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The Effects of Screen Size and Message Content on Attention and Arousal

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The number of different screens that people confront is increasing. One potentially important difference in the psychological impact of screen displays is their size; new screens are both larger and smaller than older ones. A between-subjects experiment (n = 38) assessed viewer's attention and arousal in response to three different size screens (56-inch, 13-inch, and 2-inch picture heights). Viewers responded to video images from television and film that displayed different emotions (# video segments = 60). Attention was measured by heart rate deceleration in response to the onset of pictures, and arousal was measured by skin conductance aggregated during viewing. Results showed that the largest screen produced greater heart rate deceleration than the medium and small screens. The large screen also produced greater skin conductance than the medium and small screens. For skin conductance, screen size also interacted with the emotional content of the stimuli such that the most arousing pictures (e.g., pictures of violence and sex) showed the highest levels of arousal on the large screen compared to the medium and small screens.

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Screens that display text, graphics, and video are ubiquitous. Every American household has a color television; 70% own a second one, and 25% own a third. Forty percent of households have a personal computer, a number expected to rise 20% by the year 2000. To these appliances can be added portable TVs, computers, games, electronic notebooks, and new versions of old appliances that have never had visual displays: for example, telephones, clocks, pagers, car navigation instruments—even dish washers.

What is typically most interesting about screen displays is the content of the information they show: television programs, computer applications, data bases, interfaces, information. Appliances with screens, however, differ in a more primitive feature that may significantly determine the psychological importance of the information they display. Screens come in radically different sizes. New uses for visual displays combined with advances in display technology have resulted in significant markets for unusually large and small screens.

On the large side, screens over 30 inches now account for the majority of revenue in television sales. Ten million American homes have home theater equipment that includes a large projection display. On the small side, LCD televisions (screens less than 5 inches high) are approaching annual revenue of $1 billion. There are many appliances that are now capable of small graphic displays, animation, and video. Of particular interest is the possibility of displaying identical content across the entire range of sizes. The same digital video file, for example, can produce high-definition images on the wall of a home theater or it can be displayed on a 2-inch high LCD screen on the back of a home video camera.

Virtually all of the research about psychological responses to television and computers is performed using average size screens. In the case of television, screens used in experiments are usually in the range of 15–20 inches, and they are viewed from approximately 5 to 7 feet. In the case of computers, screens are slightly smaller and viewed on a desktop from 2 to 3 feet. The results are then generalized, perhaps unthinkingly, to all sizes of screens. However, there is already evidence that different size screens can alter users' responses to the information they show. This could lead to errors when the results of research using average screen sizes is applied to newer displays. Unusually large and small screen sizes could augment or diminish expected effects.

PAST RESEARCH ON PSYCHOLOGICAL RESPONSES TO DIFFERENT SCREEN SIZES

The research on screen size has examined several different psychological responses. Across a variety of program content (talking heads, action adventure, comedy, and segments from feature films), viewers report that they like and enjoy large screens more than small ones (Lombard, 1995). Viewers also rate the action on large screens as more intense (Lombard, Ditton, Grabe, & Reich, 1995), and the movement portrayed on large screens as more physical and exciting (Lombard, Reich, Grabe, Campanella, & Ditton, 1995). One study found that the evaluation of people shown on large screens was accentuated relative to smaller presentations. If viewers liked the people portrayed when they were on small screens, then liking increased for the larger presentations. The opposite was true for the people who were disliked on the smaller screens (Reeves, Lombard, & Melwani, 1992).

Large screens have also resulted in different self-reports of emotional experience immediately after viewing. Using Self Assessment Manikin (SAM) scales to measure emotional response (P. Lang, 1980), one study showed that viewers reported feeling more aroused after watching a large screen (90-inch picture height) compared to a smaller screen (22-inch picture height; Detenber & Reeves, 1996). This finding, however, was not replicated using the same SAM scales when the picture heights were 12 inches and 46 inches (Lombard, Reich, Grabe, Campanella, & Ditton, 1995). There is also preliminary evidence that movie segments shot from a point-of-view angle can increase physiological arousal on a large screen compared to a small display (Lombard et al., 1995).

Studies have also looked at attention and memory but with conflicting results. Using a secondary task reaction time method, one study (Basil, 1994) found that large screens required more attention than small screens as viewers processed pictures of people talking (Reeves et al., 1992). Another study that used scenes from action-adventure films found the opposite result with the same reaction time measure of attention (Reeves, Detenber, & Steuer, 1993). One study showed increased memory for information presented on large screens (Detenber & Reeves, 1996), but another study did not find memory differences using similar measures (Reeves et al., 1993).

EXTENDING THE MEDIA LITERATURE ON SCREEN SIZE

The empirical literature on responses to different size screens suggests that size may determine some psychological responses, but there are several problems in this literature. Most importantly, many of the experiments are not comparable because they examine different criteria, and each may involve a different psychological mechanism. One goal of the present study is to focus the issue of display size on two outcomes—attention and arousal.

Our most general hypotheses are that larger displays will increase attention and arousal. The particular aspects of screen size that may affect these criteria, not reviewed in previous literature, include the following: changes in the meaning of size in relation to familiar qualities of objects and people, changes in the amount of information in peripheral vision, increased difficulty in visual search, and the creation of larger mental images linked to picture content. We examine each of these ideas here.

ATTENTION

The Meaning of Unfamiliar Object Sizes

Mental computations about the size of objects are complex. They involve both preattentive and attentive components (Wolfe, 1994) and use many different cues including contrast, resolution, visual angle, depth information, foreground texture, and familiarity (Meehan & Triggs, 1992; Predebon, 1992; Roscoe, 1993). When these different features of objects change, as they do when the display size of an image increases, the meaning of the objects depicted may change as well. This means, for example, that it would be highly novel for a picture to display the visual features of an ant (features that communicate its outline, depth, and texture) and also be 6 feet tall. Because media can change many of the lawful relationships that we expect in the real world—in the example of the ant by portraying a 6-foot-high bug—media may create new images that are novel, and because of the novelty they may increase attention.

More Information in Peripheral Vision

Another aspect of large displays that could increase attention—in particular selective attention—is the extension of the screen into the outer corners of vision. Large displays allow more of the picture to be viewed in the perimeter of vision, farther away from the point of central focus. This may be significant because peripheral vision is more responsive to novelty and motion than is foveal vision (Livingstone & Hubel, 1988). Attention to stimuli increases as visual surprises occur farther from the point of visual focus. On a screen that is only 2 inches high, for example, action in the corner of the screen is processed very close to the point of visual focus. On a screen that is 6 feet high, the same action is considerably farther from foveal vision even though the viewer may be seated farther from the screen. Thus, automatic attention responses may play a larger role in processing images on large displays.

Difficulty in Visual Searching

Larger screens may also compel more attention because they are more difficult to search. During the early stages of visual perception, people try to identify the most interesting features in a scene using the most salient features such as color and size. In psychology, early visual searching has been likened to the creation of topographic maps where "hills" mark more of a feature and "valleys" mark less of a feature (Wolfe, 1994). During visual processing, attention is first drawn to the hills, and when the pictures are large, more hills may be apparent. For example, a small picture that contains five trees clumped in a corner may appear to contain a single small forest. The large screen version, however, may appear to have five separate objects because the trees have substantial spaces between them; that is, five different objects contend for attention as opposed to a single object when the picture is smaller.

Larger Mental Images

Larger screen sizes may also require more attention because they may produce larger mental images. Most often, the content of displays is treated as symbolic; the words and pictures represent things that are not actually present (Worth & Gross, 1974). If this is true, then the mental image that results from processing a symbol should not be influenced by the size of the symbol. There are several experiments, however, that offer a convincing neurological argument for the functional equivalence of mental images and visual percepts (Farah, 1988; Kosslyn, 1994; Shepard & Cooper, 1982). For example, Kosslyn has shown that imaging a "large" mouse, after looking at a picture of a large mouse, results in a quicker answer to the question of whether it has whiskers than imaging a small mouse. If a picture on a large screen produces large mental images, then the resulting images may require more attention because of their imagined size.

AROUSAL

The second criterion of interest is arousal. There are two psychological reasons why larger displays might elicit more arousal in viewers: display novelty and looming.

Display Novelty

One explanation for increased arousal may be that large pictures are more novel (at least for certain types of content), and greater novelty is known to produce increased arousal (Pratto, John, & Kim, 1997). This argument may not hold, however, for content that appears "real size" on a large display (e.g., a picture of a face that is shown at the same size as it would be experienced in real life). On the other hand, large displays that are unusual in relation to the objective size of the people and objects they portray will be more novel. For example, a close-up shot of a person on a 6-foot screen shows a face that is both larger than faces experienced on more familiar displays and one that is larger than faces experienced in real life.

Looming

Large screen sizes may also increase arousal because viewers will automatically interpret the objects as closer. In particular, large people and objects may appear to "loom" over viewers and may dominate the visual field in a way that small displays do not. Generally, closer objects are more arousing than the same object seen at a distance. This is particularly true for objects that have emotional overtones and, as a result, engage the appetitive or aversive motivation systems (P. J. Lang, Bradley, & Cuthbert, 1997; P. J. Lang, Simons, & Balaban, 1997).

MEASURING ATTENTION AND AROUSAL

Despite the fact that the mechanisms theorized to be affected by screen size—attention and arousal—are primarily on-line, automatic, and unconscious, most past research about display size has gathered self-report, post viewing evaluations of content and displays. Measurement after viewing is difficult because people may not be able to remember their reactions, and subjective responses are difficult because many of the presumed effects of screen size may be unconscious. Consequently, the present study measured attention and arousal using two physiological measures that allow assessment as people view without requiring subjective evaluations of content either during or after viewing.

The physiological assessment of attention and arousal in psychology and media studies is relatively straightforward. It is well known that the onset of novel and signal information causes an orienting response that is referenced by a deceleration in heart rate (Graham, 1979; Kagan, Lacey, & Moss, 1963). This fact has been successfully used as a covert measure of on-line attention during television viewing (A. Lang, 1990; A. Lang, 1994; A. Lang, Bolls, & Kawahara, 1996; A. Lang, Bolls, Potter, & Kawahara, in press; A. Lang, Geiger, Strickwerda, & Sumner, 1993; Thorson & Lang, 1992). Heart rate has been shown to decrease briefly (indicative of orienting) in response to cuts, edits (A. Lang, Geiger, et al., 1993), videographics (Thorson & Lang, 1992), content onsets (A. Lang, 1990), and negative video images (A. Lang, Newhagen, & Reeves, 1996). In addition, longer decreases in heart rate, and slower recovery to baseline (indicative of greater attention over the course of a message) have also been linked to emotions (A. Lang, Dhillon, & Dong, 1995; A. Lang, Newhagen, & Reeves, 1995), the pacing of pictures (A. Lang et al., in press), and arousing content (A. Lang et al., in press). This study also uses heart rate as an index of attention over time. Slower heart rates are interpreted as greater attention to the message.

Arousal, defined as activation of the sympathetic nervous system, can be indexed by measuring skin conductance (Bradley, 1994; Cacioppo & Tassinary, 1990; A. Lang et al., in press). In particular, skin conductance has been frequently and successfully used to assess response to several types of media stimuli (Hopkins & Fletcher, 1994; A. Lang, Bolls, & Kawahara, 1996; A. Lang, Geiger, et al., 1993). Research has shown that self-reported emotional arousal to media stimuli correlates highly with on-line measures of skin conductance (A. Lang, Geiger, et al., 1993; A. Lang et al., in press).

The two hypotheses in the present study can be operationally stated as follows:

H1: Heart rate will be slower, indicative of greater on-line attention, for messages presented on larger screen sizes.

H2: Sympathetic arousal in the form of increased skin conductance will increase as screen size increases.

Another goal of the experiment was to use a varied set of moving pictures that were comparable to stimuli used in psychology experiments about emotional response to pictures. The video stimuli in this study paralleled a standard set of slides that have been used extensively to study attention and arousal in relation to still pictures (Bradley, Greenwald, Petry, & Lang, 1992). The total set of pictures used in this experiment included scenes judged to portray highly arousing content (e.g., a rocket launch), and calm content (e.g., tranquil lake with an island), and scenes that were positive (e.g., babies laughing) and negative (e.g., bloody surgery). This new set of pictorial stimuli not only resembles past psychological research; it also offers a reasonable sample of the range of content that appears in traditional television programs and films.

The advantage of showing pictures that can arouse or calm, and make people happy or sad, is that it allows a comparison of the effects of screen size across different pictorial content. It is already known that emotional scenes (i.e., those that have the most arousing content) get more attention and are more memorable than nonemotional scenes (Bradley et al., 1992; A. Lang, Dhillon, & Dhong, 1995; A. Lang et al., in press; A. Lang, Newhagen, & Reeves, 1996). This psychological research suggests that the ability of a message to arouse a viewer is one of the most important predictors of how well a message will be processed and remembered. Messages that are insufficiently arousing are likely to receive less processing than messages that are moderately or highly arousing. If display size adds arousal to an otherwise low arousal message, then display size alone could increase processing and memory for less exciting content. On the other hand, it is possible that larger displays and arousing pictorial content may resonate to increase attention and arousal beyond what might be expected from either factor alone.

This leads to the following research question:

RQ1: Does screen size interact with either the valence or the arousal of media messages to alter viewers' arousal or attention levels?

METHODS

Subjects

Thirty-eight female Stanford University students were recruited on campus or from classes. They participated in the experiment in exchange for $10 and/or course credit. Female students were used to control for known gender differences in response to emotional scenes (P. Lang, Greenwald, Bradley, & Hamm, 1993).

Design

The basic design allowed for the measurement of heart rate, skin conductance, and SAM self-report scores while participants watched video clips presented on one of three different size screens.

Participants viewed 60 different video clips. Each clip was 6 seconds. All participants viewed all clips; however, the order was randomly varied across respondents between four presentation sequences. The 60 pictures were taken from television and film and were known from prior research to vary on valence and arousal (Detenber & Reeves, 1996). The selection of the pictures controlled for three aspects of visual motion: the segments included no edits, they had little or no camera movement, and at no point did a central object leave the frame (Detenber, 1995; Detenber & Reeves, 1996). A Hypercard stack (Version 2.0) running on a Macintosh Quadra 605 computer was used to control the order and timing of playback using a Pioneer LD-4200 laserdisc player. The time between picture presentation varied randomly between 20 and 40 seconds.

Participants watched the pictures on screens with vertical heights of 56 inches, 13 inches, or 2 inches.[1] Each participant saw only one screen size. The large and medium images were projected with an NEC GP5000 and Eiki LC-150, respectively, and were shown on a rear-projection screen. The smallest images were shown on a Sony XV-M30 LCD monitor attached to a tripod. The viewing distances in the three conditions were as follows: large, 84 inches; medium, 84 inches; small, 24 inches.

Response Measurement

The collection of physiological data was controlled by an IBM-PC. The analog physiology signals were digitized with a Labmaster A/D D/A board. Heart rate was measured by placing two Beckman standard (0.5 cm2) AG/AGCL electrodes on the participant's forearms after washing the skin with rubbing alcohol. A ground electrode was placed on the nondominant forearm. Heart rate was recorded using a Coulbourn Model S75-01 high gain bio-amplifier with filters. Heartbeats were recorded as milliseconds between beats and were later converted to heart rate per second.

Skin conductance was measured by placing two standard AG/AGCL electrodes on the participant's nondominant hand after washing the skin with distilled water to control hydration. The signal was passed to a Coulbourn Model S71-22 constant voltage (.5V) Skin Conductance module. Skin conductance was sampled and recorded 20 times per second throughout viewing. The amplitude of the largest skin conductance measured during each clip was used as the skin conductance response (SCR). Additionally, the data were averaged over 1-second intervals to produce skin conductance level (SCL) measures.

Participants provided ratings of valence and arousal for each video clip by completing a paper-and-pencil version of Lang's SAM (P. Lang, 1980). The SAM scale for valence consists of a gender-neutral human figure that has five facial expressions varying from a big smile to a big frown. The SAM scale for arousal depicts a similar figure. However, in this case, the figure varies not in facial expression but rather in the size of the cloud and lightning depicted on its chest. At the calm end of the spectrum, the manikin has no agitation, and at the aroused end, the "storm" is bigger than the figure's chest.

Procedure

Participants were seated in a comfortable chair and were provided a brief description of the stimuli, the rating task, and the procedure. They then read and signed an informed consent letter. Their palms were washed with distilled water, and their forearms with alcohol. The skin conductance and heart rate sensors were affixed to their hands and forearm. People were then asked to relax while the experimenter finished setup. The experimenter dimmed the lights and walked behind the large screen to check the physiological readings and make any necessary adjustments. When the adjustments were done, the experimenter came back, asked whether the participant had any questions and whether they were ready to start. Then the experimenter went back behind the screen and started the picture display.

During the experiment, each participant sat alone in a partially dimmed room. Participants were asked to sit quietly and watch each video clip fully. They were then asked to rate the clips on the valence and arousal SAM and return to their resting position. Data collection began 3 seconds before each video clip was presented and continued for 9 seconds. At the end of the experiment, respondents were thanked and told that the data would be discussed in class.

Data Reduction

Heart interval data were edited to remove recording and movement artifacts. Missing heartbeats were replaced with the average heartbeat for that trial. Heartbeats were then converted to average heart rate per second. Cardiac response curves were generated for each screen size.

Skin conductance responses (SCR) were scored for each 6-second period. SCR was scored by visual inspection of the skin conductance data for the 6-second period when the video was shown. The start of an SCR was determined to be the lowest point before the SCR began to rise towards its peak. The peak was scored as the first point that reached the peak value of the SCR. Scores smaller than .10 microsiemens were omitted. Only the largest SCR per segment was scored.

RESULTS

The first hypothesis predicted that participants would pay more attention to larger screens than to smaller ones. Heart rate was used to index attention. It was predicted that heart rate would decrease, indicating that participants were attending to the message. The larger and more persistent the decrease in heart rate, the greater the attention to the message. Cardiac response curves are constructed by averaging participant's heart rate responses across messages by screen size. Trend analysis was performed on the data to determine if there was significant variation in the cardiac response curves generated for each screen size. The change in heart rate over time showed significant quadratic effects at each screen size (small: $F(1,12) = 31.25, p < .001$; medium: $F(1,12) = 34.6, p < .001$; large: $F(1,11) = 39.51, p < .001$), which together with the shape of the graphs shown in Fig. 1 confirms that an orienting response occurred to the messages (A. Lang, 1990).

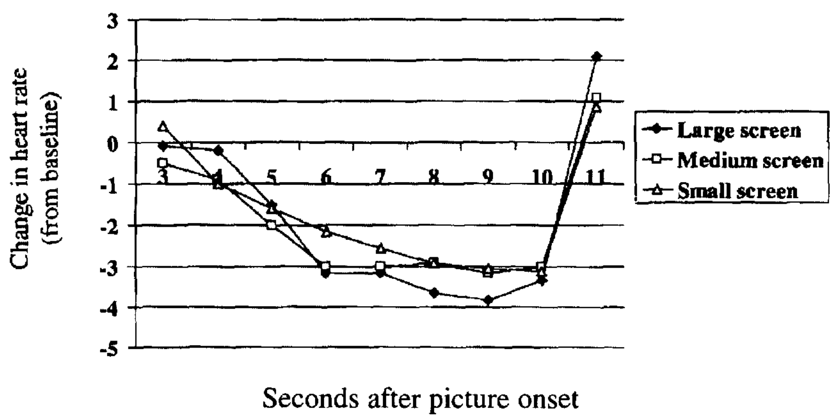

Figure 1. Change in Heart Rate Over Time by Screen Size.

The larger the initial decrease in heart rate (compared to baseline), the more attention participants are paying to the message. In this experiment, the baseline was the average heart rate for the 2 seconds before onset of the message. As the curves in Fig. 1 show, the large screen condition showed a greater drop in heart rate than the medium- and small-screen conditions. This change in heart rate over time was not statistically significant when analyzed between participants, $F(16, 304) = 1.31$; $p = .19$; however, when the data were aggregated across participants to obtain average heart rate scores for the 60 different pictures, the differences shown in Fig. 2 were statistically significant, $F(16, 1416) = 2.83$; $p < .001$. This suggests that participants pay more attention to the messages presented on large screens than they do to messages presented on small- or medium-size screens.

Hypothesis 2 predicted that larger screens should be more arousing than smaller screen sizes and this effect should be apparent in greater SCL values. The evidence for this effect should be a larger increase in SCL values after the onset of stimuli. Figure 2 shows the time course of SCL responses before, during, and after stimulus onset. There was a significant screen size by time interaction in SCL, $F(8,216) = 1.99$; $p < .05$, when comparing medium and large screens but no differences ($F < 1$) between small and medium-size screens. SCL responses in the large-screen condition reached a higher level, .2 microsiemens, at 5 seconds after the pictures appeared. The small- and medium-screen conditions showed smaller increases during the viewing.

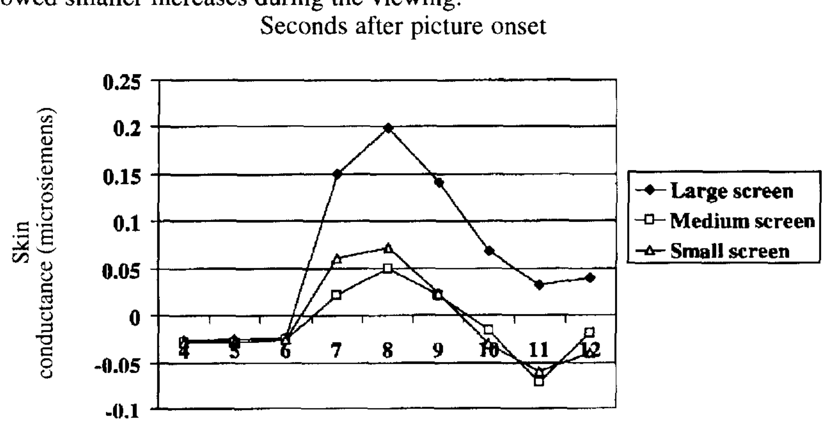

Figure 2. Change in Skin Conductance Over Time by Screen Size.

When the SCL for the small and medium screen size conditions was compared to the large-screen condition there was a main effect for screen size, $F(1,39) = 5.31$; $p < .03$. The combined small/medium condition has an average SCL of .365 microsiemens, whereas the large screen condition has an average SCL of .507 microsiemens. There was also a significant screen size by time interaction in SCL, $F(8, 332) = 2.23$; $p < .03$, for the small/medium versus large-screen conditions.

Research Question 1 suggested that the emotional impact of the moving pictures themselves (whether they were negative or positive, or calm or arousing) might interact with screen size to alter attention and arousal levels. Again heart rate and skin conductance were used to index attention and arousal, respectively.

Results show that negative pictures and arousing pictures received marginally more attention than calm or positive pictures, regardless of the size of the screen. Pictures with positive valence showed a decline in heart rate of 1.96 beats/minute, whereas negative pictures decreased heart rate 2.26 beats/minute. This was marginally statistically significant, $F(1,37) = 3.03$; $p < .09$. Although the more arousing pictures showed considerably more drop in heart rate than the less arousing pictures, –2.25 compared to –1.99 beats/minute, this difference was not significant, $F(1,37) = 1.59$; p = ns.

For attention (heart rate) there were no interactions between arousing content, valence, and screen size.

The effects on arousal were indexed by measuring the size of the largest SCR during the time the message was on screen (Cacioppo & Tassinary, 1990; A. Lang, Geiger, et al., 1993). The largest SCRs (indicative of the greatest arousal) were found for the moving pictures that were rated as being the most arousing. This effect was significant, $F(1,37) = 5.80$; $p < .02$. The average SCR during arousing clips was .47 microsiemens compared to .33 during calm clips. In addition, the negative moving pictures also resulted in more arousal than the positive moving pictures. The main effect for valence was significant, $F(1,37) = 4.87$; $p < .03$ with positive clips having an average SCR of .36 microsiemens and negative clips .45 microsiemens.

In addition, there was an interaction between screen size and arousing content for the SCR data. The effect of arousing content on the size of the SCR was greater for larger screens than for either small- or medium-size screens, $F(2,72) = 7.15$, $p < .001$. This interaction is shown in Fig. 3.

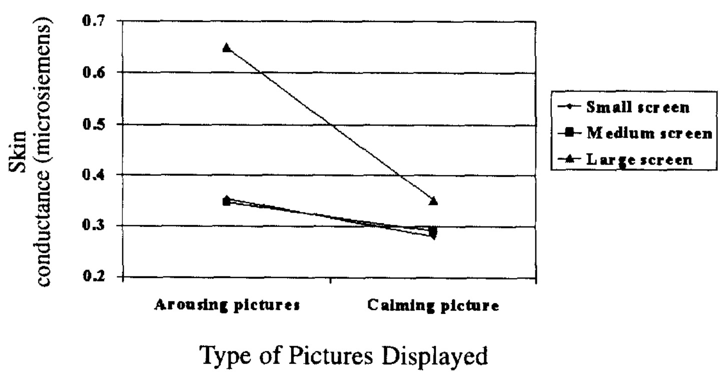

Figure 3. Average Skin Conductance Over Time by Screen Size.

DISCUSSION

The results of this experiment suggest that screen size, regardless of content, can increase attention and arousal for media messages. In addition, the results suggest that some types of content may interact with screen size to increase this effect. In particular, large screens in the range of 4 to 5 feet in picture height will increase arousal when the pictures themselves have a high potential to excite (e.g., sex and violence). The affect of size on attention is less substantial than the effect on arousal. Both of the effects, however, occur across a variety of television and film content.

One practical implication of these findings is that known effects of media could be accentuated when media are displayed on a large screen. This observation could extend to a large range of media effects that are known to involve attention and arousal. We consider three: persuasive responses, memory for mediated information, and enjoyment of media.

In research on media and persuasion, the level of psychological involvement in media is known to play an important role in determining how persuasive information is processed (Cacioppo & Petty, 1989). Messages that increase involvement receive more central processing (i.e., more rational and thoughtful consideration) and, as a result, they produce more lasting attitude change. Because increases in attention and arousal lead to increases in involvement (Cacioppo & Sandman, 1981; A. Lang, Geiger, et al., 1993), simply viewing a persuasive message on a larger screen may render that message more persuasive.

There is also good evidence that more arousing messages are remembered better than less arousing ones (Bradley, Greenwald, Petry, & Lang, 1992; A. Lang et al., in press; A. Lang, Dhillon, & Dong, 1995). If bigger screens elicit greater arousal in viewers, then better memory could be expected for information displayed on large screens. This may explain the one finding in the media literature that shows larger displays are associated with better recall of pictures (Detenber & Reeves, 1996). This suggests that display size alone could cause viewers to retain more information in areas where memory is considered an important criterion for effects; for example, in the areas of news and public affairs, advertising, and educational programming.

Another effect of increased arousal is the transference of excitation from the viewing experience to other activities (Zillmann, 1979). If viewing on a large screen causes more arousal, then the increased excitability could affect subsequent behavior. This could include greater attention to subsequent media presentations as well as more intense responses to people and events in the viewing environment. It may even be possible that viewing positive material on the big screen could increase the excitation or action readiness that is transferred to negative behavior, if that is the behavior encouraged after viewing.

It is also well known that people use media to manage arousal (Meadowcroft & Zillmann, 1987; Zillmann, 1991). When arousal is too high, people use media to calm down, and vice versa. The use of the large screen to moderate arousal could include the following. Viewers may seek out a large screen to increase arousal for specific events, like sports or movies. Also, viewers might purposely avoid the large screen when viewing content that is itself arousing. And it is not inconceivable that people might wish to retreat to a small screen in another room to calm down, either after large-screen viewing or at times when their arousal is high for other reasons. This suggests that small screens may not disappear, especially in the home or other places that have multiple screens available for identical content. Rather, multiple screens could be used to accent the effects of content or they could be used in sequence to mitigate the effects of a prior viewing experience.

The idea that screens of different sizes could take on unique roles is consistent with other media research that shows that people are willing to assign different roles to television channels and even television sets. Leshner, Reeves, and Nass (1998) showed that people will change their evaluations of identical news content when it is shown on a channel that specializes in news (e.g., CNN) versus a generalist network (e.g., NBC). Similarly, people also changed their evaluations of programs depending on whether the programs appeared on one of two identical television monitors; one that viewers were told was only used to show news, and one that was used only to show entertainment (Nass, Reeves, & Leshner, 1996). In both of these cases the evaluations changed to favor the specialty of the content or monitor: for example, people that saw news stories on CNN thought they were more newsworthy than when the same stories were on NBC.

The idea that channels and even television screens can become specialized may be generalizable to multiple-television environments. For example, a television set in the study could become specialized for news, and one in the living room for entertainment. In this same vein, it may be possible that displays of different size could develop similar specialties, in this case specialties not associated with content but with the level of excitement they could generate.

The display size differences in this study may also have implications for psychology. The question about size in psychology has been to figure out how people make size assessments in the real world and to determine the conditions under which people make errors. In answering these questions, psychologists have rarely considered identical objects shown in different sizes. Changing the "true" size of people and objects, however, is something easily accomplished with media. Furthermore, people can be expected to become increasingly familiar with similar content displayed on different size displays. The fact that the objective size of visual displays may change psychological responses suggests a new category of research issues about size as a fundamental concept in psychology.

The inclusion of display size as an important variable in media research seems critical. This may be especially true because the market for displays will likely continue to favor larger screens. There are several demonstrations in the media literature of the potential for the form of messages to change processing of content. This includes the study of cuts (A. Lang, 1990), motion (as reviewed in Reeves & Nass, 1996) and other visual surprises (Zillmann, 1991). These results suggest that display size should be added to the list of structural or formal features that can significantly change the role of media in psychological life.

NOTES

[1]These instances were chosen to partially control viewing angle. The 13-inch screen provided a viewing angle mid-way between that associated with the 56- and 2-inch screen.

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