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AN IMAGE OF COMMUNICATION: THEORIES OF IMAGING IN COGNITIVE PSYCHOLOGY

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ABSTRACT

In an empirical study, visual breakpoints were created from a motion video presentation. These were then used, along with the original motion video presentation, in a memory test experiment testing for recall of abstract information contained in the presentation narrative. Twenty subjects, undergraduate psychology students, marked the breakpoints. Next, thirteen subjects viewed a the presentation which contained only the still breakpoint frames. Fourteen students viewed the original, motion video presentation. Each group was given a recall test on the facts in the presentation narrative immediately after exposure and 48 hours later. The breakpoints were graphed and analyzed for characteristics relevant to the visual media's tradition of the decisive moment. In addition, it was proposed four types of breakpoints could be identified. The memory test yielded no significant results. The hypothesis, that breakpoint subjects would perform better than motion subjects in a memory test remains unsupported.

LITERATURE SEARCH

In journalism and mass communications, agenda setting, the ability of the media to place a topic into the popular conversation of the people, is an acknowledged phenomenum. The exact workings of agenda setting are still being researched, but the role of the image in the process has been noted by many. In the media, the most informative photograph, the one considered as contributing significantly to the agenda setting process, is referred to as the "decisive moment."

Cognitive psychologists also have noted the power of the concrete or the visual when compared to the abstract or semantic, particularly when encoding and recalling memory in paired associates experiments. Further research indicates there are breakpoints, points of action within a continuing event, which are more meaningful than other points wihin the action.

It is possible that what journalists have observed on the job, agenda setting and the decisive moment, and what cognitive psychologists have observed in the lab, paired associates and breakpoints, are very closely linked.

A Belief in the Power of Images

The job of a journalist is to create pictures of the world in readers' heads, wrote Lippman in his 1922 book, Public Opinion (Defluer & Ball-Rokeach, 1989). If the journalist is successful, the reader will be properly informed. Today, those pictures are not verbal descriptions in print or voice, but, more often than not, real-time images of life and death situations delivered by television. However, the medium that can deliver hundreds of images per newscast, only delivers the equivalent of two columns of newspaper text during that same time period (Mankiewicz and Swerdlow 1979, 97). Whether they are of equivalent value or not, pictures made in the camera now take the place of thousands of words.

Lippman wrote that the images created by journalists could change the course of history. Meyrowitz (1985) writes that the British and American militaries still believe that. They did not permit full coverage of the Falklands and Grenada conflicts because they did not wish their verbal descriptions of these "rescue missions" to conflict with any images which might appear. He said this was the legacy of Vietnam.

> The televising of the Vietnam War may have been a double blow to the support for the war as it was being conducted. First, television gave Americans an unprecedented intimate view of the "enemy." In radio and newspaper stories, the words "enemy" and "friend," or "communist" and "freedom fighter" are quite distinct. But on television, our friends and our enemies in Vietnam looked very much alike. This made it quite difficult to maintain a traditional "them versus us" attitude....

> Second, television revealed a back region view of our army and of warfare in general. The disorganized and bloody view of fighting may have been even more damaging to the war effort. The fighting pictured on television seemed very different from a war fought the way John Wayne would have fought it. The you-are-a-soldier view offered by television cameras gave little sense of overall action or movement. There were no clear "fronts," no feelings of "advance." Instead of verbal abstractions such as "fierce battle" or "victory" or "fighting for democracy" (once offered by newspapers and radio), there were concrete images of wounded soldiers and civilians, screaming children, defoliated jungles, and scared refugees. (Meyrowitz 1985, 136)

In 1950, 9% of American households owned a television. In 1960, 87 % of homes had TV (Cook, Gomery & Lichty 1989, 165). Meyrowitz suggests there is a link between the course of American history and the rise of television. He notes the civil rights movement ceased to be a local southern issue as images of the affluent life depicted on the sitcoms flowed nightly into more than half of America's homes. These were soon followed by images of abusive southern governments assaulting peaceful marchers. More importantly, TV broadcast easy to understand images, images that, unlike print, require no learned skills with which to translate the information in them. These were images which showed the conflict of appearances between public (front stage) and private (backstage) behavior--images even a child could understand.

> Exactly which age cohort should be considered the "first TV children" is not clear. But one reasonable suggestion is the first age group that had televisions in at least half of its households before entering school and being introduced to literacy and print--in other words, the age group that was 4 years old in 1953 (the year that households with children under 5 passed the 50% television saturation mark). The members of this group were 18 in 1967, the approximate time that the "integration movement," with its exclusive concern with civil rights, yielded to the "youth movement," with its wider protests against the war and it's general rejection of the traditional American way of life.... In any case, there is a striking correlation between the coming of age of these "television children" and the heating up of social conflicts in the mid- to late 1960s. (Meyrowitz 1985, 137n)

Agenda Setting: Measuring the Power of the Press

Meyrowitz's suggestion that the social consciousness of the sixties was a "mediated consciousness" puts him in league with many, including Lippman, who believe that the media's images have power to set social beliefs. The belief in the power of the press is an extension of World War I propaganda techniques. Well into the next war, World War II, the idea of the "magic bullet" or "injection" theories drove researchers such as Harold D. Lasswell to write his Propaganda Techniques in World War. Early theories were firmly based on the idea that for every communication stimulus, there was an audience response. Later research in the 1950s concluded media effects were actually quite limited as it was difficult to prove that people immediately acted upon such messages.

However, conventional wisdom rejected the idea that media messages and media itself had virtually no effect. It was not the immediate effect that counted, it was the long term accumulation of messages that mattered. Seemingly blind to the rise of television, Cohen observed of the printed press:

> (The press) may not be successful much of the time in telling people what to think, but it is stunningly successful in telling people what to think about.... The world will look different to different people, depending ...on the map that is drawn for them by writers, editors, and publishers of the papers they read. (Cohen 1963, 27)

McCombs and Shaw made the first major study to validate Cohen's observation of the concept of "Agenda Setting." They studied the 1968 presidential election in North Carolina. Content analysis was used to examine how television, newspapers and news magazines presented political issues. Attitudinal research was conducted among voters asking them to rate the level of importance of the political issues. There was a direct correlation between press coverage of an issue and the level of importance that issue had among voters. They repeated and expanded the research in the 1972 election with even stronger results.

There appear to be three major factors in agenda-setting: (1) repetition in reporting an issue; (2) visualization of an issue through a major event; or (3) adoption of an issue by the two major agenda-setting organizations in the United States--the White House and the New York Times.

In 1983 and 1984, Michael B. Salwen conducted a simultaneous content analysis of local press coverage and a random telephone survey of the public to measure the effect of accumulation of news coverage on an issue. Previous studies had measured the effect of intense press coverage of an issue already on the public agenda. Salwen wanted to know whether a minor issue, if the press reported on it long enough, would become part of the public agenda. In addition, is there a predictable period of time for the accumulated news coverage to raise the issue to salience.

Salwen (1968) based his hypothesis upon the report of Zajonc (Zajonc 1968). Zajonc suggests that if subjects are exposed to a neutral object for some duration of time, merely thinking about the object can lead to a positive disposition toward it.

To try and eliminate personal or interpersonal communication as a factor in an issue forming the public agenda, Salwen avoided obtrusive issues--things that occurred within the person's life or the life of his or her acquaintances. Crime and health are examples of obtrusive issues. He selected the debate over the global environment as an issue people would almost never deal with in their daily lives. Then he measured how often subtopics of this unobtrusive issue were reported in the press and if and/or when they showed up as issues of concern to people answering his telephone survey.

His results showed the first evidence of public adoption of a media agenda occurs in five to seven weeks. The salience of the issue peaks in eight to 10 weeks. However, even if the press coverage tapers off or ceases, the issue remains high in the public's mind for several more weeks, tapering off gradually for up to 21 weeks, at which point, salience rises briefly, then disappears below the public agenda thresh hold.

Yagade and Dozier performed content analysis of Time Magazine's coverage of two "concrete" issues (drug abuse and energy) and two "abstract" issues (nuclear arms and the federal budget deficit) (Yagade and Dozier 1990) . They compared coverage to the public's response to the Gallup Poll's long-term, continuing question, "What do you think is the most important problem facing this country today?"

The research actually consisted of two separate studies. In the first, people answered a seven-point Likert scale questionnaire which resulted in a "visual scale". To questions, such as, "Regarding this issue, I can easily visualize the events happening," responses ranged from "Does not describe my feelings" to "Describes my feelings well."

Once an issue was established to be concrete or abstract, the position of that issue among the Gallup Poll's "most important" problems was considered relative to the amount of magazine coverage. The results were:

> The nuclear arms issue showed no agenda-setting effect.... On the other hand, the energy issue did show an agenda-setting effect.... The hypothesis was confirmed. An abstract issue did not show a media agenda-setting effect, while a concrete issue showed increased salience among the public following extensive media coverage of that issue. (Yagade and Dozier 1990, 9)

Yagade and Dozier conclude that:

> A threshold point may exist where an issue is just too abstract to be changed on the public agenda by media coverage because (a) the issue is too difficult to visualize, and (b) the information is too complex, requiring much cognitive work to process.... Issue abstraction is partly a product of how an issue is framed in media content (Yagade & Dozier 1990, 10).

Yagade and Dozier in their 1990 study of agenda-setting found that it is easier for the media to set the public agenda when the issues can be visualized as being concrete--seen as real things. They also discovered, contrary to their hypothesis, that the more a person knows about an issue--the more real a subject is to them--the more influenced they are by the media agenda. Salwen may not have needed to select an unobtrusive media agenda issue in order to test his "effects of exposure" study.

However, accumulated exposure to the media agenda does serve to make something more real in the mind of the public--up to a point. Ultimately, the issue has to be linked with an image. Yagade and Dozier write:

> Individuals find it difficult to attach salience to something they don't comprehend....A concrete issue is linked to a specific event or a small set of events.... Events are occurrences or components of an issue. (Yagade and Dozier 1990, 5)

In other words, the mass communicator should spend more time "drawing a picture" if they wish their issue to achieve salience.

People can visualize those issues with which they are personally involved. It is much harder for them to see scientific or technological issues. Rogers and Chang wanted to know if "real life indicators" are important to agenda-setting. That is, how many people have to die of AIDS, for example, before the issue becomes important?

Their method was very simple. They counted the number of news stories in the indexes of the three newspapers and the Vanderbilt Television News Archive Index. Then they counted the bodies or other physical evidence connected with an issue to see if there was a correlation between the point of salience and the severity of the situation. There was not any correlation.

In the case of the NASA space program problems, that issue only became salient when millions of people could visualize the end result of alleged greed--six people dying while millions watched.

In the case of the Ethiopian famine. Thousands had to die over a two-year period until a three and one-half minute bite of video on the NBC Evening News, shot by an itinerant British Broadcasting Corporation stringer, shocked the U.S. and ultimately the world to act.

McLuhan can be interpreted as also saying the medium should strive for a more visual framing of a message. In 1963, he reframed Cohen's idea that the media can make people think about something but cannot tell them what to think. "The effects of technology do not occur at the level of opinions or concepts, but alter sense ratios or patterns of perception steadily and without resistance (Severin & Tankard, 1988, 251) ." Severin and Tankard write that McLuhan thought communications technology has "caused people to emphasize one sense over others.... McLuhan proposed that television would restore the balance of the sense ratios that print destroyed." This is why "the important effects of the medium come from its form, not its content (Severin & Tankard, 1988, 251)."

The importance of content versus form in personal interaction was explored by Anthropologist Albert Mehrabian (Meyrowitz 1993, 100). Seven percent of the message is verbal, 38% vocal inflection and 55% body language.

Because of its ability to simulate personal contact, Meyrowitz contends television creates a false intimacy that has as strong an effect as face to face relationships. Because the images are so real, people engage in what Horton and Wohl called "para-social interaction" (Meyrowitz 1985, 119). Television personalities gain "intimacy with millions." Horton and Wohl speak of the pure para-social personality, someone who is "known for being known." The death of such a personality can cause grief equal to that of the death of a close friend. More extreme are para-social murders. John Lennon was not murdered by a stranger, but by someone who believed he knew him well.

Lasorsa and Wanta, looked for evidence of reverse causality (the public setting the press' agenda, as opposed to traditional agenda setting). Like Salwen, they discovered personal experience with an issue increased the audience's curiosity about the issue and increased audience use of the media to gather even more information (Lasorsa and Wanta 1990). This raises the possibility that the pseudo familiarity of para-social interaction with television images can be a very strong element in agenda setting when using the electronic medium.

Drummond agrees with McLuhan that television has shifted the balance away from print. However, he contends, the electronic image has not restored the balance with print, but has overwhelmed traditional journalism.

> Technology and marketing are now the driving forces in the news media--nothing else. The (newspaper) industry does have a big problem--one that it's not yet ready to face. That problem is changing demographics, an aging readership, advertising flight, and the massive power of the electronic media to dominate and influence breaking stories. The issue is not whether the Los Angeles Times did a great job. It's whether the Los Angeles Times, or any newspaper, is relevant to anything. (Drummond 1993, 382)

The Rodney King beating produced a Los Angeles riot while Dr. Martin Luther King's assassination did not. Drummond lays it all to the availability and the continual repetition of video images both from the beating and from the riot as it progressed. Dr. King was murdered in the age of the print media. Mr. King was beaten in the age of the electronic media. Drummond makes reference to Meyrowitz .

> Meyrowitz makes the case very forcefully that there is a big difference between the world that was dominated by print media and the world we now have, which is dominated by electronic media.
>
> Print is accessible only to that elite group that has been trained to read. Broadcast, on the other hand, requires only that you be able to watch and listen. Print works well with facts and data, but broadcast is much better at expressing feelings and emotions (Drummond 1993, 382-383).

Drummond contends broadcasting thrives on revealing private backstage behavior, not important news.

> This hunger for demolishing official facades is a major component of most of the stuff that passes for television journalism these days. The videotape of the King beating is a perfect example of public exposure to "backstage" behavior--in this case by policemen.
>
> I doubt that any newspaper story alone, no matter how well written, could capture the violence of the poorly shot video tape of the Rodney King beating. The single biggest factor in the Los Angeles uprising was that electronic media dominated the reporting of the event while it was in progress. Those are the images that will last. (Drummond 1993, 383).

Drummond would not censor live image broadcasts, however.

> It is inconceivable that any news organization would hold back details of a disaster. For every looter who was encouraged, probably many thousands of law-abiding residents are safe today because they saw the coverage and heeded the warnings to stay away. Plain inaccuracies and, worse, stupid remarks were probably harmless, because I don't think anybody really listened to what any of the anchors actually said. Instead, they watched those pictures. Follow-up stories come along days or weeks later, but by that time, the audience's impressions are locked in (Drummond 1993, 383).

Adatto also contends the audience often does not listen to the words while looking at the pictures. She writes words will almost always lose out to images.

> This competition was illustrated in a 1984 piece on Ronald Reagan by Lesley Stahl (CBS, October 4), which criticized at length Reagan's manipulation of television imagery during the campaign. Stahl was surprised to find that the Reagan White House loved the story. Grateful that the piece included almost five minutes of potent Reagan visuals, a presidential aide seemed oblivious to Stahl's critical narrative. "They don't hear what you are saying if the pictures are saying something different. (Adatto 1993, 59).

Not only do pictures work, some pictures work better than other pictures. The term, "decisive moment," coined as a photographic concept by Henri Cartier-Bresson, is often used. (Cartier-Bresson, 1952). Cartier-Bresson proposes that there is a moment when the elements of composition come together in a scene that evokes the most response from the viewer.

> To me, photography is the simultaneous recognition, in a fraction of a second, of the significance of an event as well as of a precise organization of forms which give that event its proper expression (Cartier-Bresson 1952, XIV)

This idea has become part of the conventional wisdom of photography editors as they try to select the most effective photographs with which to communicate. However, no one editor gives the same definition to what is a "good" photograph, though a consensus can be observed as one wire photo is repeated over and over across the world, while another photo, exposed a split second later, rarely is published.

However, Cartier-Bresson contends this decisive moment is usually unattainable. It is the photographic sequence which often must tell the story on the printed page.

> What actually is a photographic reportage, a picture-story? Sometimes there is one unique picture whose composition possesses such vigor and richness, and whose content so radiates outward from it, that this single picture is a whole story in itself. But this rarely happens. The elements which, together, can strike sparks out of a subject, are often scattered--either in terms of space or time--and bringing them together by force is "stage management," and I feel, cheating. But if it is possible to make pictures of the "core" as well as the struck-off sparks of the subject, this is a picture-story; and the page serves to reunite the complementary elements which are dispersed throughout several photographs. (Cartier-Bresson 1952, III)

Cartier-Bresson writes that the photographic reporter uses "the brain, the eye and the heart."

> ...what the camera does is simply register upon film the decision made by the eye.... In a photograph, composition is the result of a simultaneous coalition, the organic co-ordination of elements seen by the eye. One does not add composition as though it were an afterthought superimposed on the basic subject material, since it is impossible to separate content from form. Composition must have its own inevitability about it. (Cartier-Bresson 1952, VIII)

Cartier-Bresson wrote that "visual organization can stem only from a developed instinct (Cartier Bresson 1952, XIV)." He offered no heuristic guidelines for scoring the effectiveness of an individual image.

If one cannot quantify the "good" photograph, one can measure its effect in the agenda setting process. Wanta studied the size of photographs in newspapers by printing his own sample editions. One edition had a large photograph on the page accompanying a story on an issue. A second edition had a smaller photograph with the story, along with other photographs, all balanced in size, accompanying other stories. The third edition had no photograph accompanying the story of the issue being measured. Each edition had three stories layed out in each of the three styles. A reader of one edition was exposed to issues layed out in each condition.

American farm economics, national defense and pollution were the issues being measured. A pre-test asked subjects to rank 12 issues in order of importance. The issues being measured were in the list. After exposure over several days, subjects were again asked to rank issues in order of importance.

Wanta found that size counts. The dominant photo increased the ranking of an issue on the test subjects public agenda markedly. The balanced photo layout also contributed to moving an issue up the agenda list. However, issues viewed without photos did not increase in importance in the estimation of the test subjects (Wanta 1988).

Cognitive Psychology: Creating an Imaging Paradigm

Journalists know pictures communicate. Cognitive psychologists are beginning to explain how and why. They suggest images may be among the most basic elements in communication. In fact, Ellis and Hunt (1983) write that some cognitive psychologists would agree that people store all knowledge as meaningful images, instead of encoding memory into the separate categories of words, pictures and emotions (Ellis and Hunt 1983). Other cognitive psychologists contend words and pictures and emotions are all reduced into propositional representations (a mental code). Sill others suggest emotions are not knowledge, but a by- product of knowledge. No matter exactly how knowledge is stored, it is agreed images are used in memory processing and that the images are a powerful form of knowledge because they appear to the reader to be the most concrete or "real".

The advent of the computer has resulted in cognitive psychologists adopting it as a popular paradigm of cognitive processing because this model of "thinking and remembering" is familiar to most educated individuals and easy to understand. Using the computer as a model, researchers now speak of input, encoding, retrieval and output (Ellis & Hunt 1983).

This cognitive model states the individual audience member either actively selects or subliminally accepts data via the senses. Depending upon the attention paid to the entering data, it is encoded creating few or many points of association within the memory (Anderson & Kosslyn 1984). The input of later data may trigger one, or many of these associations through a process of activation. Activating a variety of semantic (words), visual (pictures), and mood state (emotions) memory nodes determines not only how the new data will be encoded, but even how it will be perceived. It is suggested activation is physically a form of electro-chemical activity which spreads from node to node, gaining intensity as more nodes (or memory files) are engaged in retrieval.

The Mechanics of Seeing

The creation of a visual image involves a very mechanical device--the human eye (Long and McNally, 1992). It is very much like a camera. The lens focuses the image on the retina at the back of the eye. An iris controls the intensity of light. There the analogy ends. Rods, cones and ganglion cells line the retina. Each measure some distinct feature of the image created on the retina. Some cells measure color. Others determine shape; others motion, etc. Each eye has a left and right field. That is, the imaging cells on the left side of each retina feed data into an optical nerve which enters the right hemisphere of the brain. The imaging cells on the right side of each retina send data to the left hemisphere. The data passed into the left and right hemispheres, as best can be determined, is further deconstructed for processing in various parts of the brain. It is then reconstructed as either an image or a propositional representation. As stated, no researcher has determined the exact form of visual memory.

Models of visual encoding and retrieval have been fashioned, however, by observing subjects in a research laboratory environment. For example, it is generally agreed that visual data enters a sensory register where an image persists for approximately 300 milliseconds (Ellis & Hunt, 1983). This compares with 250 milliseconds to 15 minutes for auditory sensory data in its register. The difference in persistence of data in the visual and auditory registers relates, it is suggested, to the fact the eye sees everything at once. Every bit of detail in the scene enters the register. The auditory process, however, requires more time just for the subject to hear and digest a complete phrase. The meaning of a paragraph is not complete until the last word of the last sentence is spoken.

An individual has, as noted, about one-third of a second to select which details from the visual sensory register they will retain in short term memory. However, the viewer typically makes no conscious decisions in this process. The sensory register operates at a preattentive level. Selection appears to depend upon what element is the most demanding in the scene, or what the viewer was primed to look to see.

The Forms of Memory

Sensory register data is precatagorical--without meaning. Pattern recognition organizes the data into understandable images. Images previously moved from short term memory to long term memory are retrieved and compared with the new data. Some researchers suggest actual visual templates exist and the mind sorts through the templates until a match for the new data is found. Again, the computer model of cognition explains how a life-time of templates can be compared to match a new image using parallel processing. If serial (one at a time) processing was taking place, there would be significant time lags in laboratory recognition tests.

Images are then moved into long term memory. There is evidence they are stored in analogue form. For example, they are recalled with much more accuracy than semantic information. Standing, Conezio and Haber (Ellis and Hunt 1983, 102) showed subjects 2,560 pictures for no more than 10 seconds each. There was a 93% recall rate when the subjects were later asked which photos they had been shown. The researchers concluded their rapid rate of presentation made it impossible for individuals to verbally encode the images into memory. The images, the researchers contend, must have entered in some literal form.

Ellis and Hill cite the work of Kosslyn, Ball and Reiser. Subjects were asked to memorize a simple map. Next, they were asked to mentally travel from one significant landmark on the map to another. They pressed a buzzer as they completed their trips. The differences in times between "trips" corresponded to the actual distances on the map (Ellis and Hill 1983, 102-103).

Despite being "real," an encoded image is a picture that can be "retouched." Other experiences the reader has had will disagree with the journalist's presentation. Therefore, the reader will change the journalist's image as it is encoded. The image may be retouched again as it is retrieved if there has been contradictory, intervening experience after encoding.

Baggett experimented with something like image retouching (Baggett 1975). These are constructive processes or inferences. She conducted two experiments. In the first, she created eight cartoon-like series of four frames each. Each story had an explicit version, in which the key action was presented to the subject, and an implicit version, in which the key action was not presented. For example, (1) a long-haired man walks past a barbershop, (2) enters the barbershop, (3) sits in a barber chair and then (4) leaves with short hair. In the explicit version, frame three includes the barber cutting hair. In the implicit version, he only sits in the chair and there is no barber. Immediately following the exposure to the sequences, and 72 hours later, subjects were shown a new set of slides. They were asked to respond true or false whether these slides rationally belonged to the sequences they observed earlier. The correct true responses were measured for response times. When presented an explicit frame (Barber cutting) immediately after exposure, those who had seen this frame had markedly faster response times than those who had seen the implicit version (man sitting) but now had to decide if this logically belonged in the sequence. However, subjects given the same test 72 hours later had almost equal response times. Baggett concludes:

> It appears then that subjects, immediately after seeing a story in pictures, access their memory representations of previously viewed pictures in the story more readily than they do representations of pictures which they can only infer as fitting in with the story's meaning. Seventy-two hours after seeing the story, however, subjects access memory representations with approximately the same facility, wether they were shown pictures seen before in the story, or pictures that merely fit with the meaning. We might be tempted to conclude, therefore, that the surface memory trace, which presumably aided in making access faster at no delay, decayed and is no longer readily available after 72 hr, and that the essential representation in memory remaining for the story is a conceptual and probably nonpictorial one (Baggett 1975, 543).

Baggett conducted a second experiment to test if subjects can remember specific pictures in later recall tests. Subjects were asked to identify only those images which had appeared in the sequences they had viewed earlier. Subjects viewed explicit images some of them had seen, implicit images which fit logically into the sequences, and false dummy slides which were not logical parts of the sequences. Immediately after exposure to the sequences, subjects effortlessly identified the pictures they had seen and with equal ease rejected those who closely matched, but were not exact representations of the frame. After 72 hours, subjects still could easily identify the exact images they had seen, but it took longer to reject inexact representations. However, they still made accurate differentiations. Baggett writes, "The results indicate that the hypothesized surface memory for pictures, which is strong at no delay, still exists after 72 hr and can be accessed by the subject if the task demands it (Baggett 1975, 545)."

A third experiment was conducted by Baggett. Instead of being shown pictures, subjects were asked what they had seen. Was there a difference between response times of those who saw an implicit version and those who saw the explicit version? Instead of a slide of the barber cutting hair, a slide appeared asking, "Did the barber cut the man's hair?" In response, the subjects were asked to respond, "yes," if the answer "fits in with your understanding of the event you just saw." There was no significant difference in response times. Baggett concludes:

> We suggest that subjects, regardless of whether they had viewed the explicit or implicit story version, were responding from the same conceptual memory representation. This makes the conceptual memory for pictures look propositional or descriptive in nature (Baggett 1975, 547).

Baggett's research suggests there are two types of memory for images: A literal representation which may be submerged in memory over time and a conceptual representation.

> When given written questions about the meaning in the pictures, the adult viewer, regardless of delay, seems not to utilize his picture memory, but rather to access his conceptual memory representation. We observe that the viewer does not make every possible optional inference.... He apparently selects, at the time of viewing, those inferences which are necessary to create a coherent story, and he rejects unlikely pictures, those which are obviously not required to integrate the pictures into a meaningful story sequence (Baggett 1975, 548).

If viewers can store both individual pictures and conceptual representations of them, what do viewers do with moving images?

Heider in 1958 claimed that information is extracted from the continuous stream of another person's behavior by first breaking the continuous stream into chunks--each chunk consisting of a meaningful action (Hastie, Ostrom, Ebbesen, et al 1980). To measure if chunking takes place visually, Newtson conducted a series of experiments over several years. He suggested that at the beginning of each observed action, the viewer questions what is about to happen. As the action proceeds, the number of possible out comes are narrowed until at one point, only one outcome appears possible. This marks the end of an action unit. The more a viewer needs to infer from the continuing action, the more the viewer breaks the action into smaller units to be analyzed.

To determine if viewers do indeed learn more by using smaller action units, Newtson instructed his subjects to (1) "record as small units of behavior as seemed natural and meaningful to them by pressing a button a a continuous event recorder when 'one meaningful action ends and a different one begins;'" or (2) "record as large units of behavior as seemed natural and meaningful to them (Newtson 1973, 29)."

Newtson created a five-minute video tape of a man filling out a questionnaire, lighting a cigarette and reading books. The actions were kept simple to avoid multiple action units from overlapping or occurring simultaneously. All subjects were instructed as follows:

> I am going to show you a 5-minute videotape of another subject in a different experiment. Now, what I am interested in here are the units people use to classify other's behavior. By that I mean that people can vary the level at which they break up other's behavior. For example, I could turn around, walk over, push the door closed, turn around, and walk back (The experimenter performed these actions.). Each of these actions could be seen as a discrete event, or they might be classified into one larger unit, such as "closing the door" (Newtson 1973, 30).

Subjects were then given fine-unit or gross-unit instructions. Fine unit instructions were:

> "What I want you to do is to mark off the behavior of the person you'll be seeing into the smallest units that seem natural and meaningful to you. There are no right or wrong ways to do this; I just want to know how you do it (Newtson 1973, 30).

Gross-unit instructions were the same except the word, "largest," was substituted for the word "smallest." Fine-unit subjects divided the tape, on average, into 52.1 units while gross-unit subjects selected an average of 21.3. Newtson found his fine-unit subjects were much more confident of their opinion of what the actor in the video was doing. Fine unit subjects formed more opinions about the actor as a person. Newtson's conclusion can be summed up as: the more breakpoints a person selects, the more information they obtain.

Newtson observed that fine units were generally subsets of the gross units, both having common breakpoints. There appears to be a common heuristic definition of what constitutes a unit of visual information and the breakpoint between them.

In his next experiment, Newtson wanted to explore if the frequency with which units of action are selected would vary if an unexpected event were inserted into what was otherwise a routine action. Two tapes were made. One with the routine task progressing for five minutes without interruption. A second, or deviant, tape had the task interrupted at two minutes when the actor removed a shoe and sock and rolled up a pants leg. After 30 seconds, the tape resumed for a total playing time of 5 minutes, 30 seconds.

Subjects, following the instructions to mark meaningful units, selected 3.55 units per minute for the first two minutes. In the last three minutes, however, subjects watching the routine tape selected 2.67 units per minute while the deviant tape subjects averaged 3.37 units. Two conclusions were reached: Unexpected actions cause an increase in unit selection by viewers; in both groups, the rate of selection decreases as observation time increases.

In a confirmation of the adage that first impressions count, Newtson notes that the highest rate of unit selection occurs at the beginning of a sequence, and unitizing is how observers gather information about a person or object.

In another series of experiments (Newtson and Engquist1976), subjects were tested by observers for recognition of and recall of breakpoints and nonbreakpoints using movies and slides. They wished to establish that the breakpoints selected in the 1973 experiments actually represented perceptual units of on-going behavior.

In their first experiment, they removed frames from a 16mm film in lengths of 1/6, 1/3 and 1/2 of a second. A pretest had determined some frames were breakpoints and some were not. Subjects were instructed to press the continuous event recorder button anytime they noticed "some action or action part" missing from the films as they were projected. An identification was deemed accurate if the subject marked it with in one second after the actual time in the film the frame was deleted.

The results showed that "breakpoints were detected significantly better than deletions of nonbreakpoints at all sizes of deletion" As the period of time increased during which the breakpoints were deleted, detection increased up to 78% when the time reached 1/2 second. However, no matter what the time duration, non-breakpoints were detected at an average rate of 35% (Newtson & Engquist 1976, 439).

Newtson and Engquist examined the breakpoints which had been removed. They resembled Baggett's comic strip sequences. In a second experiment in this series, they had a control group view the motion video and reach a consensus as how to best describe the action. A series of slide show then were constructed from the breakpoints and the nonbreakpoints by mounting the 16mm frames in slide mounts. The frames were presented both in sequence and out of sequence. Subjects were asked to rate each sequence on a nine point scale from "not at all intelligible" to "very intelligible," write a one sentence description of the action, and say if the order of the slides was correct.

The researchers concluded breakpoints are more intelligible than nonbreakpoints. In fact, the correctly-ordered slide show made from breakpoints were rated as equally intelligible as the motion film sequence from which they were extracted. Breakpoints were more accurately described than nonbreakpoints. Correctly ordered slides are more intelligible. And when an incorrect order was noted by the subject, the subject could reorder the frames correctly 46% of the time.

Newtson and Engquist emphatically state:

> Results confirmed that breakpoints are the basis for the formation of perceptual units of behavior. Clearly, the units identified by the unit marking procedure are not selected according to an arbitrary criterion but are significantly related to the meaning of the behavior (Newtson and Engquist 1976, 443).

Based upon these two experiments, plus a third in which subjects were able to consistently differentiate between breakpoints they had observed and similar breakpoints they had not observed, Newtson and Engquist note that breakpoints selected by one group has important information for another group. The researchers suggest breakpoints most likely occur when there is movement, not when the actor achieves a position.

> ...(A)ctions are defined by the state-to-state changes depicted by successive breakpoints. That is, the distinctiveness of breakpoints would be due to a distinctive change having occurred, rather than a distinctive state having been achieved. (Newtson & Engquist 1976, 448)

Another experiment (Newtson, Engquist, and Bois 1977) set about to codify the characteristics of breakpoints. They reviewed the earlier Newtson, et al research. Among the qualities observed was that breakpoints occur just after a cup is set on a table and just after it leaves the surface as it leaves the table. In neither case did subjects select what would have been identical frames of a cup on the table and a hand grasping the handle. Breakpoints occur at that moment just after the elimination of the uncertainty as to the course of the action.

In an attempt to gather statistical data on the nature of breakpoints, the researchers coded sequences using the Eshkol-Wachman movement notation system. Developed for choreographers, it allows observers to specify the position of the body in three dimensional space at successive and predetermined intervals. An index was devised which allowed researchers to code the 17 different features of body position and compare one body position with another. This allows one to measure the relative amount of change.

Two hypothesis had been proposed. One, every time an actor achieves a meaningful state is a breakpoint. If this is true, every time and actor is in this position, subjects will define that as a breakpoint. The second is the meaningful change hypothesis. In this case, each breakpoint will appear significantly different from the preceding breakpoint; greater on average than any body positions used in any of the proceeding breakpoints.

Comparison of randomly paired breakpoints and nonbreakpoints showed no significant body position differences between the two. One was not necessarily more dramatic than the other. However, a comparison of breakpoints with breakpoints supported the meaningful change hypothesis. Body positions were notably different (Newtson, Engquist, and Bois, 1977).

As part of the same research, the group analyzed the nonbreakpoints prior to a breakpoint and those nonbreakpoints that came afterwards. As expected there was a great statistical difference between the nonbreakpoints preceding the breakpoints. However, those nonbreakpoints following the breakpoints were not as different. However, they were not registered as breakpoints, also, because the meaning has already been obtained by the observer.

In their discussion the researchers conclude that breakpoints mark significant changes in position, but they also have unique properties which impart more information to the viewer than nonbreakpoints which may be significantly different in body position, also. Analysis of previous experiments showed subjects often were monitoring only a few features within the total frame when determining which were the breakpoints. Some movements were more significant than others despite the fact the other movements may have been more pronounced. The researchers propose that the viewer is constantly trying to build an anticipatory schema, using as visual cues changes in those body features which contribute to their model or picture of what is happening. That is why, when the action is interrupted by an unexpected action, the viewers begin to define more action units or breakpoints in an attempt to gather more information.

> One reasonable hypothesis would appear to be there exists a feature selection and monitoring mechanism, whereby the perceiver selects certain stimulus configurations or elements and defines actions according to changes in these elements (Newtson, Engquist, and Bois 1977).

Researchers (Newtson, Rindner, Miller, and LaCross 1978) next tried to answer this question by analyzing a repetitive task. They made two six-minute videos of an actor assembling 20 five-page questionnaires. Each time he completed an assembly, the page on top of the stack of completed forms was alternately a black page or a white page. In the second video, a cardboard box hid the stack of completed documents. Subjects selecting the breakpoints in the black/white repetition video marked fewer breakpoints as the video played. However, the number of breakpoints defined by subjects increased as the video containing the hidden stack progressed.

The researchers concluded that when an event presents clearly visible stimulus cues, the information is quickly understood by the viewer and fewer breakpoints are needed to understand the action. However, when no such cues are provided, more breakpoints are sought in order to define the action.

Critics of Newtson suggest breakpoints are artificial, having been introduced by the researcher. They suggest the real processing of observed sequences could take any number of forms and button pushing is just another task the observer must perform while processing visual information.

Words and Pictures Remembered Together

As noted, the research of Baggett indicates that pictures are stored in memory, but so too are concepts or inferences about those pictures. What is the relationship between words and images, particularly when they are used together in a single form of communication? Pavio quotes Shepard:

> If I am now asked about the number of windows in my house, I find that I must picture the house as viewed from different sides or from within different rooms, and then count the windows presented in these various mental images. No amount of purely verbal machinations would seem to suffice (Shepard 1966, 203).

Pavio notes that the question, "How many windows," and the answer are verbal. But the "mediating mechanism" is visual. Pavio experimented with mental imagery in associative learning and memory. That is, he tested whether words were remembered better when learned in association with mental images. Of course, the "method of loci" was used by early Greek orators, who memorized parts of their speeches while observing objects in the room where they would speak.

Pavio experimented with concrete words instead of actual pictures or photographs. He cites Deese as an explanation as to why more research does not exist in the area.

> The modern experimental psychologist works almost exclusively with linguistic associations for the good reason that these provide controllable material for his laboratory studies; he ignores the extra existence of perceptual imagery.... (He) finds images difficult to manage in empirical study (Deese 1965, 4).

Pavio explains that the increasing order of perceived concreteness begins with abstract nouns and moves through concrete nouns, pictures and then to an object itself. The more concrete the stimulus, the more links the stimulus can activate backwards through the chain; the more possibilities there are for retrieving, mediating and expressing a remembered item. For example, in a memory aid system, one memorizes the proper sequence of a number of items by using a combination of rhyming words and mental images. The rhyming combinations are: one-bun, two-shoe, three-tree. To these are added often bizarre images of the items to be remembered. If item one is a chair, the paired associates are "one-bun-chair," with a chair on a hamburger bun being the mental image. Pavio points out that the technique is simple. The psychology of it is very complex.

In an attempt to explain the psychology of the paired associates process, Pavio posited his Conceptual Peg Hypothesis in 1965. The conceptual peg is the stimulus member of a paired association. The more the subject can "see" the stimulus, the better the "peg" works.

Among those who have performed early experiments upon which Pavio drew were Epstein, Rock and Zuckerman, 1960; Rohwer, 1966; Iscoe and Semler, 1964; and Wimer and Lambert,1959. Pavio summarizes their results (Pavio 1969, 254) as showing that memorizing an object by pairing it with another object, or remembering a picture by pairing it with another picture, worked better than using the names of the objects or the names of the items in the pictures. Also, using an object as a stimulus to elicit a nonsense word response works better than using the written name of the object as the stimulus in the paired associate.

Pavio tested his hypothesis by offering subjects combinations or concrete and abstract nouns to memorize in the four possible combinations of stimuli/response paired associates: Concrete/abstract, concrete/concrete, abstract/concrete, abstract/abstract. Use of concrete nouns scored significantly higher than the use of abstract nouns as stimuli (Pavio 1965). In another experiment, Pavio varied the image evoking quality of the meaningfulness of the concrete noun stimuli (Pavio 1966) . From his experiments, Pavio concluded that in creating paired associates, a concrete stimulus noun, even one that evokes a nonsensical image, is much stronger aid to memory than a concrete stimulus noun which is high in meaningfulness. In addition, he concluded that a concrete or image evoking stimulus will aid almost equally in remembering any type of response word; abstract, concrete or nonsensical.

In his 1969 review of the subject to that date, Pavio presents the hypothesis that in 1971 would become his dual coding theory. Writing of "A Two-Process Theory of Meaning and Mediation," Pavio says:

> The hypothesis is that concrete terms such as "house" derive their meaning through association with concrete objects and events as well as through association with other words, and thereby acquire the capacity to evoke both nonverbal images and verbal processes as associative (meaning) reactions, which could function as alternative coding systems affecting mediation and memory. Abstract terms such as "truth," on the other hand, derive their meaning largely through intraverbal experiences and more effectively arouse verbal associative than imaginal processes (Pavio 1969, 248).

Pavio asked his subjects how they perceived their answers when responding to paired associate exercises.

> A striking pattern of relations emerged in which images were predominantly reported as mediators for pairs in which both stimulus and response members were concrete, whereas verbal mediators predominated in the case of pairs in which both members were abstract. Furthermore, learning scores were highest for pairs for which imaginal mediators were reported, next highest for verbally mediated, and low for unmediated pairs, suggesting that imagery was the most effective mediator (Pavio 1969, 248-249).

Pavio suggests that images are either more available for subjects to use, or subjects just prefer using them. Critics of Pavio contend that all mediation is verbal. Pavio constructed an experiment to compare images and words as mediators. All subjects were originally given a memory task in which a list of items was memorized in numerical order. Next, one group was given rhyming words which were concrete (i.e. one-bun, two shoe) while another group was given rhyming words which were abstract (i.e. one-fun, two-true). Each group was divided. One half was told to evoke an image as part of the memory exercise. The other half were not given such instructions.

The results were "quite unequivocal (Pavio 1968)." Those who used images, regardless of whether the rhyming words were concrete or abstract did significantly better than those who relied strictly upon the rhyming words. Pavio suggests using only the rhyming words equated to verbal mediation.

Other experiments by Pavio, in which exposure and response rates were timed, suggest visual imagery is primarily a parallel processing system and the verbal symbolic system is a sequential processing system (Pavio 1969). Even if Pavio's dual coding theory is wrong and all coding is essentially verbal, Baggett, Pavio, Yagade, and Dozier have established, pictures are encoded and retrieved much more easily than the thousand words needed to describe them.

Schema: How the World Looks, Not How It Is.

The idea of someone trying to make sense of their world by creating a personal picture from the pictures and pictures made from words they receive from media, is not a new idea. Even in 1922, Lippman noted that people observe their environment and create a picture of that environment in their minds. However, he writes, "Whatever we believe to be true, we treat as if it were the environment itself (Severin & Tankard 1992, 299)." These "pictures" become pseudo environments. For events far removed from an individual's personal experience, the pseudo environments are created with the help of mass communicators. "The only feeling that anyone can have about an event he does not experience is the feeling aroused by his mental image of that event

(Severin & Tankard 1992, 299)." Lippman refers to the "medium of fictions." These fictions, which people often create themselves, are simpler models of a world much too complex or removed from direct experience to comprehend. It is possible to respond as powerfully to these fictions as to realities.

His favorite example of a pseudo environment was the business life in the United States the first few days of World War I--those few days before news of the conflict reached America. People made plans and signed contracts for business deals which could never be conducted once people knew there was a war.

A psychologist would say these retouched images become part of a schema--a concept. Schemata are the building blocks from which the reader or viewer constructs their perspective of reality--Lippman's pseudo environment. Anderson and Kosslyn write that schemata provide a structure in which to encode this information and interpret it.

"Schemata encode knowledge of how events are structured, how event sequences combine and form episodes, and how entire stories are constructed from sequences of episodes (Anderson and Kosslyn 1984, 171)." The theory of a schema being constructed based upon previous experience or current expectations is supported by the fact people often change the facts when retelling a story. People generally appear to have plot lines they develop to explain events, tailoring the information to fit into which ever plot line appears the most rational to them, even though some of the facts known to them must be ignored. They expect a pattern of goals and outcomes, or cause and effect relationships. If they are not found, they will create them.

However, the major advantage is that schemata permit reasoning when given incomplete data (i.e., the ability to make inferences) which allows a person to survive in a world too complex to know in detail.

In the theory of Agenda Setting, it is argued that one can make the reader think about an issue, but not what opinion they should hold on the issue. In order to make a person attend to an issue, one must normally present the issue frequently over a period of time. The cognitive psychologist would suggest this is a process of building mental associations within individuals which can be activated later. Ultimately, however, the would-be agenda setter must have a "visualization" event which brings the subject to salience in the public mind (Yagade and Dozier 1990).

A picture of a starving child can make a person angrier more quickly than a written report saying 500 children starved to death today in Somalia. Add in the fact readers can readily form and encode word descriptions of images and one can argue data presented as an image has a dual impact--possibly a triple impact if one accepts the suggestion mood states are closely related to images.

Using the popular model of cognition, in order for a person to decide how they feel about something (good/bad, like/dislike), a person must first recognize an object (recognition), they next note the details of the object (feature identification) and, finally, they make a decision about the object (affective response). Zajonc suggests affect need not always be postcognitive. She suggests feelings about an object may occur even before one understands what it is. While she admits, "The important pieces of evidence are still missing (Zajonc 1980, 170)," she proposes that one can, upon exposure to a stimulus, have an immediate emotional response followed by recognition and, finally, feature identification. Further, she posits there are two forms of precognitive affective responses.

> One emerges where behavior, such as that occurring in discrimination among stimuli, is entirely under the influence of affective factors without the participation of cognitive processes. Included here are such phenomena as perceptual defense and vigilance, subliminal perception and discrimination, state dependent recall, and mood and contents effects. Another form of unconscious process is implicated in highly overlearned, and thus automated, sequences of information processing; this form includes cognitive acts but has collapsed them into larger molar chunks that may conceal their original component links (Zajonc 1980, 172).

People, who have perhaps never seen a snake, react long before they even know it is a snake they are viewing. The well-trained soldier, during intense combat, shoots first, then asks what was the movement he glimpsed. Outside of combat, a normal person would not shoot. In the combat environment, the cognitive process of selecting a target and firing has been automated.

The strong connection between images and emotions is cited by Zajonc, who references a 1974 experiment by Bower and Karlin.

> (They) showed photographs of faces to subjects with instructions to judge the photographs for gender, honesty or likability. Following exposures, subjects were tested for recognition memory in two experiments. The hit rate was higher when the subjects rated photographs for honesty or likability than when they reported gender (Zajonc 1980, 165-166).

Strnad and Mueller replicated Bower's and Carlin's results in 1977. Warrington and Ackroyd in 1975 found parallel results for remembering faces and words. Zajonc paraphrases Bower and Karlin as concluding subjects must attend to a greater variety of detail and engage in deeper processing when making affective decisions.

> Judgement of honesty of face would appear to require comparison to an idiosyncratic set of vague prototype criteria regarding the patterning of features such as distance between the eyes, size of the pupils, curvature of the mouth, thickness of lips, and so on.... If you want to remember a person's face, try to make a number of difficult personal judgements about his face when you are first meeting him (Bower and Karlin 1974, 756-757)."

Patterson and Bradley conducted a similar experiment. They concluded their "results clearly did not implicate analysis of facial features as a critical or optimal basis for facial recognition (Patterson and Bradley 1977, 411)." Should researchers "ever find an optimum strategy for encoding of faces, analysis of individual features is unlikely to be its focus (Patterson and Baddeley 1977, 417)."

Zajonc concludes:

> There seems to be general agreement that when judgements of pleasantness are made of faces of (persons), individuals engage in forms of deeper information processing. What is not agreed upon is the type of content that is accessed at these deeper levels (Zajonc 1980, 166).

At least when dealing with photographs of the human face, communicators are dealing with emotions. Potentially more important, communicators are dealing with emotions which may be evoked even before the audience member recognizes whose face it is.

Summary

What journalists, such as Lippman knew, communication researchers and cognitive psychologists now explain. Pictures appear not only to be the more efficient tool in the agenda setting process than verbal messages, they seem to be necessary to the process.

As Meyrowitz noted, even a pre-school child can decode the information in a picture. Yagade and Dozier found a significant difference between public knowledge of issues which were easy to "visualize" and those which were too abstract to picture. Rogers and Chang can cite statistics that, when predicting the importance of an issue to the public, headline and picture counts are more important than body counts. Wanta added that not just the presence of a photo, but even its size can affect the agenda being set. That's how pictures work in the media.

Why pictures work is becoming clearer. Standing, Conezio and Harber demonstrated even thousands of pictures are very easy to remember. Baggett provided strong clues that pictures are remembered both as objects and as concepts--pictures and words. Baggett also showed people are capable of making strong inferences from sequences of pictures, inferences which become a part of the remembered images when recalled later. Newtson showed that people regularly create these pictures as they divide events and moving media into "chunks" of action marked by "breakpoints." These breakpoints, individual still images, as shown by Baggett, become the basic units of memory and serve as the basis of developing verbal representations of the event. Pavio demonstrates that, by pairing an image with an abstract term, greater learning of abstract information can take place. Finally, as agenda setters have learned through experience, images are inherently emotional. Zajonc presents evidence that images can even provoke emotional responses prior to the subject even interpreting the image. Particularly when the human face is involved, emotions are closely bound into the ability to remember an image of that face.

A picture, because the mind appears to encode it as (1) an image, as (2) a verbal concept, and, possibly, (3) as an emotion (Cartier-Bresson's brain, eye and heart?), can be the most effective tool available for agenda setting. Additionally, if we accept Drummond's and other industry observers' conclusion that print media has been superseded by television, is it not time for television to reconsider the uses of the still image?

More importantly, if television is being superseded by data bases which alternate and mix words, still images and moving images, is it not important that mass communicators understand the interrelationships between the three? Should they not pause to consider paired associates as they assume the task, once a monopoly of print media, of presenting the abstract information citizens of a democracy need?.

Using already available scientific research, as well as promoting further research, would help mass communicators reach their implied goal that each audience member can respond, "Yes, I see what you're saying."

Hypotheses

Hypothesis I:

Subjects in a memory test experiment, exposed to stimuli consisting of a video presentation using an abstract narrative and visual breakpoints, will perform better on an information recall test given immediately after exposure than subjects exposed to the same narrative which is paired with moving images.

Hypothesis II:

Subjects in a memory test experiment, exposed to stimuli consisting of a video presentation using an abstract narrative and visual breakpoints, will perform better on an information recall test given 48 hours after exposure than subjects exposed to the same narrative which is paired with moving images.

METHODS

A pilot study was conducted to explore the creation of breakpoints and to test the hypothesis that the use of still frames in a video presentation results in higher retention of abstract data in memory then the use of motion in a video presentation. This empirical laboratory research required: (1) Constructing a video presentation of moving images with a narrative containing abstract data; (2) replicating a portion of Newtson's research into the creation of break frames in order to create a video presentation using the same narrative but with still images extracted from the moving images; (3) constructing a multiple choice questionnaire; (4) exposing subjects to the narrative using the two separate video formats and measuring retention in memory of the abstract information; and (5) conducting analysis of variance.

Breakpoint Determination Experiment

Subjects

Twenty students enrolled in the research participation laboratory portion of Psychology 1113, Elements of Psychology--Beginning Course, volunteered as subjects in return for partial course credit. Institutional Review Board Approval for using human subjects was obtained through the Psychology Department.

Materials

One VCR

One Video Monitor

One Continuous Event Recorder Button

One 120-minute Video Tape with on-screen time tracks measuring a single 3:22- minute presentation which was repeated 30 times

Design and Procedures

In the laboratory, twenty students, 15 of whom were women, were exposed one at a time to the motion version of the video presentation without a narration. The video footage, all of industrial scenes, was selected from the files of a video production company. No more than two people appeared in any scene. Two on-screen time tracks had been added. One time track, located in the lower left corner of the screen, timed the internal content of the presentation. The second time track, located in the upper right corner, timed the entire length of the video tape which had 30 repetitions of the presentation recorded on it. This allowed the researcher to precisely locate each subject's performance. Subjects were told:

> I am going to show you a videotape. Now, what I am interested in here are the units people use to classify other people's behavior. By that, I mean that people can vary the level at which they break up other people's behavior into understandable units. For example, I could (1) turn around, (2) walk over, (3) push the door closed, (4) turn around, and (5) walk back. (The experimenter performed these actions.) Each of these actions could be seen as one of five discrete events or they might be classified into one larger unit, such as "closing the door.
>
> What I want you to do is to mark off the behavior of the persons you'll be seeing into the smallest units (the five events versus one) that seem natural and meaningful to you. There are no right or wrong ways to do this; I just want to know how you do it.
>
> Just press the continuous event recorder button when, in your judgement, one unit ends and a different one begins. Pushing the button will create an audible beep.

The continuous event recorder button was connected to the audio dub track of the video tape recorder. Every press of the button placed a beep on the audio track of the video tape in direct relation to the video frame (or breakpoint) selected by the subject.

When the tape was replayed, the beeps sounded as the selected frame appeared on the monitor. The noted breakpoints were be collated and those frames that are selected by at least 25% of the subjects became the still frames for the second part of this research. Because of the differential in hand-eye coordination among subjects, an editorial decision had to be made in selecting many frames. In coding the results, it was determined there was, on average, a three tenths of a second delay between selecting a breakpoint and recording it using the continuous event recorder button.

Still/Motion Video Experiment

Subjects

Twenty-seven students enrolled in the research participation laboratory portion of Psychology 1113, Elements of Psychology--Beginning Course, volunteered as subjects in return for partial course credit. Institutional Review Board Approval for using human subjects was obtained through the Psychology Department.

Materials

One VCR
One Video Monitor

One Narrated Motion Video Presentation (3:22 min.)

One Narrated Still Video Presentation using only the selected breakpoints (3:22 min.)

27 Pre-Tests

54 Questionnaires

Design and Procedures

The selected breakpoint frames from the Breakpoint Determination Experiment were isolated using an off-line video editing system and recorded as still images under the same narration as used by the motion video presentation. The frames appear on the screen at the same moment in the narration as they appear in the motion video presentation and remain until the next selected breakpoint frame appears at its point in the narration.

Twenty-seven subjects, 20 women and 7 men, were divided into four groups. The groups were scheduled from mid morning to mid afternoon in an attempt to eliminate biological variables. All 27 subjects were given the same pre-test. In the laboratory, 14 subjects were exposed to the motion video presentation. The other 13 subjects were exposed to the still image video presentation. Three other subjects failed to fully complete the procedure and their data was discarded.

The narration of the video presentations was designed to be very abstract. Industrial safety information was drawn from abstracts located in the data base of the ABI Inform ProQuest on Business Periodicals Ondisc. The narrator was a professional broadcaster. As noted, the footage had been extracted from professional industrial video presentations. It was believed the research subjects, whose average age was 19.74 years, would have little prior exposure to this information. There are a total of 21 sentences in the script. Except for two sentences, every sentence contains one statistical fact. Prior to their exposure to each video presentation, subjects were instructed, "Please, watch the following video."

It was believed results could be skewed considerably using any other instruction. To tell the subject to watch the video as they would television would imply the subject should have a distracted attention level. To suggest the subject view the video as a classroom training experience would invoke a higher than normal attention level.

After exposure, each group was immediately tested using the questionnaire. Forty-eight hours later, the subjects were retested using the same questionnaire.

The multiple choice questionaire was intended to gauge factual recall. A pre-test had been conducted to eliminate floor or ceiling effects. The target for correct responses to the questionnaire after having viewed the video was 33% to 50%. The questions in Section I were randomized using a computer randomization program to avoid patterned responses based upon the order of presentation of the facts within the narrative or through the placement of the multiple choice answers..

Post Hoc Comparison

The final step was the post hoc comparison of subject responses using variance analysis and qualitative techniques.

Measures

The design was a two by two mixed model with two degrees of freedom. These were (1) the two levels of video message formats to which subjects are exposed and (2) the two levels of time at which subjects were tested, with time as the repeated measure. Because of the small sample population, Student-t distribution was used for the significance test. The actual calculations were done using a Lotus spreadsheet.

RESULTS

Hypothesis I:

The hypothesis remains unsupported.

Those viewing the motion video presentation scored higher on the immediate recall test than those viewing the video with breakpoints. They average11.4 correct answers compared with 10.4 for the breakpoint stimulus group. However, an analysis of variance showed no statistically significant differences beween the moving and still image recall scores.

Hypothesis II:

The hypothesis remains unsupported.

Those viewing the motion video presentation scored higher on the48-hour delay recall test than those viewing the video with breakpoints. They averaged 9.1 correct answers compared with 8.8 for the breakpoint stimulus group. However, after analysis for variance, the scores were shown not to be statistically significant.

A confidence level of 20 percent was obtained when comparing the relative amount of data recalled. The breakpoint group had less of a difference between its immediate average score and the 48-hour delay average score.

CONCLUSION

Memory Test Experiment

While the hypotheses remain unsupported, several observations emerged from the memory test experiment. First, the 27 subjects who participated in the memory test expressed a strong preference for pictures in general and moving images in particular in the pre-test. Ninety-seven percent of the subjects agreed they "like looking at pictures," and a majority of these said they strongly agreed. One-hundred percent disagreed that "pictures are not interesting," of which 67 % strongly disagreed.

They like video and television. While only 8% agree with or are neutral to the statement that "radio is only good for music," 70% indicate that radio is not where most of their information is obtained. At the same time, 52% disagree and another 30% strongly disagree with the statement, "I would rather read statistical information than view it with pictures." Every subject thought that statistical information is easier to understand when accompanied by pictures.

Not only does 67% disagree, and another 26% strongly disagree with the statement, "Television and video is not a good place to learn abstract information," but 59% and 22% agree or strongly agree, respectively, that "using television and video to learn detailed, hard to understand information is fun."

It is moving images they prefer. Fifty-six percent agree that "Training videos are more effective than slide presentations." Forty-eight percent agree, and another 4% strongly agree, that the pictures used should relate "directly to the narration." Only 18% disagreed or strongly disagreed.

While this information was derived almost exclusively from lower division undergraduates and cannot be generalized across the entire population of the United States, it suggests a strong indication of audience trends for the future of imaging research. Even at a university, in an environment strongly orientated to the written text, its citizens want pictures, preferably pictures that move.

In the memory test experiment using still and motion stimuli, there was not enough subjects, or power, to yield statistically significant results. The subjects, who had an average education of 13.81 years (sophomores in college), proved too diverse in their performance to be able to rule out chance as a factor in any results.

Initially, the experimenter was concerned that using students would not yield a demographic sample broad enough to be valid. However, analysis suggests that the demographic spread among the subjects was too broad and contributed more variables than could be controlled. A pre-test for subject performance, selecting only those subjects within a particular band of ability, could have yielded statistically significant results. However, the results then would be difficult to generalize beyond that selected group. The only way to validate this experiment is to increase the number of subjects many fold. An attempt to determine the power necessary to achieve significance proved inconclusive.

Despite the lack of statistical significance, several observations can be made about the experiment. The hypotheses were that subjects exposed to the still frame format would perform better on a memory recall test. Because cognitive effort is required to divide motion into breakpoints, it was proposed that this effort would detract from the attention given to the narrative. However, it is possible that viewers of still frames may have to put even more effort into reconstructing a sequence of breakpoints, despite the fact that Newtson suggested meaningfulness to the viewer is approximately the same for motion and still frame formats.

Breakpoint Determination

This breakpoint determination experiment was conducted for two reasons: One (1), to analyze breakpoints not as a tool of psychology, but as a tool of mass communication (What does a breakpoint look like?); and two (2), to create breakpoints for a video of still images to be used in the memory test experiment. In analyzing the concept of the breakpoint, it occurs that the definition of a breakpoint appears to parallel Cartier-Bressson's definition of the decisive moment in photography.

According to Cartier-Bresson, the decisive moment is when the elements of the composition selected in the viewfinder come together to form an image which conveys the greatest amount of meaning with the greatest amount of emotion to the viewer. Newtson's research suggests a breakpoint is significantly different in composition than the previous frames and that, when isolated, is capable of being decoded by subjects who were not exposed to the original action event. According to Newtson, a breakpoint represents that moment when uncertainty as to the course of the ongoing action has been eliminated.

For the photographer, the decisive moment is often measured in hundredths parts of a second. Newtson defined breakpoints as lasting from one to two seconds. In this experiment they were calculated to have a duration of 0.1 seconds to 1.4 seconds. It is possible this experiment had a technological advantage for matching the pulses from the continuous event recorder button directly to the frames selected.

Newtson used 16mm film for his early research. That is projected at 24 frames per second. A decoder would have to estimate the precise moment a frame was on the screen and the continuous event recorder button was pushed. Additionally, no record was located as to how a coder would define a Newtson breakpoint.

In the current research, video was used. This is projected at the rate of 30 frames per second. The pulse from the continuous event recorder button was recorded audibly on the video sound track.

It allowed the coder to pause the tape each time the tone was heard on record the correct time as it was displayed on the screen. (Experimentation showed there was a 0.3 second delay between the coder hearing the tone and the video cassette recorder pausing.) For measurement purposes, the presentation was broken into one-tenth of a second segments. As note, these time divisions appeared on the screen. One-tenth of a second represents three actual video frames--or for the purposes of reference, a frame/unit. For the purposes of this experiment, a breakpoint was initially defined as all the continuous-event recorder button pulses which were contiguous with each other (i.e. 0.3, 0.4, 0.5) and represented selections by 25% of the subjects. In order to create enough breakpoints to meet the needs of pacing the still video presentation, the definition of a breakpoint was expanded to include frame/unit selections which were not contiguous but closely clustered (i.e. 0.1, 0.3, 0.4, 0.5, 0.7). As noted, the expanded breakpoints never exceeded 1.4 seconds in length before significant time gaps occurred. The mean duration of a breakpoint in this experiment was five tenths (0.5) of a second.

How breakpoints are selected appears to be highly selective among individuals, though a concensus is readily perceived when individual data is combined. Newtson's subjects averaged 52.1 breakpoints selected over 5 minutes when given fine unit instructions. Subjects given gross unit instructions averaged 21.3 breakpoint selections over the same period. Fine unit subjects averaged 10.42 breakpoints per minute. Gross unit subjects averaged 4.26 breakpoints per minute. Subjects in this experiment were given fine unit instructions. They averaged 45.45 breakpoints over the 3:22 minutes of video stimulus, or 13.49 units per minute. However, the quantity of breakpoints selected by individual subjects ranged from 15 to 72, or from 4.45 frames per minute to 21.36 frames per minute. Between these two individuals, there were only two breakpoints upon which they agreed. The experimenter noted the most marked quality of their performance was the extremes of uncertainty and confidence exhibited by the two personalities.

Newtson noted in his use of the Eshkol-Wachman movement notation system that subjects appear to monitor particular body parts of a participant in an event. In 29 of the 63 breakpoints agreed upon in this experiment, subjects appeared to be monitoring the movement of the hands. In one case the head was the only body part moving and in two others, both the head and the hand were moving during the duration of the breakpoint. In another breakpoint, the foot taking a step appears to have stimulated subjects' selection of frame/units. The other breakpoints involved scenes where most or all of the body was included in the frame. In these, body movement was the most notable movement. In one scene two men appeared as very small figures in the frame. In another, a man was visible only through the windshield of a moving vehicle. In both cases, no breakpoints were agreed upon by the subjects. The same thing happened in an extreme close-up of hands typing.

As the video footage selected emphasized manufacturing tasks--tasks done primarily with the hands--and as the instructions referred to the behavior or other people, one cannot reach any conclusions about the importance of one body member over another in the creation of breakpoints.

There are four patterns which emerge from the breakpoint data: One (1) the **descending breakpoint** in which a peak appears and is then followed by a descending number of selections; (2) the **rising breakpoint** in which selections increase toward a peak; (3) the **sequential breakpoint** in which no two individuals select the same frame unit, but enough are contiguous to indicate a consensus; and four (4) the **spiked breakpoint**, in which many selections are registered in a single tenth of a second with no, or virtually no, nearby selections.

Using Newtson's idea that a breakpoint occurs just after the moment uncertainty has been eliminated, it is possible to suggest some reasons behind the four patterns. Consider Scene 12 in which a man is dipping parts into and removing them from a vat (see appendix I). This begins at 1:37:1 minutes into the presentation. Within three-tenths second of the scene beginning, a subject marks 1:37:4. Then, four subjects all mark 1:37:6, the man still reaching down into the vat but beginning to rise, as a breakpoint. Two more subjects mark the adjoining frame, 1:37:7. It was not until 1:38:5 that the hand with the part in it could actually be seen, yet no one marked this moment. If the subjects were following the instructions of how to use the continuous event recorder button, they reached an understanding of the man's action almost immediately and needed no more breakpoints to define it, thus creating a descending breakpoint.

As the man turns and appears to be placing the part down on the counter, subjects again begin, one by one, to register selections which will define a new breakpoint. The first hit is at 1:40:1, another at 1:40:3, two at 1:40:4, and then three at 1:40:5. Then, no more hits for four tenths seconds, ending the breakpoint under this experiment's definition. It is not until 1:41:1, six-tenths seconds later that the part is actually down on the counter and the man is releasing his grip. It appears to be as Newtson predicted, as the course of the part downward to the counter became more certain, more subjects registered their selections for a breakpoint. It also appears that, once virtually all uncertainty was eliminated, they needed no more breakpoints to define the action, thus creating an ascending breakpoint.

The sequential breakpoint, in which subjects' selections are evenly distributed appear when there is repetitive action, such as the woman composing type in scene 20 (2:40:7). In an earlier action, there is an extremely sharp ascending breakpoint as the woman closes the lid on her optical scanner. Only one more hit occurs after six subjects define 2:41:6 as the peak. However, when the woman turns to her computer, putting first her right hand, then her left on her keyboard, there are only scattered selections. As the typing begins, creation of a breakpoint involving 45% of the subjects begins. However, only two frame/units out of seven have more than a single selection. A near majority of subjects agree something meaningful is happening, the data would suggest, but just when that decision is reached varies by individual.

In another situation, when a man walks beside his pickup and slowly puts on his hat (2:51:4-2:51:6), there is again even distribution of two selections over three sequential frame/units. There were only three sequential breakpoints out of the 63.

There was one spiked breakpoint registered in this experiment. Five subjects selected frame/unit 1:50:1. A man carries a piece of metal past the camera. The previous frame/unit selected was 1:49:8. The subsequent frame/unit registered was 1:50:9. The man's head is cut off as he enters the scene. The part is the focal point of the camera. The man's stride and hands remain unchanged through the scene. This spiked breakpoint was registered the moment the man's eye becomes visible.

The largest number of subjects to select a single frame/unit (2:06:0) was nine. A man reaches for a box on a warehouse shelf inserting his left arm behind the box as his right hand begins to move up from his side. Under the original definition by this experiment, it would have been a spiked breakpoint. However, under the expanded definition, the contiguous frame/units, 2:06:2 to 2:06:6, are counted as part of this breakpoint. The apparent casualness of the man's action versus the strength of this response invites further study of multiple limb movement in the creation of breakpoints.

Newtson, as reported in his experiments, never used a film or video with more than one actor. He was concerned a second person in the composition would introduce too many variables. As this experiment was an attempt to examine a real life viewing experience, in two scenes two individuals were shown. In each case it appears the research subjects showed little confusion defining the breakpoints. In Scene 9 (1:10:4), a man offers another man a computer printout. The rate of selection of frame units rise and fall without ambiguity. Man offers printout (1:11:1), both men hold printout (1:12:3), and other man remains holding printout as the first man turns away. While the peak selection of a single frame/unit was when both men held the paper, the bulk of the hits making up this ascending breakpoint occurred as the recipient was reaching for or not yet firmly holding the paper.

If a spiked breakpoint indicates absolute certainty among subjects as to where the significant action occurs and a sequential breakpoint indicates a great uncertainty as to where the peak of the breakpoint is, then it could be hypothesized that the degree of increase or decrease in the ascending or descending breakpoints is could be a measure of the efficiency of the breakpoint to communicate to the viewer.

For example, an ascending breakpoint would indicate the bulk of subjects required more attending to the event before a significant number of subjects found it meaningful. A descending breakpoint would indicate a significant number of subjects found the breakpoint immediately understandable, with other subjects "catching on" a little more slowly. In order for such a measure to be valid, a standard scale for rating frame/unit selection would have to be constructed. A value would be computed based upon the number of decisions making up the breakpoint and the steepness of the slope associated with it when it is graphed. Should a spike of six frame/unit selections have a value greater than an ascending breakpoint of ten frame/unit selections which stair step from one to four selections per 1/10th second time division?

The advantage of such a system is that a media researcher could analyze the effectiveness of a video scene; or select a point in the action to create a freeze frame. Such a scale could be the basis of measuring visual literacy by seeing how an individual selects breakpoints compared to a standard group of subjects who have already segmented the testing video.

More importantly, Deese noted that experimenters avoid using pictures in paired associate and similar tests because of the diffiuclty coding pictures. A breakpoint meaningfulness or stimulus scale could aid future researchers.

In mass communications and journalism, photographers and picture editors would benefit from a knowledge of breakpoint studies. Primarily, it offers a possible explanation as to why traditional professional practices have evolved. Photographers and editors knew certain "tricks" worked, with a study of breakpoints, they can have a better idea why such things work.

First, it suggests why there is the often observed difference between "good" and "bad" photographers. Some photographers may not be capable of "seeing" a picture, no matter how good their reflexes or fast their motor drives are. Photography may not be a totally learned skill.

Second, this experiment suggests the importance of people in the picture in order that viewers may monitor their body language as part of the message. The lack of any consensus when small figures or extreme close ups of body parts was presented suggests personality judgements may be an important part of the message, as Zajonc (Zajonc 1980) noted.

Third, the four types of observed breakpoints suggests to still picture editors that there is no place for the ambiguous photograph if one is to communicate. When selecting images, the most communication appears to come, as Newtson first observed and as this experiment also indicates, not at the concluding moment of an action, but just before or just after. The dish just before it hits the floor has an inevitable destination. The shards flying in all directions explains what must have happened. However, the dish, at the moment it touches the floor could just be laying there.

Fourth, the inclusion of several people in a single picture need not distract from the message as long as it is clear as the action passed clearly from one actor to the other.

This has immediate, practical applications for the photographer, photo editor and other image handlers in making editorial decisions. Frame grabbing for publication from Cable News Network will require a new type of picture editor. With the latest trend in television toward shorter and shorter cuts(essentially self-contained breakpoints), even film and video editors could better understand the decisions they now attribute to intuition and experience.

Of more interest to the experimenter is the possibility that breakpoints can even be measured for meaningfulness or stimulus potential. And, by extension, human subjects can be measured for visual literacy. As researchers delve deeper into dual coding and related subjects, being able to quantify a subject's band width of visual categorization should aid measurement.

The breakpoint creation experiment suggests that photojournalism's belief in the "decisive moment" is a lay expression of cognitive psychology's visual breakpoint. This provides the basis of many more mass communication research studies.

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APPENDIX I

BREAKPOINT SELECTION DATA BY 20 SUBJECTS

		Frame--Duration	Scene	Frame Time/Sec.
1:7			**(1) Man Welding**	
1.7		*(1) Cl/U welding torch*		**5.2**
2:3				
2:5				
3:8				
4:8				
5.0				
6:6 (starts to remove welding rod from metal)				
6:7				
6:8 6:8	(touches hand to back of helmet)			
6.9 6:9	***6:9***	***(2) Man lifting welding helmet--1.1***		***2.5***
7.0 7:0		(no face showing, poor as still photos go)		
7:1 7:1				
7.3 7:3	(hand leaves raised helmet			
7:4 7:4				
7:5 7:5				
7:6 (hand leaves picture frame)				
8:0				
8:1				
8:5				
9.4 9:4	***9:4***	***(3) Man with hand on welding clamp--0.5***		***1.7***
9:5				
9.6				
9:8				
9:9				
10:2				
10:3			**(2) man handling frame**	
10:8 10:8	10:8			
11:1	***11:1 11:1***	***(4) Man raising frame--0.9***		***3/3***
11:3				
11:4				
11.5	***11:5***			
11:6				
11:7	***11:7***			
11:8	(face covered by metal frame support)			
12:1				
12:2				
12:3				
14:4	***14.4 14:4 14:4***	***(5) Pushing frame forward--0.3***		***1.8***
14:5	***14:5***			
14:6				
14:7				
15:3				
16:1	(hand leave picture frame)			
16:2	***16:2***	***(6) Man turning away--0.4***		***0.7***
16:3				
16:4				
16:5	(starts to move away)			

16:9 ***16:9*** ***16:9*** ***(7) Man walking around frame--0.2*** ***2.7***
17.0 ***17:0*** (face hidden by support on metal frame)
17:1 ***17:1*** (face clears other side of frame)
17:4
18:0
18:1 (measuring top of frame)
18:3
18:5
18:6 18:6
19:1 19:1 (hands brought quickly down)
19:4
19:6 ***19:6*** ***19:6*** ***(8) Man starting to measuring bottom of frame--0.92.5***
19:7 ***19.7***
19:9 ***19:9***
20:1 ***20:1*** ***20:1*** (hands swing to right of picture frame)
20:2 ***20:2***
20:3 ***20:3***
20:4 (hands brought together below bottom of picture frame)
20:6
21:7 (hands can be seen moving across bottom of frame)
21:8
21:9
22:0 ***22:0*** (left hand reaches right hand which holds tape measure)
22.1 ***22:1*** ***22:1*** ***(9) Man with hands holding tape--0.6*** ***2.0***
22:2
22:3
22:6 (right hand moving)
22:7
23:5
23:6 **(3) man with QC caliper**
23:8 (right hand poised, posture remains unchanged until 24:9)
23:9
24.0 ***24:0*** ***24:0***
24:1 ***24.1*** ***24:1*** ***(10) Man holding part to caliper--1.4*** ***2.2***
24:2 ***24:2***
24:4
24:5
24:6
24:8 ***24:8***
24:9 (right hand begins to move)
25:4
25:8 (right hand reaches lever on caliper)
26:0 (right hand begins to pull lever on caliper)
26.1
26:2
26.3 ***26:3*** ***(11) Man has lever on caliper pulled half way--0.7*** ***0.3***
26:5
26:8 (right hand leaves caliper lever)
26:9
27:0
27:3
27:5 (right hand reaching for computer key)
27:7 ***27:7*** ***27:7*** ***27:7*** ***(12) Man with finger on computer key--0.8*** ***0.5***
27:8 ***27:8***
27:9 ***27:9*** ***27:9*** (hand comes off computer key)
28.0 ***28:0*** ***28:0***

28:1
28:2 *28:2*
28.4 *28:4* *28:4* (hand half way back to caliper)
28:7 **(4) woman with QC caliper**
29:2
29:3
29:4
29:6
29:9 ***(13) Woman with caliper--0.8*** ***2.8***
30:0 *30:0* (no change in position)
30:1
30:6
31:3
31:5
31:9
32:2 32:2 (lifting hand-held caliper from work)
32:6
32:7 *32:7* *32:7* *32:7* ***(14) Woman looking at hand-held caliper--0.4*** ***2.2***
32.9 *32:9*
33:0 *33:0* (beginning to put caliper down)
33:3
33:9 33:9 33:9 (bringing hand up from caliper)
34.1 (finger on writing pen)
34:6
34:7 (pen being raised)
34:8 (pen above paper)
34:9 *34:9* ***(15) Woman holding pen over paper--0.5*** ***4.6***
35:0
35:1 *35:1*
35:3
35:5
35:7
35:9
36:1 36:1 (woman writing)
36.6 36:6
36:7
36:8
37:0 37:0 (camera begins zoom in on pen)
37:1
37:5 (blurred close-up of pen writing)
38:00
39:0 (pen in process of being lain down, poised over paper)
39:1 (hand leaves pen)
39:2 *39:2*
39:3
39:4 *39:4*
39.5 *39:5* *39:5* ***(16) Woman just lain down pen--0.9*** ***2.0***
39:6
39:8 *39:8*
39:9
40:3
41:1
41:3 **(5) overall mining**
41:4
41.5 ***(17) Overall of mine w/small man--N/A*** ***5.7***
42:0 (Camera pulls back from shot of dredge at work to long shot of
42:1 small figures at work on slim hole tool rig. Though no consensus was
42:3 reached by subjects, a shot was selected to satisfy technical needs.)

42:9
45:0
45:3
45:7
45:8 (can see men at work)
46:2

46:6 **(6) two men with tool**

47:0
47:1
47:2 *47:2* ***(18) Man pulling tool wire--0.4*** ***4.4***
47:3 *47:3*
47:4
47.9
48:0
48.1 48:1
48:3
48:7 48:7 48:7 (first man walks out of frame)
48:9
49:4 (second man at log truck facing away from camera0
50:0 (second man starts to turn toward camera)
50:3 *50:3*
50:4 ***(19) Man carrying tool--0.2*** ***5.9***
50:5 *50:5*
50.8
50:9 50:9 (second man moves closer to camera)
51.0
51:6 51:6 (second man dominates frame)
51:7
52:3
52:5
53:5
55:5

55:6 **(7) Two men hoisting tool**

56:0
56:2 *56:2*
56:3 *56:3* ***(20) Two men hoisting tool--0.5*** ***5.8***
56:4
56:5
56.7
56:9 56:9
57:2 57:2 (second man turns away)
57.4
57:7
57:8
58:6 58:6 (second man leaves frame)
58:7
59.5
59:6
59:8
59:9
1:00:1
1:00:9
1:01:6
1:01:8

1:01:9 **(8) man putting tool in hole**

1:02:0
1:02:1 *1:02:1* ***(21) Man holding tool vertically--0.3*** ***4.3***
1:02:3 *1:02:3*
1:02:5 1:02:5
1:02:7 1:02:7 1:02:7

102.9				
1:03:1				
1:03:2				
1:03:3	1:03:3	(first man pushing tool toward hole)		
1:03:6				
1:04:0	1:04:0	1:04:0 (first man holds tool directly over hole)		
1:04:6				
1:05:5	1:05:5	(tool beginning to drop into hole slowly)		
1:06:1	***1:06:1***	(rate of descent increases)		
1:06:2	***1:06:2***			
1:06:4	***1:06:4***		***(22) Man putting tool down hole--0.9***	***4.7***
1:06:5	(hand releases tool and begins to fall back)			
1:06:7	(descending hand clearly seen)			
1:06:8				
1:06:9				
1:07:0	(hand reaches side)			
1:07:3	1:07:3	(hand at side)		
1:07:6	(camera pans away from man to close up of only tool descending)			
1:08:2				
1:09:3				
1:10:3				
1:10:4			**(9) men with printout**	
1:10:8	***1:10:8***			
1:11:0	***1:11:0***			
1:11:1	***1:11:1***		***(23) Second man offering printout--0.6***	***1.2***
1:11:2				
1:11:4				
1:11:7	(new breakpoint)			
1:11:8				
1:11:9				
1:12:0				
1:12:2	***1:12:2***			
1:12:3	***1:12:3***	***1:12:3***	***(24) Both men holding printout--0.9***	***1.1***
1:12:5				
1:12:6	***1:12:6***			
1:13:0				
1:13:1	(third man turns from camera)			
1:13:3	***1:13:3***			
1:13:4			***(25) Third man begins to turn to camera--0.6***	***5.0***
1:13:5	***1:13:5***			
1:13:7	***1:13:7***			
1:13:9	(second man has left picture frame)			
1:14:1				
1:14:3	(third man turned back to handout)			
1:14:9				
1:15:1				
1:15:3				
1:15:9				
1:16:7	1:16:7	(man opens printout)		
1:17:0			**(10) tool truck moving**	
1:17:4				
1:17:5	1:17:5	1:17:5		
1:17:7				
1:17:8				
1:18:0				
1:18:2	***1:18:2***	(second vehicle becomes visible)		
1:18:4			***(26) Logging truck on road--n/a***	***12.8***
1:18:5	***1:18:5***		(only 14 subjects marked a breakpoint in this sequence)	

1:20:3
1:27:1
1:30:5 **(11) man painting**
1:30:5
1:30:9 *1:30:9* (face completely hidden behind support, but arm can be seen moving)
1:31:0
1:31:1 *1:31:1* *1:31:2*
1:31:3 *1:31:3* ***(27) Man painting behind frame--0.6*** ***6.4***
1:31:4 (in frame above, one-half of face is visible)
1:31:5 (whole face becomes visible)
1:31:8
1:31:9
1:32:1 1:32:1
1:32:4 1:32:4 1:32:4 (man painting beside frame)
1:32:5
1:32:7
1:32:9
1:34:3
1:35:5 1:35:5 (man painting beside frame)
1:35:8
1:36:0
1:36:3
1:37:1 **(12) man dipping parts**
1:37:4
1:37:6 *1:37:6* *1:37:6* *1:37:6* ***(28) Man reaching into vat--0.5*** ***2.9***
1:37:7 *1:37:7*
1:37:8
1:37:9
1:38:4
1:38:5 1:38:5 (part clearing vat)
1:38:9
1:39:0 1:39:0
1:40:1
1:40:3
1:40:4 *1:40:4*
1:40:5 *1:40:5* *1:40:5* ***(29) Setting part down--0.4*** ***1.3***
1:40:9
1:41:0
1:41:1 1:41:1 (releases grip on part)
1:41:5
1:41:6
1:41:7
1:41:8 *1:41:8* ***(30) Reaching for new part--0.3*** ***1.0***
1:42:1
1:42:3
1:42:5
1:42:7 *1:42:7*
1:42:8 *1:42:8* *1:42:8* ***(31) New part showing--0.3*** ***0.6***
1:43:2 (new breakpoint)
1:44:3 *1:43:3*
1:43:4 *1:43:4* ***(32) New part over vat--0.5*** ***1.2***
1:43:5
1:43:7
1:43:8 *1:43:8*
1:44:1
1:44:3 *1:44:3*
1:44:4

1:44:5

1:44:6 *(33) Lowering part into vat--0.6* ***0.9***

1:44:7 *1:46:7*

1:44:8

1:45:0 **(13) man taking part**

1:45:4

1:45:5 *1:45:5* *(34) Man taking part off plating machine--0.4* ***4.6***

1:45:6 *1:45:6*

1:45:8 *1:45:8*

1:46:3 1:46:3 1:46:3 (man turning toward camera)

1:46:4

1:46:7 1:46:7

1:46:9

1:47:2

1:47:3 (man walking with part)

1:49:0

1:49:2

1:49:4 **(14) man carrying part**

1:49:5

1:49:8

1:50:1 *1:50:1* *1:50:1* *1:50:1* *1:50:1* *(35) Man carrying part--0.05* ***3.3***

1:50:9

1:51:2

1:51:3

1:51:7

1:52:5

1:52:7

1:53:3 *1:53:3*

1:53:4 *1:53:4* *1:53:4* *1:53:4* *1:53:4* *(36) Putting part on shelf (side view)--0.1* ***0.9***

1:53:5 **(15) man putting up part**

1:53:8

1:54:0

1:54:2 *1:54:2* *1:54:2* *(37) Putting part on shelf (front view)--0.5* ***3.8***

1:54:3 *1:54:3*

1:54:4

1:54:5

1:55:2

1:55:3 (man putting part up on shelf)

1:56:5

1:56:6 (man setting part firmly down on shelf)

1:57:0

1:57:4

1:57:7

1:57:9

1:58:0 *1:58:0* *1:58:0* *(38) Man walking away--0.4* ***4.4***

1:58:1

1:58:4 1:58:4

1:58:6 1:58:6 1:58:6 ((leaving area, back to camera)

1:64:7

2:01:2 **(16) man moving boxes**

2:01:9

2:02:0 2:02:0 (hefting box)

2:02:2 *2:02:2*

2:02:3

2:02:4 *2:02:4* *2:02:4* *(39) Man lowering box--0.7* ***3.6***

2:02:5

2:02:7

2:02:9 2:02:9 (box directly over pallet)

2:03:1
2:03:2
2:03:7 2:03:7 2:03:7 2:03:7 (box firmly down on pallet)
2:04:3
2:04:5
2:05:2
2:06:0 ***2:06:0 2:06:0 2:06:0 2:06:0 2:06:0 2:06:0 2:06:00 2:06:0***
2:06:2 frame above ***(40) Reaching for next box with left hand--0.6*** ***2.0***
2:06:3
2:06:5
2:06:6
2:07:0
2:08:0 ***2:08:0*** ***(41) Pulling out next box--0.2*** ***1.2***
2:08:1
2:08:2
2:08:3 (end breakpoint)
2:09:2 ***2:09:2 2:09:2*** ***(42) Lowering box to pallet--0.1*** ***0.1***
2:09:3 ***2:09:3*** (very similar to breakpoint 2:02:4)
2:09:4 **(17) man stamping metal**
2:09:7
2:09:9 2:09:9 (man bending piece)
2:10:1 2:10:1
2:10:5
2:10:7
2:10:9 ***2:10:9 2:10:9*** ***(43) Man bending piece--0.3*** ***4.6***
2:11:1
2:11:2
2:11:5
2:11:9 2:11:9 2:11:9 (action not clear, note increase in breakpoints as subjects search for information)
2:12:1 2:12:1
2:12:7 2:12:7
2:12:8 2:12:8
2:13:7
2:13:8
2:14:3
2:14:4 (moving away from machine)
2:14:6 (lightly tosses part. both hands on part)
2:14:9
2:15:1 ***2:15:1 2:15:1*** (man turning so partly facing camera)
2:15:3
2:15:4
2:15:5 ***2:15:5 2:15:5*** ***(44) Man completely turned to camera--0.7*** ***2.3***
2:15:6
2:15:7
2:15:8 (left hand releases part)
2:16:4
2:17:0 2:17:0 (part poised over the table)
2:17:1
2:17:2
2:17:5
2:17:7 ***2:17:7***
2:17:8 ***2:17:8*** ***(45) Putting part down--0.7*** ***2.0***
2:17:9
2:18:1 ***2:18:1 2:18:1*** (man releases part)
2:18:2
2:18:5 2:18:5
2:18:8
2:19:5

2:19:6 ***2:19:6*** ***(46) Both hands on new part--0.2*** ***2.4***
2:19:8 ***2:19:8*** ***2:19:8*** ***2:19:8*** (man turning toward machine with new part which left hand has
2:20:1 2:20:1 just released. picture too blurred to make good still image, but understandable
in motion)
2:20:3 2:20:3 (man walking to machine)
2:20:4
2:20:6
2:21:7 (reaches machine)
2:22:1 (camera begins rapid zoom for close-up of hands working)
2:22:2 ***2:22:2*** ***(47) Man almost inserting new part in machine--0.4*** ***4.5***
2:22:3
2:22:4
2:22:5
2:22:8 (completes zoom)
2:23:1
2:23:2 2:23:2 (hand moves, inserting part)
2:23:6
2:24:3 2:24:3 (positioning part)
2:25:4
2:25:8
2:26:1 2:26:1 2:26:1 (bending part up)
2:26:5

2:26:7 **(18) woman setting type**

2:26:9
2:27:0 ***2:27:0***
2:27:1 ***2:27:1*** ***(48) Panning back of typesetter at computer--0.3*** ***5.3***
2:27:2
2:27:5 2:27:5 (No hands or face can be seen. Action not totally clear to non-typesetter.)
2:27:7
2:28:0
2:28:3
2:28:4
2:31:8
2:32:1
2:32:2
2:32:3 ***2:32:3***
2:32:4 ***2:32:4*** ***(49) Panning back of typesetter--0.4*** ***2.8***
2:32:5

2:33:5 **(19) woman's hands typing**

2:33:9
2:34:3
2:34:6
2:34:8
2:35:1
2:35:2 ***(50) Close up of typing hands--0.2***
6.4
2:35:3 (no consensus as to which frame is a breakpoint. the action is repetitive,
2:35:8 but there is no defined change between action units. one subject tried to select
2:36:3 every stroke, others made no selection.)
2:37:5
2:38:2
2:38:5
2:39:4
2:40:7

2:40:7 **(20) woman composing**

2:40:9
2:41:1 ***2:41:1*** ***2:41:1*** (begins to close lid)
2:41:3
2:41:4 ***2:41:4***

2:41:5 ***2:41:5*** ***2:41:5***
2:41:6 ***2:41:6*** ***2:41:6*** ***2:41:6*** ***2:41:6*** ***(51) Woman lowering scanner lid--0.6*** ***3.8***
2:41:7
2:42:0 (woman turns to monitor)
2:42:5 2:42:5 (reaching for keyboard)
2:42:9
2:43:0
2:43:1 (right hand on keyboard)
2:43:5
2:44:0 (both hands on keyboard)
2:44:1
2:44:3
2:44:4
2:44:5 2:44:5 (both hands on keyboard, eyes looking up at monitor)
2:44:7
2:45:1 (typing begins)
2:45:3
2:45:4 ***2:45:4*** ***(52) Both hands typing--0.8*** ***2.2***
2:45:5
2:45:6
2:45:7
2:45:9 ***2:45:9***
2:46:7 **(21) man leaving truck**
2:47:3 ***2:47:3***
2:47:4
2:47:6 ***2:47:6*** ***2:47:6*** ***(53) Opening truck door--0.8*** ***3.9***
2:47:7
2:47:8
2:47:9 ***2:47:9***
2:48:1
2:48:3
2:48:5 (left foot hits ground)
2:48:7
2:48:8 (right foot appears under truck door, poised over ground)
2:49:0
2:49:3
2:49:6 2:49:6 (man clears open door)
2:50:3
2:50:5
2:51:4 ***2:51:4***
2:51:5 ***2:51:5*** ***(54) Man walking and putting on hat--0.2*** ***1.7***
2:51:6 ***2:51:6***
2:52:1 **(22) man at back of truck**
2:52:7 (man turns toward hole)
2:52:9
2:53:0
2:53:1 ***2:53:1*** ***2:53:1*** (begins to take step)
2:53:2 ***2:53:2*** ***2:53:3*** ***2:53:5*** ***(55) Man carrying tool, striding forward--0.5*** ***3.7***
2:53:9 2:53:9
2:54:0
2:54:1
2:54:6
2:55:7
2:56:1
2:56:3
2:56:7 (raising tool to near vertical)
2:56:8
2:56:9 ***2:56:9*** ***(56) Tool poised over hole--0.3*** ***0.9***

2:57:0 (tool descends)
2:57:4 (new breakpoint)
2:57:5 ***2:57:5*** ***2:57:5***
2:57:6 (Technical quality of frame forced use of breakpoint below instead of this frame.)
2:57:7 ***2:57:7***
2:57:8 ***2:57:8*** ***(57) Man lowering tool into hole--0.4*** ***6.8***
2:59:5
2:59:7
3:02:5
3:02:6
3:02:9
3:03:2
3:03:3 (turning from hole, left leg moving)
3:04:0 ***3:04:0*** (hand on hatch of pickup shell)
3:04:2
3:04:3
3:04:4
3:04:5 ***3:04:5***
3:04:6 ***3:04:6*** ***3:04:6*** ***(58) Raising hatch of truck shell--0.7*** ***1.6***
3:04:7
3:05:1
3:05:3 3:05:3 (moving away hand after raising hatch)
3:05:4
3:05:7
3:06:0 (left hand touches tailgate of pickup)
3:06:1 ***3:06:1***
3:06:2 ***(59) Man leaning into truck--0.3*** ***4.2***
3:06:3 ***3:06:3***
3:06:6
3:06:9 (man begins to stand up, no limbs seen)
3:07:1
3:07:8 (man begins to lean back into truck, no limbs seen)
3:08:6
3:08:8
3:09:1
3:09:4 3:09:4 (leaning farther into back of truck)

3:09:5 **(23) two men at computer**

3:09:8
3:09:9
3:10:2 ***3:10:2*** (pencil begins to move)
3:10:3
3:10:4 ***3:10:4*** ***(60) Man pointing at computer with pencil--0.3*** ***4.7***
3:10:5
3:10:8 (pencil pointing at screen begins to descend)
3:11:0 3:11:0 (pencil descending)
3:11:4 (man has turned toward camera)
3:11:8
3:12:1
3:12:2 3:12:2 (man looking at other man)
3:12:3
3:12:6
3:12:7 (man looking back at screen)
3:13:1
3:13:3
3:13:8

3:14:4 **(24) man at drafting table**

3:14:9 (man begins to turn from picture left to right)
3:15:0

3:15:1	***3:15:1 3:15:1***	***(61) Man looking at drawings--0.8***	***2.4***
3:15:2			
3:15:3			
3:15:5			
3:15:6			
3:15:7	***3:15:7*** (looking at other side of drafting table)		
3:15:9			
3:16:2	3:16:2		
3:16:4	(in next frame, right hand begins to move)		
3:17:1	***3:17:1*** (right hand has reached left side of picture frame)		
3:17:2			
3:17:3			
3:17:4			
3:17:5	***3:17:5 3:17:5***	***(62) Man marking on drawing--0.8***	***3.3***
3:17:6			
3:17:7			
3:19:9			
3:20:8	***3:20:8***	***(63) Man moving right hand back across desk--0.7***	***1.8***
3:20:9	(left hand begins to move)		
3:21:0			
3:21:1			
3:21:3			
3:21:4			
3:21:5	(left hand poised over right side of desk)		
3:22:0	(hand on desk)		
3:22:4	(right hand moving)		
3:22:6		**END**	

APPENDIX II

MEMORY TEST
NARRATION SCRIPT
TEST VIDEO

revised 12/26/93

TIME:3:22 min.

BREAKPOINT $_{\#}$ FACT [#]

$_{1}$OVER TEN -THOUSAND[1] AMERICAN WORKERS WILL DIE$_{2}$ AND SIX-MILLION[2] WILL SUFFER$_{3}$ DISABLING WORK-RELATED INJURIES THIS YEAR,$_{4}$ THE A-F-L-C-I-O ESTIMATES.$_{5}$ HOWEVER, THE NUMBER OF ACCIDENTAL$_{6}$ DEATHS$_{7}$ ON THE JOB IS THE LOWEST, ACCORDING$_{8}$ TO THE NATIONAL SAFETY COUNCIL, SINCE$_{9}$ NINETEEN TWENTY-FOUR[3] EVEN $_{10}$THOUGH, TODAY, ALMOST ONE-HUNDRED-FIFTY$_{11}$ MILLION[4] AMERICANS$_{12}$ ARE EMPLOYED.$_{13}$

WORK EXPERIENCE,$_{14}$ AGE AND LITERACY LEVEL ARE$_{15}$ STRONG PREDICTORS OF WHICH WORKERS ARE MOST LIKELY TO BE KILLED OR INJURED.$_{16}$ FORTY-EIGHT PERCENT[5] $_{17}$OF ACCIDENTS HAPPEN TO WORKERS IN THEIR FIRST YEAR OF EMPLOYMENT.$_{18}$ IN CALIFORNIA, ALMOST FORTY PER CENT OF$_{19}$ WORKERS INJURED ON THE JOB ARE BETWEEN THE AGES OF TWENTY AND TWENTY-NINE YEARS OLD[6]. $_{20}$ACCIDENTAL INJURIES ARE THE SIXTH[7] MOST COMMON CAUSE OF DEATH IN PEOPLE$_{21}$ OVER SIXTY-FIVE. FOREIGN-BORN$_{22}$ WORKERS

CONSTITUTE TWELVE PER CENT[8] OF ON-THE-JOB DEATHS.$_{23 - 24 - 25}$

SOME TASKS HAVE AN OBVIOUS POTENTIAL TO KILL. APPROXIMATELY $_{26}$THREE-THOUSAND SIX-HUNDRED[9] WORKERS DIE EACH YEAR IN CAR AND TRUCK ACCIDENTS. OTHER TASKS KILL YEARS LATER AND EACH CANNOT BE COUNTED AS AN ON-THE-JOB DEATH.$_{27}$ AN ESTIMATED SIXTY-THOUSAND[10] PEOPLE DIE ANNUALLY FROM DECADES OF CHEMICAL$_{28}$ EXPOSURE. FIFTY-TWO[11] CANCER$_{29}$ DEATHS EACH YEAR$_{30}$ ARE THOUGHT TO BE$_{31}$ CAUSED BY$_{32}$ LOW-LEVEL RADIATION$_{33}$ EXPOSURE,$_{34}$ AGAIN, ACCUMULATED OVER YEARS OF LABOR.$_{35}$

SOME JOBS$_{36}$ ARE LINKED TO PARTICULAR$_{37}$ TYPES OF INJURIES. TOE, FOOT AND LEG$_{38}$ INJURIES ACCOUNT FOR TWENTY PER CENT[12] OF ALL ON-THE-JOB$_{39}$ INJURIES. OVER ONE-HALF[13] OF THESE CLAIMS$_{40}$ ARE MADE BY PEOPLE WORKING IN$_{41}$ WAREHOUSING.$_{42}$ AT THE SAME TIME,$_{43}$ REPETITIVE MOTION TASKS RESULT IN ONE-HALF[14] OF ALL WORK PLACE$_{44}$ ILLNESSES REPORTED TO THE$_{45}$ OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION.$_{46}$ MANUFACTURING EMPLOYEES GENERATE$_{47}$ NINETY PER CENT[15] OF THESE REPEATED TRAUMA CLAIMS.

$_{48}$OF EVERYONE EMPLOYED IN THE UNITED STATES, FIFTEEN TO TWENTY PERCENT[16] ARE AT RISK$_{49}$ OF DEVELOPING CARPAL TUNNEL SYNDROME$_{50}$--JUST ONE OF THE REPETITIVE MOTION DISORDERS.$_{51}$

ACCIDENTS COST MORE THAN LIVES. THE$_{52}$ AVERAGE BUSINESS MOTOR VEHICLE ACCIDENT$_{53}$ COSTS EIGHT-THOUSAND, NINE-HUNDRED, EIGHTY-SIX[17] DOLLARS,$_{54}$ FOR A TOTAL OF FIFTEEN POINT TWO$_{55}$ MILLION[18] DOLLARS IN LOST PRODUCTIVITY ANNUALLY.$_{56\text{-}57}$ OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION FINES ARE BETWEEN TEN-THOUSAND$_{58}$ AND SEVENTY-THOUSAND[19] DOLLARS$_{59}$ FOR REPEATED AND WILLFUL VIOLATIONS.$_{60}$ ULTIMATELY, THE LOSS TO PRODUCTIVITY FROM UNSAFE WORK PLACES TOTALS$_{61}$ FORTY-EIGHT POINT SIX BILLION[20] DOLLARS$_{62}$ PER YEAR.$_{63}$

-30-

APPENDIX III

MEMORY TEST
PRE-TEST

Revised 1/22/94

Male / Female **Age** ____________

Years of Educ: 8 9 10 11 12 13 14 15 16

Occupation ____________________

1. Pictures should be used in delivering abstract information only when the pictures related directly to the narration.

Strongly agree Agree Neutral Disagree Strongly Disagree

1 (1) 2 (13) 3 (8) 4 (3) 5 (2)

2. I always collect a lot of facts about an issue before I actually make up my mind.

Strongly agree Agree Neutral Disagree Strongly Disagree

1 (4) 2 (11) 3 (5) 4 (7) 5

3. Pictures are not interesting to me.

Strongly agree Agree Neutral Disagree Strongly Disagree

1 2 3 4 (9) 5 (18)

4. Using television and video to learn detailed, hard to understand information is fun.

Strongly agree Agree Neutral Disagree Strongly Disagree

1 (6) 2 (16) 3 (3) 4 (1) 5 (1)

5. Television and video is not a good place to learn abstract information.

Strongly agree Agree Neutral Disagree Strongly Disagree

1 2 3 (2) 4 (18) 5 (7)

6. I often use the phrase, "I see what you are saying."

Strongly agree Agree Neutral Disagree Strongly Disagree

1 (5) 2 (8) 3 (10) 4 (3) 5 (1)

7. I like looking at pictures.

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1 (15)	2 (11)	3 (1)	4	5

8. I would rather read statistical information than view it with pictures.

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	2 (2)	3 (3)	4 (14)	5 (8)

9. A slide show is a much more effective medium than video.

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	2 (1)	3 (8)	4 (15)	5 (3)

10. How one feels about an issue is more important than knowing a lot of facts.

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	2 (3)	3 (7)	4 (12)	5 (5)

11. I often use the phrase, "I hear what you are saying."

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	2 (5)	3 (7)	4 (12)	5 (4)

12. Most of my information comes from radio.

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1 (1)	2 (5)	3 (2)	4 (17)	5 (2)

13. Training videos are more effective than slide presentations.

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1 (2)	2 (15)	3 (9)	4 (1)	5

14. Statistical information is easier to understand when it is accompanied by pictures.

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1 (12)	2 (15)	3	4	5

15. Radio is only good for music.

Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	2 (1)	3 (1)	4 (20)	5 (5)

16. In any presentation of abstract information, is important to have photographs, even if those photographs do not directly illustrate the commentary delivered at the same moment.

Strongly agree		Agree		Neutral		Disagree		Strongly Disagree	
1	(1)	2	(6)	3	(11)	4	(8)	5	(1)

Appendix IV

MEMORY TEST QUESTIONNAIRE

Revised 1/22/94

Format: M ____ S ____

Male / Female **Age ____________**

Years of Educ: 8 9 10 11 12 13 14 15 16

Occupation ________________

1. How many American workers die each year on the job? (1)

A. Over 6,000 B. Over 7,500 C. Over 10,000

2. Approximately how many workers die each year in vehicular accidents? (9)

A. 1,200 B. 2,400 C. 3,600

3. How many workers die each year from the effects of long-term chemical exposure? (10)

A. 6,000 B. 60,000 C. 6,000,000

4. For people over 65, accidental deaths rank in what place as the most common cause of death? (7)

A. 6th place B. 9th place C. 12th place

5. Toe, foot and leg injuries account for what percentage of on-the-job accidents? (12)

A. 20% B. 22% C. 25%

6. Repetitive motion tasks result in what fraction of all work place illnesses reported to the Occupational Safety and Health Administration? (14)

A. 1/4 B. 1/3 C. 1/2

7. What percentage of people employed in the United States are at risk of developing Carpal Tunnel Syndrome? (16)

A. 5%-10% B. 10%-15% C. 15%-20%

8. Fines for repeated, willful safety violations assessed by the Occupational Safety and Health Administration cover what range? (19)

A. $1,000 - $7,000 B. $10,000 - $70,000 C. $100,000 - $700,000

9. Immigrants account for what percentage of on-the-job deaths? (8)

A. 6% B. 9% C. 12%

10. In California, forty per cent of accidents happen to workers between which ages? (6)

A. 18-24 B. 20-26 C. 20-29

11. How much does the average commercial motor vehicle accident cost? (17)

A. $6,898 B. $8,986 C. $9,868

12. The number of on-the-job accidental jobs are the lowest since which year? (3)

A. 1907 B. 1924 C. 1988

13. Workers with less than one-year of experience account for what percentage of accidents? (5)

A. 29% B. 48% C. 65%

14. How many American workers suffer disabling injuries each year? (2)

A. 6 Million B. 7 Million C. 16 Million

15. Commercial motor vehicle accidents annually cost American business how much in lost productivity? (18)

A. $15.2 million B. $25.1 million C. $52.1 million

16. What percentage of all repeated trauma claims are filed by manufacturing employees? (15)

A. 36% B. 60% C. 90%

17. Loss in productivity from unsafe work places in the United States totals how much per year? (20)

A. $48.6 billion B. $64.8 billion C. $86.4 billion

18. What fraction of toe, foot and leg injuries are made by people working in warehousing? (13)

A. Over 1/8 B. Over 1/4 C. Over 1/2

19. How many cancer deaths among American workers each year are attributable to long-term, accumulated exposure to low-level radiation? (11)

A. 52 B. 102 C. 172

20. Approximately how many Americans are employed? (4)

A. 50 million B. 150 million C. 250 million

APPENDIX V

MEMORY TEST QUESTIONNAIRE ANSWERS

Revised 1/22/94

1. C. Over 10,000
2. C. 3,600
3. B. 60,000
4. A. 6th Place
5. A. 20%
6. C. 1/2
7. C. 15-20%
8. B. $10,000 - $70,000
9. C. 12%
10. C. 20 - 29
11. B. $8,986
12. B. 1924
13. B. 48%
14. A. 6 million
15. A. $15.2 million
16. C. 90%
17. A. $48.6 billion
18. C. Over 1/2
19. A. 52
20. B. 150 million

APPENDIX VI

MEMORY TEST SUBJECT'S CORRECT SCORES

SUBJCT	SEX	STILL/ MOTN	FIRST TEST	DELAY TEST
5699	F	S	7	5
3365	F	S	16	11
3959	F	S	9	3
1294	M	S	12	5
5919	F	S	14	12
4650	F	S	12	13
7678	F	S	13	13
6239	F	S	11	11
7878	F	S	9	11
0430	F	S	6	7
6780	F	S	10	7
4259	M	S	10	9
0395	F	S	6	8
0696	M	M	13	13
4867	M	M	9	7
3633	M	M	13	9
5475	F	M	12	10
3911	F	M	13	8
5616	F	M	11	5
7095	F	M	11	9
5203	F	M	12	11
6585	M	M	12	11
6196	F	M	14	10
4824	F	M	10	12
8893	M	M	9	8
6746	F	M	7	8
0829	F	M	13	7

NAME AND ADDRESS	DATE