to elicit imagery processing (e.g., Miller & Marks, 1997). This type of manipulation of imagery is feasible for experiments where researchers produce their own stimulus messages. Such experiments tend to use a single message, produced in high-imagery and low-imagery versions. The primary weakness of experiments that manipulate imagery with two versions of a single, specially produced message is a loss of external validity caused by failing to use multiple, real world, professionally produced messages. An alternative way to manipulate imagery is to assess the ability of a group of "real world" advertisements to engage imagery processing and select as stimuli advertisements that score extremely high or low on a self-reported imagery-processing scale. For this experiment, imagery was manipulated by having a group of undergraduate students rate 47 radio advertisements on Babin and Burns' (1998) imagery processing scale. The 12 advertisements that scored the highest and the 12 ad-

vertisements that scored the lowest on the Babin and Burns scale were used as high- and low-imagery stimulus messages.

**Visual task.** Visual task involved introducing a set of visual stimuli, unrelated to the content of the radio advertisements, to be processed simultaneously with randomly selected advertisements. Six advertisements within each level of imagery were randomly selected to include the visual task. The visual stimuli used for the visual task were still slides selected from the International Affective Picture Show (IAPS; Lang, Greenwald, Bradley, & Hamm, 1993; Lang, Ohman, & Vaitl, 1988). The IAPS is a collection of still slides that have been coded for emotional arousal and valence on the Self-Assessment Mannequin (SAM) scale. The SAM scale is a nine-point, pictorial scale that has been shown to be a reliable and valid measure of emotional response to various forms of mediated stimuli including still slides and television messages (Bradley, 1994; Lang, Dhillon, & Dong, 1995; Morris, 1995). The IAPS has four categories of pictures: arousing / positive, arousing / negative, calm / positive, and calm / negative.

Pictures from the IAPS were chosen based on their arousal level. Only pictures that were rated between seven and three on the arousal dimension of SAM were selected for the visual task. This excluded extremely calm and extremely arousing pictures from being used in the experiment. Pictures scoring on the extreme ends of the arousal dimension of SAM were not considered for the visual task in an attempt to have pictures that were arousing enough to attract attention but not so arousing as to command attention and therefore overwhelm processing of the radio advertisements.

After controlling for arousal, 96 pictures were semi-randomly chosen with the requirement that an equal number of pictures from each of the four arousal  $\times$  valence categories be chosen. The 96 pictures were further divided into two groups of 48 with the same requirement that equal numbers of pictures from the arousal  $\times$  valence categories be in each group. One group of pictures was assigned to be presented with high-imagery radio advertisements, and the other group was assigned to be presented with low-imagery radio advertisements.

The 48 pictures assigned to the high-imagery advertisements were coded for relatedness to the mental images evoked by the selected high-imagery advertisements. Four graduate students performed the coding working in teams of two. The coders listened to a selected high-imagery advertisement and then were shown a group of twelve pictures. Coders were instructed to think about the mental images evoked by the advertisement and then responded to a single item placed on a seven-point Likert scale that asked "How related is this picture to any of the mental images brought to mind by the advertisement you just heard?"

The ratings given by the two coders for each picture were summed to obtain a single score representing how related a picture was to each of the selected high-imagery advertisements.

Eight pictures were paired with each advertisement that was selected to include the visual task. Pictures were assigned to advertisements with the requirement that two pictures from each Arousal  $\times$  Valence category be assigned to each advertisement. Pictures were semi-randomly assigned to the low-imagery advertisements by assigning pictures using the previously stated requirement. Pictures which were selected to be presented with high-imagery advertisements were assigned to the ads with which they had the lowest possible relatedness score. This was done so that the content of the pictures would not directly facilitate processing of the content of the high-imagery ads.

### Dependent Variables

**Secondary-task reaction time.** Secondary-task reaction time was obtained as follows. Participants listened for a 500 Hz computer generated tone and pushed the button on a joystick as soon as possible after hearing the tone. Three advertisements from each Imagery  $\times$  Visual Task condition were randomly chosen to include the secondary-task reaction time tones. Thus, the advertisements that included the secondary-task cue consisted of three high-imagery advertisements with the visual task, three high-imagery advertisements without the visual task, three low-imagery advertisements with the visual task, and three low-imagery advertisements without the visual task. Three time points from each advertisement were semi-randomly selected for the secondary-task tone. One time point was chosen from each third of an advertisement, excluding the first and last five seconds of the advertisement. Secondary-task reaction time was measured in milliseconds between the onset of the tone and participants' response on the joystick.

**Involvement.** Self-reported involvement with the message was measured on a four item, seven-point scale that has been shown to be reliable and valid in previous advertising research (Muehling & Lacznik, 1988; Yoon, Bolls, & Muehling, 1999). Participants were asked to indicate the degree to which they "paid attention to," "concentrated on," and "put thought into evaluating the messages in the advertisement," as well as how relevant to their needs they perceived the advertisement to be. Responses to the four involvement items were summed and averaged to form a single involvement index.

## Stimuli

Stimulus messages were 60-second radio advertisements selected from a pool of Mercury Award winning advertisements from the years 1994–1997. The Mercury Award is an awards program administered by the Radio Advertising Bureau that recognizes the best national, local, and public service announcements produced each year.

Forty-seven Mercury Award winning advertisements were selected for pretesting by choosing all 60-second advertisements for nationally or regionally available products. During the pretest, undergraduate students who were recruited from the same telecommunication courses as participants listened to each advertisement and rated it on an adapted version of the Babin and Burn's (1998) imagery-processing scale. The Babin and Burns scale normally consists of 14 items placed on seven-point Likert scales. This scale is designed to measure imagery along three dimensions: vividness, quantity and elaboration. The adapted version used in this pretest included the fourteen original items, plus a fifteenth item that allowed pretest participants to indicate that no images came to their mind while listening to an advertisement. Each advertisement was rated by ten students. Responses to the imagery-processing scale were summed and collapsed across the three dimensions of the scale. A pretest imagery score for each advertisement was obtained by taking an average of the summed ratings the pretest participants gave it.

An attempt was made to use the 12 advertisements with the highest and 12 advertisements with the lowest pretest-imagery score. Pretest advertisements included different advertisements for the same product. In this case, the advertisement that scored at the furthest extreme of the high / low imagery continuum was chosen. Stimulus advertisements were also chosen to avoid having an over-representation of a single product category in the experiment. In the instance in which one of the 12 highest- or lowest-scoring advertisements would lead to an over-representation of a single product category, the next highest- or lowest-scoring advertisement for a different product was chosen. A 2 (imagery)  $\times$  12 (advertisement) repeated-measures ANOVA was conducted on the pretest data. This analysis indicated that the advertisements selected as high-imagery advertisements  $M = 77.47$ ,  $SD = 7.25$  were rated significantly different than the advertisements chosen as low imagery advertisements  $M = 49.37$ ,  $SD = 5.82$ ,  $F(1,9) = 164.9$ ,  $p < .000$ .

## Apparatus

The stimulus tapes were played on a 3/4 inch videocassette recorder with time code being read by a Horita TRG-50 PC Time Code Reader/Generator. The video-

cassette recorder was connected to a 19-inch color television and medium sized home-stereo speaker located behind participants. During the experiment, the video signal from the VCR was sent to the television while the audio signal was sent to the home-stereo speaker. No audio signal was passed through the speakers of the television. Pictures in the visual task were viewed on the 19-inch screen while the radio advertisements were heard through the home-stereo speaker located behind participants.

Secondary-task reaction time was collected and stored on a 386 computer running the Slimy Recognition/Reaction Time program (Newhagen, 1993). The time code reader/generator interfaced with the videocassette player and computer running Slimy. This allowed Slimy to generate the secondary-task cues at precise time code points corresponding to the selected secondary-task reaction time points in the advertisements.

### Participants and Procedure

Participants ( $N = 46$ ) were undergraduate students enrolled in a Telecommunications course at a large Midwestern university. Participants received course credit for their participation. Participants completed the experiment one at a time in a psychophysiology laboratory.

On arrival at the laboratory, participants were greeted by the researcher and given an informed consent form. The informed consent form stated that the purpose of the study was to learn how people listen to the radio. It also informed participants of the procedures and risks involved in the collection of heart-rate data. Participants were also informed that they would be listening to 24 radio advertisements and would be asked some questions concerning the advertisements. After informed consent was obtained, the researcher attached the heart-rate electrodes to participants, handed them the packet containing the self-report measures, and played the first set of recorded instructions for the experiment.

The first set of recorded instructions informed participants of the visual task and secondary-task reaction time tones and instructed them how to complete the self-report measures. For the visual task, participants were told that during some of the advertisements, pictures unrelated to the advertisements would appear on the television screen. They were told they should look at the pictures because they would be asked questions about the pictures as well as the radio advertisements.

After listening to the instruction tape, participants were given the opportunity to ask questions. Once any questions had been answered, participants listened to the 24 stimulus advertisements. The researcher paused the stimulus tape in between each advertisement and waited for participants to indicate they were finished com-

pleting the self-report measures before restarting the tape. After completing the self-report measures for the last stimulus advertisement, participants were given a distractor task followed by memory tests (reported in Bolls, 2002). Once the memory tests were completed, participants were thanked and dismissed.

## RESULTS

### Manipulation Check

As a manipulation check for imagery, participants completed the vividness and quantity dimensions of the Babin and Burns (1998) imagery-processing scale. Data from this scale were submitted to a 2 (imagery)  $\times$  2 (visual task)  $\times$  6 (message)  $\times$  3 (order) repeated-measures MANOVA. Imagery had a significant main effect on self-reported imagery processing,  $F(1,42) = 133.36$ ,  $p < .000$ , epsilon squared = .75. Specifically, self-reported imagery processing was higher for high-imagery radio advertisements ( $M = 5.04$ ,  $SD = .64$ ) compared to low-imagery advertisements ( $M = 4.11$ ,  $SD = .53$ ). This indicates a successful manipulation of imagery.

### Analysis

An examination of the distribution of the secondary-task reaction time data revealed that the data were not normally distributed. A square root transformation was applied to the secondary-task reaction time data to bring the data closer to a normal distribution. Secondary-task reaction time data from 43 participants were initially submitted to a 2 (imagery)  $\times$  2 (visual task)  $\times$  3 (message)  $\times$  3 (time)  $\times$  3 (order) repeated-measures MANOVA. Data from three participants were lost due to experimenter error. This analysis revealed that Message and Order did not significantly affect reaction time, so these variables were dropped from further analysis. Self-reported involvement data from 45 participants were submitted to a 2 (imagery)  $\times$  2 (visual task)  $\times$  3 (message)  $\times$  3 (order) repeated-measures MANOVA. Data from one participant were lost due to experimenter error. Analysis of the self-reported involvement data revealed that Order did not have a significant effect, so it was dropped from further analysis. There was a significant effect of Message on self-reported involvement,  $F(5,210) = 9.65$ ,  $p < .000$ . This is not all that surprising, given that the ads were for different products that could have been perceived as more or less relevant to the participants.

### Hypothesis 1

Hypothesis 1 predicted that secondary-task reaction time would be faster during exposure to high-imagery radio advertisements compared to low-imagery radio advertisements. Imagery had a significant main effect on secondary-task reaction time,  $F(1,42) = 4.974$ ,  $p < .031$ , eta squared = .106. As predicted, secondary-task reaction time was faster during high-imagery radio advertisements ( $M = 23.982$ ,  $SD = .709$ ) compared to low-imagery advertisements ( $M = 24.543$ ,  $SD = .613$ ).

### Hypothesis 2

This hypothesis predicted that secondary-task reaction times would be faster during the visual-task condition compared to the no visual task condition. There was a significant main effect of visual task on the secondary-task reaction time data,  $F(1,42) = 12.971$ ,  $p < .001$ , eta squared = .236. However, the effect was in the opposite direction, with participants having slower secondary-task reaction time during the visual-task condition ( $M = 24.685$ ,  $SD = .656$ ) compared to the no-visual-task condition ( $M = 23.840$ ,  $SD = .666$ ).

Further analysis of the secondary-task reaction time data uncovered a significant effect of Time,  $F(2,84) = 48.728$ ,  $p < .000$ , eta squared = .537 and an Imagery  $\times$  Time interaction,  $F(2,84) = 3.943$ ,  $p < .025$ , eta squared = .086. Secondary-task reaction time got progressively faster for each of the three time points in which there was a reaction time cue in each message (time 1  $M = 26.153$ ,  $SD = .705$ , time 2  $M = 23.648$ ,  $SD = .695$ , time 3  $M = 22.987$ ,  $SD = .635$ ). Reaction time got faster for each time point in both high- and low-imagery messages; however, the change from time 1 to time 3 was greater for low-imagery messages compared to high-imagery messages.<sup>1</sup> This interaction is not theoretically meaningful.

### Hypothesis 3

The third hypothesis predicted that self-reported involvement will be greater during exposure to high-imagery radio advertisements compared to low-imagery radio advertisements. Imagery had a significant main effect on self-reported involvement,  $F(1,42) = 63.23$ ,  $p < .000$ , epsilon squared = .58. Involvement was greater for high-imagery radio advertisements ( $M = 4.81$ ,  $SD = .90$ ) compared to low-imagery advertisements ( $M = 4.20$ ,  $SD = .88$ ).

Further analysis of the self-reported involvement data uncovered a significant effect of Visual Task,  $F(1,42) = 75.91$ ,  $p < .000$  and a Imagery  $\times$  Visual Task interaction,  $F(1,42) = 13.83$ ,  $p < .001$ . Self-reported involvement was lower for adver-



tisements that included the visual task. Further, although the visual task lowered self-reported involvement for both high- and low-imagery advertisements, the decrease was greater for low-imagery advertisements.<sup>2</sup>

## DISCUSSION

The results of this study offer some support for applying a perception-based conceptualization of imagery processing to advertising-evoked imagery processing. The same pattern of results found for encoding complex television messages noted by Lang and Basil (1998) was found in this study on high-imagery radio advertisements. Specifically, secondary-task reaction time was faster during exposure to high-imagery ads compared to low-imagery ads. This supports the conclusion that advertising-evoked imagery processing, like visual processing, might result in the allocation of unnecessary resources, increasing the resources available at encoding to respond to a secondary-task reaction time signal. Based on the conclusion that advertising-evoked imagery processing is similar to visual encoding, the Radio Advertising Bureau seems justified in claiming that during exposure to high-imagery radio advertisements people do, in a way, see it on the radio.

It is interesting to note that, although the encoding of high-imagery radio ads appears to be easier than encoding low-imagery radio ads, participants in this study reported that they put more effort into processing the high-imagery ads. Self-reported involvement with the ad was significantly greater for high-imagery ads compared to low-imagery ads. This indicates that people are willing to allocate more controlled resources to high-imagery advertisements compared to low-imagery advertisements. These controlled resources, plus resources that are automatically allocated to high-imagery advertisements due to orienting to structural features of the message, likely lead to the overabundance of resources available for encoding high-imagery advertisements. If people consciously allocate more cognitive resources to high-imagery ads than are required to encode the ad into memory, that means that more cognitive resources may be available for other cognitive tasks such as storing information from the ad in memory. Indeed, previous research has demonstrated that high-imagery advertisements are more memorable than low-imagery advertisements (Miller & Marks 1997; Unnava, Agarwal, & Haugtvedt 1996).

The results found in the dual-task condition of this study do not support previous research suggesting that the encoding of visual-like stimuli is cost-free. If visual encoding is truly cost-free, secondary-task reaction time should have been faster when the visual task was present than when it was not present. When partici-

pants had to listen to the radio advertisements and view pictures, secondary-task reaction time was slower than when participants only had to listen to the radio advertisements. This pattern of results indicates that encoding the visual stimuli used in this study was not cost-free. One possible explanation is that because the visual stimuli and the radio advertisements were not related, the resources allocated to encoding the messages were actually needed to make sense of the divergent messages. The stimuli used by Lang et al. (1999) in reaching the conclusion that visual encoding is cost-free were television messages. For most television content, there is a strong relationship between information in the audio and video channels. It could be that there has to be a certain amount of similarity between the audio and video channels in order for visual encoding of a mediated message to be cost-free.

A second possibility is that the results in this study are consistent with a multi-component view of working memory. Working memory has been conceptualized as a limited capacity system that supports the temporary storage and processing of information (Richardson, 1996). Baddeley (1986) proposed a multi-component model of working memory consisting of a visuo-spatial sketchpad, phonological loop, and central executive. The visuo-spatial sketchpad serves the temporary processing of visually presented information. The phonological loop supports temporary processing of verbal/language-based information. The central executive serves as a supervisory attention system aiding the comprehension of information and providing limited cognitive resources when the resources of the visuo-spatial sketchpad and phonological loop become overloaded. Other researchers have also supported a conceptualization of working memory that consists of distinct verbal and visual sub-systems (Caplan & Waters, 1999; Bischel & Roskos-Ewoldsen, 1999). Under a multi-component view of working memory, one would expect the combination of high-imagery advertisements and unrelated pictures to overload the capacity of the visual sub-system, as evidenced by slower secondary-task reaction time. Future research could more directly test predictions based on a multi-component model of working memory using more appropriate stimuli than were used in this study.

A multi-component view of working memory has some implications for studying media. Researchers need to be aware that media messages can have the ability to activate cognitive resources beyond what may be suggested by the simple physical characteristics of the message. High-imagery audio messages appear to have the ability to activate visual working memory. The degree that a media message differentially activates visual and verbal working memory could lead to very different outcomes as a result of exposure. More research needs to be conducted to test the utility of a multi-component view of working memory for developing theories of media-message processing. The dual-task experimental paradigm, as was

used in this study, appears to be well suited for this line of research, but will require researchers to pay close attention to task design.

As a laboratory experiment, this study is subject to limitations in external validity by not directly replicating “real world” exposure to media messages. Participants in this study sat in a chair with electrodes attached to them and were instructed to pay attention to the radio advertisements and pictures. Further, the radio advertisements were presented isolated from surrounding media content. The purpose of this study was to investigate the allocation of processing resources to high-imagery radio advertisements and to further explore the methodological conundrums involved in the use of secondary-task reaction time methodology with mediated stimuli. The control and tools for measuring participants’ responses available in a laboratory were more important to obtaining valid answers to the question being addressed in this study than replicating more naturalistic listening conditions.

Despite limitations, this study illustrates that one way advertising-evoked imagery processing of radio content is visual-like is in the way cognitive resources are allocated to encoding the message. Like visual media content, high-imagery radio advertisements grab more resources than are actually needed to encode the message. Future research should explore other, more specific ways advertising-evoked imagery processing may be visual-like. One promising way to do this would be to explore the possibility of conducting brain imaging studies using PET and FMRI to directly measure activity in visual areas of the brain during exposure to high-imagery radio advertisements.

## NOTES

<sup>1</sup>The means for the Imagery  $\times$  Time interaction were as follows: High time 1  $M = 25.576$ ,  $SD = .645$ , High time 2  $M = 23.375$ ,  $SD = .643$ , High time 3  $M = 22.995$ ,  $SD = .66$ , Low time 1  $M = 26.73$ ,  $SD = .812$ , Low time 2  $M = 23.92$ ,  $SD = .779$ , Low time 3  $M = 22.978$ ,  $SD = .646$ .

<sup>2</sup>The means for the Imagery  $\times$  Visual Task interaction were as follows: High Imagery/No Visual Task  $M = 5.02$ ,  $SD = .83$ , High Imagery/Visual Task  $M = 4.6$ ,  $SD = 1.07$ , Low Imagery/No Visual Task  $M = 4.61$ ,  $SD = .83$ , Low Imagery/Visual Task  $M = 3.78$ ,  $SD = 1.03$ .

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