A Semiotic Analysis of Biotechnology and Food Safety Images in *Time, Newsweek,* and *U.S. News & World Report*

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Abstract

This study examined the photographs and photo illustrations used in Time, Newsweek, *and* U.S. News & World Report *biotechnology and food safety stories in 2000 and 2001. Semiotic theory provided a conceptual framework for interpreting data collected through a quantitative content analysis. The evaluation of 45 images indicated that the news magazines had relatively balanced coverage of the issues. Five categories of images were determined to be used by the news magazines: food, animals, scientists or food handlers, producers, and foreign. These results are consistent with journalism research in relationship to the use of images to create perceptions and support stereotypes. Based on the results of this study, agricultural communications and journalism programs should emphasize visual media literacy. Understanding how images support stereotypes or influence public perception, rather than providing objective information, can be used to develop communications campaigns advocating a point-of-view.*

So What?

Photographs have the power to persuade public opinion. This study analyzed 45 photographs from *Time, Newsweek,* and *U.S. News & World Report* to evaluate differences in the quantity and nature of images used in biotechnology and food safety. Communicators can use the results to evaluate their own photograph selections to accompany agriculturally-based news stories.

Introduction

The influence of media on public perception has been researched for decades by mass communication researchers. As the general population has moved away from first-hand agriculture experience, it has become more important to study the media coverage of agriculturally-based issues. Research in agricultural communications has shown that the treatment of agricultural issues by the popular press is lacking and that there is a difference in the sources used by agricultural and popular press magazines (Whaley and Doerfert, 2003; Whitaker and Dyer, 2000). These studies focused on the text of the message and did not consider the images photographs that accompanied the story.

This study examined how images were used by *Time, Newsweek,* and *U.S. News & World Report* in stories about biotechnology and food safety. Images create statements. When combined with text, images dominate words and are processed in the brain to create perceptions about the subject (Barry, 1997). The visual content of *Time, Newsweek,* and *U.S. News & World Repor*t communicates to the public to create or support perceptions.

A 2005 study of eye movement (Wartenberg & Holmqvist) compared designers' predictions of reader eye movement through a newspaper spread and the actual readers' eye movement data. Statis-

tical significance was found for the factors of use of color, picture type, and picture size. Interestingly, "greyscale images were seen earlier and coloured (sic) images seen later" (p. 8) than what was predicted by designers. Photographs were found to attract the reader more than information graphics, maps, or drawings (Wartnerberh & Holmqvist). Finally, large pictures were found to have shorter viewing times than what designers would predict. This study demonstrates a need to continue to study images and their influence on readers, as the results indicated significant differences in designers' prediction and readers' behaviors.

Frick, Birkenholz, Gardner, and Machtmes (1995) found that inner-city high school students from Midwestern states were significantly less knowledgeable about agriculture than their rural counterparts. Both respondent groups were reported to have a positive perception of agriculture; however, it was concluded that the urban population's perception was based on something other than personal interaction with individuals employed in agriculture. It is likely that residents of larger cities and metropolitan area rely more heavily on information presented by the media. Understanding this relationship is important when considering how to educate and inform various audiences about food and agriculture.

The field of semiotics, which guides this study, was first introduced by Saussure in 1916. Semiotics was further developed by the American philosophers Charles Pierce and Charles William Morris (Chandler, 1994). Roland Barthes' work in the field contributed to the expanded use of semiotics in cultural studies (Chandler). More recent use of semiotics theory has been in the field of mass communication. Semiotics decodes the meaning of a visual image through examination of signs. Signs are indications of how a message is communicated to the reader and are classified into three different layers. An iconic sign represents what the object is. For example, a photograph of a car would represent the actual vehicle. An indexical sign represents a meaning that is implied through the photographed object. For example, an expensive car would indicate that the owner was wealthy. A symbolic sign is when an image represents another object or idea. The same expensive car could represent luxury or affluence.

Purpose and Objectives

Biotechnology and food safety have been highly emotional and visual topics in the news. But are these portrayals objective? Or do they support a perception by the public or media?

This study evaluated differences in the quantity and nature of images used in biotechnology and food safety articles in three popular news magazines: *Time*, *Newsweek*, and *U.S. News & World Report*. Two objectives guided the study: (a) To identify and quantify the types of messages conveyed through the images used in biotechnology and food safety stories, and (b) To classify representation of the images and decode the messages conveyed.

Marks and Kalaitzandonakes (2001) evaluated the framing and agenda setting of agrobiotechnology, which includes food safety, in three US and two UK national newspapers. The findings confirmed framing bias of agrobiotechnology issues at various times, from positive in the early '90s to less favorable following major events. This study did not include images in the content analysis, leaving a gap in the overall evaluation of agrobiotechnology.

Agricultural issues in the media

Research in agricultural communications has extensively examined the treatment of agricultural issues in the popular press. Whitaker and Dyer (2000) examined articles in *Time*, *Newsweek*, and *U.S. News & World Report*, and the top three circulated agricultural magazines—*Farm Journal*, *Progressive*

Farmer, and *Successful Farming*. One objective of the study was to determine if the sources used in a news story affect the balance of the story. The researchers reported that both the news magazines and the agricultural publications most often used sources from educational institutions (62.2%) and governmental agencies (60.8%). A contrast in source choice was identified: Agricultural sources (36.5%) were mostly used by agricultural publications while nearly all activist sources (29.7%) were cited in the news magazines.

Whaley and Doerfert (2003) sought to quantify the nature of food safety coverage by *Time*, *Newsweek*, *U.S. News & World Report*, and *Business Week*, using content analysis. This study found that stories about food-borne illnesses appeared most frequently in the magazines, and stories about technological advances, second. The most quoted sources were governmental officials.

Whaley and Doerfert (2003) wrote:

> Understanding how a major mass media channel such as news magazines reports food safety and related risks can enhance the ability of agricultural communicators and university specialists to support the news industry and increase coverage of food safety-related university research. (p.18)

Both of these studies confirmed that different news organizations seek different sources and choose different angles when presenting agricultural news stories. Continuation of this line of inquiry will strengthen the application of agenda-setting and framing theories in agricultural communication.

Stringer (1999) surveyed managing editors and reporters employed at Pennsylvania newspapers. More than 70% of those surveyed considered food safety and human health to be agricultural topics, in addition to pest and disease control, farmland development, and gardening. More than 90% indicated that they considered environment, business, and water quality to also be agricultural topics. These are all issues that have been broadly covered in news magazines, but not necessarily identified as agricultural topics.

Image-based research

Zillmann, Gibson, and Sargent (1999) used an experimental design to determine if photographs exemplifying one side of an issue were more influential than descriptive images on viewer perceptions and recall. One component of the study exposed subjects to four different news story layouts about the economics of farming: no image, poor farmer, rich farmer, and both images. The respondents were asked to recall the images at a later time. They recalled the compelling photograph of a poor farmer or a danger-projecting roller coaster ride more easily than other images (Zillmann, Gibson, & Sargent).

These studies verify that agriculture-related stories should be examined for bias and evaluated for journalists' proficiency at relaying these stories to audiences. Grunig, Nelson, Richburg, and White (1988) concluded that agricultural audiences actively seek helpful information and are in turn educating themselves. There is a need to determine the influence of images related to biotechnology and food safety based on issue representation. The lack of visual studies found in agriculture communications indicates a gap in the research.

Lester (1995) quoted Walter Lippmann as saying: "Whether right or wrong…imagination is shaped by pictures seen…consequently they can lead to stereotypes that are hard to shake" (p.100).

To fully understand how images create stereotypes, it is important to understand how media messages can be interpreted.

The process of interpreting messages is an active process. Lester (1995) wrote that to find meaning within a photograph, the viewer must actively concentrate on the subject of the photograph rather than just observing the photograph. An example of concentration on the subject is found in Griffin's (2004) visual content analysis of *Time*, *Newsweek*, and *U.S. News & World Report* to compare the photographic coverage of the Gulf War, the war in Afghanistan, and the war in Iraq. He found that the most frequently used photographs were of the military, were aligned with the government's position and did not offer fresh perspectives.

Trumbo (2000) called attention to the importance of researching the visual images used to communicate scientific information. She outlined several research studies describing the lack of public understanding of basic scientific facts despite Americans access to science issues through television, newspapers, images, and the internet. Trumbo issued a challenge to evaluate how visual communication influences public understanding of science.

Huxford (2001) found that the claims of objectivity by the media were not supported by the evidence in his analysis of visual media used by the press. He wrote that the media needed to support their stories through the inclusion of pictorial representations. This need drives news media professionals to create photographs, even when the subject does not lend itself to visual portrayal. Taylor (2000) supported this idea when he wrote that the nature of news will keep the public from having an accurate visual portrayal because pictures are used to provide sensationalized images rather than the documentary style photographs that were once highly valued.

Singletary and Lamb (1984) found, through an analysis of National Press Photographers Association winning news photographs, that images containing emotion and feature photographs depicting hardship were most frequently chosen as the winning photographs. The researchers concluded that photographs cannot be seen as reality because an expectation of what a photographer should capture exists. To become an award-winning photographer, a news photographer must be able to capture emotionally charged, negative images of violence, crime, and disasters, and feature photographers must be able to capture positive images of triumph and courage.

The NPPA code of ethics is to "promote the highest quality in all forms of photojournalism." The code creates accountability for photojournalists to capture accurate and balanced images (www.nppa.org), suggesting that consumers of mass media should be able to view the images as accurate portrayals of reality.

Semiotics

Semiotics is one of the many ways image messages are evaluated to determine if they portray reality. Chandler (1994) wrote that the shortest definition of semiotics is simply "the study of signs" (para. 1). F. de Saussure and C.S. Pierce are credited as the founders of semiotics; while Roland Barthes is a leading semiotic theorist. Barthes is well known for his work in the semiotic field and is credited with bringing the concepts to the visual communication field (Chandler).

Saussaure (1959) wrote that a person lives in a world shaped by decoded signs found in images, actions, words, and more that he or she has encountered. The purpose of semiotics is to become aware of the construction of reality created by those signs (Chandler, 1994). In doing this, the researcher is able to understand how the audience will decode the message, create that reality, and give insight into the culture (Bignell, 2002).

Chandler (1994) wrote that understanding messages reveals the equality of the messages that create that reality. Moriaty (1997) added to that concept when he wrote that using semiotic methodology in visual communications is ideal because the cognitive processes and interpretive processes are parallel.

Danesi (2002) found that the semiotician is concerned with what a certain structure means, how it is able to represent what it means, and why it means what it means. In image-based research, identifying these signs within a photograph gives insight into the meaning of the photograph and what that photograph will mean to the average viewer.

The application of the Saussurean model includes interpreting images through the signifier and the signified. The meaning of a sign is not contained within it, but interpreted from it (Chandler, 1994). Therefore, the signifier is the form of the sign, and the meaning beyond the form or the concept it represents is the signified. The signified can be broken down into three modes: Iconic, indexical, and symbolic (Chandler). The iconic mode is what the signifier appears to be: what it looks like, sounds like, feels like, and smells like. The indexical mode is the direct connection between the signifier and the signified; this connection may be observed or inferred. The third mode is symbolic. The symbolic mode is a "learned relationship; the signifier does not resemble the signified "(Chandler, Signs section, para 39).

Bignell (2002) explained the three modes with the example of a Rolls-Royce. The car is a material signifier, a symbol that not only communicates the make of the car, but also communicates a mental concept of value. When the average viewer sees a photograph of this car, several messages are communicated through this single image. Each of these messages is a different mode.

The iconic mode would interpret the sign (Rolls-Royce) as a car, automobile, or mode of transportation. The interpretation of the indexical mode would attach a meaningful connection, such as wealth or ownership, to the sign. Finally the symbolic mode would interpret the sign through a learned understanding, wealthy people drive expensive cars, or it may symbolize all expensive automobiles.

Deprawt (2002) used semiotics to analyze the photographic representations of the Japanese during the attack on Pearl Harbor and the representation of terrorists after September 11, 2001, in the Washington Post and the New York Times. He found that the media played a role in developing the perception of the enemy. His findings indicated that semiotic methodology provided researchers with information about the content of the images and an understanding of how the audience would interpret the image and the effect it could have on building perceptions. He reported that the news media worked with power structures to create an image of "otherness" about an adversary of the United States.

Methods

This study employed descriptive methodology and quantitative content analysis to analyze the images in the 2000 and 2001 issues of *Time* (n=10), *Newsweek* (n=16), and *U.S. News & World Report* (n=19). A semiotic analysis was employed to meet the research objectives. Bignell (2002, p. 11) wrote: "The same principles underlie the semiotic study of visual sign and linguistic signs. In each case, there is a material signifier, which expresses the sign, and a mental concept, a signified, which immediately accompanies it."

To decode an image, it is important that the researcher understands the culture of the photograph (Chandler, 1994). The primary researcher for this study was female, Caucasian, was completing an

advanced degree, had an educational background that included photography and graphic design, and was an active photographer from a southern U.S. state. Therefore the interpretation of the signs is based on the culture of the United States.

Codes are the rules and constraints that guide the researcher in the meaning making task, as they are used in production of the meaning as well as its interpretation (Chandler, 1994). Intra-coder reliability was established through repeated measures (Leeuwen and Jewitt, 2001). The coder identified the type of message and classified all symbols based on relevant variables. She repeated the classification one week later with 90% agreement.

Semiology often involves the study of only a few images without concern for generality. The study relies on analytical integrity and interest; therefore the results of this study are not generalizable to all popular press photographic coverage of biotechnology and food safety. Semiotic theory recognizes that different researchers will interpret signs differently based on their background, culture, and experiences. Therefore the decoding of meaning may vary from the intended or encoded meaning of the image (McQuail, 2005). An apparent weakness in semiological analysis of photographs or images in a news publication is the increasing capability to digitally manipulate photographs. "They (photographs) nevertheless always retain a visual trace of what was there when the picture was made" (Rose, p. 82).

The population for this study was all published issues of three national general interest news magazines in 2000 and 2001: *Time*, *Newsweek*, and *U.S. News & World Report*. All three publications are weeklies, distributed on Monday, with circulations of 4,109,962 (*Time*), 3,125,151 (*Newsweek*) and 2,201,351 (*U.S. News & World Report*) (Bacon's, 2004). *Time*, *Newsweek*, and *U.S. News & World Report* were chosen due to their circulation and previous usage in the Whaley and Doerfert (2003) and Whitaker and Dyer (2000) studies.

Images for inclusion in the study were selected by a committee after reviewing the contents of the population. The committee consisted of two faculty members, one high school teacher, and one student. This committee represented the readership of popular news magazines: average age of 46, predominately male, and above average incomes (Journalism.org, 2007). Stories were identified as biotechnology or food safety by committee consensus. The usable sample included 45 images: 10 in *Time*, 16 in *Newsweek*, and 19 in *U.S. News & World Report*.

The story pages were scanned into a digital file and saved in Adobe Photoshop®; the images were extracted from the story and saved in a separate folder. Only images were considered and other visual elements such as non-photo graphics, graphs, and charts were not included in the study. Captions can provide information and description of an image, but the caption may also contradict the image's message (Leeuwen & Jewitt, 2001). Therefore captions were not included in the analysis. Additionally, in one specific story family members had provided images of loved ones whose deaths were attributed to mad cow disease. These photos were not taken to illustrate the story; therefore, while they offered insight into image choice, they were determined to be incompatible with the objectives of this study.

The images were classified into categories according to the main subject of the image. Categories were developed based on generally-accepted denotations in the American culture (Leeuwen & Jewitt, 2001). Categorization provided a level of generality from which numerical description of the biotechnology and food safety images used in the magazines could be extracted. The final analysis yielded five classification categories: Food, animals, scientists/research, producers/food handlers, and foreign, and three types of messages: Positive, negative, and neutral.

The researcher used semiotic methodology to gain insight into image messages communicated to viewers by looking for signs that would communicate a message to the United States populace. The semiotic analysis consisted of decoding each image by identifying its iconic, indexical, and symbolic meaning through the signs found in the image. Those signs were then interpreted to decode the message conveyed.

Results

The 45 images were first coded into message tone – positive, negative, or neutral. The images were then categorized by content to identify and quantify the types of messages. Signs within the image were used to determine whether the message was positive, negative, or neutral toward agriculture in the articles about biotechnology and food safety.

A positive message type subject evoked a positive emotional response, reinforced a positive message, or made the viewer react positively toward the subject. Positive photographs in this study included healthy, well-cared-for animals; fresh meats and vegetables; and individuals with positive expressions. For example, the man with the Brahman cow in Figure 1 appears to be moving away from the "kiss" he is receiving, but his expression does not indicate fear. Emotionally, the viewer responds to the playful tone conveyed because the man appears to be caught off-guard and does not appreciate being licked.

Neutral message types do not communicate a message due to a lack of signs, or they convey both positive and negative emotions. An example of a neutral photograph is the fish illustration in Figure 1. The image merely depicts the size difference in two salmon, but does not portray one as better than the other.

Negative message types include such things as protestors, animals in poor conditions, and frightening pictures of piles of burning beef carcasses. In Figure 1, the cow being moved by the pallet jack evokes a negative response from the viewer. The head of the cow is not distinguishable, the driver of the pallet jack appears to be keeping the cow as far away as possible, and the background of the image is dark and empty. These photographs may shock, scare, or sadden the reader with the negative messages.

Figure 1. Positive, neutral, and negative photo examples

Table 1 depicts the tone of messages that the three magazines *Time*, *Newsweek*, and *U.S. New & World Report* used in their 2000 and 2001 stories about biotechnology and food safety. The image analysis revealed that *Time* and *U.S. News & World Report* used a majority of positive pictures while *Newsweek* used a majority of negative photographs. This finding is consistent with the research of Singletary and Lamb (1984); Zillman, Gibson, and Sargent (1999); Trumbo (2000); Taylor (2000); and Huxford (2001). Media are more likely to use images that can influence perceptions rather than neutral, objective images.

Table 1
Messages Portrayed in Biotechnology and Food Safety Images (N=45)

Source Category	*Time* (n=10)		*Newsweek* (n=16)		*U.S. News & World Report* (n=19)	
	n	%	n	%	n	%
Positive	6	60	6	40.0	9	47.4
Negative	1	10	8	53.3	6	31.6
Neutral	3	30	1	6.3	4	19.0

The photographs were then categorized by the researcher and committee into five categories based on the main subject: food, animals, scientists/food industry workers, producers, and foreign. Semiotic analysis was then applied to decode the messages in the images. Messages were validated by committee members.

Table 2
Categorization of Biotechnology and Food Safety Images (N=54)

Source Category	*Time* (n=10)		*Newsweek* (n=16)		*U.S. News & World Report* (n=19)	
	n	%	n	%	n	%
Food	3	30	2	12.5	5	26.3
Animals	2	20	7	43.8	6	31.6
Scientists/ Research	1	10	2	12.5	2	10.5
Producers/Food	2	20	3	18.8	2	10.5
Foreign	1	10	1	6.3	3	15.8

Food

There were ten images of food in all forms: processed, raw, and cooked. Many of these images were positive, based on their healthful appearance. Healthful appearance could be interpreted as an indexical sign meaning the food is safe to eat. Figure 2 shows packaged tomatoes, the iconic message being packaged tomatoes sold in a grocery store. The indexical sign can be interpreted as safe and healthy, based on the color, cleanliness, and packaging. Symbolically, the viewer can interpret the image to mean that tomatoes sold by this distributor are nutritious, a message learned from previous

experience. This photograph could trigger a positive response from the viewer about the subject before the article is read. Likewise, Figure 2 includes a close-up shot of what appears to be fresh hamburger meat (iconic) in a clean environment (indexical) because we only see the white paper under the meat. The meat does not have discoloration or any other visual signs that would indicate to a viewer that the meat would be unsafe to eat; therefore it would symbolize safe food.

Figure 2. Positive representation of tomatoes and ground beef

Figure 3 indicates a different message. The Porterhouse steak is on a clean, stainless steel surface (iconic), which would be an indexical sign indicating to the viewer the meat is in a sanitary environment. However it is wrapped in yellow caution tape with the words caution do not eat (iconic). To the reader, this is symbolic of a dangerous situation, which indicates that the meat, although healthy in appearance, should not be eaten.

The other food images included extremely oversized vegetables, raw food products, and meat hanging in a meat locker as story illustrations.

Figure 3. Negative representation of steak

Animals

Images classified as animal images included both live and dead animals. Some of the 15 images included people, but the subject of the photograph was always the animal. These images included positive and negative connotations. Images such as confined chickens, a shepherd hooking a lamb, and sheep without grass are examples of negative connotations. Figure 4 shows caged chickens with their heads out of the cage (iconic sign). The large number of chickens in the small amount of space is an indexical sign indicating to the viewer that the chickens are in tight quarters and are uncomfortable. American viewers may decode this as ill treatment of the chickens.

Likewise, there were images of well-cared-for animals, also seen in Figure 4. The image of a doctor holding a small pig and a man holding a lamb can be interpreted as protected from its environment (symbolic) based on the animal's position and relationship to the person. People hold things close that are important or purposeful;

Figure 4. Positive and negative representations of animals

therefore, it is an indexical sign that the animal is important and is being cared for because it is important to that person.

Other images showed animals in unnatural situations, such as being used in science experiments. The indexical signs of wires attached to the crab shown in Figure 5 lead the reader to draw the conclusion that this crab is not in its usual environment (indexical) and is probably being used in an experiment (symbolic). The photograph of the scientist with a cat depicts a woman smiling as she holds a bobcat that appears aggressive (Figure 5). The expression of the bobcat, ears forward, mouth open, teeth exposed, is an indexical sign that the animal is unhappy. The leash is symbolic for captivity. Viewers could read the message to be a negative tone concerning wild animal captivity.

Figure 5. Representations of research and experimentation

Scientists/Research

This category included five images that involved scientists or research; some of these photos were also classified as animals. The photos in this category tended to be negative based on subject placement, subject choice, and lighting. The symbol of a white coat (iconic) indicates to the viewer that the individual has a high amount of education (indexical) or works in a sterile environment (symbolic). A viewer can interpret that the white coats represent science and medical doctors. The symbol of a white coat, as shown in Figure 5, has consistently been shown through media outlets and educational materials to be worn by doctors and scientists working in labs. It can be interpreted that these are careers involving power, education, and economic advantage.

The photos classified as research displayed instruments used for measurement or collection of information. The crab in Figure 5 appears to be wired with the blue tape and visible wires; these are iconic symbols of measurement that can indicate research (indexical) while the forward ears and bared teeth of the cat and the tight line of the leash indicate confinement (indexical) and restraint of wildlife by research. The other photos showed animal embryos with metal instruments. This can be symbolically interpreted as research related to cloning, DNA, or other research requiring collection of tissue or fluid samples.

The female scientist portrayed in Figure 6 overshadows the positive interpretation by adding a symbolic sign of danger or evil through the use of red and black. Her facial expression can be interpreted as negative because she appears to be staring at the viewer with the edges of her mouth turned down — a indexical sign of unhappiness, annoyance, or disinterest.

The photograph of the man leaning over the counter, Figure 6, is somewhat difficult to analyze. Although he may be a scientist or in a field of science as indicated by the iconic symbols in the background, bottles and tools associated with a lab, he does not immediately gain viewers' attention based on his career. His stance, expression, and hand placement lead the viewer toward a mes-
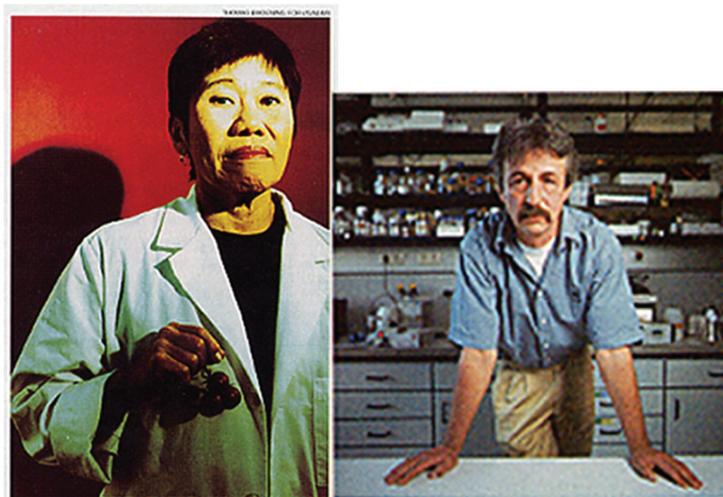
Figure 6. Images of Scientists/Researchers

sage of disinterest and confidence as he leans toward the viewer. The forward lean could be interpreted symbolically as a challenge or intimidation stance. While the iconic signs indicate scientist, the indexical signs and symbolic signs do not immediately support the iconic interpretation.

The images of scientists tended to be portrait-style photographs, as seen in Figure 5 and Figure 6. While this does not directly relate to the determination of the positive or negative value of the photograph, it could be a sybolic sign to a viewer about the importance of the individual.

Producers/Food Handlers

The workers in the meat industry were also wearing white coats, but protective items such as hairnets, gloves, and safety glasses were included. The photographs were more positive than negative based on the clean environments, the healthy color of the product, and the obvious safety measures. These indexical signs indicate to a viewer that the workers are cautious when handling food products. These images symbolically represent the safety of the food supply. Another observation was that the images of food safety workers were action shots captured while they performed their jobs inspecting or working with food, as in Figure 7. Symbolically, that image can represent the active role taken to ensure food safety.

The producer images were classified based on the inclusion of an agricultural product in the image. These images were all positive; the subjects had many similar characteristics. The subjects were all white males and were assumed to be American, based on clothing and background details. The grey hair, an indexical sign, of the subjects would lead the viewer to believe they are older individuals. Each of the subjects was dressed in protective overalls or plaid shirts with the sleeves rolled up and jeans; these can be interpreted as indexical signs for hard work and blue-collar jobs. Figure 7 illustrates an example of a producer photograph.

Figure 7. Food handlers and producers

Similar to the scientist images, all of the producer photos appeared to be posed. But in the case of these photos, the subject was obviously tied to food production: fish and corn specifically. The corn and fish were indexical signs for staples in the food supply. These are both products that are promoted as nutritionally sound components of a healthy diet. The iconic signs supporting this message are the bright colors of the product and the environment and the quantity of the product in the photo. The symbolic sign could be a safe and abundant food supply, learned from experiences of well-stocked grocery stores and product availability.

Foreign

Foreign images were classified based on qualities indicating that the photographs were taken in a country outside of the US. In four pictures, the dress and living conditions of the subjects indicate a low socio-economic status. For example a photograph of children smiling, an iconic sign, indicates they are happy. However there are holes in their clothes and they appear thin, which is an indexical sign that a viewer would link with not having a lot of money. They are standing in a tall, green field, an indexical sign that they could have a good harvest that year. Symbolically the image indicates a better future for children in other countries. The images classified as foreign in general show the people doing manual labor, such as Figure 8, which symbolizes to the reader that they are not wealthy. The other picture in Figure 8 features former British Agriculture Minister John Gummer eating a hamburger as a symbol of food safety. The iconic signs are the hamburger, Gummer, and a young girl. The indexical sign is that hamburgers are safe because Gummer and the young girl are eating them. Symbolically it again indicates a safe food supply for adults and children; the viewer does not need to be concerned about their children becoming ill.

Figure 8. Foreign agriculture

Discussion

This study found that although *Newsweek* had more negative images, while *U. S. News & World Report* and *Time* leaned more toward the positive side, all three publications were close to having balanced coverage. This is desirable since balanced news coverage is a value of the news industry. However, the number of positive and negative images does not completely reflect the messages implied to a viewer through signs and symbolism. Semiotics researchers recognize that interpretation of signs is influenced by experience and culture. When analyzed in a context other than American culture the signs could produce alternative messages.

Five categories emerged from the semiotic analysis: food, animals, scientists/food industry workers, agricultural producers, and foreign nations. The small number of categories indicates that the same types of photographs are used to illustrate biotechnology and food safety stories. Consequently, the media world that is created through the images introduced reinforces stereotypes (Potter, 2001) about agriculture, especially biotechnology and food safety issues.

For example, because of the time frame of this study and the topic of food safety, an abundance of images were extracted from stories about mad cow disease. These images included burning beef carcasses, a headless cow being moved by a pallet jack, and a motherless family. These images are

graphic and call for an emotional response from the reader. The images consistently communicate the same messages about mad cow disease before the viewer reads the article.

The Zillmann, Gibson, and Sargent (1999) study found that compelling photographs, especially danger-projecting photographs, are more easily recalled and shape viewers' perception more so than non-compelling photographs. The use of negative images will shape viewers' perceptions more so than neutral or positive images. Therefore, photographers and journalists should be held accountable for objectivity not only in reporting, but also in photograph selection.

This research supports Trumbo's (2000) view that it is important to research visual images used in stories about scientific information. Images are encoded to elicit a response from the reader. The decoding of the message, without corresponding factual information, may result in misinterpretation of the image. Therefore continuing to build the knowledge base of visual literacy will provide more detail to be applied in photography and graphic design.

Another observation was the semiotic signs used in the images. Iconic, indexical, and symbolic signs were found in the images and were utilized to create image categories. These signs communicated messages, positive and negative, to the audience about the agricultural issues. Although some would say that meaning is made from a photograph only if the viewer is actively reading it (Lester, 1995), this research found deliberate use of signs to convey specific messages, as demonstrated in the steak with caution tape illustration and the pallet jack moving the cow carcass. This information would have the most impact on the reader and, as the Zillmann, Gibson, and Sargent (1999) study found, be what the viewer remembers and uses to form their opinions.

These findings indicate that even when a content analysis portrays balanced photographic content, additional reading of the image may present a contradictory message. Therefore, a photograph should not be judged by first glance, but read with a deeper purpose. The messages that these images convey have a much greater impact on public opinion related to an issue.

This study found that there is a need for photographers to have more knowledge about the subjects that they are shooting. Their knowledge and understanding of the subject may directly impact the ability to foresee messages created in their images. Therefore, it would benefit the agricultural communications and journalism field if students were trained in photographic technique and visual image interpretation. This type of study would produce more media-literate graduates who can influence future image production.

Developing visual literacy allows individuals to understand how images impact their perception of issues. As Frick, Birkenholz, and Machtmes (1995) found, inner-city students did not have experience with agriculture, so they turned to other sources for information. The media serve as an accessible source of information. Therefore, unless consumers become media literate, agricultural communicators will make minimal progress in developing agricultural literacy.

Future research should continue to fill the gap in agricultural communications image-based research. Many studies can be found in journalism, anthropology, sociology, and communications, but agricultural communications has not entered this research arena. Visual communication research provides another tool for understanding perceptions, media influence, agricultural portrayal, and more.

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