THE EMOTIONAL AND COGNITIVE PROCESSING OF NEGATIVE NEWS PHOTOGRAPHS

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The undersigned, appointed by the Dean of the Graduate School, have examined the dissertation entitled

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Presented by Renee Martin-Kratzer

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And hereby certify that in their opinion it is worthy of acceptance.

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ABSTRACT

The purpose of this study was to determine if the structural features and emotional content of negative news images affected viewers' responses. A pair of within-subjects experiments manipulated the color and size of the photographs as well as the intensity, which was defined by the arousal and valence ratings of the content. Experiment 1 manipulated the variables of color and intensity, and Experiment 2 manipulated size and intensity. Physiological and self-report scales were used to measure orienting responses, arousal, valence, newsworthiness and offensiveness. Recognition tests were administered to measure accuracy and response times. Results indicate that the structural feature of color failed to produce significant responses. The size of images and the intensity of the content had a greater influence on people's emotional assessments and news judgment. In addition, the intensity variable was replicated across two experiments, and the findings show that the results were the same for both.

Chapter 1

THE DILEMMA OF DISTURBING PHOTOGRAPHS

The field of mass communication is full of implicit assumptions (Severin & Tankard, 1992). Practitioners frequently rely on common sense to guide their decisions. An example of this is when editors are confronted with disturbing images that might offend some readers. A maxim for dealing with these images is that running them in black-and-white or in a reduced size will lessen the emotional impact on readers. The underlying assumption is that structural features of photographs can influence emotion. Two experiments will be conducted determine if this common sense approach to handling controversial images is backed by empirical support.

Newsroom debates

When faced with images depicting death and destruction, newspaper picture editors must decide whether to disseminate the gruesome scenes or withhold them out of concern for readers. Several images from recent times have provoked heated debates, including the Sept. 11 terrorist attacks, the Madrid train bombing, the Nicolas Berg execution, the burned hanging corpses in Fallujah, and the coffins of American soldiers.

As gatekeepers, picture editors must balance their duty of informing the public with the possibility of offending readers. These decisions are never easy, and a recent online survey shows that journalists and readers often disagree on what images should be published. The Association of Managing Editors selected five images that sparked debate in the past year for a survey posted on the organization's website. Newspaper readers and journalists were encouraged to complete the online survey, and the results reveal that journalists supported publishing the images more often than the readers (Ritts, 2005). Of course, this survey lacks a representative sample, which means that the results are likely biased and unreliable. Despite this major design flaw, the written responses are nonetheless informative in terms of the main issues that arise in these types of debates.

For example, an image from the Asian tsunami aftermath shows a mother, her hands on her head and her face pointed upward, grieving over numerous dead children. More than half of the readers and journalists said the image should be published. "'I believe the only way to make something as vast as this tragedy understandable is to reduce it to single, human images,'" a journalist said. **(**Ritts, 2005) Others felt the woman's privacy was being invaded. "'If your child were killed in some horrific manner, would you rush a reporter to get a picture of your wife's reaction?' asked Red Thomas, a reader from Mesa, Ariz. 'If not, why does this woman deserve less dignity?'" **(**Ritts, 2005).

The APME online survey is similar to a feature, called "You Be the Editor," that ran in The Montreal Gazette (Raudsepp, 1999). The feature included 10 ethical dilemmas and asked the readers to make a decision. In 20 percent of the cases, the readers made different choices than the editors (Raudsepp, 1999).

In cases that dealt with the issue of privacy, the editors were more likely to publish the photographs than the readers. "Quite clearly, readers tend to be more protective of privacy than editors, who, after all, make their living by disseminating information" (Raudsepp, 1999).

A scholarly study that looked at this issue of reader and journalist agreement presented participants with 19 hypothetical ethical situations and asked for their judgment (Hartley, 1983). In 17 of the 19 cases, the two groups differed significantly. The study's conclusion was that journalists and readers have different ethical news values.

These studies show that editors are more likely than readers to advocate for the publication of controversial photographs. But the decision-making process doesn't end with that decision. Now, editors must decide how to present the image. Sometimes they rely on changing a photograph's structural features, such as color and size, to reduce the emotional impact. For example, the Pittsburgh Tribune-Review published photographs showing the beheading of American Paul Johnson. The staff debated running the alarming images and decided to place run them small and in black-and-white "to somewhat minimize its gruesome impact" (Craig, 2004). This compromise is not uncommon in other newsrooms. The Oregonian had an entire sequence of images showing a Palestinian being shot and killed by an Israeli sniper. Editors chose to run the image in black and white and in medium size on an inside page. "It's a haunting photo but not particularly graphic or as unsettling as it would have been had we run the entire shooting sequence in color on the front page" (Rasmussen, 2002). In fact, Ken Irby of the Poynter Institute, who is a leader in the photojournalism field, advises photographers to consider size, color and placement when discussing controversial images (Robertson, 2005). Thus, the belief persists that altering the color and size of disturbing images can decrease readers' emotional responses.

Study goals

The goal of these experiments was to determine if two structural features of photographs (color and size), and one content feature (intensity), affected viewers' emotional and cognitive responses. Heart rate data was collected to determine if these features elicit different orienting responses. Self-report data measured people's emotional responses to the photographs. In addition, the participants indicated their support for having these negative news images published in a printed newspaper or online news site. The studies include a replication for one hypothesis to determine if the findings were the same across different message samples. Mass media scholarship not only lacks study replications, but this type of replication is rarely done (Reeves & Geiger, 2000). The results of this study have practical implications for newspaper editors. The findings offer empirical evidence as to whether changing the size and color of images is an effective way to decrease viewers' emotional responses.

Chapter 2

ACTIVATING THE AVERSIVE SYSTEM

This chapter begins with a definition of emotion that will be used to guide this study's predictions and explanations. Next, research on emotional responses to the structural features of color and size will be reviewed. Finally, the visual processing of pictures and potential reader responses to negative news images will be examined.

Emotion

This study uses the dimensional theory of emotion and focuses on the two dimensions that are cited the most - affective valence and arousal (Lang, 1995 & 1993). Affective valence emotions range from negative to positive. Arousal ranges from extremely calm (low) to extremely aroused (high).

Affective valence and arousal are tied to the brain's motivation systems. The aversive system controls the body's defensive reactions, and the appetitive system seeks to sustain the body. These motivational systems are an important part of bio-informational theory. This theory was developed after Lang noticed that the some of his phobic patients were doing better than others in overcoming their fears. The ones who were doing the best were those who were aroused (Lang, 1993). Based on this initial observation, Lang developed this theory in which emotion is viewed as networks involving action. These emotional networks are linked to systems that control approach and withdraw behavior (Lang, 1993).

These emotional networks have been useful in aiding the survival of the human species. Whether humans living centuries ago chose to approach or withdraw dangerous stimuli in their environment affected their survival. According to Shoemaker (1996), humans have a surveillance function that helps them monitor stimuli. Dangerous or deviant stimuli are attended to so people avoid harm. The early ancestors that successfully surveyed their environment had a reproductive advantage (Shoemaker, 1996). Thus, the human brain has evolved to perceive danger in our environment. According to bio-information theory, emotional responses have evolved over time, too. "The bio-informational theory regards emotions as motivationally tuned states of readiness that are products of Darwinian development" (Detenber & Reeves, 1996, p. 66).

The emotional networks can also be activated by media representations, such as photographs. Pictures "can match the stimulus properties of real object or event referents, activating cognitive representations associated with strong emotional responses" (Lang, Greenwald, Bradley, Hamm, 1993, p. 262). Manipulating various attributes of stimuli can elicit the appetitive or the aversive systems. If media are perceived as a danger, then the aversive system is activated. For example, (Bradley, 2000) found that negative valence and high-arousing stimuli are more likely to activate the aversive system, which functions to protect us from harm. If the stimuli are non-threatening, then the appetitive system becomes activated.

Physiological measures can be used to indicate which motivational system has been activated. In terms of picture viewing, physiological measures typically reveal that negative images produce increased corrugator muscle activity, which is linked to negative valence, and a larger deceleration in heart rate, which means that viewers allocated resources to encoding the information. In addition, there is an increased skin conductance for high-arousal images (McManis, Bradley, Berg, Cuthbert & Lang, 2001). These biological responses are a result of activating the motivational system.

Previous research on photographs has focused on manipulating the content to examine the responses. The International Affective Picture System (Center for the Study of Emotion and Attention, 2001) includes a set of images rated on the dimensions of valence, arousal and dominance. These pictures have served as stimulus materials in numerous studies investigating the affect of picture valence and arousal on physiological responses and self-reported emotions (Hamm, Schupp & Weike, 2003).

The autonomic nervous system plays a role in people's emotional responses. The autonomic nervous system includes the sympathetic division, which is linked to emotional arousal, and the parasympathetic division, which is linked to attention. Stimuli in the environment activate these divisions, and the body responds with either a faster heart rate from the activation of the sympathetic division or a slower heart rate from the activation of the parasympathetic division (Lang, 1994). Measuring a person's heart rate during stimulus exposure offers insight into the body's automatic emotional responses.

One physiological response that is frequently measured is the orienting response. Pavlov first noted the orienting response when the dogs he was studying would attend to him as he entered a room and not the stimulus (Stern, Ray & Quigley, 2001). The orienting response is defined as a brief, automatic reaction that occurs when people respond "to stimuli that are novel, learned, intense, complex, and/or surprising" (Lang, 1994, p. 101). Heart rate slows down in the first few seconds following stimulus exposure as a person orients to new information.

Research indicates that photographs can elicit an orienting response in which the heart rate decelerates as a person attends to new stimuli in the environment. This orienting response occurs for both positive and negative stimuli, but this study is interested in responses to negative photographs. A typical response to negative images is initial heart rate deceleration that continues to decelerate throughout the stimulus exposure time (Bradley, 2000). In addition, the heart decelerates more for negative valence rather than positive valence scenes (Lang, Greenwald, Bradley, & Hamm 1993). When the orienting response occurs, resources are allocated to encoding the information, which increases the likelihood it will be remembered. Memory for high-arousing photographs is better, and this finding holds up for both positive and negative valence images. (Bradley, 1992). This study will include a measure of heart rate to determine if negative news photographs elicit an orienting response, and if these responses vary depending on the color, size or intensity of the images.

Color theory

Color is elusive because it is "something that is seen at a given moment and nothing more" (Holtzschue, 1995, p. 2). The source of color is light. There are different wavelengths of light in the visible spectrum, and these wavelengths are perceived by viewers to be different colors. Colors can appear to change because our perception is dependent on the object being viewed, the light source, and the person viewing the object. People vary in their ability to discriminate between colors, but the average person can see 150 different colors of light. Hue is the term used when talking about distinct colors (red, green, etc.). However, these 150 colors can vary in value and saturation. Value refers to how light or dark the color appears. Saturation is the dullness or brilliance of the hues. Because the hues vary in value and saturation, this means that the average person can detect millions of colors (Holtzschue, 1995).

Not all colors are perceived the same. For example, objects with warm colors (e.g. red, yellow) appear to advance while cool colors (e.g. blue, green) recede. This same visual effect occurs with saturated colors. The more saturated colors come to the front, while the less saturated colors recede (Holtzschue, 1995). In terms of emotion, this "movement" effect for color could activate the brain's motivational systems. The aversive system would be more likely to be activated by the "advancing" color stimuli because it would appear more dominant than the receding black-and-white stimuli. In addition, color can be a salient cue, so that it attracts more attention from viewers. This means that the aversive system would be more likely to attend to the color stimuli as well as produce responses in the dimensions of valence and arousal.

Understanding how the brain processes visuals provides insight into our biological responses to color. In the cortex, there are more than 30 visual areas (Eysenck & Keane, 2000). Studies of the brain have shown that different structural features, such as color, form and motion, are processed in different parts of the visual cortex. Color processing occurs in the area identified as V4 (Eysenck & Keane, 2000). One study that involved brain scans found that people viewing grey or colored shapes had increased blood flow in the V4 area in response to the colored shapes only. In addition, people suffering from achromatopsia, which is a condition marked by a minimal ability to perceive colors, have brain damage in the V4 (Eysenck & Keane, 2000). These findings indicate that colors can produce a biological response and not just subjective evaluations.

Color and photography

A look at the scholarly research on emotion and color photography turns up studies with conflicting findings. Livesay & Porter (1994) manipulated the color of images and collected physiological data, including corrugator activity. This activity is used as a measure of negative valence. The researchers found there was no difference in corrugator activity between the two color conditions, suggesting that the color and black-and-white images do not differ in terms of negative valence. The study also compared emotional and neutral images. The "emotional" photograph showed a drug addict injecting a vein in his neck with drugs, and his forearm was covered in blood. The "neutral" picture depicted a building with a blue sky at the top and flowers and bushes in the foreground. The findings showed that the "emotional" image elicited more corrugator activity than the "neutral" image. Yet these findings are based on the responses to only two photographs – one for the color condition and one for the black-and-white condition. As Reeves and Geiger (2000) point out, messages vary on many different features, so it is better to use multiple representations of messages in each condition. For example, the photographs differed not only in emotional content, but also in composition, subject matter, colors in the scene, lighting, etc. The emotional feature was not isolated, and only one exemplar for each emotion category was used. Thus, this study's findings that color did not elicit greater corrugator activity may not hold up if additional message exemplars were included. In other words, the impact of color on emotion may be dependent on a variety of media features. Another potential problem with this study is that only 12 subjects used, and the level of power was not reported, so it is unclear if Type 2 error was a problem. The issues with this study make it difficult to draw a definitive conclusion regarding emotional responses to color.

A more recent study (Detenber & Winch, 2001) looked at the emotional significance of color in newspaper photographs. The images chosen for the experiment were based on three categories: blood, fire and tragedy. The images were embedded in mock newspaper pages, which increased the ecological validity of the study but also introduced the text, captions and design as potential confounds. This experiment was conducted in groups of six, and different pictures were shown for the black-and-white condition and the color condition. The dimensions of emotion were measured using the Self-Assessment Manikin (SAM) scales. The findings show that color photographs elicited more negative valence, which differs from Livesay & Porter's (1994) findings; however, different measures were used. Color images also rated higher on arousal (Detenber & Winch, 2001).

A study that compared color to black-and-white video used self-report and physiological measures (Detenber, Simons, Reiss, 2000). Valence responses were greater and arousal was higher on the self-report measures when the clips were viewed in color, but the physiological data showed no difference. The researchers concluded that people's subjective evaluations differ from their body's responses. They point out that this disconnect between measures of emotion is not unique. A similar finding occurs when participants view same-sex erotic images and report low arousal, although the physiological data show otherwise (Detenber, Simons & Reiss, 2000).

The non-scholarly literature also offers opinions on the effect of color. When *USA Today* debuted, some newsrooms were already printing in color, but many were not. For the latter group, this bright and bold newspaper caused concern for some newspaper editors and publishers. They were worried that the switch to color would make the newspaper appear less important and less professional to readers. A study by Smith (1989) showed that these beliefs were not true and that readers enjoyed color. Eventually, even the *New York Times*, known as the "Old Gray Lady," added color in 1997.

Textbooks for design and photography courses are filled with ideas about how color affects viewers' emotional responses. For example, the following passage appears in a popular design book:

> While black-and-white most strongly represents the craft of photography and generates an intellectual response, color elicits a more emotional response from the viewer. Both are translations of reality, but color photography is a much closer representation. An immediate advantage to a print in shades of gray is that it is different from reality, so a curiosity factor is built in. Curiosity exists for a color photograph, but it is based on its familiarity (Smith, 2001, p. 83).

This author believes that color elicits more emotion. However, a book on color theory asserts that black-and-white images have more visual impact. Holtzschue (1995) recommends changing the value of colors in photographs to maximize contrast. Value refers to how bright or dark the colors appear. The lowest possible color value is found in black, and the highest value is found in white, making these strong contrasting colors to place next to each other. Because these opposite colors make such a dramatic pairing, Holtzschue (1995) says the result is "powerful images" (p. 100).

The non-scholarly and scholarly literature presents conflicting results about the impact of color on emotion, so this is an area in need of additional research. This study will examine the independent variable of color, which has two levels: black-and-white and full-color. Black-and-white is defined as having only white, black and shades of gray, while full-color includes the color spectrum.

Size and emotion

The effect of size has interested researchers who track the navigation of a printed newspaper page. The Poynter eye-tracking study (Garcia & Stark, 1991) found that the most dominant element on the page served as the point of entry. Readers consistently looked at the largest photographs first. It made no difference whether the images were in color or black-and-white; size is what mattered. Seventy-five percent of all photographs (color and black-and-white) in the prototypes were processed. The larger the photograph, the more likely it was to be processed. Only 45 percent of mug shots were processed compared to 92 percent of photographs that were three columns wide or larger. This finding is significant because Wanta (1988) found that the size of a photograph not only directs readers' viewing patterns, but it can also influence what issues they think are important.

A study by Detenber and Reeves (1996) examined how the size and motion of an image affected emotional processing. In this study, the researchers used self-reports as the operational measures for three dimensions of emotion (valence, arousal and dominance). The findings showed that the large images were more arousing and were perceived as more dominant than the small images, but there were no differences in terms of valence.

Because there was an effect on size, the researchers concluded that "the significance of media messages to an individual resides not only in their content, but also in the nature of their presentation" (Detenber & Reeves, 1996, p. 80).

A study that manipulated the size of newspaper pictures instead of screen size discovered that larger photographs on a printed page increased the readership of the accompanying story (Huh, 1994). In addition, the participants who viewed the large photograph were able to correctly answer two multiple-choice questions. One drawback of this study is that there was no statistical analysis, so it's unclear if the reported percentages vary by chance or are true differences.

In this study, the concept of "size" refers to the length and height in inches of the photograph. These dimensions will vary while the computer monitor's size remains constant. The independent variable of size will have two levels:

large (707 x 530 pixels) and small (354 x 265 pixels). Thus, the width of the small images is half the width of the large images.

Newsworthiness and Offensiveness

High-arousal, negative news photographs often feature images of death, destruction or suffering. This content is certain to offend some viewers. When news editors encounter these images, they have to weigh the possibility of offending readers with the need to disseminate important information.

Examining the concepts of offensiveness and newsworthiness can provide insight into viewers' assessment of the news. When editors are hashing out these issues in a newsroom, they are simply guessing the responses that readers will have. Will they be completely offended and outraged? Or, will they perceive the images as newsworthy and agree with the decision to publish?

Reader feedback via phone calls, letters to the editor and e-mails offers some insight into the emotional responses evoked by these images. These personal communications also offer a glimpse into the level of support the newspaper had for publishing them. However, the people who take the time to respond may not represent typical readers.

An editor who is concerned about offending readers but is dedicated to publishing a controversial image may choose to alter the structural format by converting a picture to black-and-white or reducing its size. Because of a lack of research on this topic, the interaction of the structural features with offensiveness, newsworthiness and publication support is unclear. However, the bio-informational framework suggests that altering features of the stimuli can affect which motivational system is activated. Also, people have evolved to respond to danger in the environment. The structural features of color and large size make the stimuli more salient to the viewers. These features also make the stimuli appear more dangerous, which makes these photographs more likely to activate the aversive system. In addition, photographs with the high-arousal content will appear more dangerous than the ones with low-arousal content. The aversive system's function is to avoid danger, so if this system is activated, it is likely that ratings for offensiveness will be higher, ratings for newsworthiness will be lower and publication support will decrease.

Visual Processing

Visual processing has been referred to as "cost free" because it occurs automatically (Eysenck, 1993; Lang, Potter, Bolls, 1999). In other words, In terms of emotional content, high-arousal images are better remembered than low arousal images. Bradley et al. (1992) found that participants remembered high-arousal images a year following exposure. These high-arousal images activate the aversive system, causing a person to attend to the information and allocate resources to encoding. But sometimes attention can be overloaded, and a viewer will not be able to encode the information.

Lang (1995) argues that memory must be measured in different ways to uncover the effectiveness of processing. These subprocesses are encoding, storage and retrieval, which can be measured by recognition, cued recall and free recall, respectively. For recognition, numerous cues, such as multiple-choices, are included to help participants recognize the material from memory. Cued recall uses a single cue to help participants in retrieval, and free recall does not include any cues at all. These tests reveal how fully the messages were encoded, stored and available to be retrieved. The following two experiments will examine memory only in terms of encoding. Both response accuracy and latency will be analyzed. The responses will be taken at two different times. The first recognition test will take place following exposure to the stimuli, and the second recognition test will take place one week later. The purpose of these tests is to determine how well the information is remembered. Human memory is comprised of interacting systems. The purpose of these systems varies from encoding to storing (Baddeley, 1999). Study participants are expected to have poorer memory after the one-week delay because a time lag can lessen the ability to remember – especially if the information was not rehearsed or stored in long-term memory.

Signal detection theory

Signal detection theory can be used to examine responses from yes-no tasks. In any yes-no task, there are four possible outcomes: hits, misses, correct rejections and false alarms. If a researcher only considers the hit category, a true picture of recognition will not be achieved (Johnson & Proctor, 2004). It is possible that the increased accuracy rate is due to a shift in judgment and not enhanced memory for a condition (Shapiro, 1995). To avoid this problem, signal detection theory takes into account the proportion of false alarms as well as the hits. The distribution curves of these two groups (noise and signal) should result in two overlapping curves. If the curves don't overlap, then this indicates there was no noise. If these distributions are far apart, then the person is sensitive. This means he is better able to discriminate between new and old information. (Norris, 1995). One advantage to using this theory is that it isolates the sensitivity measure and criterion bias. The criterion bias is calculated to indicate if respondents made a shift in their decision-making. A liberal criterion shift results in more "yes" answers, which increases the chances of false alarms, and a conservative shift indicates that "no" is answered more frequently, which increases the chances of false alarms (Shapiro, 1995).

Reaction Times

Reaction times measure the length of time from stimulus onset to a response. Although this is a simple measure to collect, interpreting the data can be a complex task as the responses can be interpreted two ways. First, faster reaction times can be interpreted as a sign of better recognition. The person recognizes the target or foil immediately and can react quickly. But reaction times are also affected by the speed-accuracy tradeoff. Participants might slow down because they are trying to be more accurate, so in this instance, the slower times would not indicate worse encoding (Murdock, 1982). This study will make use of all four memory measures to provide a fuller picture of encoding.

Conclusion

The previous literature indicates that emotional processing can activate underlying motivational systems. In this study, only negative news content that varies by arousal level will be used, so it is expected that the aversive system will be activated instead of the appetitive system. Because humans have evolved to perceive danger in their environment, the negative media messages can elicit a similar response. The structural features of full-color and large size should appear more salient and more like reality. Also, the content feature of high-arousal should appear more dangerous to viewers. This negative, high-arousal content should elicit larger orienting responses, be remembered better and effect how people assess the emotional content of the photographs. Based on this theory of emotion, the following hypotheses and research question are posed:

Experiment 1

H1: Full-color photographs will elicit a larger orienting response than black-and-white photographs.

H2: High-intensity photographs will elicit a larger orienting response than low-intensity photographs.

H3: Full-color photographs will be remembered better than black-and-white photographs. High-intensity photographs will be remembered better than low-intensity photographs. Test scores at time 1 will indicate better memory than test scores at time 2.

H4: Full-color, high-intensity photographs will be rated more arousing and more negative than black-and-white, low-intensity photographs.

H5: Full-color, high-intensity photographs will be rated more offensive and less newsworthy than black-and-white, low-intensity photographs.

H6: Full-color, high-intensity photographs will receive less publication support than black-and-white, low-intensity photographs.

RQ1: Does the medium influence support for publishing the full-color, high-intensity photographs?

Experiment 2

H1: Large photographs will elicit a larger orienting response than small photographs.

H2: High-intensity photographs will elicit a larger orienting response than low-intensity photographs.

H3: Large photographs will be remembered better than small photographs. High-intensity photographs will be remembered better than low-intensity photographs. Test scores at time 1 will reflect better memory than test scores at time 2.

H4: Large, high-intensity photographs will be rated more arousing and more negative than small, low-intensity photographs.

H5: Large, high-intensity photographs will be rated more offensive and less newsworthy than small, low-intensity photographs.

H6: Large, high-intensity photographs will receive less publication support than small, low-intensity photographs.

RQ1: Does the medium influence support for publishing the large, high-intensity photographs?

Chapter 3

THE EMOTIONAL IMPACT OF NEGATIVE NEWS PHOTOGRAPHS

The goal of this study is to determine if structural and content features of negative news photographs affect emotional and cognitive processing. Before running the two main experiments, the appropriate stimulus materials needed to be identified. This led to a pretest in which participants rated a total of 100 photographs. The next section explains the pretest's stimulus materials, methodology and findings.

Method

Stimulus materials

Photographs that were entered in the Missouri School of Journalism's Pictures of the Year International contest were selected for the stimulus materials. The contest is in its 62nd year and receives more than 35,000 entries that are judged over a three-week period. Professional photojournalists captured the images for the purpose of publication in newspapers or magazines worldwide. Although contest entry rules allowed the submission of unpublished photographs, the majority had appeared in national and international publications. A benefit of using photographs taken by professionals and published in various media outlets was that it increased the study's external validity. These photographs represent the types of images that people encounter in the media.

The photographs for the pretest were chosen based on the content – all images had to depict scenes with negative valence. Valence refers to pleasantness (positive valence) and unpleasantness (negative valence). Negative valence images were desired for both studies because these are the types of photographs that provoke the most controversy among editors and readers.

To determine what types of scenes are considered unpleasant, ratings from the International Affective Picture System (IAPS) were examined. The IAPS are a set of images that have been rated on levels of valence and arousal (Center for the Study of Emotion and Attention, 2001). Examples of photographs that were rated negative in valence and low in arousal included scenes of cemeteries and guns. Examples of ones with negative valence and high arousal included scenes of dead and wounded bodies. Although many studies have used images from the IAPS for stimulus materials, one of the purposes of this study was to measure responses to photographs that people encounter during typical media use. The IAPS includes news photographs, but there are also images that would not appear in the news, such as autopsy photos, as well as images that appear heavily manipulated. However, the IAPS is an invaluable resource for determining what types of images rate high and low in valence and arousal.

The Pictures of the Year International contest archive was searched to identify negative valence images that varied in arousal. Most of the chosen images were from the 2004 and 2005 breaking news category. To be selected, the photographs had to include negative content, such as natural disasters, traffic accidents, crime scenes or people in grief, but vary in arousal. Many images showed injured people, and others included dead bodies that were fully visible or placed in body bags. Black-and-white photographs were excluded because there was no way to change these images back to full-color once the color data was deleted from the digital file. The composition and technical quality of the photographs were also considered in the selection process. To be selected, the quality level had to be high to avoid against the potential confound that could result from drastically different levels of quality. Images that had been widely circulated were not included to decrease the chance that participants were familiar with them. Many images showed scenes from abroad, which also lessened the chance that they ran in the local media. Vertical images were excluded to avoid a potential confound from varying the dimensions. One hundred images were chosen that fit the above criteria. The pretest was administered to identify 20 high-arousal photographs and 20 low-arousal photographs.

Participants

The pretest participants were recruited from a community church group and an undergraduate journalism class at a large Midwestern university. The average age of participants was 23.67. There were 20 females and 10 males. The local church group was treated to a pizza party after participating in the pretest, and the journalism students were offered extra credit.

Procedure

The 30 participants were told that the purpose of the experiment was to understand how people feel about negative news images. After informed consent was obtained, each participant was given a handout with the Self-Assessment Manikin (SAM) scales for valence, arousal and dominance (Lang, 1980). The 9-point SAM scales offer a pictorial representation of these concepts. For the valence rating, a figure with expressions that gradually change from a frown to a smile represent feelings of unpleasantness and pleasantness. The procedures for familiarizing participants with the SAM scale were similar to those used in the IAPS studies (Center for the Study of Emotion and Attention, 2001). Participants were asked to mark toward the pleasant end of the scale if they felt happy, pleased, satisfied, contented or hopeful. They were asked to mark toward other end of the scale if they felt unhappy, annoyed, unsatisfied, melancholic, despaired or bored. The participants were shown two example photographs from the IAPS. The high-arousal photograph showed a burn victim, and the low-arousal photograph showed a cemetery. This helped anchor the scales.

For the arousal rating, the figure representing feelings of calmness has its eyes closed and a relaxed body, but this gradually changes until the eyes are extremely wide open and the stomach appears to explode. This latter figure represents feelings of excitement. The participants were told to mark toward the calm end of the scale if they felt calm, relaxed, sluggish, dull, sleepy or unaroused. They were to mark toward the excited end of the scale if they felt stimulated, frenzied, jittery, wide-awake or aroused. These two scales were explained, and participants were reminded that they could answer anywhere along the continuum. After questions were answered, the experiment began.

MediaLab software was used to project the images from a computer onto a large screen in an auditorium. The procedures that were used for the IAPS photographs were adopted for this study. A warning message stating "Get ready to rate the next picture" was shown for 5 seconds, followed by the image for 6 seconds. Then a black screen appeared for 15 seconds, during which time the participants completed the SAM scales. To guard against subject fatigue, there were three short three-minute breaks that occurred after picture 25, picture 50 and picture 75. The entire pretest took about an hour to complete.

Results

The responses were analyzed to look at each photograph's mean scores for arousal and valence. Only images that had negative content were included in the pretest, so the low mean scores for valence were anticipated. The variable that was expected to vary significantly was arousal. The 20 images that had the highest mean arousal scores were selected for the high-arousal group (Table 1), and the 20 images that had the lowest mean arousal scores were selected for the low-arousal group (Table 2).

TABLE 1
Mean Scores for Negative News Photographs (High Arousal)
(N=30)

Picture	Arousal Mean (SD)	Valence Mean (SD)
1	7.03 (1.92)	2.26 (1.14)
2	6.87 (1.87	2.67 (1.37)
3	6.73 (2.05)	2.13 (1.17)
4	6.60 (2.41)	2.23 (1.04)
5	6.57 (2.34)	2.50 (1.25)
6	6.40 (1.73)	1.83 (.97)
7	6.30 (2.00)	3.03 (1.16)
8	6.30 (1.94)	1.80 (1.06)
9	6.27 (1.87)	2.07 (.91)
10	6.27 (2.12)	2.17 (1.07)
11	6.20 (1.94)	2.50 (1.20)
12	6.17 (2.31)	2.93 (1.68)
13	6.13 (2.36)	1.60 (.81)
14	5.93 (2.57)	2.43 (1.43)
15	5.93 (2.32)	2.90 (1.12)
16	5.90 (2.09)	2.23 (1.17)
17	5.87 (2.16)	2.37 (1.27)
18	5.70 (2.25)	3.23 (1.17)
19	5.67 (2.22)	2.33 (1.06)
20	5.63 (2.11)	2.77 (1.30)

Note: Valence: 1=*unpleasant*, 9 = *pleasant*; Arousal: 1 = *calm*, 9 = *excited*. N=30

TABLE 2

Mean Scores for Negative News Photographs (Low Arousal)
(N=30)

Picture	Arousal Mean (SD)	Valence Mean (SD)
1	3.90 (1.71)	3.67 (.92)
2	3.90 (2.19)	2.63 (1.19)
3	3.87 (1.70)	3.30 (1.29)
4	3.87 (2.30)	3.97 (1.22)
5	3.83 (1.76)	3.83 (1.46)
6	3.73 (1.86)	4.47 (1.17)
7	3.60 (1.52)	3.63 (1.16)
8	3.57 (1.85)	4.30 (1.06)
9	3.57 (1.38)	3.97 (1.30)
10	3.53 (1.83)	3.53 (1.14)
11	3.53 (2.06)	4.43 (1.07)
12	3.33 (1.58)	3.70 (1.15)
13	3.27 (1.66)	4.50 (.97)
14	3.17 (1.95)	4.03 (1.03)
15	3.13 (1.57)	3.67 (1.06)
16	3.00 (1.80)	4.17 (1.14)
17	3.00 (1.44)	4.57 (1.04)
18	2.77 (1.65)	3.70 (1.02)
19	2.57 (1.14)	3.93 (1.20)
20	2.53 (1.48)	4.33 (1.37)

Note: Valence: 1=*unpleasant*, 9 = *pleasant*; for Arousal: 1 = *calm*, 9 = *excited*. N=30

A 2 (group) x 20 (photograph) repeated measures analysis of variance (ANOVA) revealed that there was a significant difference between the two groups on ratings of arousal. [$F(1,29)=174.240$, $p<.00$, $\eta^2=.857$]. The high-intensity group was rated more arousing than the low-intensity group (see Table 3).

TABLE 3

Means for Arousal and Valence by Intensity Group (pre-test)

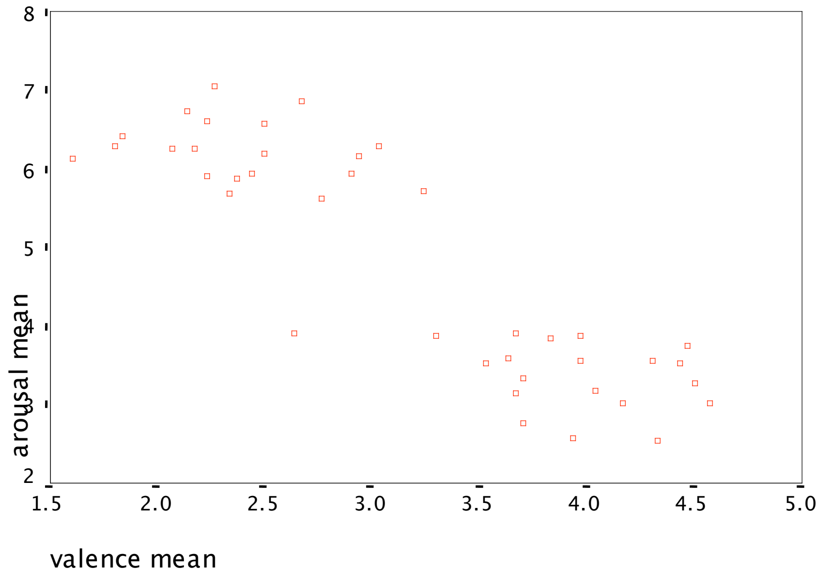
Group	Arousal Mean (SE)	Valence Mean (SE)
High	6.17 (.301)	2.40 (.137)
Low	3.38 (.216)	3.92 (.109)

Previous research has shown that high-arousal, negative messages tend to be rated more unpleasant than low-arousal, negative messages (Ito, Cacioppo & Lang, 1998). The selected photographs all rated low in valence, but a 2 (group) x 20 (photograph) repeated measures analysis revealed a significant difference in valence between the images in the high-arousal group and the low-arousal group [$F(1,29)=317.809$, $p<.00$, $\eta^2=.916$]. The photographs that were rated highest in arousal were also rated as more unpleasant than the low-arousal images (see Table 3). The effect size for both the arousal (.857) and valence (.916) ratings indicated that these are large effects.

To explore this relationship further, a Pearson product-moment correlation was run using the valence and arousal ratings from the 40 selected photographs. These continuous ratings were normally distributed. The analysis revealed a significant negative relationship between valence and arousal ($r= -.855$, $p<.01$). Photographs that were perceived to be the most arousing were also the most unpleasant (see Figure 1).

Figure 1

Scatterplot of Valence and Arousal



Discussion

The pretest findings reveal that viewers do not perceive all negative news photographs to be the same in terms of emotional content. The photographs varied in arousal, with participants rating the images of suffering, grief and dead bodies as the most arousing. The image receiving the highest arousal rating showed a close-up of a man with a bleeding wound. His hand is over his eye, and he is covered in bright red blood. His face bears a look of anguish (see Figure 2).

FIGURE 2

High-intensity Photograph

This photograph received the highest arousal rating (M=7.06) from among the 100 photographs that were pre-tested. Valence also rated low (M=2.26).

In contrast, the images in the low-intensity group were perceived as less arousing. They included scenes of the aftermath of hurricanes and house fires. Among the low-arousal images, the one rated the least arousing was a picture of people carrying a casket (see Figure 3), but it also had the highest valence rating, which demonstrates the negative relationship between these variables. Two other images rating low on arousal and valence featured scenes of headstones in cemeteries. (See Figure 4).

FIGURE 3

Low-intensity Photograph

This photograph had the lowest arousal rating (M=2.53) among the 100 pretested images, and it rated highest in valence (M=4.33).

FIGURE 4

Symbols of Death

Cemetery photographs are examples of images that rate low in arousal and negative valence.

Although this pretest set out to group photographs according to ratings on the arousal dimension, the analysis shows that valence and arousal have a significant negative relationship. As arousal increases, valence decreases. The photographs that cause people to feel the most on edge are also the ones that are viewed as most unpleasant. Previous research has also demonstrated these findings (Ito, Cacioppo & Lang, 1998).

Because of the strong relationship between arousal and valence, the grouping of the stimulus materials cannot be based solely on the arousal ratings. Thus, the two groups of images will not be referred to as high-arousal or low-arousal, which was the original plan. Instead, the groups will be referred to in terms of both the arousal and valence levels, and the term "intensity" will be used. The high-intensity photographs are more negative and more arousing than the low-intensity photographs. In this study, arousal was rated on a scale of 1 (calm) to 9 (excited). Valence was measured on a scale of 1 (unpleasant) to 9 (pleasant). The photographs that were placed into the high-intensity group had an arousal rating above 5 and a valence level of 3.03 and below. The low-intensity photographs had an arousal level below 4 and a valence level above 2.63. Both scores were looked at to determine which category the photographs were placed into. The mean scores for these two groups clearly show that the high-intensity photographs are more arousing and more unpleasant than the low-intensity photograph (See Table 3).

This pretest shows that it is difficult to find images that are both negative and low arousing. This is not surprising, as the IAPS picture ratings are distributed mainly in the high-arousal pleasant and low-arousal unpleasant quadrants. This pattern remains even after effort has been made to find unpleasant, low-arousal images. Lang, Bradley & Cuthbert (1997) argue that this pattern reflects the underlying systems of appetitive and aversive motivation. These two systems vary based on arousal.

Another interesting finding is that that photographs that included symbols of death (caskets and headstone) produced the infrequent combination of variables (negative valence/low arousal). This replicates the findings of the IAPS images in which cemetery images received low ratings on both dimensions (Center for the Study of Emotion and Attention, 2001). Perhaps one way to fill in this gap in the affective space is to investigate if other symbols produce these same results. Looking at the IAPS ratings reveals that other low-arousal, negative valence images feature a gun, vomit and needle. These images represent danger and death without actually showing people suffering or dying. Perhaps these symbolic representations evoke an extremely negative rating as people relate to the symbol's concept, but without viewing a scene that blatantly shows what the concept stands for, people do not feel aroused. If we relate this idea to the field of photojournalism, it is similar to the difference between photo illustrations that represent a concept (e.g. execution) and a documentary image showing the concept being acted out (e.g. man shooting victim in the head). Future studies should explore if there is a difference in the emotional responses to symbolic and concrete images.

In addition, researchers who conduct studies on emotion and manipulate only one of the dimensions of the stimulus messages should ensure that they are not unintentionally manipulating the other dimension. This study set out to manipulate only the arousal level, but even among news photographs with ratings that were clearly low in valence (4.5 or less on a 9-point scale), the arousal level was clearly related to valence.

Chapter 4

METHODOLOGY

An experimental design is the best method to determine if structural and content features of photographs affect cognitive and emotional responses to negative news photographs. The manipulated variables can be controlled in an experiment, which can lead to stronger conclusions about causation (Watt & Van den Berg, 1995). Another advantage to experimental design is the ability to replicate studies, which can lead to better external validity (Wimmer & Dominick, 2000)

Participants

Fifty participants were recruited from two journalism undergraduate classes and one journalism graduate class at a large Midwestern university. They received either course extra credit or $20 for completing both sessions. Two people failed to return for the second sessions, so they were dropped from the analyses. Experimenter error, equipment problems and participation outside the one-week timeframe for the recognition tests led to the exclusion of additional subjects. This results in a range of 38 to 46 cases reported, depending on the measure. The sample sizes for each of the dependent variables are reported in the results section.

Design for experiment 1

This was a 2 (color) x 2 (intensity) x 10 (photograph) within-subjects design. Using a within-subjects design offered the advantage of eliminating variability of individual differences for the dependent measures. This advantage makes repeated measures designs more powerful than completely randomized between-subjects designs (Stevens, 1999). In terms of the physiological measures, the use of a within-subjects design helped to "statistically minimize individual differences in basal physiological responses" (Blascovich, 2000, p. 126).

The first factor, color, referred to the photographs' appearance. This factor had two levels, full-color and black-and-white. The full-color condition featured photographs with a range of hues. For the black-and-white condition, the hues were stripped out, and the photographs were changed to monochromes. The second factor, intensity, also had two levels - high intensity and low intensity. High-intensity photographs had high arousal ratings and negative valence ratings. These photographs were exciting and unpleasant. The low-intensity group had negative valence ratings, and they rated low in arousal. These photographs had calm and unpleasant content. The third factor, photographs, referred to the number of images that participants viewed.

The design for the recognition analysis included an additional factor of time. There were two levels of time that referred to when participants took the recognition test. The first level referred to immediate recognition. Participants took a test within 30 minutes of viewing the photographs. The second level was delayed recognition, and this was measured with a test administered a week following stimulus exposure.

The factor of medium was included in the analysis for publication support. The first level referred to a printed newspaper, and the second level referred to an online news website.

Design for experiment 2

Experiment 2 used a 2 (size) x 2 (intensity) x 10 (photograph) within-subjects design. Size had two levels, large and small. The large photographs were 707 pixels by 530 pixels. The small photographs were half this size (354 by 265 pixels). The intensity factor had two levels, high and low. The high intensity images had negative valence and high arousal, and the low intensity images had negative valence and low arousal. The number of messages used in the manipulation is the third factor. In addition, the recognition analyses include the factor of time, which had two levels. The first level was immediate recognition and referred to the test administered in the 30-40 minutes following picture viewing. The second level was delayed recognition, which was measured by the same recognition test administered a week following picture viewing.

Stimulus materials

The photographs used in both experiments were taken by professional photographers and had been entered into Missouri's School of Journalism's Picture of the Year International contest. All images had unpleasant content. The pretest ratings indicated those that scored high or low in arousal. The 20 photographs that rated highest in arousal and the 20 that rated lowest in arousal were selected for the experiments. Ten images from each category were randomly assigned to either the first or second experiment (see Appendix 2).

Apparatus

The experiments took place at the Missouri School of Journalism's Psychological Research on Information and Media Effects (PRIME) lab. The photographs were presented on a 17-inch computer monitor using MediaLab software. Participants used a computer mouse to answer questions.

Physiological measures were taken by attaching Vivo Metric Ag/AgCI electrodes to participants. The placement of the electrodes was as follows: two electrodes on the palm of their non-dominant hand for skin conductance data; two electrodes on each forearm for heart rate data; two electrodes on the cheek for the zygomatic (smile) data; and two above the eyebrow for the corrugator (frown) data. There were also three electrodes that served as grounds. One was on the non-dominant forearm near the wrist, the second was attached to an earlobe, and the third one was on the forehead. Coulbourn V-series modules that were hooked to a computer amplified and recorded the physiological signals[1].

Multiple sessions

In experiment 1, the independent variables were color and intensity. Reeves and Geiger (2000) recommend altering only the feature being

[1] Equipment problems led to inaccurate skin conductance readings. This study reports only the heart rate data.

manipulated to avoid potential confounds. They also encourage the use of multiple messages in each condition to reduce systematic error. This study will follow their suggestions and use 20 images (10 high intensity/10 low intensity) that are shown two times – once in color and once in black-and-white. To avoid unintended effects from viewing the same image twice in the same session, the experiment was run in separate sessions. In the first session, half of the images were in color and half were in black and white. A week later, participants returned to participate in the second session. This time, the images were switched – those that were in color for the first session were now in black and white, and vice versa. Having a week elapse between treatments and using multiple sessions helped eliminate carryover effects.

Experiment 2 uses a different set of target images than experiment 1. The 10 high-intensity and 10 low-intensity images varied by size (large/small). The same photographs were used in each category to again reduce the potential for confounds. Two sessions were used so that participants viewed each image only once per session. For the first session, the images were varied so that some were large and some were small. A week later, the images were switched so that those that were large were now small, and vice versa.

When participants returned a week later, the procedures for the second session were identical to the first except for two changes: the order of experiments and the addition of a delayed recognition test. The studies were counterbalanced so that experiment 2 was run first followed by experiment 1. Counterbalancing the studies helped control for carryover effects.

The other change in procedure for session 2 was that a delayed recognition test was given. This recognition test was administered before participants viewed any photographs. The purpose of the test was to discover if participants could recognize the images they had been exposed to a week earlier. The foils for the delayed recognition tests were different from those in the immediate recognition test to make sure that participants didn't confuse their prior exposure of stimulus materials with the exposure to foils presented in the first set of recognition tests.

Experiment 1 Procedures

Participants were tested one at a time. After arriving at the PRIME lab, they were seated at a small table that had a computer monitor and mouse. They were given a written consent form to read and sign. They were also given time to ask any questions.

After informed consent was given, the electrodes were placed on the participants. This involved cleaning their skin with distilled water on the palm and with alcohol on their forearms, cheek and forehead. The participants were then shown a copy of the SAM scale for valence. The experimenter explained that the scale ranged from the frowning figure representing unpleasantness to the smiling figure representing pleasantness. Participants were told that they could answer anywhere along the scale to show how pleasant or unpleasant the photograph made them feel.

Next, the SAM scale for arousal was shown. The illustrations range from a calm figure to one that has an exploding stomach, which represents excitement. Participants were told that excitement is a positive term that seems odd when applied to the negative content of the photographs. In other words, it is unlikely that people would describe themselves as feeling excited about seeing dead bodies. Instead, participants were encouraged to substitute the terms “jittery” or “on edge” for this high end of the scale.

Participants were verbally told the instructions, then the experimenter left the room. The instructions also appeared on the screen, and participants read these before starting the experiment. The instructions asked the participants to view each photograph and then answer questions about each one.

There were 20 different presentation orders that were randomly constructed by the computer program. Participants were randomly assigned to one of these orders. Having a random presentation order helped reduce problems associated with order effects such as fatigue effects, practice effects and carryover effects.

A black screen appeared for 5 seconds, during which time baseline physiological data was collected. A picture then appeared for 10 seconds. Following picture viewing, participants answered a set of questions. First, they completed the SAM scales for valence and arousal. Then they responded to a series of eight statements. The statements were as follows: This photograph offends you; this photograph is informative; this photograph tells the truth; this photograph upsets you; this photograph helps you understand; this photograph angers you; this photograph represents reality; this photograph depresses you. In addition, the participants answered how strongly they supported publishing the photograph in a printed newspaper and on an online news site.

After finishing experiment 1, participants were given a news story to read for five minutes. This served as a brief distraction task. Then, the visual recognition test was administered. Participants viewed 20 target photographs as well as 20 additional photographs that served as foils. The foil images had negative content similar to the target images. The color and arousal were manipulated so that an equal number of foils appeared. The number of foils in each of the four conditions was equal to the number of target images. Because memory for visuals is quite good, the photographs in the recognition test were shown for only 400 milliseconds. Participants were asked to respond "yes" or "no" following each picture. Answering "yes" meant that participants believed that they had seen the image during stimulus exposure, and "no" meant that they did not see it.

Experiment 2 Procedures

The second experiment began immediately following the first. This experiment is similar to experiment 1, except a new set of full-color images will vary by size and intensity. Similar to experiment 1, there was a unique picture order for each participant. A black screen appeared for 5 seconds, followed by an image for 10 seconds and then the same set of questions that were used in experiment 1. After the 20^{th} photograph has been viewed and evaluated, the participants read a news story for five minutes as a distraction task.

The recognition test included the 20 target images as well as the 20 foil images. These images were presented for 400 milliseconds. For each recognition test, the foils were unique to that test. If the same foils were used repeatedly, then participants would have multiple exposures to these images and might not be able to separate if they saw it during the target presentation or during the recognition task. This could lead to confusion and inaccurate responses. Shapiro

(2000) points out that participants' decisions should be based only on their exposure to stimulus materials.

At the end of the second session's final recogntion test, the participants were asked if they could identify what each experiment was investigating. This was done to determine if the color and size manipulations were transparent. Only 9 participants responded that they noticed the color of the photographs had changed, and four of these participants were graduate students enrolled in a research methods course. Only two people noticed that the size of the pictures had changed. When told about the manipulations, most of the respondents then indicated that they had noticed one or two photographs changing in color or size, but many expressed surprise that all photographs had been switched. Then, the participants were thoroughly debriefed and dismissed.

Dependent Variables

Orienting response

The orienting response is measured by examining heart rate data. Deceleration of heart rate is used as a measure of attention. When the heart rate decelerates, more resources are being allocated to encoding the stimulus materials.

Arousal

According to the dimensional view of emotion, arousal ranges from low (extremely calm) to high (extremely excited) (Greenwald, Cook & Lang, 1989).

The concept was measured using the 9-point arousal scale from the Self-Assessment Manikin. Higher numbers reflect greater arousal.

Emotional valence

Emotional valence, another dimension of emotion, is experienced as positive (pleasant) or negative (unpleasant). This concept was measured using the SAM scale for valence. The illustrations range from sad to happy facial expressions. Higher numbers indicate more positive valence (pleasantness).

Encoding

Memory is made up of three subprocesses: encoding, storage and retrieval. Information comes into the memory system during encoding. Information must first be encoded before it can be stored and then recovered during retrieval (Eysenck, 2001). There are three separate ways to measure these stages: a recognition test for encoding; a cued recall test for storage; and a free recall test for retrieval (Lang, 2000). In these studies, encoding is the variable of interest.

To test for encoding, visual recognition tests were given within 40 minutes following stimulus exposure and one week later. Four different measures were examined to determine if the information was encoded.

First, accuracy proportions were calculated. In the recognition test, there were four possible outcomes: hits, misses, correct rejections or false alarms. Both the hit and the correct rejection were accurate responses, so these were combined to calculate the accuracy proportion. Within each condition, the accuracy proportion was a ratio of hits and correct rejections to total number of photographs.

The accuracy proportions provide one indication of recognition. Signal detection analysis is another method that can be used to calculate measures of sensitivity and criterion bias. The formulas for non-parametric data were applied. One advantage of using the non-parametric formulas is that the assumption of normality does not have to be met (Snodgrass & Corwin, 1988).

Sensitivity was measured by calculating A′ (Shapiro, 1995). The formula for A′ takes into account the proportion of hits as well as the proportion of false alarms. These proportions were entered into a formula[2], and A′ was calculated for all the responses in each condition.

Another measure used in signal detection theory is the criterion bias. This criterion bias was calculated using a non-parametric formula[3] for B″ (Shapiro, 1995). The criterion bias represents a shift in judgment. Scores range from +1 to –1, and 0 represents the crossing point for the two distributions. A higher score indicates a conservative shift in judgment in which false alarms are minimized, and a lower score indicates a liberal shift in which misses are minimized.

To gain further insight into how well the message was encoded, response times were captured for each image in the recognition test. The response times refer to how long it took for participants to remember if they did or did not see the image during the stimulus presentation. The response times were measured

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[2] $A' = 1 - .25[p(FA)/p(h) + (1-p(h))/1-p(FA)]$

[3] $$B'' = \frac{p(h)[1 - p(h)] - p(FA)[1- p(FA)]}{p(h)[1 - p(h)] + p(FA)[1 - p(FA)]}$$

in milliseconds from the onset of the image to a response (Cameron & Frieske, 2000).

Offensiveness

A factor analysis indicated that four adjectives composed the "offensiveness" index. These adjectives were angry, depressed, offended and upset.

Newsworthiness

A factor analysis indicated that there were four questions that made up the "newsworthiness" index. These questions used the following adjectives and phrases: informative, tells the truth, helps to understand and represents reality.

Publishing support

This variable refers to how strongly participants agreed or disagreed that an image should be published.

The case for message replication

Experiment 1 and experiment 2 both include the independent variable of intensity. Because this variable is being repeated in both experiments, there is an opportunity to discover if the results for this variable can be replicated. Too often, social science studies are not replicated. When replication is discussed, researchers usually refer to whether the findings can be generalized to other settings or to other samples of participants. Reeves and Geiger (2000) argue that external validity should also be examined in terms of the ability to generalize to other media samples. “This question is especially critical because the complexity of media makes any single message example unique – perhaps even more unique than any single person that processes it” (Reeves & Geiger, 2000, p. 166).

In this research project, the pictures for each experiment will have negative valence and vary in their intensity ratings (high and low). However, it would be wrong to conclude that these complex media messages vary only along this single dimension. Indeed, they likely vary in content, composition, depth of field, shutter speed, lighting, focal length, color balance, film speed, and many other variables. “Media messages are never an example of one thing and nothing else” (Reeves & Geiger, 2000, p. 166). Because of the complexity of messages, the second experiment will attempt to replicate experiment 1’s findings relating to high-intensity images. Specifically, the hypotheses involving the intensity variable will be tested again with a new set of pictures. If the analysis shows that different sets of photographs can evoke similar responses, there will be greater confidence in the findings.

Chapter 5

THE EFFECTS OF COLOR AND INTENSITY ON EMOTION AND COGNITION

Experiment 1

Manipulation check

The first experiment manipulated the color and intensity of photographs. Adobe Photoshop software was used to strip out the color information from the digital photographs, leaving them in black-and-white. Manipulating the intensity level was not so straightforward. Although the photographs in the study were chosen based on the pre-tested ratings of intensity (valence and arousal), it was necessary to determine if the study participants perceived them to have varying degrees of valence and arousal. The two intensity groups

A 2 (group) x 10 (photos) repeated measures analysis of variance (ANOVA) revealed that the valence of the two groups of photographs differed significantly [$F(1,45)=263.199$, $p<.00$, $\eta^2=.854$]. The high-intensity photographs were rated as more unpleasant than the low-intensity photographs (see Table 4).

There was a significant difference in how arousing people perceived the two groups of photographs [$F(1, 45)=146.847$, $p<.00$, $\eta^2=.765$]. The photographs in the high-intensity group were rated as more arousing than the photographs in the low-intensity group (see Table 4). These significant differences for arousal and valence indicated that the manipulation for intensity was successful.

TABLE 4

Means for Arousal and Valence by Intensity Group (exp. 1)

Group	Arousal Mean (SE)	Valence Mean (SE)
High	4.863 (.202)	2.386 (.138)
Low	3.078 (.163)	3.801 (.135)

Note: Arousal: 1=*calm*, 9=*excited*; Valence: 1=*unpleasant*, 9=*pleasant*. N=46

Data Cleaning

Prior to analysis, all the dependent variables were examined for inaccurate entries, missing data and outliers. The recognition data had no missing data, and fewer than 5% of the cases were missing for the other measures. All missing data were replaced with the series mean. Outliers were replaced with the next nearest score. The skewness and kurtosis for all the variables fell within the acceptable range. In cases where the univariate analyses violated the assumption of sphericity, the Greenhouse-Geisser adjusted F-test was used. This conservative test adjusted the degrees of freedom for the F-test.

Heart rate data analysis

Fifty people participated in Experiment 1, but 7 subjects were excluded from the analysis. One person did not return for the second session, and the others were left out because of inaccurate heart rate readings. This left a total of 42 participants for the heart rate analyses.

The data collected reflected the milliseconds between R-spikes in participants' cardiac waves. VPM software (Cook, Atkinson & Lang, 1987) was used to convert these interbeat intervals to beats per minute after the experiment was completed. Change scores were calculated by subtracting the baseline heart rate, which represented the moment preceding stimuli presentation, from the 9 seconds of exposure time. The data were plotted to create cardiac waveforms that indicated participants' heart rate response during picture viewing.

The first hypothesis predicted differences in orienting responses for the color and intensity conditions. Before trying to identify differences between the conditions, it was first necessary to determine if an orienting response occurred. First, each condition was analyzed separately to look for a main effect of time. For the color condition, a 20 (picture) x 10 (time) repeated measures analyses of variance (ANOVA) was executed for the color photographs only. Next, the same analysis was repeated using only the black-and-white photographs. This step was then repeated for the intensity variable. A pair of 20 (picture) x 10 (time) repeated measures ANOVAs were run for the high-intensity and low-intensity conditions.

If the time main effects were significant, then the cardiac waveforms needed to be examined to determine if they were biphasic (s-shaped) or monophasic (u-shaped) patterns. In the biphasic response, the heart rate decelerates for the first 2-3 seconds after stimulus exposure, then accelerates before decelerating again. In the monophasic response, the heart rate decelerates for the first 2-3 seconds before accelerating and returning to the level preceding stimulus exposure. Either of these patterns demonstrates an orienting response (Graham, 1979; Ohman, 1979).

The third step in assessing whether an orienting response occurred was to determine if the time main effect had a significant quadratic or cubic trend. The quadratic trend is examined for monophasic responses, and the cubic trend is examined for biphasic responses. A significant effect for time indicates an orienting response.

After completing these three steps, the data were analyzed to test for a significant difference between conditions for the color and intensity variables. The heart rate data were analyzed using a 2 (color) x 2 (intensity) x 10 (picture) x 10 (time) repeated-measures ANOVA. It was necessary to include time because the orienting response takes place over several seconds. A significant interaction between color and the quadratic or cubic trend of time, and a significant interaction between intensity and the quadratic or cubic trend of time indicated differences in orienting. Because the univariate analyses violated the assumption of sphericity, the Greenhouse-Geisser adjusted *F*-test was used. This conservative test adjusted the degrees of freedom for the *F*-test.

Recognition analysis

Recognition was measured with accuracy proportions, sensitivity, criterion bias and reaction times. The accuracy proportions were analyzed using a 2 (color) x 2 (intensity) x 2 (time) repeated measures ANOVA.

The sensitivity measure was calculated by using the formula for A'. These values were entered into a 2 (color) x 2 (intensity) x 2(time) repeated measures ANOVA to determine if there were differences among conditions. Higher scores indicated greater sensitivity.

The criterion bias was calculated using the formula for B", then these scores were entered into a 2 (color) x 2 (intensity) x 2 (time) repeated measures ANOVA to detect differences among conditions.

The final measure of recognition was response times. These were analyzed with a 2 (color) x 2 (intensity) x 10 (photograph) x 2 (time) repeated measures ANOVA.

SAM scale analysis

The ratings for the SAM scale measure of valence ranged from 1 (unpleasant) to 9 (pleasant), and the ratings for arousal ranged from 1 (calm) to 9 (excited). The data for each measure was analyzed using a 2 (color) x 2 (intensity) x 10 (photograph) repeated measures ANOVA.

Offensiveness and newsworthiness analysis

Participants were asked to rate each picture on how upset, angry, depressed and offended they felt on a scale of 1 (not at all) to 9 (extremely). They also rated the pictures on how well they told the truth, helped them understand, were informative and represented reality. These were rated on a scale of 1 (not at all) to 9 (extremely). The data for the last four questions were recoded so that all the scales were in the same direction.

There were 46 respondents to these questions, and each question was asked for all 40 of the photographs. This resulted in 1,840 responses for each of the eight questions. In the data file, the responses for each question were recorded in that respondent's row. The data were restructured so that the responses for each question (and not respondent) were placed in the same row. The 1,840 resulting cases exceeded the minimum requirement of 300 cases for executing a factor analysis (Tabachnick & Fidell, 2001).

Because the goal of this analysis was exploratory in nature, principal axis factoring was used. The assumptions of normality and linearity were met. First, an unrotated principal axis factor analysis was run. The results showed that there were two factors with eigenvalues greater than 1. These two factors explained 70.95% of the total variance. Then, the analysis was repeated with a varimax solution, and only two factors were retained. These two factors were comprised of four questions each. The four questions clearly loaded on just a single factor (see Table 5). Factor 1 accounted for 42.65% of the variance, and factor 2 accounted for 28.30%, for a total variance of 70.75%.

TABLE 5

Factor Analysis of Offensiveness and Newsworthiness (Experiment 1)

Upset	
Depressed	.813
Angry	
Offended	.727
Tells Truth	.110
Understand	.067
Informative	.104
Reality	.059

Note: Principal Axis Factoring with varimax rotation
N=1,840

The first factor was named "offensiveness" because this is the variable that best articulates the concept made up of the four variables. The second factor was named "newsworthiness" because the four variables in this factor are often debated when determining the newsworthiness of images.

The four questions for the offensiveness factor and the four factors for the newsworthiness factor were summed for each of the four conditions (BW/high, BW/low, color/high, color/low). The final step was entering these sum scores into a 2 (color) x 2 (intensity) repeated measures ANOVA.

Strength of publication support analysis

The data were analyzed using a 2 (color) x 2 (intensity) x 10 (rep) x 2 (medium) repeated measures ANOVA. The two levels of medium were printed newspaper and online newspaper site.

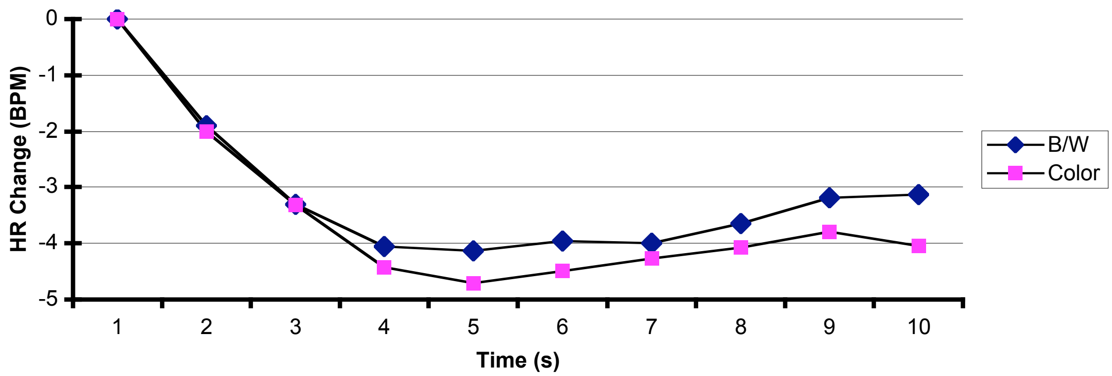
Results

Heart rate results

The first experiment manipulated the color and intensity of the images. Hypothesis 1 predicted that full-color photographs would elicit a larger orienting response than black-and-white photographs. Before discussing the differences between the conditions, it was first necessary to determine if an orienting response occurred.

The main effect of time was significant for the color pictures [$F(9,369)=24.034$, $p<.00$, $\eta^2=.53$] as well as for the black-and-white pictures [$F(9,369)=34.246$, $p<.00$, $\eta^2=.46$]. Next, the cardiac waveforms were examined. The waveforms for both color and black-and-white photographs had a monophasic pattern in which the heart decelerated following onset of the stimuli. The deceleration typically takes place during the first few seconds of exposure to the stimuli before accelerating to the pre-stimulus level. Figure 5 shows that the two waveforms in this study had a longer deceleration time of 5 seconds, which indicates a large orienting response.

Figure 5: Cardiac Response to Color



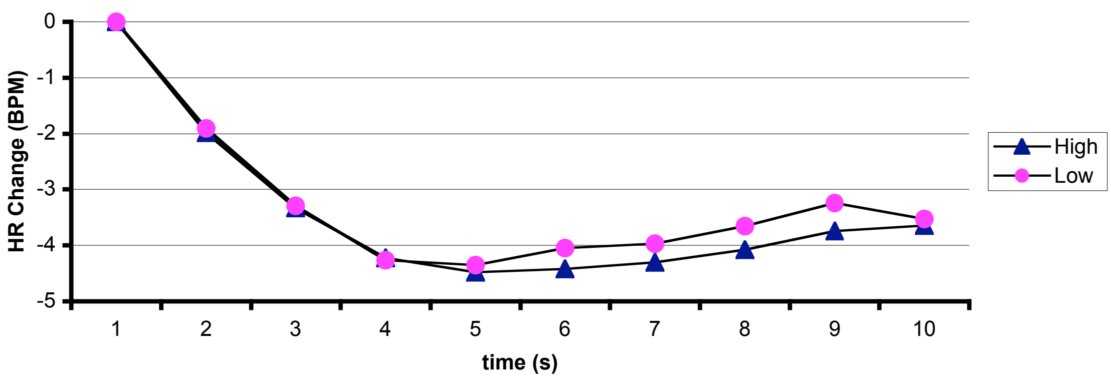
To determine if these patterns depict an orienting response, the quadratic trend was examined. There is a significant quadratic trend for the color photographs [$F(9,360)=41.748$, $p<.00$, $\eta^2=.51$] as well as a significant quadratic trend for the black-and-white photographs [$F(9,360)=32.677$, $p<.00$, $\eta^2=.45$]. Thus, the main effects of time, the monophasic patterns and the significant quadratic trends indicate that an orienting response occurred for both the color and the black-and-white conditions.

The next step was to examine whether the orienting responses differed significantly between conditions. There was no significant difference in the quadratic trend of the color x time interaction [$F(1,41)<1$, $p=.633$, $\eta^2=.006$]. Figure 5 shows that both of the orienting responses have similar patterns. Heart rate decelerates for five seconds and remains lower than the baseline level during the entire 10 seconds. Thus, Hypothesis 1 is not supported.

Hypothesis 2 predicted that high-intensity photographs would elicit a larger orienting response than low-intensity photographs. The data were first examined to determine if an orienting response occurred. The high-intensity condition had a significant main effect for time [$F(9,360)=40.00$, $p<.00$, $\eta^2=.50$], and so did the low-intensity condition [$F(9,360)=36.472$, $p<.00$, $\eta^2=.477$].

Next, the cardiac waveforms were examined. Figure 6 shows monophasic patterns for both intensity conditions. In addition, there were significant quadratic trends for the high-intensity [$F(1,41)=70.918$, $p<.00$, $\eta^2=.639$] and low-intensity conditions [$F(1,41)=64.957$, $p<.00$, $\eta^2=.619$]. These results indicate that an orienting response occurred for both conditions.

Figure 6: Cardiac Response to Intensity (exp. 1)



The quadratic trend for intensity x time revealed no significant difference between conditions [$F(9,351)<1$, $p=.06$, $\eta^2=.084$], so Hypothesis 2 is not supported. Figure 6 shows that heart rate decelerates for five seconds for both high- and low-intensity photographs, then slowly accelerates but does not return to the heart rate that preceded the stimulus exposure. Both of the conditions evoked similar orienting responses.

Recognition results

Hypothesis 3 predicted that full-color photographs and high-intensity photographs would be better remembered. Also, it was predicted that the immediate recognition test would show higher memory scores than the delayed test. The data from the four memory measures provided a more complete picture of recognition.

Accuracy results

The analysis shows that there was no significant main effect for color [F(1, 37)<1, p=446, η^2=.016]. Participants hits and correct rejections were the same for both the full-color (M=.98) and the black-and-white photographs (M=.98).

There was a significant main effect for intensity [F(1,37)=13.732, p<.00, η^2=.271]. Participants were more accurate when responding to the low-intensity photographs (M=.99) than the high-intensity photographs (M=.97).

The time factor referred to when the recognition test was taken. The participants took it twice; the first test was administered within 40 minutes of picture exposure, and the second test was taken a week later. Time was significant [F(1, 37)=4.641, p<.05, η^2=.11]. Participants had higher hits and correct rejections at time 1 (M=.99) compared to time 2 (M=.97).

Sensitivity and criterion bias

The measure of sensitivity was calculated using A'. There was no significant main effect for color, but there was a significant main effect for intensity [F(1,37)=13, p<.00, η^2=.260]. There was greater sensitivity for the low-intensity group (*M*=.987) than the high-intensity group (*M*=.995). There was also a significant main effect for time [$F(1,37)=4.194$, $p<.05$, $\eta^2=.102$]. The immediate recognition test (*M*=.994) resulted in greater sensitivity than the delayed (*M*=.987).

A look at the criterion bias shows there was also a shift in judgment for intensity and time but not for color. The criterion bias, calculated using B", showed a significant main effect for intensity [$F(1,37)=12.578$, $p<.00$, $\eta^2=.254$], with the higher number indicating that participants became more conservative in their judgment. This meant that they were more likely to respond "no" when asked if they had seen the target or foil in the experiment. This was more likely to occur for the low-intensity group (*M*=.067) than for high-intensity group (*M*=.004). There was also a significant main effect for time [$F(1,37)=6.342$, $p<.05$, $\eta^2=.146$], and the means indicate that participants were more conservative at time 1 (*M*=.142) compared to time 2 (*M*=.039).

Reaction times

The reaction times for each of the yes-no responses were collected as another indicator of recognition. The analysis revealed significant differences for all main effects and all two-way interactions. There was also a significant three-way interaction for color x intensity x time [$F(1,38)=5.842$, $p<.00$ $\eta^2=.133$]. The slowest reaction time occurred for the high-intensity, black-and-white photographs at time 1, and the fastest responses were for the low-intensity, black-and-white photographs at time 2 (see Table 6). All the time 2 scores became faster, except for the low-intensity, color condition.

TABLE 6

Response Times for Color x Intensity x Time Interaction

Variable	High Intensity Mean (SE)	Low Intensity Mean (SE)
TIME 1		
Color	670.36 (20.3)	647.81 (25.06)
B/W	850.67 (34.82)	664.66 (18.86)
TIME 2		
Color	654.45 (28.55)	688.01 (40.82)
B/W	635.34 (19.60)	618.84 (26.57)

Note: There is a significant three-way interaction with color, time and intensity. $F(1,38)=5.842$, $p<.00$ $\eta^2=.133$. N=39

Recognition results summary

Looking at the measures of recognition for color, there were no differences in accuracy proportions, sensitivity or criterion bias. For the response times, color did play a role in the three-way interaction with time and intensity, but this sole finding is not enough to support hypothesis 3.

There were differences between the intensity conditions for all four encoding measures. The low-intensity photographs produced better accuracy proportions, better memory strength and a shift in judgment. These three measures indicate that encoding is better for the low-intensity condition, so reaction times were expected to be faster for this condition. But the three-way interaction of color, intensity and time revealed a more complicated result. At time 1, response times were fastest for the color, low-intensity images, but at time 2, the black-and-white, low-intensity pictures had much faster responses. These speeds might have been influenced by the shift in criterion bias. The hits and correct rejections and the sensitivity measure indicate that the low-intensity images were remembered better, so hypothesis 3 is not supported.

Recognition for the photographs was better for the immediate test compared to the delayed test as indicated by better accuracy scores and better sensitivity. Also, the participants were more conservative for the immediate test. This conservative shift for test 1 was accompanied by slower reaction times for three of the four conditions. The accuracy scores and sensitivity measure indicate that encoding is better immediately following stimulus exposure, and the slower latency times for the immediate test don't discount these findings. Instead, slower reaction times can reflect a speed-accuracy tradeoff in which greater accuracy is obtained at a cost to speed (Murdock, 1982). Thus, there is support for hypothesis 3's prediction that recognition was better tested immediately following stimulus exposure.

SAM scale results

Hypothesis 4 stated that the full-color photographs would be rated as more arousing and more negative than the black-and-white photographs. The results showed that for valence, there was no main effect for the color condition [$F(1,45)=1.066$, $p=.307$, $\eta^2=.023$]. All the photographs were given ratings less than 4 on the SAM scale (ranging from 1 to 9), indicating that they are perceived as negative, but the color photographs were not perceived as more negative than the black-and-white photographs (see Table 7).

TABLE 7

Means for Arousal and Valence by Color Group

Group	Arousal Mean (SE)	Valence Mean (SE)
Color	4.04 (-.168)	3.18 (.127)
B/W	3.91 (-.168)	3.23 (.136)

Note: Arousal: 1=*calm*, 9=*excited*; Valence: 1=*unpleasant*, 9=*pleasant*. N=46

For the dependent measure of arousal, the main effect for color approached significance [$F(1,45)=3.779$, p=.058, $\eta^2=.077$, power=.477]. The color photographs were rated more arousing than the black-and-white photographs (see Table 7). However, if the same alpha level (p<.05) that was used in the rest of the study were applied to this analysis, then arousal was not significant.

The intensity findings are discussed in terms of the manipulation check, but there are no significant interactions with color and intensity. All of these findings indicate that the two dimensions of emotion are not affected by color, and hypothesis 4 is not supported.

Hypothesis 5 predicted that the color, high-intensity photographs would be rated more offensive and less newsworthy than the black-and-white, low-intensity photographs. For the offensiveness factor, the results revealed a significant main effect for intensity [$F(1,45)=128.809$, p<.00, $\eta^2=.741$]. The high-intensity photographs were rated more offensive (M=179.98, SE=8.23) than the low-intensity photographs (M=126.45, SE=6.662).

Neither the main effect for color [$F(1,45)<1$, p=.349, η^2=.019] nor the interaction of color and intensity were significant [$F(1,45)$=1.036, 0=.314, η^2=.023].

For ratings of newsworthiness, there was a significant main effect for intensity [$F(1,45)$=38.476, p<.00, η^2=.461]. Figure 7 represents the significant interaction for color and intensity [$F(1,45)$=9.076, p<.00, η^2=.168]. The color, high-intensity photographs were rated the least newsworthy, and the black-and-white, low-intensity photographs were rated the most newsworthy (see Table 8). These results indicate that hypothesis 5 is partially supported. The intensity level made a difference for both the upsetting and newsworthiness ratings, but color only influenced newsworthiness.

TABLE 8

Newsworthiness Ratings by Color and Intensity

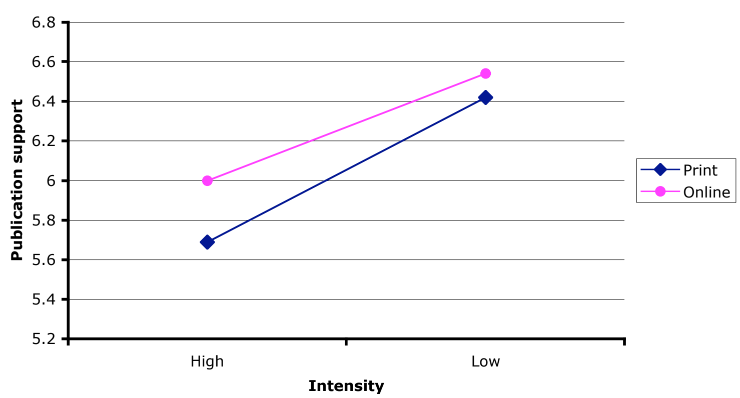
Variable	Color Mean (SE)	B/W Mean (SE)
High intensity	283.54 (3.75)	279.57 (3.28)
Low intensity	257.02 (3.74)	263.15 (3.80)

Note: A lower score indicates a higher newsworthiness rating. N=46

Hypothesis 6 predicted that participants would have more support for publishing the black-and-white, low-intensity photographs. There was a significant main effect for intensity ($F(1,45)$=12.587, p<.00, η^2=.219] but there was no significant main effect for color [$F(1,45)<1$, p=.893]. The interaction between color and intensity was not significant [F(1, 45)=2.55 p=.188). These findings indicated that the intensity made a difference for publication support. The high-intensity photographs (*M*=5.88) received less support than the low-intensity photographs (*M*=6.51). Hypothesis 6 is partially supported.

The first research question looked at whether the medium influenced the publication support. The results showed significant main effects for intensity and medium. Figure 9 represents the significant interaction between the two variables [$F(1,45)=10.706$, $p<.00$, $\eta^2=.192$]. The high-intensity photographs had more support when the medium was an online newspaper site than a printed newspaper.

Figure 7: Medium x Intensity Interaction (Experiment 1)



Participants were also more likely to support publication of the low-intensity photographs in an online environment (see Table 9).

However, there was less support for publishing the high-intensity photographs in either environment than there was for the low-intensity photographs.

TABLE 9

Publication Support for Medium x Intensity Interaction (exp. 1)

Variable	Print Mean (SE)	Online Mean (SE)
High intensity	5.69 (.201)	6.00 (.202)
Low intensity	6.42 (.198)	6.54 (.193)

Note: A higher score indicates greater publication support. N=46

Chapter 7 is devoted to discussing the results of this experiment. This allows for experiment 1 to be discussed in relation to the findings from experiment 2. Both experiments have the same dependent variables. They also share an independent variable to discover if the results from experiment 1 are replicated across message samples. In addition, there will be a discussion on the study's limitations and practical implications to the news industry.

Chapter 6

THE EFFECTS OF SIZE AND INTENSITY ON EMOTION AND COGNITION

Experiment 2

Manipulation check

The second experiment manipulated size and intensity of photographs. The 20 images used in this experiment were not the same as those in experiment 1. The 10 images comprising the low-intensity group had been randomly selected from the 20 photographs that rated lowest on the arousal dimension in the pretest. Ten of the 20 images that rated the highest in arousal were randomly selected for the high-intensity group. For the size manipulation, Adobe Photoshop software was used to resize the images so that the small ones (354 by 265 pixels) were half the size of the large ones (707 by 530 pixels). For the intensity variable, a manipulation check was necessary to determine if the participants perceived this difference in intensity.

A 2 (group) x 10 (photograph) repeated measures analysis of variance (ANOVA) showed that there was a significant main effect for intensity [$F(1, 45)=202.23$, $p<.00$, $\eta^2=.818$]. The images in the high-intensity group were perceived to be more arousing than the photographs in the low-intensity group (see Table 10).

The 2 (group) x 10 (photograph) repeated measures ANOVA was repeated for the valence ratings. There was a significant main effect for intensity [$F(1, 45)=263.199$, $p<.00$, $\eta^2=.854$]. The high-intensity photographs were rated more unpleasant than the low-intensity photographs (see Table 10). These two findings indicate that the manipulation for intensity was successful. The photographs in the high-intensity group were perceived as more negative and more arousing than those in the low-intensity group.

TABLE 10

Means for Arousal and Valence by Intensity Group (exp. 2)

Group	Arousal Mean (SE)	Valence Mean (SE)
High	5.47 (.235)	2.39 (.138)
Low	3.13 (.175)	3.80 (.135)

Note: Arousal: 1=*calm*, 9=*excited*; Valence: 1=*unpleasant*, 9=*pleasant*. N=46

Data Cleaning

Prior to analysis, all the dependent variables were examined for inaccurate entries, missing data and outliers. The recognition data had no missing data, and fewer than 5% of the cases were missing for the other measures. All missing data were replaced with the series mean. Outliers were replaced with the next nearest score. The skewness and kurtosis for all the variables fell within the acceptable range of –3 to +3. In cases where the univariate analyses violated the assumption of sphericity, the Greenhouse-

Geisser adjusted *F*-test was used. This conservative test adjusted the degrees of freedom for the *F*-test.

Heart rate data analysis

There were 50 students who participated, but two failed to return for both sessions. Another 11 cases were excluded from analysis because inaccurate readings led to too many missing cases. This left a total of 37 participants. The same heart rate analysis procedures that were used in experiment 1 were followed in this experiment. Heart rate change scores were calculated by subtracting the baseline heart rate from the 9 seconds of exposure time. These scores were then plotted to create cardiac waveforms that represented heart rate response during stimulus exposure.

Hypothesis 1 predicted that there were differences in orienting responses for the size and intensity conditions. The first step in analysis is to determine if an orienting response occurred for each condition. For the size condition, a 20 (picture) x 10 (time) repeated measures ANOVA was executed for the large photographs only. Then, the same analysis was repeated using only the small photographs. For the intensity variable, a pair of 20 (picture) x 10 (time) repeated measures ANOVAs were executed for the high-intensity and low-intensity conditions.

Next, the cardiac waveforms were examined for a biphasic or monophasic response. These patterns demonstrate an orienting response (Graham, 1979; Ohman, 1979). Another indicator of the orienting response is a significant quadratic or cubic trend for the main effect of time.

These three steps were completed to discover if participants oriented to the stimulus materials. Then, the data were analyzed to test for significant differences between conditions for the size and intensity variables. The heart rate data was analyzed using a 2 (size) x 2 (intensity) x 10 (picture) x 10 (time) repeated-measures ANOVA. Time was a necessary variable to include because the orienting response takes place over several seconds. A significant interaction between size and the quadratic or cubic trend of time, and a significant interaction between intensity and the quadratic or cubic trend of time indicate differences in orienting. Because the univariate analyses violated the assumption of sphericity, the Greenhouse-Geisser adjusted *F*-test was used. This conservative test adjusts the degrees of freedom for the *F*-test.

Recognition data analysis

Accuracy proportions were analyzed using a 2 (size) x 2 (intensity) x 2 (time) repeated measures ANOVA.

The formula for A' was used to calculate sensitivity measures, then these values were entered into a 2 (size) x 2 (intensity) x 2(time) repeated measures ANOVA to determine if there were differences among conditions. The higher the score; the greater the sensitivity.

The criterion bias was calculated, and these values were entered into a 2 (size) x 2 (intensity) x 2 (time) repeated measures ANOVA to detect differences among conditions.

Response times were also collected as an indicator of encoding. These were analyzed with a 2 (size) x 2 (intensity) x 10 (photograph) x 2 (time) repeated measures ANOVA.

SAM scale analysis

The SAM scale for valence ranged from 1 (unpleasant) to 9 (pleasant). The SAM scale for arousal ranged from 1 (calm) to 9 (excited). A pair of 2 (size) x 2 (arousal) x 10 (photograph) repeated measures ANOVAs were run for valence and arousal.

Offensiveness and newsworthiness analysis

After stimulus exposure, the participants rated each picture on how upset, angry, depressed and offended they felt on a scale of 1 (not at all) to 9 (extremely). They also rated the pictures on how well they told the truth, helped them understand, were informative and represented reality. These latter four items were rated on the same scale of 1 (not at all) to 9 (extremely) They also rated the pictures on if they told the truth, helped them understand, were informative and if they represented reality. These were rated on a scale of 1 (not at all) to 9 (extremely) and were recoded so that all the scales were in the same direction.

There were 46 respondents to these questions, and each question was asked for all 40 of the photographs. This resulted in 1,840 responses for each of the eight questions. In the data file, the responses for each question were recorded in that respondent's row. The data were restructured so that the responses for each question (and not respondent) were placed in the same row. The 1,840 resulting cases exceeded the minimum requirement of 300 cases for executing a factor analysis (Tabachnick & Fidell, 2001).

Because the goal of this analysis was exploratory in nature, principal axis factoring was used. The assumptions of normality and linearity were met. First, an unrotated principal axis factor analysis was run. The results showed that there were two factors with eigenvalues greater than 1. These two factors explained 78.79% of the total variance. Two factors were retained, and the analysis was repeated with varimax solution. These two factors were comprised of four questions each. Table 11 shows that the four questions clearly loaded on just a single factor. Factor 1 accounted for 55.41% of the variance, and factor 2 accounted for 23.38%, for a total variance of 78.79%.

TABLE 11

Factor Analysis of Offensiveness and Newsworthiness (Experiment 2)

Tells Truth	.873
Understand	.861
Reality	.843
Informative	.791
Upset	
Depressed	.-.25
Angry	
Offended	-.00

Note: Principal Axis Factoring with varimax rotation
N=1,840

The next step is to name the factors. Factor 1 was called "newsworthiness" because it is composed of four concepts that are often considered by journalists when determining if content is newsworthy. The second factor was named "offensiveness" because this concept best describes the combination these four feelings: upset, depressed, angry and offended.

The four questions for the offensiveness factor and the four factors for the newsworthiness factor were summed for each of the four conditions (small/high, small/low, large/high, large/low). The final step was entering these sum scores into a 2 (size) x 2 (intensity) repeated measures ANOVA.

Strength of publication support analysis

The data were analyzed using a 2 (size) x 2 (intensity) x 10 (rep) x 2 (medium) repeated measures ANOVA. The two levels of medium were printed newspaper and online newspaper site.

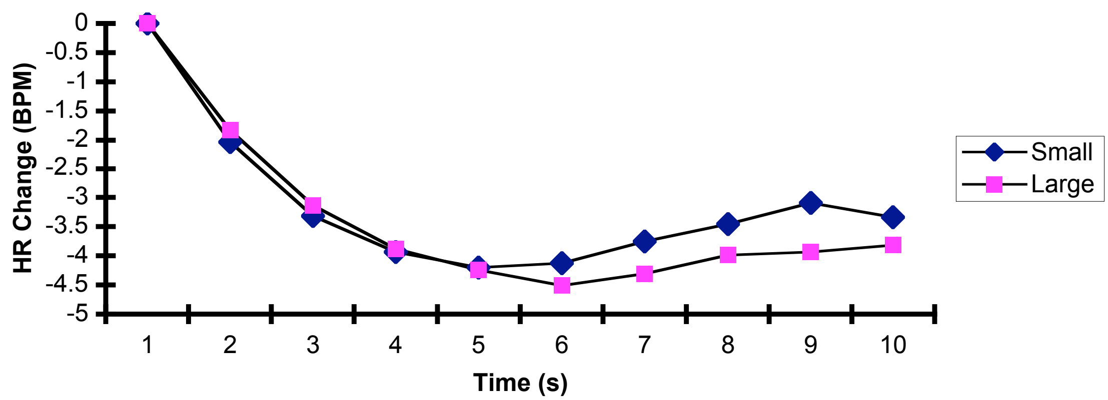
Results

Heart rate results

The second experiment manipulated size and intensity. Hypothesis 1 predicted that large photographs would elicit a greater orienting response than small photographs. The data were first examined to determine if an orienting response occurred. There was a significant effect for time for both the large [$F(9, 324)=38.644$, $p<.00$, $\eta^2=.518$] and small pictures [$F(9, 324)=29.917$, $p<.00$, $\eta^2=.454$].

Figure 8 shows the cardiac waveforms. The patterns are monophasic. The quadratic trend for time is significant for both large [$F(1,36)=62.046$, $p<.00$, $\eta^2=.633$] and small images [$F(1,36)=56.187$, $p<.00$, $\eta^2=.609$]. These findings indicate that photographs in both size conditions elicited orienting responses.

Figure 8: Cardiac Response to Size

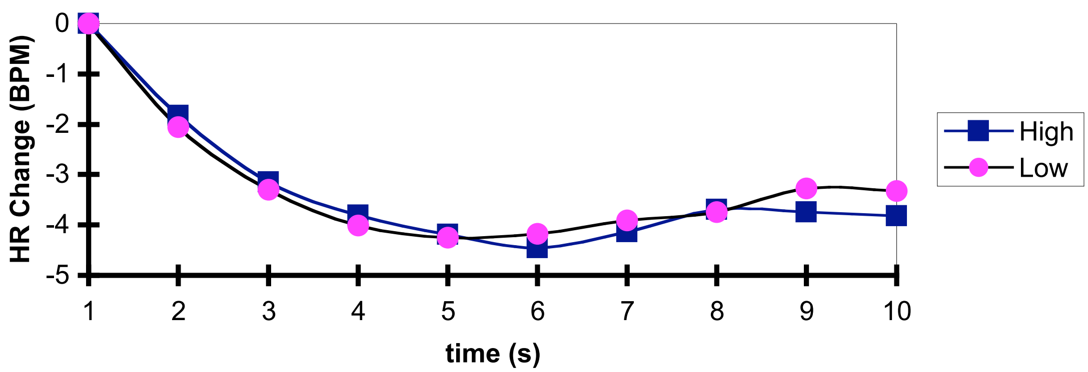


When participants viewed photographs from both of the size conditions, their heart rate decelerated for five seconds. At about the sixth second, there was an acceleration of the heart rate for the small condition. For the large condition, there was a continued deceleration at second seven, followed by a more gradual heart rate acceleration. This signified a large orienting response for both conditions. However, the quadratic trend for size by time was not significant [$F(1,36<1$, $p=.88$, $\eta^2=.001$], so Hypothesis 1 was not supported.

Hypothesis 2 predicted that high-intensity photographs would elicit a greater orienting response than low-intensity photographs. There was a significant effect for time for both the high-intensity [$F(9, 324)=38.644$, $p<.00$, $\eta^2=.518$] and low-intensity pictures [$F(9, 324)=29.917$, $p<.00$, $\eta^2=.454$].

In addition, Figure 9 shows cardiac waveforms with monophasic patterns. The quadratic trend was significant for both the low-intensity [$F(1,36)=90.639$, $p<.00$, $\eta^2=.716$] and high-intensity groups [$F(1,36)=48.115$, $p<.00$ $\eta^2=.572$]. Thus, the main effects of time, the monophasic patterns and the significant quadratic trends indicated that an orienting response occurred for both intensity conditions.

Figure 9: Cardiac Response to Intensity (exp. 2)



Participants oriented to all the stimuli, but did the two levels of intensity elicit different orienting responses? An analysis showed that there was no significant quadratic trend for the size x time interaction. [$F(1, 36)<1$, $p=.703$, $\eta^2=.019$]. The pictures in both conditions elicited similar orienting responses, so there is no support for Hypothesis 2.

Recognition results

Hypothesis 3 predicted that the large photographs and the high-intensity photographs would be better remembered. In addition, it was predicted that the test taken immediately following stimulus exposure would reflect better recognition. First, the hits and correct rejections were examined. There were no significant main effects for size or intensity. However, there was a main effect for time [$F(1,37)=6.5$, $p<.05$, $\eta^2=.131$]. Participants had higher hits and correct rejections for the immediate recognition test ($M=.984$, $SE=.008$) than the delayed recognition test ($M=.954$, $SE=008$).

Sensitivity and criterion bias

The sensitivity measure indicates memory strength. There were no significant main effects for size, intensity or time, and there were no significant interactions. Looking at the criterion bias, there was a significant main effect only for time [$F(1,43)=15.988$, $p<.00$, $\eta^2=.271$]. Participants became more conservative in their responses to the delayed recognition test ($M=.064$, $SE=.009$) compared to the immediate recognition test ($M=.018$, $SE=.007$). They were more likely to reply "no" for the delayed recognition test, which minimized the number of false alarms, but also resulted in fewer hits.

Reaction times

For the reaction times, there were no significant main effects for size, intensity or time. There was a significant interaction between size and time [$F(1,43)=11.45$, $p<.00$, $\eta^2=.133$]. During the immediate test, the reaction times were faster for the small photographs (see Table 12). For the delayed test, the reaction times were faster for the larger photographs.

TABLE 12

Response Times for Size x Time Interaction

Variable	Time 1 Mean	Time 2 Mean
Small	619.24	677.75
Large	639.19	611.34

Note: There is a significant two-way interaction with time and intensity. $F(1,43)=11.45$, $p<.00$ $\eta^2=.133$. N=46

These measures of encoding offered a more complete picture of encoding. The significant difference in accuracy scores for the immediate and delayed tests were due to the criterion bias and not the manipulation of time. This shift in judgment may have slowed the reaction time speed, so Hypothesis 3 is not supported.

SAM scale results

Hypothesis 4 predicted that the large photographs would be more arousing and more negative than the small photographs. There was a significant main effect for size on arousal [$F(1,45)=26.305$, $p<.00$, $\eta^2=.369$]. The large images ($M=4.15$, $SE=.187$) were rated more arousing than the small images ($M=4.45$ $SE=.197$).

For the valence ratings, the main effects of size [$F(1,45)=26.928$, $p<.00$, $\eta^2=.374$] and intensity [$F(1,45)=263.199$, $p<.00$, $\eta^2=.854$] were both significant. Also, there was a significant interaction between size and intensity [$F(1,45)=10.14$, $p<.00.$, $\eta^2=.184$]. The high-intensity photographs were rated as more negative in both the large and small conditions, but the large, high-intensity photographs were rated the most negative, and the small, low-intensity photographs were rated the least negative (see Table 13). Hypothesis 4 is supported.

TABLE 13

Valence Means for Size x Intensity Interaction

Variable	High-Intensity Mean (SE)	Low-Intensity Mean (SE)
Large	2.24 (.133)	3.75 (.130)
Small	2.54 (.149)	3.85 (.143)

Note: There is a significant two-way interaction with time and intensity. $F(1,45)=10.14$, $p<.00$ $\eta^2=.133$. Valence: 1=*unpleasant*, 9=*pleasant*. N=46

Offensiveness and newsworthiness results

Hypothesis 5 predicted that the large, high-intensity photographs would be rated more offensive and less newsworthy than the small, low-intensity photographs. Looking at the offensiveness ratings, there were significant main effects for size [$F(1,45)=24.797$, $p<.00$, $\eta^2=.355$] and intensity [$F(1,45)=186.690$, $p<.00$, $\eta^2=.806$]. Participants rated the large pictures more offensive than the small pictures. In addition, they rated the high-intensity pictures more offensive than the low-intensity ones (see Table 14). The size x intensity interaction approached significance [$F(1,45)=3.08$, $p=.086$, $\eta^2=.06$] with the large, high-intensity images rated the offensive.

TABLE 14

Offensiveness Ratings for Size x Intensity Interaction

Variable	High Mean (SE)	Low Mean (SE)
Large	214.37 (10.57)	122.35 (7.31)
Small	203.26 (10.00)	127.71 (7.24)

Note: Larger scores indicate higher ratings of offensiveness. N=46
This was interaction marginally significant [F(1,45)=3.08, p=.086]

Low scores on the newsworthy measure indicate higher newsworthiness. The results showed that the interaction between size and intensity was not significant [$F(1, 45)=1.154$, $p=.289$, $\eta^2=.03$]. However, there was a significant main effect for size [$F(1,45)=26.725$, $p<.00$, $\eta^2=.373$], with participants rating the large photographs more newsworthy (*M*=149.55**,** *SE*= 7.14) than the small photographs (*M*=157.62**,** SE=6.85). There was also a significant main effect for intensity **[**$F(1,45)=22.277$, $p<.00$, $\eta^2=.331$]. Participants rated the high-intensity images as less newsworthy (*M*=143.60, *SE*=7.67) than the low-intensity images (*M*=163.54, *SE*=6.84). Although there was no significant interaction between size and intensity for either offensiveness or newsworthiness, the main effects for the variables were significant. In addition, the size x intensity interaction for offensiveness was marginally significant. These results reveal partial support for hypothesis 5.

Publication Support Results

Hypothesis 6 predicted that participants would have more support for publishing the small, low-intensity photographs. There was a main effect for intensity [$F(1,45)=47.256$, $p<.00$, $\eta^2=.512$] but not size [$F<0$, $p=.995$]. However, Figure 10 shows an interaction between size and intensity [$F(1,45)=8.11$, $p<.00$, $\eta^2=.153$]. The large, high-intensity photographs received the most support for publication, and the low-intensity, small photographs received the least amount of support (see Table 15). Thus, hypothesis 6 is supported.

Figure 10: Size x Intensity Interaction

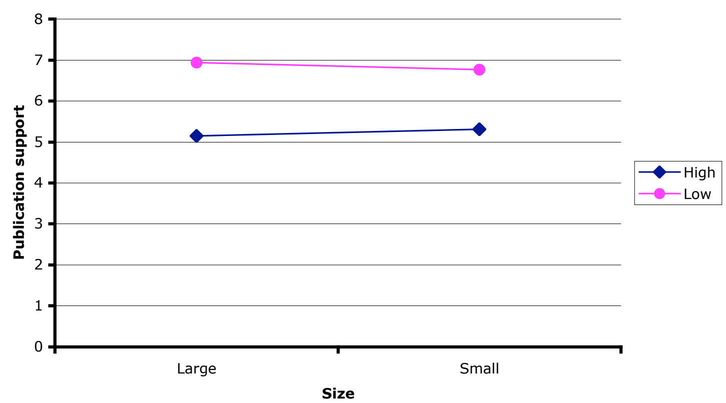


TABLE 15

Publication Support for Size x Intensity Interaction

Variable	Large-size Mean (SE)	Small-size Mean (SE)
High intensity	5.15 (.272)	5.31 (.259)
Low intensity	6.94 (.191)	6.77 (.209)

Note: A higher score indicates greater publication support. N=46

The first research question examines whether the publication support is dependent on the type of medium. There was a main effect for medium [$F(1,45)=10.527$, $p<.00$, $\eta^2=.190$]. Participants gave more support to publishing the images online (M=6.141) than in a printed newspaper (M=5.944**)**. The interaction for intensity and medium was also significant [$F(1,45)=6.976$, $p<.01$, $\eta^2=.134$]. The high-intensity photographs received less support for being published in both the online and printed media (see Table 16).

Figure 11: Medium x Intensity Interaction

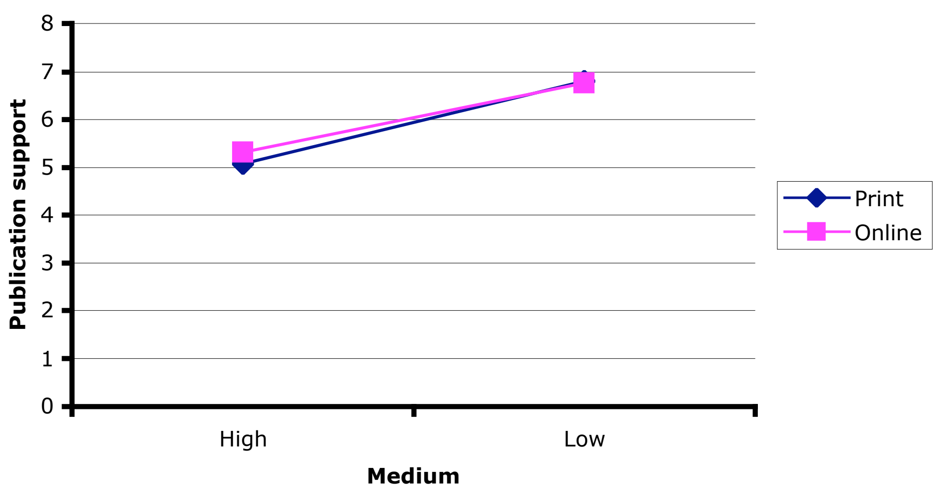


TABLE 16

Publication Support for Medium x Intensity Interaction (exp. 2)

Variable	Print Mean (SE)	Online Mean (SE)
High intensity	5.08 (.263)	5.31 (.259)
Low intensity	6.81 (.197)	6.77 (.209)

Note: A higher score indicates greater publication support. N=46

The results from this experiment are discussed in the next chapter along with the results from experiment 1. Combining these two discussions offers a better look at how structural and content features of photographs affect attention, emotional responses and recognition.

Chapter 7

THE EFFECT OF PHOTOGRAPHS' STRUCTURAL AND CONTENT FEATURES

Discussion for cognition findings

Orienting to color and intensity

Previous research has shown that negative stimuli elicit an orienting response (Lang, 1997). During an orienting response, the parasympathetic system takes over and quiets the body so that new information in the environment can be attended to. For experiment 1, an orienting response occurred in response to all images regardless of the color or intensity, so Hypothesis 1 and 2 were not supported.

After the onset of stimuli, there was an initial heart rate deceleration, which is consistent with findings that valence is responsible for this initial drop (Bradley, 2000). The orienting response for both sets of photographs caused the heart rate to decelerate for at least 5 seconds and then to gradually accelerate, but it never returned to its rate prior to stimulus exposure. This response is not surprising, as research shows that large decelerations are elicited by unpleasant stimuli (Bradley, Greenwald & Hamm, 1993; Winton, Putnam & Krauss, 1984). What is surprising is that the color and intensity didn't play a role in this response. Based on the bio-informational framework, media that appeared more threatening were expected to activate the underlying aversive system and elicit a greater response. This prediction was not supported in experiment 1.

Orienting to size and intensity

Experiment 2 used negative news photographs that varied by size and intensity. While viewing the pictures, the heart rate decelerated for at least 5 seconds and remained low, never returning to baseline level. This is similar to the orienting response elicited in Experiment 1. These results indicate that participants oriented to the news photographs, but neither the structural features of color and size nor the content feature of intensity played a role in changing the size of the response. One explanation is that these features do not influence what types of stimuli that people attend to. This is plausible, but another explanation is more likely – that the negative content of the photographs overpowered any other effects. The negative picture content activated the aversive system, which is motivated to protect the body from harm, and this elicited such a strong orienting response that the true effects of size, color and intensity were masked.

One clear finding from both experiments is that negative news information in the environment is attended to regardless of other features that are present. This study was only concerned with negative news images, but repeating the experiment with negative and pleasant photographs could allow potential differences between the structural and content conditions to emerge.

The orienting response is used as a measure of attention. As the heart slows down, people allocate more resources to the stimuli (Lang, 1995). The cardiac waveforms indicate that participants in both experiments clearly attended to the pictures. Greater resource allocation should lead to improved recognition. The next section looks at whether the stimuli that were attended to were remembered.

Visual Recognition

Experiment 1

The results for Experiment 1 show that memory for visuals remained high a week following picture viewing. On average, people had accuracy rates of 97% and above. This was a statistically significant drop from the 99% accuracy percentage observed for the immediate recognition test. This outstanding performance on the visual recognition tests was expected. Previous research indicates that encoding visuals is automatic and "cost-free" (Lang, Potter & Bolls, 1999). Although recognition for the target photographs was significantly better for the immediate test than the delayed, participants still achieved 97% accuracy a week following stimulus exposure. This indicates that visual recognition for photographs slightly deteriorates over time, but that the overall recognition remains high. In fact, researchers have found that people can recall some visuals a year following exposure (Bradley, Greenwald, Petry & Lang, 1992).

The photographs that were recalled the best had content that rated high in arousal. In addition, Experiment 1 predicted that participants would have better encoding for the color photographs and the high-intensity photographs. The results reveal that color had no effect on the percent of hits or correct rejections, memory strength or decision-making. For these analyses, the power for color was extremely low, so there is a chance that this manipulation does make a difference, but that these differences went undetected. Another possibility is that the structural feature of color is not helpful in remembering photographs.

In fact, participants were asked after the experiment if they could guess what had changed in the pictures from the first time they viewed them to the second time. All the pictures were switched – those that appeared in black-and-white during the first session were changed to color, and vice versa. Many participants expressed surprise upon being told of this manipulation. Some indicated that after being told, they could recall that the color did change, but others said they did not notice this switch and thought they were viewing the exact same images. The recognition data and this anecdotal evidence indicate that people might overlook the structural feature of color to get to the content.

The fact that people do not notice change in scenes has been documented in studies that manipulate photographs so that one item is different while the rest of the scene remains the same. People perform poorly on these tests. Pashler (1998) says that when viewing and encoding a scene, people "do not, and presumably cannot, form a representation that allows them to keep track of each object in the scene and its identity, its appearance, and its location." (p. 252). Because short-term memory limits the information that can be retained, perhaps the picture content gets encoded, and the less important color information is not stored. Color information may be considered a peripheral structural element that fails to be encoded in favor of the actual picture content.

In Experiment 1, the content of the photographs was manipulated in terms of intensity level. Participants were expected to remember the high-intensity photographs better. This is because high-arousal photographs elicit an orienting response in which resources are allocated to encoding the information. The heart rate findings indicate that a large orienting response for the high-intensity group did occur, although it was not statistically different from the orienting response elicited by the low-intensity photographs. Hypothesis 3 predicted that the high-intensity photographs would be remembered best, but the opposite occurred. Participants had greater accuracy rates for the low-intensity images, and this finding is given more support by the significant sensitivity measure. Participants with greater sensitivity for low-intensity photographs were better able to detect the target images from the foils. The intensity level also caused people to change how they made decisions about what they saw. There was a conservative shift for the low-intensity group. These findings indicate that the low-intensity images were encoded better than high-intensity images. This latter group may have overloaded capacity, resulting in a poorer performance on the recognition test. Another possibility for these findings is explored in the "Replication" section.

Looking at the time the test was taken indicates that recognition scores are better immediately following exposure. Despite having a decrease in the number of accurate responses, the overall recognition score remained high for the delayed recognition task (97%). The high recognition for visuals at time 2 is not surprising since encoding them does not require a lot of resources.

Experiment 2

Size and intensity did not affect recognition for the images. However, participants had more hits and correct rejections for the immediate test compared to the delayed one. The sensitivity measure was not significant, indicating that greater memory strength was not the reason for this difference. The criterion bias indicates a significant conservative shift for the delayed test, which means that they were more likely to respond "no." Thus, this lower accuracy score for the delayed test was due to this shift in judgment and not the condition. This is a good example of signal detection theory being able to determine the true explanation of the recognition findings.

In this study, the response times are not given as much weight as a measure of recognition because they can be interpreted as support for better encoding or a speed-accuracy trade-off. Fast responses can indicate better recognition, or it can indicate the speed-accuracy trade-off. Without one of the other recognition measures being significant, it becomes difficult to find out what is going on. For experiment 2, the predicted effect that picture size and intensity would enhance encoding did not occur. The size and intensity didn't offer any recognition advantages.

Discussion for emotion findings

Experiment 1

Hypothesis 4 predicted that the color, high-intensity photographs would rate higher on measures of arousal and valence because these images would be more likely to activate the aversive system. However, this hypothesis is not supported because there is no significant interaction between color or intensity on these measures. There was also no main effect for color. Color did not make a difference on valence ratings. How pleasant/unpleasant the content was remains independent of whether it was viewed in full color or black and white; if it was unpleasant in one condition, it was likely to be given a similar rating in the other condition.

A previous study manipulated the color of video clips and found that people did rate the color clips more arousing and more pleasant than the black-and-white clips (Detenber, Simons & Reiss, 2000). Of course, this study used only still photographs and not video. In the previous study, only moving video clips were used. A future study should examine why color is significant for these measures when the stimulus materials are video instead of still photographs.

Experiment 2

Manipulating the size of the photographs influenced how unpleasant and exciting people perceived them to be. The larger photographs resulted in more negative valence ratings and higher arousal ratings. People were more aroused when viewing the images in a larger size. The combination of high-intensity, large photographs resulted in people feeling the most aroused. These findings support Hypothesis 4 and indicate support for the activation of the aversive system.

Offensiveness & Newsworthiness

Experiment 1

Color had no effect on how people's ratings of offensiveness for these negative news photographs, but the intensity of the content did make a difference. People were most offended by the high-intensity photographs. This indicates that people looked beyond the color to the content. One reason color was predicted to make a difference was because many of the images included scenes with bright red blood. These findings indicate that the color did not matter. The high-intensity images were just as offensive in black-and-white.

However, there was a significant interaction for color and intensity in terms of newsworthiness. The color, high-intensity photographs received the least support for publication, and the black-and-white, low intensity photographs received the most support. Color did not make a difference in terms of arousal, valence or offensiveness, so it's interesting that it's part of a significant interaction for newsworthiness.

Experiment 2

The large photographs were rated more offensive, and the high-intensity photographs were rated more offensive, but the interaction between these two variables only approached significance. This finding offers partial support for Hypothesis 5.

For the newsworthiness ratings, the larger images were rated more newsworthy. This hypothesis was looking for an interaction with size and intensity, so this main effect for size was unexpected. However, people are familiar with newspaper design, and the most important photograph of the day is published large on the front page. Even on websites, the most important images often appear larger. People might be used to this news judgment, as indicated by their response on this variable.

The high-intensity photographs were rated less newsworthy. People were not only offended by these images, but they also deemed then as less newsworthy. This also offers partial support for Hypothesis 5.

Strength of publication support

*Experiment **1***

The low-intensity photographs received more support for publication and the high-intensity received less. This offers some evidence that people want to avoid these negative, high-intensity stimuli. The color of the images did not affect these ratings. This partially supports Hypothesis 6.

Experiment 2

As predicted, the large, high-intensity photographs received less support for publication. These photographs are the ones that were most likely to activate the aversive system, and people are indicating that they want to avoid these stimuli.

Medium

Experiment 1

The high-intensity photographs received less support for publication in printed newspapers. People would rather see this disturbing material distributed on the Internet.

Experiment 2

The high-intensity, large photographs received less support for publishing them in the printed newspaper. These findings are similar to Experiment 1. People do not want to encounter these high-intensity images when they open their newspaper.

Summary of findings

People orient to negative news photographs. This orienting occurred across conditions. In fact, this orienting to the negative stimuli might be hiding the effects of the variables.

This study also demonstrated that recognition for negative news photographs remained high a week following stimulus exposure. In addition, the analysis of recognition scores can be enhanced by using Signal Detection Theory. This analysis helps ensure that true memory sensitivities and differences due to a criterion shift are detected.

The structural feature of color was a weak manipulation. There were no significant findings for color except for an interaction with high-intensity on newsworthiness ratings. The images in the color group varied in intensity, and the high-intensity ones were rated as more arousing, more negative, more offensive and less newsworthy. These high-intensity photographs also received less support for publication, and if they were published, people preferred that they be on online news sites. These findings for intensity occurred no matter if the picture was in color or black-and-white.

This lack of significant findings for color was surprising. As humans, we view the world in color and react to threatening stimuli. Color, high-intensity photographs were predicted to be more arousing, but the data did not support this. Also, color did not make a difference for any of the emotional or news judgment ratings. One possibility for these findings is that color is a peripheral cue, so the presence or absence of color went undetected. Anecdotal evidence offers support for that, as many research participants said they had not noticed that the color of the photographs had changed from Session 1 to Session 2. Although it appears to be an obvious manipulation, additional research on color indicates that other information about the objects are attended to before the color information. Experienced map users found that color did not help them match a map to a three-dimensional object, and airline pilots did not find it easier to use colored landing simulators (Davidoff, 1991).

Manipulating the structural feature of size did reveal different responses to the large and small photographs. The larger ones did not elicit greater orienting responses or result in better recognition, but they did affect emotional responses. People rated the larger photographs as more arousing, more negative, more offensive and less newsworthy. Intensity also had similar significant findings. The high-intensity photographs elicited these same emotional responses across both sets of pictures. These findings indicate that for negative news photographs, the size of the photograph and the intensity of the content play a role in how people emotionally respond.

In addition, there was more support for publishing the high-intensity images online than in the newspaper. This finding indicates that people do make different decisions about where they want to encounter negative, high-intensity news images. This finding should be explored further to determine the reasoning behind these judgments. Is it because people are more purposeful in what sites they visit online, so they feel protected from seeing it online, but there is no avoiding the image when it is on the front page of your newspaper? Or do people believe these images should be disseminated, but they are worried about other people, such as small children, who might see them in a print publication? These possibilities should be explored.

Replication

The intensity variable was present in both Experiment 1 and Experiment 2 to discover if the findings could be replicated across message samples. Manipulating intensity produced similar results for both sets of images, with the recognition data being the exception. In Experiment 1, recognition was better for the low-intensity photographs. In Experiment 2, neither intensity condition enhanced recognition. Why would this finding be true for one set of negative news photographs and not the other?

Both sets were made up of photographs from the pre-test. The 20 images that scored the highest in arousal and the 20 images that scored lowest in arousal were randomly assigned to a message sample. Within these samples, there were significant differences between the high- and low-intensity groups.

To investigate if there was a difference between the message samples, a pair of 2 (experiment) x 10 (photograph) repeated measures analyses were executed for the measures of arousal and valence.

The findings revealed significant differences between message samples. Experiment 2's high-intensity group was more arousing and more unpleasant than Experiment 1's (see Table 17).

TABLE 17
Means of Arousal and Valence for Experiment 1 and Experiment 2's Message Samples

Variable	Arousal Mean (SE)	Valence Mean (SE)
Experiment 1		
High	5.99 (.312)	2.53 (.153)
Low	3.22 (.225)	3.90 (.115)
Experiment 2		
High	6.36 (.302)	2.27 (.130)
Low	3.54 (.219)	3.83 (.119)

Note: A higher score indicates greater publication support. N=46

This difference helps explain why the low-intensity group in Experiment 2 did not aid recognition like it did in Experiment 1. The images in Experiment 1 are significantly lower in intensity, which means that they do not require an abundance of resources for encoding. In addition, performance on memory tests can vary according to arousal level. People perform better on immediate memory tests if arousal is low. Higher levels of arousal can result in poor performance for the immediate test, but then higher performance at a later time. This delayed improvement is attributed to the arousing material consolidating over time so that retrieval becomes easier (Baddeley, 1999). Future tests should include a recognition measure that is delayed much longer than a week to determine if this is happening.

The same main effects for intensity (besides the one just mentioned) were significant for both groups of images. This indicates that the replication for the intensity variable was successful even though it was discovered that these two groups of negative news images differed in their arousal and valence ratings. A benefit of having these intensity findings replicated is more confidence in the results.

Limitations

The problem with power

The power analysis conducted prior to the experiment recommended a minimum of 40 participants for a power level of .70. For all the variables except color, this power level was met or exceeded with each analysis. But color repeatedly fell below this level, which meant the chance of detecting a difference was diminished.

Because of this problem, the variable of color should be included in future studies. Color may influence our emotional and cognitive processing of negative news photographs, but its role was obscured in experiment 1. To overcome this problem, more participants should be included to ensure that type II error is avoided. The standard limitations of experiments apply to both of these studies.

Practical implications

On any given day, there are journalists across the country engaged in a debate about what images are or are not appropriate to use in the media. Whether it's a photograph of a car wreck, a grieving widow or an injured soldier, there are editors who worry about the effect these images will have on the audience. The photographs that often spark these debates are negative in valence but high in arousal. The Poynter Institute advises that one way to handle such controversial images is to run them in black-and-white and small. But this study found that on their own, these two methods might appease anxious editors but fail to change people's emotional reactions. One finding is very clear from this study – people orient to negative news photographs. Changing the color of the photograph to black-and-white neither lessens the orienting response, nor does it change people's ratings of offensiveness or newsworthiness. Also, manipulating the color failed to influence people's support for publishing a photograph. The variable that does make a difference is intensity. These results were found using an experimental design in a lab setting, so they may not generalize to typical media use. Nonetheless, editors should consider the intensity (high arousal/low valence) of the image when discussing readers' emotional responses. The high-arousal images in the study were more offensive, less newsworthy and less likely to receive publication support. These reactions from viewers do not mean that the images are any less newsworthy or shouldn't be published. They just indicate that many viewers do not like them and want to avoid seeing them.

Changing the size of the photograph was an effective manipulation in the lab that reduced the emotional responses of arousal and unpleasantness as well as feelings of being offended. The smaller photographs were rated more newsworthy. In addition, the small, low-intensity photographs were more likely to receive publication support in printed newspapers. The large, high-intensity material was deemed more appropriate on the Web. Online publishing may be a good solution for editors wary of publishing a disturbing photograph in the printed edition.

Future Research

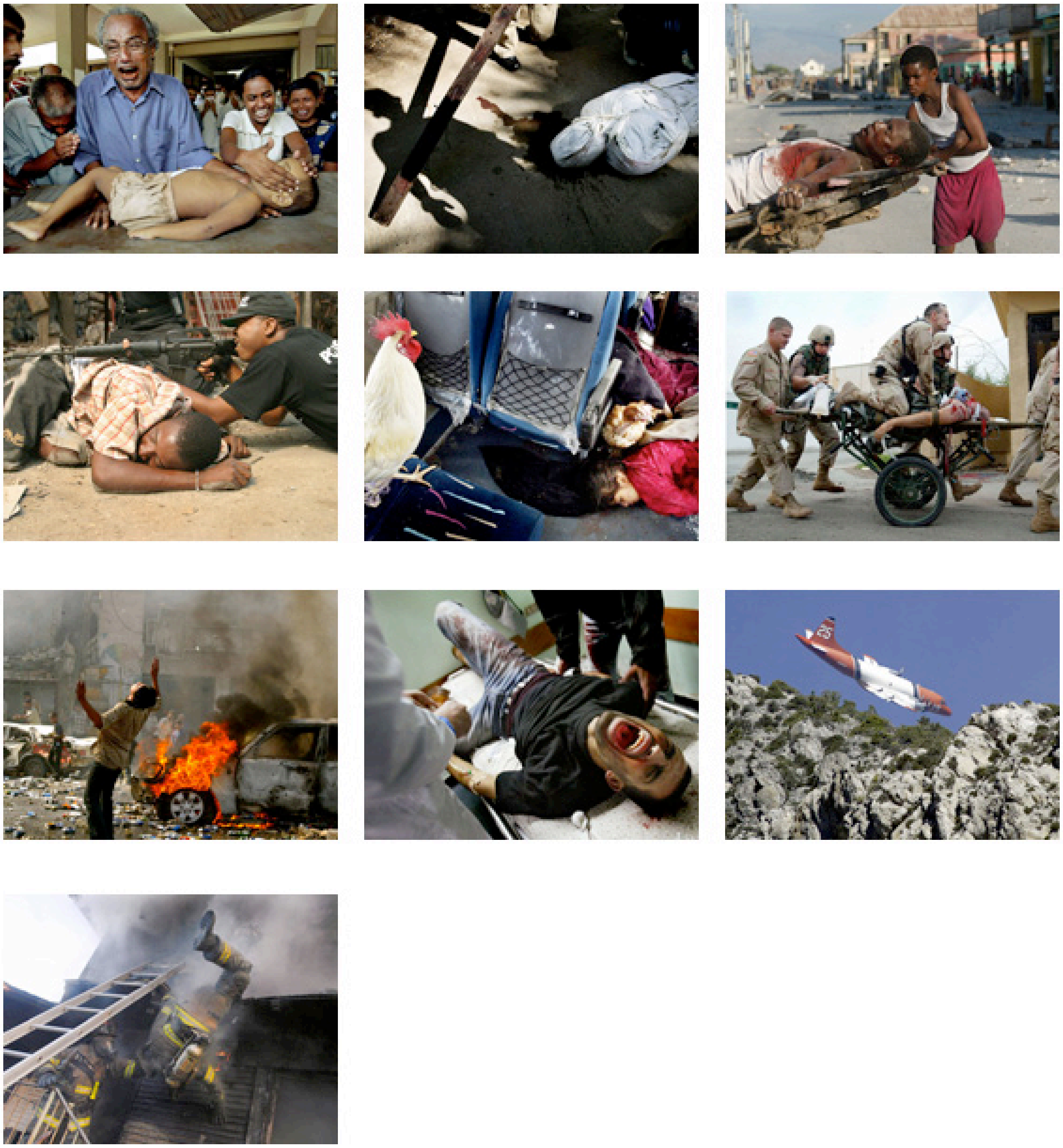
The idea that color is a peripheral cue and not a main item that is attended to is fascinating because it appears to be such an obvious manipulation. In this study, color did not make a difference in people's emotional or cognitive responses to negative news photographs, but perhaps it does make a difference for pleasant images or for all low-intensity images. The role of color in cognition should continue to be explored.

Also, the effect for color, intensity and size and the orienting response should be tested again using positive as well as negative photographs. These same photographs could be used in mock-ups of newspapers to determine if they elicit the same responses when they are presented in this manner.

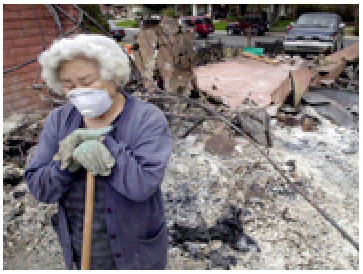
Also, the context was completely missing from these images. People oriented to them without knowing exactly what they were seeing. One idea to explore is if emotional responses change when viewers learn what is actually taking place in the scene versus what they assume is taking place. For example, this study included a photograph of an airplane that appears moments away from crashing into a mountain. This image was rated as high-arousal and negative valence in the pretest. At least five people asked after the experiment was over if the plane had actually crashed.

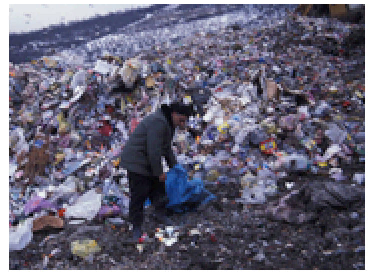
But the plane only appears to be crashing; it is actually a picture of a pilot fighting a wildfire. Would these participants have found this same image as arousing if they had understood the true circumstances? Relating this to print journalism, providing context for photographs is the role of captions. When controversial photographs are published, editors often write columns explaining their decisions to publish these images. Offering this context might alter people's emotional reactions as well as their support for publication. The area of negative news photographs and their effect on attention, emotion and memory should continue to be explored through physiological experiments and other methods.

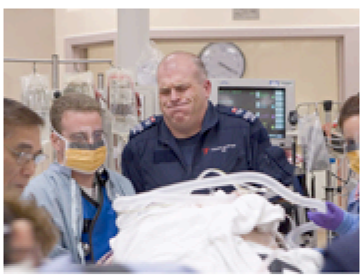
Appendix A: Experiment 1 Photographs (High Arousal)

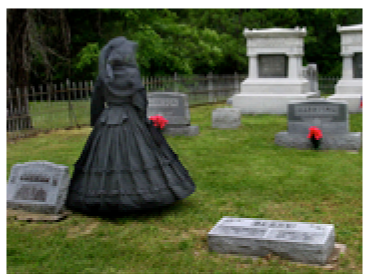


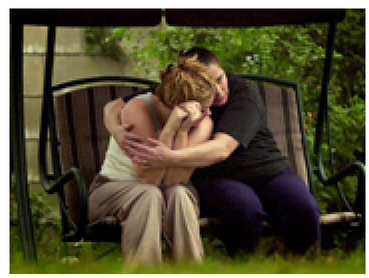
Experiment 1 Photographs (Low Arousal)



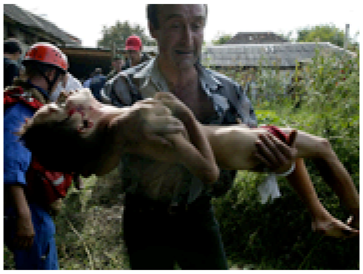


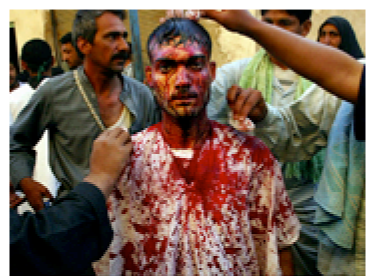


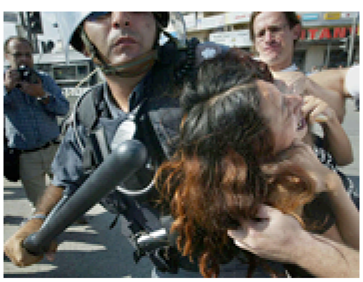




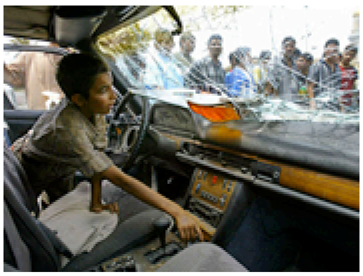
Appendix B: Experiment 2 Photographs (High Arousal)

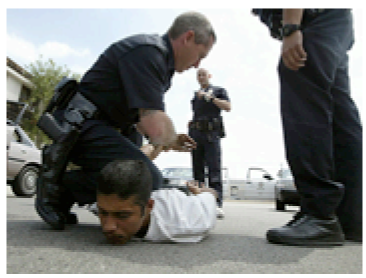






Experiment 2 Photographs (Low Arousal)





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