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Exploring the Hardwired for News Hypothesis: How Threat Proximity Affects the Cognitive and Emotional Processing of Health-Related Print News

Kevin Wise, Petya Eckler, Anastasia Kononova,
& Jeremy Littau

This study explored how the proximity of threatening health news affects cognition and emotion through a 2 (Proximity: High/Low) × 4 (Topic) fractional experiment. Fifty-one participants read four news stories about either local or distant health threats, with their heart rate, skin conductance, and corrugator electromyography recorded. Results showed that high-proximity health threats elicited greater heart rate deceleration than did low-proximity health threats, indicating greater allocation of automatic resources to encoding high-proximity threats. Recognition data demonstrated that details from high-proximity health threats were recognized more accurately than details from low-proximity health threats. There were no significant effects of proximity on either skin conductance levels or corrugator activation. These results are discussed in terms of Shoemaker's (1996) hard-wired for news hypothesis and A. Lang's (2000, 2006) limited capacity model.

Keywords: Cognition; Emotion; Health News; Proximity; Psychophysiology

Journalistic routines, such as the well-worn phrase, “If it bleeds, it leads,” reflect the notion that bad news may be more valuable to readers than good news. Shoemaker (1996), however, wrote that the emphasis on bad news is about more than industry

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values, as she theorized that humans are “hardwired” through evolution to prioritize bad news. According to this theory, humans assess new stimuli first to discover whether something is a source of danger before deciding how to respond. In adapting this psychological process to news, journalists play an important role in helping news consumers to determine potential threats in society. In this sense, journalists are on the lookout for the public, providing information that citizens need to stay out of harm’s way.

Research that further clarifies Shoemaker’s (1996) conception of the role that news plays in society has both practical and theoretical value. With regard to the practical value of such research, journalists who understand this role may better anticipate the needs of audiences in light of the day’s events, which is important because most people do not have the same access to societal institutions necessary to keep up with current affairs. In this sense, not only do journalists provide necessary information that people need to make sense of their world (Lippmann, 1922) but they also serve as a collective “watchdog” in providing a check on government for the benefit of society (Flink, 1997). In industry terms, this role is called “news judgment,” and it is important to understand the audiences on behalf of whom journalists make such judgments. In addition, research in this area informs other communication practitioners on how to better construct more effective messages for their audiences.

Although provocative and logically consistent, the “hardwired for news” hypothesis has undergone minimal experimental testing. Previous research has explored the hypothesis through a limited capacity model of information processing (LC4MP; A. Lang, 2006), but only with regard to news headlines (A. Lang, Borse, Wise, & David, 2002) and broadcast news (Grabe & Kamwahi, 2006). This study further explores the hardwired for news hypothesis through the lens of the LC4MP by measuring people’s physiological responses to and memory for threatening health news presented via text. The proximity, or closeness in physical space, of the news was manipulated, as existing research suggests that it is a key element in the evaluation of threatening information. Health news was chosen because it provides a context in which threatening information is often presented. Before explaining this experiment, we describe the hardwired for news hypothesis, conceptualizations of threat, and our hypotheses about processing threat-related news based on the LC4MP.

Hardwired for News Hypothesis

Shoemaker (1996) argued that people are compelled to pay attention to bad news because doing so has proven advantageous over time. Throughout history, those aware of pending danger before it occurred were more likely to survive and reproduce, thus promoting surveillance behavior through evolution. Although conceding that news is also a product of culture, Shoemaker concluded that biological evolution serves as a foundation for all other factors for news production. Sherry (2004) extended the biological argument by stating that the study of media effects needs a theoretical approach that acknowledges media use is influenced by both nature and nurture. Such an approach would apply both neural and behavioral understandings

of human behavior to interaction with the media and may ultimately provide better explanations than other approaches for media effects. With regard to news, such an approach might begin with an understanding of how different features of news affect people's cognitions and emotions.

Existing research has generally shown that bad news elicits more attention than does good news (for a recent review, see Grabe & Kamhawi, 2006). Negative news stories have been shown to attract more attention and longer reading times than positive stories from audience members (Zillmann, Lei, Knobloch, & Callison, 2004). A similar effect has been observed for photographs, with unpleasant photos depicting victimization attracting longer reading times of the accompanying text and better retention of the information presented, relative to text containing no photos or innocuous photos (Zillmann, Knobloch, & Yu, 2001). However, although valence is certainly an important content attribute, research in psychology suggests a dimensional view of emotion defined by both valence and arousal (P. J. Lang, 1995). Research using standardized pictures, in fact, has shown that whereas short-term encoding is affected by both valence and arousal of stimuli, long-term memory performance is driven largely by arousal (Bradley, Greenwald, Petry, & Lang, 1992). This idea has been supported in news research, with Miller (2006) finding that when people are faced with news that is all negative but with various levels of urgency, attention goes to the most urgent news—that is the “breaking” news instead of the less urgent “live” or traditional negative news stories.

Although the extant research suggests that bad news elicits more attention than does good news, and that breaking news elicits more attention than does live news, an important question is whether there are discrete elements that comprise negative, arousing news. Based on the hardwired for news hypothesis, it would seem that bad, breaking news would provide some threat to readers, but what are the specific attributes of such a threat? Research exploring the effects of fear appeals addresses this question.

Fear appeals have long been used in health promotion campaigns as a way to influence attitudes and behaviors toward desired health outcomes. Examples of such uses date back to the early 1950s and cover a wide range of topics, from dental health (Janis & Feshbach, 1953), safe driving (Leventhal & Niles, 1965), smoking (Insko, Arkoff, & Insko, 1965; Leventhal & Niles, 1964), and tetanus vaccinations (Dabbs & Leventhal, 1966) to, more recently, AIDS prevention (Freimuth, Hammond, Edgar, & Monahan, 1990), breast cancer screening (Kline & Mattson, 2000), and skin cancer prevention (Cho & Salmon, 2006). A number of theoretical models have addressed how people process such fearful or threatening messages; these include the drive model (Higbee, 1969; Janis, 1967; Leventhal, 1970; McGuire, 1969), the parallel response model (Leventhal, 1970), and, more recently, protection motivation theory (PMT; Rogers, 1985) and the extended parallel process model (EPPM; Witte, 1992). Threat is central to both the PMT and the EPPM, which focus on danger control processes—that is, ways of thinking about the threat and how to prevent it. These processes include perceived susceptibility, perceived severity, perceived response efficacy, and perceived self-efficacy.

The rich communication literature on the effects of fear appeals has been systematically examined in several meta-analyses (Boster & Mongeau, 1984; Mongeau, 1998; Sutton, 1982; Witte & Allen, 2000), which concluded that, overall, fear increased the persuasiveness of a message, although the documented relationships have been weak. For instance, for the relationship between fear manipulation and attitude change, the mean correlation found by Boster and Mongeau (1984) was .21; for Mongeau (1998), it was .19; and for Witte and Allen (2000), it was .15. The mean correlations between fear appeal and behavior were .10 (Boster & Mongeau), .12 (Mongeau), and .16 (Witte & Allen). Sutton (1982) employed combined *z* scores, rather than correlations, in his meta-analysis and ignored the effects on attitudes but did find a similar positive relationship between behavior and intention. Witte and Allen examined separately the severity and susceptibility aspects of fear appeal messages and found that susceptibility was positively correlated with attitudes (.12), intentions (.17), and behavior (.14). Given the results, the authors recommended that more attention be paid to these specific features. We do so in this study by exploring how a particular susceptibility cue (proximity) affects cognitions and emotions.

If people are hardwired for bad news, relevant information should elicit a primitive response that enables them to deal with an imminent threat. Recent research by Knobloch-Westerwick, Carpentier, Blumhoff, and Nickel (2005), which tested selective exposure effects for positive and negative online news, supports this view. Knobloch-Westerwick et al. defined the process of *information selection* in terms of utility of news, with news utility increasing with (a) the perceived magnitude of challenges or gratifications, (b) the perceived likelihood of their materialization, and (c) the perceived immediacy, or proximity in time, of their materialization.

This brief discussion of threat models suggests two things: first, perceived susceptibility is an important general cue in processing threatening news; second, the proximity of the particular threat is a specific component of perceived susceptibility. In terms of proximity, closer threats should elicit a stronger response than distant threats. This conclusion is further supported by the manner in which perceived threat has been measured in previous research. For example, Slater and Rasinski (2005) measured concern, worrying, familiarity, and controllability over alcohol-related risks. Cantor and Omdahl (1991) ordered assessments in the following way: (a) liking for activities, (b) likelihood of threatening events, (c) severity of threatening events, and (d) worry about threatening events. Following Atkin and Arkin (1990), Griffin and Dunwoody (2000) measured perceived hazard presence, perceived personal control, and perception of risk posed by the hazard.

Likelihood and proximity are two factors that emerge from this research. The extent of a threat is based largely on the likelihood of its occurrence, and one factor in determining likelihood is proximity, such that something bad happening nearby, in space and/or time, is more threatening than something occurring in the distance. However, what is the relationship between proximity of threat and cognitive processing? Support for the hardwired for news hypothesis requires variance in primitive, psychophysiological responses to threatening stimuli. Such responses have been

explored in previous research using a limited capacity model of motivated mediated message processing (A. Lang, 2006).

The Limited Capacity Model of Motivated Mediated Message Processing

The LC4MP (A. Lang, 2000, 2006) provides a theoretical framework for understanding how the human brain interacts with media over time. The LC4MP has a few central assumptions. First, the brain has limited resources for processing information in the environment. Information processing consists of at least three major subprocesses that occur continuously and simultaneously: encoding, storage, and retrieval. The allocation of resources to these subprocesses can be either controlled or automatic: controlled allocation of resources is purposeful and reflects a person's current goals; automatic allocation of resources, in contrast, occurs in response to aspects of a message that represent novel or signal stimuli. Activation of the aversive (avoid) and appetitive (approach) motivational systems also elicit both controlled and automatic resource allocation. The combined allocation of controlled and automatic processing resources to encoding, storage, and retrieval determines how well a person remembers a particular stimulus.

Research using the LC4MP has demonstrated that motivationally relevant stimuli elicit automatic processing resources (A. Lang, 2006). One study even investigated the hardwired for news hypothesis by using physiological methods to see if people had cardiac-orienting responses to headlines appearing on a computer screen (A. Lang et al., 2002). This study predicted that headlines appearing on a computer screen that were both novel and signal stimuli would elicit orienting responses. First, because the appearance of information on the screen (regardless of content) would represent a change in the environment, the headline should be a novel stimulus and, therefore, elicit an orienting response and the accompanying allocation of resources to encoding. Second, because people "know" that headlines are meant to signal important information, it was thought that headlines might be signal stimuli and, thereby, elicit orienting and resource allocation. In addition, it was thought that deviant, or unusual, headlines might elicit greater orienting due to their motivational relevance—that is, the unusual has more significance than the expected. Surprisingly, however, the results did not support any of these hypotheses. Rather, headlines appearing on a computer screen did not elicit orienting; although deviant headlines were remembered better than nondeviant headlines. In another experiment in the same article, a new condition was added: headlines that provided a personal warning (e.g., "There's someone behind you"). In that study, these personally relevant headlines did elicit orienting, whereas the other types of headlines did not. These results suggest that when reading text on a screen, only certain types of information elicit orienting. However, differences in the memory data as a function of deviance suggest that other mechanisms of resource allocation (e.g., controlled processing and motivational relevance) are operating.

According to the LC4MP, threatening news presented on a screen should activate the aversive motivational system, which serves to protect people from harm. There

are two elements of motivational activation: resource allocation and emotional experience. Concerning resource allocation, low-level aversive activation leads to the automatic allocation of resources to encoding and storage. As activation increases, however, a person must shift resources from taking in the threat to considering whether to do something about it (i.e., fight or flight). At that point, resources shift from encoding the threatening stimulus to retrieving information that dictates the appropriate action to be taken to protect the organism from threat. Resources continue to be allocated to storage, as protection is well served by remembering what a person has done.

In terms of news consumption, reading threatening news should activate the aversive motivational system, but probably at low levels, resulting in some increase in resource allocation to encoding and storage. Increasing the proximity of the threat should further activate the aversive system, leading to a further increase in resources automatically allocated to encoding and storage. Unless the threat is extremely relevant or proximate, it is doubtful that reading news sufficiently activates the aversive system to the point where resources shift from encoding and storage to storage and retrieval. Hence, as indicated by the aforementioned threat models, proximity is an important component of threat; as threat gets closer, the aversive system is activated and more resources are allocated to encoding. As long as the stimulus remains mild enough (which should be the case with news reports), people are unlikely to feel that they must escape from the stimulus (that is, the news story). However, the greater the likelihood that they might have to respond to the threat being described at some point in the future, the more resources should be allocated to encoding, storage, and, possibly, retrieval, as people assess the personal relevance of the story and steps they should take to mitigate future harm to themselves. This increased resource allocation should lead, overall, to more elaborative processing, resulting in greater evidence of cognitive effort during message processing and increased recognition, cued recall, and free recall post processing.

Operationally, resource allocation can be measured in a couple of ways. Previous research has used heart rate deceleration as a physiological indicator of resources allocated to encoding (A. Lang, 1994), because as people increase their attention to an external stimulus, their heart rate tends to decelerate as a function of parasympathetic activation. However, when people attend to internal stimuli (e.g., mental arithmetic or mental imagery), heart rate tends to accelerate. In the case of reading threatening stories, it is likely that heart rate should decelerate over time, indicating that cognitive effort is being expended on reading the stories. However, as proximity increases, it is conceivable that heart rate might (towards the end of stories) accelerate in the most proximate stories, as people focus more internally on how to deal with the threat represented in the story. In addition, recognition can be used as an indicator of how well the information has been encoded (A. Lang, 2006).

If people are, indeed, hardwired for news, as has been hypothesized, meaning that news acts as a motivationally relevant stimulus, the LC4MP and previous conceptualizations of perceived threat would predict:

- H1: News articles of high-proximity health threats elicit greater heart rate deceleration than news articles of low-proximity health threats.

H2: Details of news articles about high-proximity health threats are recognized more accurately than details of news articles of low-proximity health threats.

The second component of motivational activation is emotional experience. Many researchers use a dimensional theory of emotion to assess emotional experience. In this approach, emotion is described along two major dimensions: arousal and valence (P. J. Lang, 1995). The LC4MP suggests that motivationally relevant stimuli increase emotional experience and elicit greater activation in the motivational systems. Such a change in motivational activation would be reflected by increased sympathetic nervous system (SNS) activation, which can be measured by skin conductance. Thus, to the extent that high-proximity health threats are more motivationally relevant than are low-proximity health threats, high-proximity health threats would be expected to elicit greater skin conductance. Therefore, the following hypothesis was posed:

H3: News articles about high-proximity health threats elicit greater skin conductance than news articles about low-proximity health threats.

Furthermore, to the extent that high-proximity health threats elicit greater aversive activation than do low-proximity health threats, high-proximity health threats would be expected to elicit a more unpleasant emotional experience. Unpleasantness can be measured physiologically through activation of the corrugator supercillii muscle (Tassinari, Cacioppo, & Vanman, 2007). Therefore, the following hypothesis was posed:

H4: News articles of high-proximity health threats elicit greater corrugator activation than news articles of low-proximity health threats.

These hypotheses were explored through an experiment in which participants read health-related news reports pertaining to either the local community or a distant community, with their physiology measured as they read each story. Later, they were given a recognition test to assess.

Methods

Participants

Fifty-one undergraduates were recruited from an introductory journalism class at a large Midwestern university to participate in this study. Participants received extra credit for their participation. One participant's data were discarded due to equipment malfunction. Skin conductance and corrugator data from an additional 6 participants and heart rate data from an additional 13 participants were discarded due to experimenter error, equipment malfunction, or excessive noise in the physiological signal. Therefore, data from 50 participants (44 for skin conductance/corrugator and 37 for heart rate) were analyzed.

Design

This experiment employed a 2 (Proximity) \times 4 (Topic) fractional within-participants design. *Proximity* referred to the likelihood of a particular health issue having a

perceived impact on participants, which was manipulated in terms of high versus low. In the high condition, the stimulus discussed a story about a health concern in the same town where the participants lived; in the low susceptibility condition, the story took place more than 500 miles away. *Topic* referred to the health concern featured in each story, with stories presented randomly in either a high- or low-proximity condition, such that each participant read two high- and two low-proximity stories.

Stimuli

Much of the empirical literature on threat and fear appeals comes from the field of health communication and promotion (e.g., Cho & Salmon, 2006; Dabbs & Leventhal, 1966; Freimuth et al., 1990; Insko et al., 1965; Janis & Feshbach, 1953; Kline & Mattson, 2000; Leventhal & Niles, 1964, 1965). This study examines the threat concept in a health context to build on this tradition. Four stories were written about health issues relevant to college students: drunken driving, depression, meningitis, and consumption of trans fats.

We chose these topics after examining national health news coverage and because of the high relevance of these topics to college students. Among college students, 29% reported driving after consuming alcohol and another 23% reported riding with a driver who was high or drunk. Among students who drove at least once a week, the numbers were even higher (Wechsler, Lee, Nelson, & Lee, 2003). Depression is another salient issue for college students; as the 2006 National College Health Assessment Survey of more than 23,000 students from 34 schools nationwide showed, 13% of respondents said they felt so depressed that it was difficult to function three to eight times during the past year, and for another 9% these episodes occurred nine or more times. Meningitis was included as a topic to represent the array of health threats occurring from acute and infectious, rather than chronic, diseases. Threat susceptibility acquires a whole new connotation when it refers to bacterial meningitis, a true medical emergency, which often strikes young adults and spreads by close contact. The issue of trans fats consumption was chosen because of its recent presence in the news as a possible subject of regulation in the restaurant industry. This issue also seemed relevant because of its implications for health policy and the possibility that research participants could soon be affected by such decisions in their communities.

Each story was edited into a local threat (high-proximity) version and a distant threat (low-proximity) version. High- and low-proximity stories were identical in terms of details and names used; the only difference between them was the physical location of the health issue. Keeping details consistent allowed us to ask the same recognition memory questions for both stories. Story length ranged from 430–500 words. Stimulus materials are available upon request from the first author.

Dependent Variables

Physiological signals were measured, amplified and recorded using Coulbourn V-series modules linked to a PC computer. The VPM software program (Cook,

Atkinson, & Lang, 1987) coordinated the sampling and storage of physiology data. The MediaLab software program (Jarvis, 2004) controlled stimulus presentation and self-report data collection. Physical properties of the text (e.g., font, font size, and clarity) were kept consistent across stories and conditions.

Heart rate

Participants' heart rates were recorded by placing 8 mm In Vivo Metric Ag/AgCl electrodes on each participant's forearm. A Coulbourn V75-04 bioamplifier amplified and filtered the heart rate signal. A Schmitt trigger interrupted the computer every time it detected the R-spike of the cardiac wave. The computer initially collected data in interbeat intervals, or milliseconds between consecutive R-spikes. Using VPM, we edited data offline and converted it to beats per minute.

Skin conductance

Skin conductance was recorded by placing two 8 mm InVivo Metric Ag/AgCl electrodes on the palm of each participant's nondominant hand. We computed skin conductance curves using the same method described above for heart rate.

Corrugator activation

Corrugator activation was recorded by placing two 4 mm InVivo Metric Ag/AgCl electrodes over each participant's left eyebrow, where the corrugator supercili is located. Corrugator response curves were computed using the same method described for heart rate and skin conductance above.

Recognition memory

Recognition memory was measured with a 16-item, four-option multiple-choice test, with four questions for each story. The response to each question was scored as either a 1 (hit) or 0 (miss). We then computed participants' percentage accuracy for each story and collapsed those accuracy scores across the two levels of proximity.

Procedure

Each participant entered the laboratory, provided informed consent and sat down at a computer terminal with a 15-inch monitor. An experimenter prepared the participant's skin, attached the necessary sensors and ensured that the data-acquisition computer was capturing a clear physiological signal. The experimenter then explained that the participant would read four news stories and answer several questions about how each story made him or her feel. Data collection began when each participant indicated that he or she understood the procedure and had no further questions.

Participants read four news stories in the experiment, with two from the high-proximity condition and two from the low-proximity condition. MediaLab randomized the story order for each participant. Stimulus presentation began with instructions appearing on the video monitor, followed by a 10-second baseline period

in which participants saw a black screen. After the baseline period, the first story appeared on the screen. Participants read the story and then clicked on a “Continue” link that prompted another 10-second baseline period. At that point, physiological data collection stopped as participants answered self-report questions (not reported here). Participants then moved onto the next story. This process was repeated until all four stories were completed.

After completing all four stories, participants took part in an unrelated experiment that served as a distraction task for this study, to clear short-term memory prior to the recognition test. The distraction task lasted approximately 30 minutes and consisted of participants looking at four news Web sites and reading news stories with embedded video about international affairs. When participants had completed the distraction task, the experimenter administered a 16-item forced-choice recognition test consisting of four questions for each of the stories that participants had read previously. Each set of four questions was given to participants as a block corresponding to a particular story, with MediaLab randomizing the order of the question blocks. Upon completion of the recognition test, participants were thanked, debriefed and dismissed.

Data Reduction

Response curves were created for all three physiological signals by computing change scores across the period when participants read each story. Because of individual differences in reading speed, the time spent reading each article varied across participants. To use time as a repeated measure in these analyses, it was necessary to transform these reading periods into an equal number of segments, which was done by dividing each reading period into thirds (i.e., beginning, middle, and end), and then computing the average heart rate or skin conductance for each third. For example, if a participant took 30 seconds to read a particular story, that period was divided into three equal segments of 10 seconds each. The average physiological level during each of those 10-second segments was then computed, and the average level during the 5-second period immediately prior to the appearance of the story was subtracted from the average level during each of the three reading segments, yielding change scores for each third of the reading period.

If the time spent reading a particular story was not divisible by three, remaining seconds were divided between the first two segments. For instance, a 32-second reading period would have been divided into segments of 11, 11, and 10 seconds. This technique yielded four data points for each segment (counting the onset of each story), allowing repeated-measures analyses of tonic heart rate and skin conductance level as participants read the stories.

Analyses

Physiological data were analyzed with a 2 (Proximity) \times 2 (Repetition) \times 4 (Time) repeated measures ANOVA, as these measures represent different concepts.

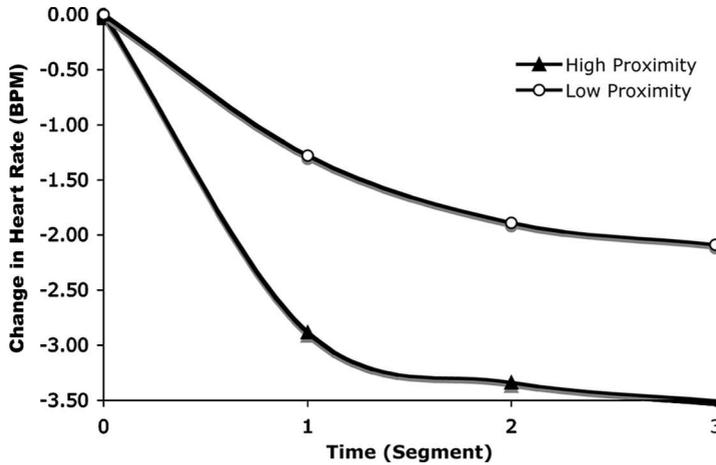


Figure 1 Heart rate change over time as a function of the proximity of threatening health news.

The Huynh-Feldt degrees of freedom correction was used for univariate analyses that violated the sphericity assumption. Recognition data were analyzed with a paired samples *t* test.

Results

Hypothesis 1 predicted that news articles of high-proximity health threats would elicit greater heart rate deceleration than news articles of low-proximity health threats. The quadratic trend of the Proximity \times Time interaction was significant, $F(1, 35) = 3.63$, $p < .05$, partial eta-squared = .11. As Figure 1 shows, high-proximity health threats elicited greater heart rate deceleration than did low-proximity health threats, providing support for Hypothesis 1.

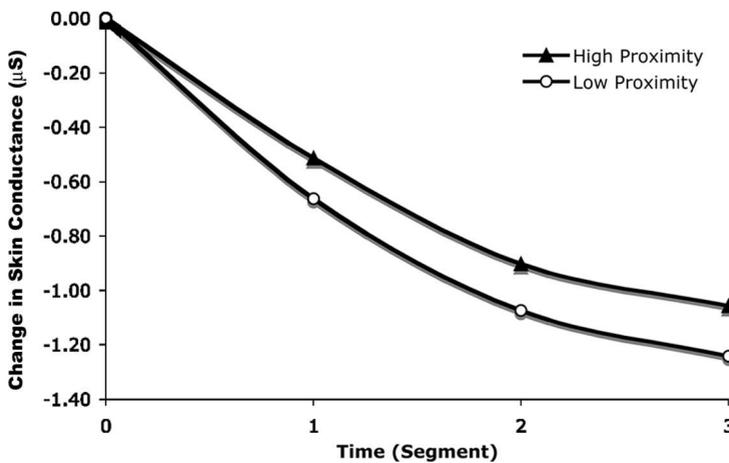


Figure 2 Skin conductance change over time as a function of the proximity of threatening health news.

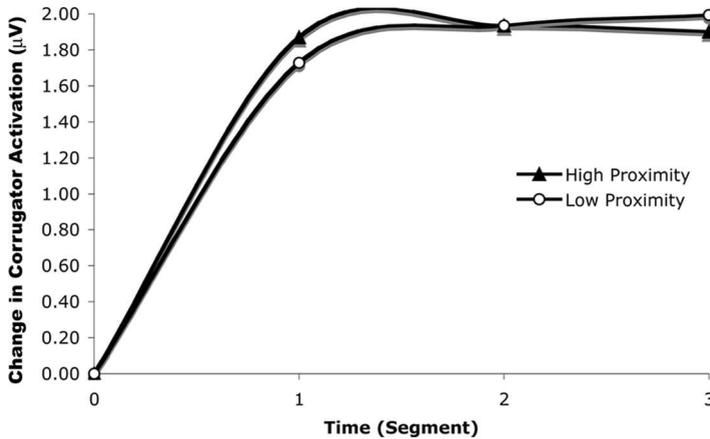


Figure 3 Corrugator activation change over time as a function of the proximity of threatening health news.

Hypothesis 2 predicted that details of news articles about high-proximity health threats would be recognized better than details of news articles of low-proximity health threats. The main effect of proximity on recognition memory was significant, $t(49) = 6.18$, $p < .01$, $d = .96$. Specifically, participants recognized details of high-proximity health threats ($M = .38$, $SD = .09$) more accurately than they recognized details of low-proximity health threats ($M = .29$, $SD = .08$), providing support for Hypothesis 2.

Hypothesis 3 predicted that news articles about high-proximity health threats would elicit greater skin conductance than news articles about low-proximity health threats. Figure 2 shows that skin conductance decreased steadily during the period when participants were reading articles. This decrease is typical, as electrodermal activity tends to return to prestimulus levels if no new stimulation occurs. However, this decrease was not moderated by threat proximity, as the Proximity \times Time interaction on skin conductance was not significant, $F(3, 129) = .16$, partial eta-squared = .00, observed power = .08. Hence, Hypothesis 3 was not supported.

Hypothesis 4 predicted that news articles about high-proximity health threats would elicit greater corrugator activation than news articles about low-proximity health threats. Figure 3 shows increased corrugator activation during the first segment of the reading period that tapers off through the rest of the period. Although this increase in corrugator activation indicates that threatening health-related news did lead to unpleasant emotional experience, this experience was not moderated by threat proximity, as the Proximity \times Time interaction on corrugator activation was not significant, $F(3, 129) = .72$, partial eta-squared = .02, observed power = .16. Thus, Hypothesis 4 was not supported.

Discussion

The findings from this experiment provide partial support for the hardwired for news hypothesis and advance our understanding of how people process written news.

As the hardwired for news hypothesis and the LC4MP suggest, threatening news is capable of eliciting primitive physiological responses associated with resource allocation and emotional experience. Specifically, cardiac response, typically associated with resource allocation, was moderated by threat proximity, and more cognitive resources were allocated to encoding high-proximity health news than to low-proximity health news. Skin conductance and corrugator activation, however, were not moderated by threat proximity. Although the heart rate data suggest that proximal threats are more motivationally relevant, the skin conductance data do not support this finding. Although no meaningful difference emerged between high- and low-threat proximity on corrugator activation, Figure 3 does suggest that threatening text-based news is capable of eliciting physiological unpleasantness.

These data suggest the following time course of events when people read threatening news: Corrugator activation quickly ramps up as people realize they are reading something unpleasant but reaches its peak fairly quickly and then levels off for the rest of the reading period. This corrugator activation finding may suggest a ceiling effect in the unpleasant emotional experience that comes with the identification of threatening news. Although the unpleasantness of reading threatening news is physiologically manifest, in this case, the motivational relevance of this news was not enough to elicit skin conductance activity, as it diminished in its usual linear fashion with repetitive stimuli (words). As people recognize the proximity of threat, resource allocation is modulated, such that local threats are encoded better than distant threats; yet those threats are not immediate enough to elicit the skin conductance increase that might be expected if people truly were preparing for action. It, thus, appears that, although people do recognize threat proximity, text is not vivid enough to elicit the type of preparatory response activation that would include skin conductance increase. This finding was consistent across topics, both for the chronic threats of depression, drunk driving, and trans fats and for the acute and contagious bacterial meningitis. Hence, although these findings indicate that text news is capable of eliciting physiological responses associated with resource allocation and emotional experience (as expected from the hardwired for news hypothesis), there is no evidence of the type of primitive aversive activation that has been associated with more vivid audio/visual stimuli (A. Lang, 2006). Clearly, more work is needed to identify if there are features of text-based news that can elicit such activation. This study drew from prominent theories of threat processing in selecting proximity as an independent variable. Future research should look at other components of threat, such as threat severity and self- or response-efficacy.

By looking at news stories instead of headlines, this study builds on the finding that people orient to personally relevant headlines (A. Lang et al., 2002). There is now moderate evidence that elements of longer news stories, in addition to headlines, are capable of eliciting primitive physiological responses associated with cognitive resource allocation. Furthermore, the hardwired for news hypothesis is extended by the finding that a particular content feature, threat proximity, compels the automatic allocation of processing resources to encoding.

Considerable previous research has demonstrated how various features of broadcast news affect resource allocation and emotional experience (for a summary, see Lang, Potter, & Grabe, 2003). Here we illustrate the motivational relevance of print (as opposed to broadcast) news. This study is one of only a few that has used physiological responses to explore how people process text (Lang et al., 2002; Thorson & Lang, 1992; Wise, Bolls, & Schaefer, 2008). Ironic as it may seem, much of the time that people spend on so-called “new” media goes towards reading text. Therefore, research on how people process text and how text interacts with other modalities is critical to understanding the cognitive and emotional processing of interactive media.

The heart rate and recognition data suggest that proximate threats elicit more encoding resources than distant threats, which supports conceptualizations of threat that emphasize proximity. The theoretical utility of this finding is limited, however, by the absence of cued or free-recall data, which would have provided additional insight into how threat proximity affects storage and retrieval, in addition to encoding. Although it was initially suggested that heart rate might accelerate towards the end of messages, as people became more internally focused on how to handle the threats described in these messages, it is apparent from Figure 1 that no such acceleration took place. Had there been acceleration, we might have expected differences in retrieval, as people identify old information that might help them to handle a particular threat. Although the obtained data do not completely eliminate this possibility, the heart rate data suggest that people were still externally focused on encoding the information in the story rather than internally focused on retrieving old information to deal with a particular threat.

One practical implication of these results relates to localization of news. Given that more resources are allocated to high-proximity than low-proximity news, there is support for the practice of localizing news stories. The results from the present study indicate that a localized story would also personalize the threat, and that journalists' inclination to emphasize negative news, therefore, is justified. The media are often criticized for reporting too much negative news, but, in terms of getting readers' attention, it appears that for online reading, highly local, negative news may be most compelling.

This application of the findings should not be seen as a justification for employing unethical journalistic methods but, rather, it confirms past thinking that negative news does get people's attention. This information is helpful for news practitioners, but future research could test whether it benefits news consumers by providing them with a counterweight against any unethical application of this knowledge. These results could also serve practitioners involved in the creation of health promotion campaign messages or risk communication, as they could apply geographical proximity, in addition to the recommended use of psychological proximity (Murray-Johnson & Witte, 2003), when trying to increase perceived susceptibility. As Witte and Allen (2000) demonstrated, susceptibility is positively, although weakly, correlated with attitudes, intentions, and behaviors, and, consequently, this aspect of

message creation should be an important part of the overall campaign and the strategies employed.

The results from this study must be tempered by some possible limitations evidenced in this research. First, this experiment was conducted in a controlled laboratory environment. While this is certainly different than other environments in which people normally read online news, there is no reason to believe that such differences would affect the mechanics of reading from a computer monitor. Participants were seated in a chair at a desktop workstation, similar to the furnishings they would experience when reading online news in a home office, computer lab, or classroom. Furthermore, participants have little conscious control over the autonomic responses reported here. We are also confident that fatigue should not have confounded these results, as people, on average, read news for 42 minutes at a time (National Newspaper Association, 2008), and the participants in this study spent approximately 6–7 minutes reading the news stories.

Second, although print news appears capable of eliciting responses consistent with the hardwired for news hypothesis, it seems to lack the impact (in term of motivational relevance) of broadcast news. Perhaps this difference occurs because text lacks the structural features of broadcast news that have been shown to elicit responses more consistent with motivational relevance. Nonetheless, at least one feature of print news, threat proximity, does appear to moderate cognitive resource allocation. This finding raises the possibility that other features of written news may have similar effects. As Shoemaker (1996) suggested, news fulfills the surveillance function that helps people to survive. Research identifying concrete message features that activate the embodied human motivational and cognitive systems can contribute to improvement in how newspapers and other media fulfill this important function.

References

- Atkin, C., & Arkin, E. B. (1990). Issues and initiatives in communicating health information. In C. Atkin & L. Wallack (Eds.), *Mass communication and public health: Complexities and conflicts* (pp. 13–40). Newbury Park, CA: Sage.
- Boster, F. J., & Mongeau, P. (1984). Fear-arousing persuasive messages. In R. N. Bostrom (Ed.), *Communication yearbook* (Vol. 8, pp. 330–375). Beverly Hills, CA: Sage.
- Bradley, M. M., Greenwald, M. K., Petry, M. C., & Lang, P. J. (1992). Remembering pictures: Pleasure and arousal in memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 18, 379–390.
- Cantor, J., & Omdahl, B. L. (1991). Effects of fictional media depictions of realistic threats on children's emotional responses, expectations, worries, and liking for related activities. *Communication Monographs*, 58, 384–401.
- Cho, H., & Salmon, C. T. (2006). Fear appeals for individuals in different stages of change: Intended and unintended effects and implications on public health campaigns. *Health Communication*, 20, 91–99.
- Cook, E. W., III, Atkinson, L. S., & Lang, K. G. (1987). Stimulus control and data acquisition for IBM PCs and compatibles. *Psychophysiology*, 2, 726–727.

- Dabbs, J. M., Jr., & Leventhal, H. (1966). Effects of varying the recommendations in a fear-arousing communication. *Journal of Personality & Social Psychology*, 4, 525–531.
- Flink, S. E. (1997). *Sentinel under siege: The triumphs and troubles of America's free press*. Boulder, CO: Westview Press.
- Freimuth, V. S., Hammond, S. L., Edgar, T., & Monahan, J. L. (1990). Reaching those at risk: A content-analytic study of AIDS PSAs. *Communication Research*, 17, 775–791.
- Grabe, M. E., & Kamhawi, R. (2006). Hard wired for negative news? Gender differences in processing broadcast news. *Communication Research*, 33, 346–369.
- Griffin, R. J., & Dunwoody, S. (2000). The relation of communication to risk judgment and preventive behavior related to lead in tap water. *Health Communication*, 12, 81–107.
- Higbee, K. L. (1969). Fifteen years of fear arousal: Research on threat appeals: 1953–1968. *Psychological Bulletin*, 72, 426–444.
- Insko, C. A., Arkoff, A., & Insko, V. M. (1965). Effects of high and low fear-arousing communications upon opinions toward smoking. *Journal of Experimental Social Psychology*, 1, 256–266.
- Janis, I. L. (1967). Effects of fear arousal on attitude change: Recent developments in theory and experimental research. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 3, pp. 166–225). New York, NY: Academic Press.
- Janis, I. L., & Feshbach, S. (1953). Effects of fear-arousing communications. *Journal of Abnormal and Social Psychology*, 48, 78–92.
- Jarvis, W. B. G. (2004). *MediaLab* [Computer software]. New York, NY: Empirisoft.
- Kline, K. N., & Mattson, M. (2000). Breast self-examination pamphlets: A content analysis grounded in fear appeal research. *Health Communication*, 12, 1–21.
- Knobloch-Westerwick, S., Carpentier, F. D., Blumhoff, A., & Nickel, N. (2005). Selective exposure effects for positive and negative news: Testing the robustness of the informational utility model. *Journalism & Mass Communication Quarterly*, 82, 181–195.
- Lang, A. (1994). What can the heart tell us about thinking? In A. Lang (Ed.), *Measuring psychological responses to media* (pp. 99–113). Hillsdale, NJ: Lawrence Erlbaum.
- Lang, A. (2000). The limited capacity model of mediated message processing. *Journal of Communication*, 50, 46–70.
- Lang, A. (2006). Using the limited capacity model of motivated mediated message processing to design effective cancer communication messages. *Journal of Communication*, 56, S57–S80.
- Lang, A., Borse, J., Wise, K., & David, P. (2002). Captured by the World Wide Web: Orienting to structural and content features of computer-presented information. *Communication Research*, 29, 215–245.
- Lang, A., Potter, D., & Grabe, M. E. (2003). Making news memorable: Applying theory to the production of local television news. *Journal of Broadcasting & Electronic Media*, 47, 113–123.
- Lang, P. J. (1995). The emotion probe: Studies of motivation and attention. *American Psychologist*, 50, 372–385.
- Leventhal, H. (1970). Findings and theory in the study of fear communications. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 5, pp. 119–186). New York, NY: Academic Press.
- Leventhal, H., & Niles, P. (1964). A field experiment on fear arousal with data on the validity of questionnaire measures. *Journal of Personality*, 32, 459–479.
- Leventhal, H., & Niles, P. (1965). Persistence of influence for varying duration of exposure to threat stimuli. *Psychological Reports*, 16, 223–233.
- Lippmann, W. (1922). *Public opinion*. New York, NY: Macmillan.
- Mongeau, P. (1998). Another look at fear-arousing persuasive appeals. In M. Allen & R. W. Preiss (Eds.), *Persuasion: Advances through meta-analysis* (pp. 53–68). Cresskill, NJ: Hampton Press.
- McGuire, W. J. (1969). The nature of attitudes and attitude change. In G. Lindzey & E. Aronson (Eds.), *The handbook of social psychology* (Vol. 3, pp. 136–314). Reading, MA: Addison-Wesley.

- Miller, A. (2006). Watching viewers watch TV: Processing live, breaking and emotional news in a naturalistic setting. *Journalism & Mass Communication Quarterly*, 83, 511–529.
- Murray-Johnson, L., & Witte, K. (2003). Looking toward the future: Health message design strategies. In T. L. Thompson, A. M. Dorsey, K. I. Miller, & R. Parrot (Eds.), *Handbook of health communication* (pp. 473–495). New York, NY: Lawrence Erlbaum.
- National Newspaper Association (2008, February). *83% of adults (18-years-old or older) read America's community newspapers weekly*. Columbia, MO: Brian Steffens.
- Rogers, R. W. (1985). Attitude change and information integration in fear appeals. *Psychological Reports*, 56, 179–182.
- Sherry, J. L. (2004). Media effects theory and the nature/nurture debate: A historical overview and directions for future research. *Media Psychology*, 6, 83–109.
- Shoemaker, P. J. (1996). Hardwired for news: Using biological and cultural evolution to explain the surveillance function. *Journal of Communication*, 46(3), 32–47.
- Slater, M. D., & Rasinski, K. A. (2005). Media exposure and attention as mediating variables influencing social risk judgments. *Journal of Communication*, 55, 810–828.
- Sutton, S. R. (1982). Fear-arousing communications: A critical examination of theory and research. In J. R. Eiser (Ed.), *Social psychology and behavioral medicine* (pp. 303–337). London: Wiley.
- Tassinari, L. G., Cacioppo, J. T., & Vanman, E. J. (2007). The skeletomotor system: Surface electromyography. In J. T. Cacioppo, L. G. Tassinari, & G. G. Berntson (Eds.), *Handbook of psychophysiology* (3rd ed., pp. 267–291). New York, NY: Cambridge University Press.
- Thorson, E., & Lang, A. (1992). The effects of television videographics and lecture familiarity on adult cardiac orienting responses and memory. *Communication Research*, 19, 346–369.
- Wechsler, H., Lee, J. E., Nelson, T. F., & Lee, H. (2003). Drinking and driving among college students: The influence of alcohol-control policies. *American Journal of Preventive Medicine*, 25, 212–218.
- Wise, K., Bolls, P. D., & Schaefer, S. (2008). Choosing and reading online news: How available choice affects cognitive processing. *Journal of Broadcasting & Electronic Media*, 52, 69–85.
- Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs*, 59, 329–349.
- Witte, K., & Allen, M. (2000). A meta-analysis of fear appeals: Implications for effective public health campaigns. *Health Education & Behavior*, 27, 591–615.
- Zillmann, D., Knobloch, S., & Yu, H. S. (2001). Effects of photographs on the selective reading of news reports. *Media Psychology*, 3, 301–324.
- Zillmann, D., Lei, C., Knobloch, S., & Callison, C. (2004). Effects of lead framing on selective exposure to Internet news reports. *Communication Research*, 31, 58–81.

Appendix

Examples of Stories Used (Low Proximity and High Proximity)

Sharp Rise in Drunk Driving Concerns Seattle Officials

By Peter Hirschfeld

Staff Writer

The number of people charged with driving under the influence of alcohol has skyrocketed in Seattle over the past two years despite a concerted effort by law enforcement designed to curtail this dangerous behavior.

Between 2000 and 2005 the number of drivers charged with drunk driving has increased sharply each year. Overall, 702 people were arrested last year on Seattle streets for driving while intoxicated, and it has consistently held at a rate of nearly two drivers per day since last year. The number of accidents related to drunk driving also is sharply on the rise, with 40 accidents last year and 18 of them fatal.

Of the 30 fatalities that came at the hand of drunk drivers, 10 were pedestrians, meaning that even those walking the streets are not immune to the danger.

“We’ve seen a dramatic rise in the numbers,” says John Flannigan, public information specialist for the city of Seattle. “It’s a concerning figure, from a traffic safety perspective. What concerns us most is that these incidents are happening during any time of the day, even during the daytime. It’s just not safe to be a driver in this town right now.”

City officials are worried mostly because this increase has come even as the city and the University of Seattle both have made a concerted effort to curtail drunk-driving behavior. Several programs on and off campus were created in 2003 with a \$100,000 grant from the federal government. Since the programs were created, the number of arrests per year has gone from 550 to 702.

Flannigan said the number of incidents in his city, where drunk-driving arrests are about twice the national average, is sending the wrong message to students.

“Our prevention messages are based on the idea that if you drink and drive, you will get caught,” he said. “When people do it and get away with it, it sends the message to these drivers that they can do it without penalty.”

Of greater concern is that quite a few of the DUI cases in the past two years are the result of stops related to other problems. Many, if not most, DUI-alcohol cases in the past year stem from conventional stops for speeding, faulty equipment, or other run-of-the-mill civil offenses.

Police chief Tom Kelly is afraid this means that the police department, already stretched thin and undermanned due to budget cuts, is merely catching drunk drivers because they are violating another law first.

“In a DUI-alcohol case, oftentimes it’s a stop for running a red light or going 10 miles over the speed limit,” Kelly said. “The driving wasn’t bad necessarily. And there was no accident. We’d much rather catch them because they were driving erratically and showing signs of being intoxicated.”

Sharp Rise in Drunk Driving Concerns Local Officials

By Peter Hirschfeld

Staff Writer

The number of people charged with driving under the influence of alcohol has skyrocketed in (local town) over the past two years despite a concerted effort by law enforcement designed to curtail this dangerous behavior.

Between 2000 and 2005 the number of drivers charged with drunk driving has increased sharply each year. Overall, 702 people were arrested last year on (local town) streets for driving while intoxicated, and it has consistently held at a rate of nearly two drivers per day since last year. The number of accidents related to drunk driving also is sharply on the rise, with 40 accidents last year and 18 of them fatal.

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