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Using values to communicate agricultural science: An Elaboration Likelihood Model approach

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Using values to communicate agricultural science: An Elaboration Likelihood Model approach

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The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

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DEDICATION

For my family, friends, Jason and the rest of my unfailing support system. This is as much yours as it is mine.

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ABSTRACT

This study explored how preexisting values influence attitudes about GMOs and if aligning messages about GMOs with these values would lead to a greater chance of central processing, and subsequently, greater alignment with message-congruent attitudes. Utilizing the Elaboration Likelihood Model as a theoretical foundation, an online experiment was used to measure several values of participants, including altruistic, biospheric and egoistic value orientations as well as agricultural identity. Attitude accessibility and pre- and post-opinions were also measured in order to determine how much of an effect the presented stimuli had on the participants. All participants were presented with a stimulus that either aligned or didn't align with their self-ranked GMO value-argument. It was found that attitude accessibility, agricultural identity and in some cases a biospehric value orientation were the most important predictors for a number of constructs related to GMO attitudes. In addition, agricultural identity did not correlate with any other value orientation, yet was the strongest predictor of many related attitudes. Future research should continue to explore the complexity of values within agricultural communication contexts and expand the understanding of how agricultural identity influences such outcomes.

CHAPTER 1. INTRODUCTION

Communicating complex science to the public is a difficult task (Besley & Tanner, 2011; Davies, 2008). Communicating agricultural science has an additional level of complexity because of strong, polarizing values held by various audiences about the topic (Hart & Nisbet, 2012). Scientists and communicators often conceptualize their communication of agricultural science as the transmittal of facts to an information-deficient audience with a focus on how to best portray objectivity (Hart & Nisbet, 2012; Juanillo, 2001). While in some situations this approach can be useful, it fails to recognize that the receiver of the message brings their own values to the interpretation of the message, which will likely lead to the processing of identical agricultural information in heterogeneous ways (Goodwin, Chiarelli, & Irani, 2011; Hart & Nisbet, 2012).

One timely topic within this agricultural science context is genetically modified organisms (GMOs). GMOs were introduced in the 1980s and since then, many in the agriculture community have attempted to communicate the positive aspects of the technology to various audiences. Yet opposition still remains strong (Miller, Annou, & Wailes, 2003). Although scientific evidence suggests GMOs are safe for human consumption, many audiences doubt these findings and oppose GMO technology due to perceived health risks. Other audiences oppose GMOs for different reasons, such as possible environmental risks or a perceived shift away from family farms (Borlaug, 2000; Frewer, Howard, Hedderly, & Shepherd, 1997; GMO, 2011; Herrera-Estrella & Alvarez-Morales, 2001; Johnson, 2014; Schmidt, 2015). GMOs represent a relevant communication context for the study of values because the current social debate extends

far beyond the science to often focus on more value-based arguments about morality, economics or justice.

According to the Elaboration Likelihood Model (ELM), people process messages in one of two ways, using either the peripheral route or the central route (Rucker & Petty, 2006). Audiences with low motivation and/or ability to interpret information are more likely to use the peripheral route where their evaluation is based on cues present in or around the message, such as the perceived credibility of the source of the message, the mood of the recipient or a number of other surface-level factors that impact positive or negative emotions (Bhattacherjee & Sanford, 2006; Briñol & Petty, 2015; Rucker & Petty, 2006; Petty & Cacioppo, 1986). In contrast, audiences with high motivation and/or ability to interpret information are more likely to use the central route where their evaluation is instead based on a careful consideration of the arguments present in the message (Cacioppo, Petty, & Morris, 1983; MacDonald, Milfont, & Gavin, 2015; Petty & Briñol, 2015; Petty & Cacioppo, 1986; Rucker & Petty, 2006). Central processing does not necessarily correlate with either support or opposition for a particular topic but instead represents that the information was carefully considered.

The ELM acknowledges that audiences have their own preconceived values (Rucker & Petty, 2006; Petty & Cacioppo, 1986) and these preexisting values will affect their motivation to process a message—therefore also affecting the processing pathway used to comprehend a message (Cacioppo, Petty, & Morris, 1983; MacDonald, Milfont, & Gavin, 2015; Rucker & Petty, 2006; Petty & Briñol, 2015; Petty & Cacioppo, 1986). Returning to the context of GMOs, if scientists and communicators would instead consider the preexisting values of their audiences, they would likely be able to construct

messages about GMOs that encourage audiences to process information centrally, and possibly, consider novel information when forming attitudes about GMOs (Bhattacherjee & Sanford, 2006; MacDonald, Milfont, & Gavin, 2015; Petty & Cacioppo, 1986; Rucker & Petty, 2006).

This study aims to explore this question by examining the effects of GMO messages through the theoretical lens of the ELM that takes audience values into account. Specifically, this study will explore how preexisting values influence attitudes about GMOs and if aligning messages about GMOs with these values would lead to a greater chance of central processing, and subsequently, greater alignment with message-congruent attitudes.

CHAPTER 2. LITERATURE REVIEW

Values and Agricultural Identities

A person's individual values are described by Hitlin as "deeply personal but socially patterned and communicated" and "are essential for understanding social identity" (p.119, 2003). Values are essential for understanding a person's personal identity as personal identity is produced through commitments of the values (Hitlin, 2003). Multiple values about the same topic can form a value orientation. A value orientation is defined as "clusters of compatible values or value types" (Hansla, Gamble, Juliusson & Gärling, p. 2, 2008). Similarly, personal identity is defined as "a subjective awareness and experience of inner content, coherence, continuity, uniqueness, self-boundaries and self-worth" (Pilarska, p. 85, 2016). This identity is made up of a variety of individual factors including concepts, beliefs and desirable behaviors (Hitlin, 2003). Unique to every person, an identity influences how a person conducts themselves and evaluates others' behavior (Hitlin, 2003; Pilarska, 2016).

All of these constructs share five characteristics. First, both involve concepts and beliefs and secondly, are formed with a desirable end state or behavior in mind (Hitlin, 2003; Schwartz, 2012). These first two tie a person's values and identity to their ideal self. Third, both a person's values and their identity remain strong regardless of the situation. The fourth shared characteristic is influencing how a person chooses and responds to others' behaviors and actions (Hitlin, 2003; Schwartz, 2012). The final characteristic shared by both values and identity is that the individual orders them by importance (Hitlin, 2003; Schwartz, 2012). There are parts of a person's identity, based on their order of values, that are at the core of a person's self or more important than

others. While situations may require certain aspects of a person's identity or values, the core aspects do not change.

The Norm Activation Theory of Altruistic Behavior proposes three value orientations; egoistic, a concern for oneself; altruistic, a concern for others; and biospheric, a concern for the environment itself (Schultz, 2001; Swami, Chamorro-Premuzic, Snelgar, & Furnham, 2010). This triad of value orientations has been tested and replicated by many researchers. Swami, Chamorro-Premuzic, Snelgar, & Furnham (2010) tied them to larger personality traits finding that biospheric values can significantly predict the person's age and political orientation as well as other personality factors. Schultz (2001) found that egoistic and biospheric values were significantly correlated with the values of self-enhancement and self-transcendence. Participants with egoistic values were more likely to be interested in self-enhancement, a preference for positive self-views, and not interested in self-transcendence, instead considering themselves an important part of the universe (Schultz, 2001). In contrast, participants holding biospheric values were more likely to be interested in self-transcendence and not in self-enhancement (Schultz, 2001). Moving toward behaviors, Ojea and Loureiro (2007) found that people with altruistic and egoistic values were much more likely to show monetary support to reduce the likelihood of extinction of a local species.

Within an agricultural context, another structure of values is associated with an individual's agricultural identity, a set of beliefs and values built over time and based on how agricultural experiences and knowledge have (or have not) been present and incorporated into an individual's life (Alho, 2015; Hitlin, 2003). Alho found that a person's birthplace had a larger influence on agricultural identities than their current

residence. Other influences on agricultural identity included having an immediate family member work in agriculture as well as the number of interactions they had with a farmer (Alho, 2015). Neal and Walters (2008) support this idea finding that a person who grew up on a farm, but has since moved away, still has a deeply embedded relationship with farming culture (Cassidy & McGrath, 2014). People with a strong agricultural identity are more likely to rely on their own experiences and geographical local knowledge than typical authorities, are more likely to invest in local food production and are less likely to want organic certification (Alho, 2015; Selfa, Jussaume & Winter, 2008). Individuals with a low agricultural identity reported having more "concern and caution" about the environmental risks of GMOs (Selfa, Jussaume & Winter, p. 269, 2008).

As the proportion of society involved in agriculture continues to decrease (Chassy, 2007) there is a growing disconnect between people with high and low agricultural identities (Goodwin, Chiarelli, & Irani, 2011; Martin, 2016; Perez & Howard, 2007; Whitford, 1993). The disconnect has led to a number of conflicting views around social controversies surrounding agricultural topics. One example is pesticide use. Concerns about pesticide residues on food or detrimental impacts on the environment have been around since the 1960s (Govindasamy, Italia, Thatch, & Adelaja, 1998, Whitford, 1993). Farmers are more likely to have a positive attitude toward pesticides, likely because they will personally experience their benefits (Govindasamy, Italia, Thatch, & Adelaja, 1998; Whitford, 1993).

Antibiotics are another long-standing conflict between audiences of different agricultural identities. Many in the agriculture industry maintain that they administer antibiotics to treat sick and injured animals and only use them as needed (Lardy, Garden-

Robinson, Stoltenow, Marchello, & Lee, 2003), yet there is still concern that misuse or overuse of antibiotics given to animals who do not need them will lead to antibiotic resistance in humans (National Resources Defense Council, 2017). The Food and Drug Administration (FDA) (Food and Drug Administration, 2017) supports the treatment of sick animals with antibiotics but does not support off-label use. The FDA recently began working with numerous veterinary and producer organizations to ensure appropriate use of antibiotics for medical issues rather than as a feed enhancer (Food and Drug Administration, 2017). Yet the FDA is taking more of a voluntary approach to this policy rather than a regulatory approach, and this is a source of contention between sides of the debate (Food and Drug Administration, 2017; National Resources Defense Council, 2017).

Of course, agricultural identity is just one of many possible factors underlying these social debates. Additional factors such as value-orientations defined by the Norm Activation Theory, political ideology or general demographic factors are also likely influencing opinions (Schultz, 2001; Swami, Chamorro-Premuzic, Snelgar, & Furnham, 2010).

Yet, one similarity within the conflicts of GMOs, pesticide and antibiotic-use is the accepted value of the information. As part of the farm-to-table movement, people with few ties to production agriculture are becoming more interested in what products are being used on their food and what influence those products have on the atmosphere and the environment (Goodwin, Chiarelli, & Irani, 2011; Govindasamy, Italia, Thatch, & Adelaja, 1998; Whitford, 1993). At the same time, farmers would like consumers to become more ag literate; to better understand the decisions necessary to the production of

food (Goodwin, Chiarelli, & Irani, 2011; Martin, 2016). This suggests that better understanding how to communicate about agricultural science in ways that take individual values and identities into account may help some scientists and communicators move toward their goal of sharing the positive aspects of one of the most contentious areas of agricultural technology, GMOs.

Genetically Modified Organisms

Genetically Modified Organisms (GMO) in production agriculture were introduced in 1988 in soybeans (Borlaug, 2000; Chassy, 2007). The gene inserted into these first soybeans made the bean glyphosate-tolerant so the beans could be sprayed with a glyphosate-herbicide without suffering damage, but the weeds surrounding the plants, without the new gene, would wither. Since that first DNA transfer, transgenic crops have been planted on more than a billion acres worldwide by more than 10.3 million farmers (Chassy, 2007). The process of genetically modifying a plant involves isolating DNA from a plant with a preferred gene, such as disease-resistance, and implanting it into another plant to give the second plant the disease-resistance ability (Chassy, 2007). The ability to breed specific resistances into a plant offers benefits to agriculture producers, such as reducing the amount of chemical applications needed to protect the plant against disease, weeds and other pests.

While GMOs have become widely-used globally, there are still many who believe altering the DNA of plants, especially those meant for human consumption, could cause unforeseen damage. Thousands of consumer, environmental and charitable nongovernment organizations have fought against the production and sale of GMOs (Borlaug, 2000; Chassy, 2007). There are several reasons for this opposition, including

unknown long-term effects on human health and/or the environment, not wanting scientists to 'play God' and, according to Chassy, the drive to market and sell non-GMO products at a higher price (2007).

This myriad of arguments is why GMOs represent one of the timeliest societal conflicts regarding agriculture (Borlaug, 2000; Besley & Tanner, 2011; GMO, 2011; Goodwin, Chiarelli, & Irani, 2011; Herrera-Estrella & Alvarez-Morales, 2001; Johnson, 2014; Juanillo, 2001; Martin, 2016; Miller, Annou, & Wailes, 2003; Perez & Howard, 2007; Schmidt, 2015). Opponents argue that scientists don't know enough about GMOs and are gambling with the public's health (GMO, 2011; Herrera-Estrella & Alvarez-Morales, 2001; Johnson, 2014) and unknown or long-term environmental issues (GMO, 2011; Schmidt, 2015). Instead, those opposed to GMOs often push for a return to traditional agriculture (Goodwin, Chiarelli, & Irani, 2011; Martin, 2016; Perez & Howard, 2007) and value food being produced sustainably and in a way that is good for the environment (Govindasamy, Italia, Thatch, & Adelaja, 1998; Martin, 2016; Whitford, 1993). Supporting these concerns are the 27 European Union countries and a growing number of others around the globe, many of whom have outlawed the importing of GMO products or growing of them domestically (GMO, 2011). While most groups in the United States have not called for a complete ban, they have begun pushing legislation at the state and national levels that would require foods produced with GM products to be labeled (GMO, 2011).

Many in the agriculture industry, on the other hand, see mostly benefits to biotechnology (Frewer, Howard, Hedderly, & Shepherd, 1997; Herrera-Estrella & Alvarez-Morales, 2001). Genes in row crops have been modified to provide disease,

insect and weed resistance, meaning fewer applications and reduced chemical use (Borlaug, 2000; Herrera-Estrella & Alvarez-Morales, 2001; Johnson, 2014; Juanillo, 2001; Schmidt, 2015). Additionally, GMO technology allows for the identification and reproduction of desirable traits much quicker than traditional cross breeding. While these are all positives, the predominant argument from the agriculture industry about GMOs is they are necessary to fulfill the farmer's responsibility to feed the world (Borlaug, 2000; Herrera-Estrella & Alvarez-Morales, 2001). It is estimated that by 2050, there will be 9.3 billion people on the earth (Borlaug, 2000, p. 487). Genetically modified plants allow farmers to grow more produce on less land with less applied product, making it an option for farmers both in the U.S. and internationally that focuses on this goal (Borlaug, 2000; Herrera-Estrella & Alvarez-Morales, 2001). The agriculture industry also emphasizes scientific studies showing no negative health effects to either humans or the environment as a result of exposure to GMOs (Borlaug 2000; Herrera-Estrella & Alvarez-Morales, 2001; Schmidt, 2015). This conflict has led to a number of research studies exploring how communicating about GMOs can influence perceptions about the issue.

Communication About GMOs

Even outside the realm of agriculture, communicating science with the public is viewed by scientists as difficult and potentially dangerous (Besley & Tanner, 2011; Davies, 2008). Despite an increase in interactions between scientists and the media, many scientists still believe information is reported inaccurately (Besley & Tanner, 2011; Davies, 2008). In a survey of scientists, 49% said oversimplification of science by the media was a "major problem" (Besley & Tanner, 2011, p. 242). Contributing to the problem, according to 76% of scientists, is reporters' inability to distinguish good science

from bad science (Besley & Tanner, 2011, p. 242). Once science is reported, there is still the fear that the public can't understand the science and may misuse it (Davies, 2008).

Studies about how to communicate the science behind GMOs have often focused on specific words used in the communication and strategies scientists have used to spread their message (Besley & Tanner, 2011; Juanillo, 2001; Marks, 2001; Miller, Annou, & Wailes, 2003). For instance, Miller, Annou and Wailes conducted a content analysis of a variety of publications to see which GMO-related terms had more positive or negative connotations (2003). They found that "bio-engineered" and "genetically altered" were often used in negative-leaning articles, "biotechnology" was most often used in positive-leaning articles and "genetically modified" was neutral (Miller, Annou, & Wailes, 2003).

Other research examines how a scientist's communication style regarding GMOs, using either an empiricist repertoire or contingent repertoire, influences audiences (Juanillo, 2001). The empiricist method presents data as scientific observation and is used to convey the message that scientists are unequivocally dedicated to their observations and data, not their personal thoughts (Juanillo, 2001). This is thought to give the impression that science represents objectivity, precision and fairness (Juanillo, 2001). The contingent repertoire, on the other hand, depicts outcomes as the result of the scientists' beliefs and actions, not as scientific realities (Juanillo, 2001). It relies more on the scientist's judgment than on the data (Juanillo, 2001). This type of strategy is used more often during informal talks or when it is important to devalue an opponent's claims (Juanillo, 2001). Regardless of which strategy is used, the researchers note that good communication must branch out beyond the science (Juanillo, 2001).

Much of this previous research shares a similar assumption that communicators need to educate an ignorant audience about the science of GMOs. This assumption is embodied by the deficit model, which is "the belief that public skepticism toward modern science is caused by a lack of adequate knowledge about science" (Besley & Tanner, 2011, p. 243). In order to fill this deficit, "increased communication and awareness about scientific issues will move public opinion toward the scientific consensus and reduce political polarization around science-based policy" (Hart & Nisbet, 2012, p. 701-702). To put it simply, the public doesn't know about science, but if provided with enough information, they will understand things in the same manner as scientists.

The deficit model also embodies the belief that communication is a one-way transfer of information (Davies, 2008). In this model, scientists communicate what they have to say and hope the receivers of the message are persuaded by the scientist's point of view (Davies, 2008). The top reasons scientists give for communicating with publics are to educate, specifically to reassure publics and not scare them, and to recruit future scientists to the profession (Davies, 2008).

However, the deficit model does not accurately capture how science communication works (Hart & Nisbet, 2012). This model doesn't take into account preexisting beliefs, opinions or values the audience may have (Hart & Nisbet, 2012), which will act as a screen for information (Goodwin, Chiarelli, & Irani, 2011; Hart & Nisbet, 2012). People are more likely to pay attention to information that reinforces, rather than challenges, what they already believe (Goodwin, Chiarelli, & Irani, 2011; Hart & Nisbet, 2012). The interpretation of information, even scientific information, will

change from person to person depending on their preexisting beliefs (Goodwin, Chiarelli, & Irani, 2011; Hart & Nisbet, 2012).

Often when individuals read about a controversial agriculture topic, they already hold an opinion about the topic (Folkerth, 2015; Hart & Nisbet, 2012). Complicating this is the politically polarizing stances many agricultural issues bring (Hart & Nisbet, 2012). Research has shown that exposure to messaging about a politically polarizing issue that conflicts with a person's current beliefs may have the opposite effect than what was intended (Hart & Nisbet, 2012).

News stories, advertisements, friends, family, peers, professional organizations and political groups can all have an impact on a person's values and beliefs (Bhattacherjee & Sanford, 2006; Goodwin, Chiarelli, & Irani, 2011; Hart & Nisbet, 2012). Some people may hold onto those values so strongly that it becomes an identity marker. An identity marker is a "characteristic associated with an individual that they might choose to present to others" (Hart & Nisbet, 2012, p. 706). This marker allows them to differentiate themselves from others, solely based on such an identifier. Some people support or oppose agriculture topics strongly enough that they consider their stance an identity marker (National Resources Defense Council, 2017; Whitford, 1993; Young, 2017). What is needed is a better understanding of how to craft messages in such an environment that will persuade audiences to actually attend to and process the information at hand rather than merely reacting based on these preexisting values.

Elaboration Likelihood Model

The Elaboration Likelihood Model (ELM) describes persuasion as operating along one of two routes; the central route and the peripheral route (Bhattacherjee &

Sanford, 2006; Cacioppo, Petty, & Morris, 1983; Frewer, Howard, Hedderley & Shepherd, 1997; Hyland, 2010; Miller, Annou, & Wailes, 2003; MacDonald, Milfont, & Gavin, 2015; Petty & Briñol, 2015; Petty & Cacioppo, 1986). The route taken by the receiver of the message depends on their ability and motivation to process the message (Cacioppo, Petty, & Morris, 1983; MacDonald, Milfont, & Gavin, 2015; Rucker & Petty, 2006; Petty & Briñol, 2015; Petty & Cacioppo, 1986). The central route is more likely when ability and motivation are high and results in an evaluation based on a careful consideration of the arguments present in the message. The peripheral route is more likely when ability and motivation are low and results in an evaluation based on surface-level cues present in or around the message that impacts positive or negative emotions (Bhattacherjee & Sanford, 2006; Cacioppo, Petty, & Morris, 1983; Frewer, Howard, Hedderly, & Shepherd, 1997; Petty & Briñol, 2015; Petty & Cacioppo, 1986; Rucker & Petty, 2006).

Individuals using either route can change their opinion based on the information received in the message (MacDonald, Milfont, & Gavin, 2015; Petty & Cacioppo, 1986; Rucker & Petty, 2006). However, opinions and decisions made using the thoughtful elaboration of the central route are often more long-lasting, stable, persistent and less susceptible to counter-arguments than those made through the peripheral route (Bhattacherjee & Sanford, 2006; MacDonald, Milfont, & Gavin, 2015; Petty & Cacioppo, 1986; Rucker & Petty, 2006).

The ELM goes past the assumptions in the deficit model as it acknowledges that people's preexisting attitudes and values about a topic are also important. An attitude is a "general evaluation people hold in regard to themselves, other people, objects and issues"

(Petty & Cacioppo, 1986, p. 127). Attitude certainty is the degree to which people believe their held attitude is correct or their conviction of the attitude (Rucker & Petty, 2006). Attitudes with great certainty, often formed through the central route of processing, are more likely to influence a person's behavior and last longer than attitudes with low certainty (Rucker & Petty, 2006). Therefore, these preexisting attitudes and values are likely to influence an individual's motivation to process certain information, which will then influence the processing pathway used.

Additionally, Fabrigar, Priester, Petty and Wegener (1998) found that even beyond the presence of a value or attitude, the accessibility of that construct in the individual's mind impacts its influence. Attitude accessibility is "the likelihood that an attitude will be automatically activated from memory upon merely encountering the attitude object" (Fabrigar, Priester, Petty & Wegener, 1998). A highly accessible value or attitude increases the chance that it will be activated and influence the motivation and processing of a message. However, the choice to elaborate centrally upon a topic is still a choice and independent from attitude accessibility. High attitude accessibility could lead to greater motivation to process topical information centrally, or it could prime the individual to think they already know the information or have decided on the topic, leading to less elaboration and greater peripheral processing. Combining all these areas of literature, this study aims to explore the role of values when communicating about GMOs through an ELM framework.

CHAPTER 3. PILOT STUDY

Pilot Study Objectives

In order to align messages with preexisting audience values, these values need to first be identified. Many arguments from within the agricultural industry focus on values of saving, preservation, helping developing countries and scientific reasoning (Johnson, 2014; Schmidt, 2015). One argument that embodies these values is that in addition to fewer chemical applications, GMO seeds can help save farmers time, labor, fuel and machine wear and tear (Johnson, 2014; Schmidt, 2015), leading to lower overall costs for food. Often farmers share messages about how GMOs allow them to farm sustainably while improving their soils, meaning they have less of a negative impact on the environment and the farmers are leaving a better farm to their children (Johnson, 2014; Schmidt, 2015). Another argument is that GMOs improve the nutritional quality of food for developing countries and help lower input costs so farmers in those countries can begin to grow their own food (Herrera-Estrella & Alvarez-Morales, 2001). Borlaug (2000) points out that had wheat yields remained the same since 1961, 850 million more acres of land would have been needed by 1999 to feed the world population. With land being lost from production due to commercialization, crops need to grow more on less land to keep up with the growing population (Borlaug, 2000).

Critics of GMOs often share the same values but use them to instead refute these claims, arguing that the long-term potentially harmful and unknown health and environmental effects are more important than short-term health and environmental benefits (Borlaug, 2000; Herrera-Estrella & Alvarez-Morales, 2001). Similarly, critics often claim rather than feeding the world, agriculture is taking advantage of international

farmers and simply creating new markets for themselves (Herrera-Estrella & Alvarez-Morales, 2001) or that first-world consumers have never been directly impacted by these advantages of biotechnology (Herrera-Estrella & Alvarez-Morales, 2001).

While all of these values are valid, individual preexisting values and identities will prioritize some more than others. These above arguments were distilled into four common arguments used to form evaluations about GMOs, and these four became the basis for four messages: (a) more affordably priced food, (b) potential health impacts, (c) potential environmental impacts, and (d) feeding the growing population. Yet it is important to assess if these value-based arguments are indeed relevant to the intended participant pool. Therefore, a pilot study was conducted to capture the distribution of values participants hold about GMOs both before and after being prompted with these four identified values, as well as to pre-test possible message stimuli and questions attempting to activate and align with these values for quality. The pilot study sought to answer the following research questions.

RQ1. What primary values do participants use to form their evaluation about GMOs?

RQ2. How do these values compare to the four value-arguments identified in the literature of (a) more affordable food, (b) potential health impacts, (c) potential environmental impacts, and (d) feeding the growing population?

RQ3. What is the distribution of the following factors in this sample: (a) caring about GMOs as an issue, (b) support of GMOs and (c) certainty of opinions about GMOs?

RQ4. How do participants evaluate the quality and credibility of the four stimulus messages?

Pilot Study Methods

Participants

Participants in the pilot study were students from a junior-level mass communication class at Iowa State University. Ninety-four responses were collected, and 17 were removed for either not answering the majority of the questions or because their time to read the blog post was too short to process the message (under 20 seconds) or very long (more than 600 seconds). The final sample size of 77 participants were 70 percent female with an average age of 21. Participants received extra credit in their course for participation.

Protocol

Data was collected for one week across four treatments in a between-subject design. Participants were told they would be evaluating blog posts for writing style and quality. After consenting to participate (for full pilot study consent form see APPENDIX A), participants were randomly shown one of four stimuli blog posts and asked to complete a number of questions about their perceived quality and credibility of the blog post. They were then asked questions about their thoughts and values about GMOs. Participants were not asked about their opinions regarding GMOs until after reading the stimulus as to not prime any values that could influence the quality and credibility measures. Upon completion of the survey, participants were thanked for their time and taken to a separate survey where they entered their name in order to receive extra credit.

Stimuli

Four stimuli were created in the style of a persuasive blog post from a company announcing and justifying why it supports GMOs with a recent business decision, specifically a coffee company making a switch to GMO soybeans in their creamers. This context was created as it allows the company to focus on the values underlying the decision without a confounding impact to the consumer—it was emphasized that customers will likely not even notice the difference. Four versions of the message were created by emphasizing different value-arguments as to why the company made the switch and supports GMOs: either to support (a) more affordable food, (b) potential health impacts, (c) potential environmental impacts or (d) feeding the growing population.

The four blog posts were structured identically and differed only in the manipulated value statements and specific arguments relative to those values. Participants were introduced to a coffee company that would be switching to GMO soybeans in their creamers, told that the company worked with scientists to make the decision and then the company explained why the decision was being made. Each blog post had two pro-GMO arguments and one anti-GMO argument relative to a specific value to decrease the appearance of bias and to counter potential opposition arguments. For instance, in the stimulus focused on worldwide health, one argument cited as a reason to support GMOs was their ability to increase the nutritional content of foods already eaten in countries where malnourishment is an issue. All four stimuli are available in the APPENDIX B. Final word counts for the blog posts are: (a) more affordable food: 623, (b) potential

health impacts: 630, (c) potential environment impacts: 634 and (d) feeding a growing population: 663.

Variables

Quality

Participants were asked to rate the stimulus they read based on how (a) realistic, (b) understandable and (c) well written they found the message on a 1-7 scale with greater values representing more agreement with these factors. These three were combined into one measure of message quality (M=5.64, SD=.92, α=.73).

Credibility

Credibility was measured with the Meyer Credibility Index (Meyer, 1988). Since its introduction, the Meyer's Credibility Index has been evaluated and has been shown to be both reliable and externally valid (McComas & Trumbo, 2001) and can simultaneously capture both the credibility of information and the source of the information (Roberts, 2010). Participants were asked to rate their perception of (a) credibility, (b) trustworthiness, (c) fairness, (d) accuracy, (e) whether or not the blog post was biased and (f) whether or not the blog post told the whole story on a 1-7 scale with greater values representing more agreement with these factors. These factors were combined into one measure of message credibility (M=4.95, SD=1.06, α=.886). Participants were also asked through an open-ended question to justify their ranking and offer any specific improvements that could be made to the blog post.

GMO Opinions

For a more targeted picture of what this population in particular thinks about the issue of GMOs, it was important to capture a measure of their opinions. Funk and

Kennedy (2016) conducted research about Americans' views on a variety of topics regarding food and science, including GMOs. Three important constructs surrounding GMOs came out of their research; how much participants cared about the GMO issue, how much they supported GMOs in the marketplace and how certain they were of the opinions they had just expressed (Funk & Kennedy, 2016). These three constructs were measured on a 1-4 scale with greater values representing more agreement. The first question asked how much participants cared about the topic of GMOs (M=2.59, SD=.715). The second and third questions asked about their support for the production and support for the sale of GMO products, respectively. These two were combined into one measure of support (M=2.75, SD=.603, r_s=.90). The final question asked about the certainty with which the participant held those opinions (M=2.54, SD=.682).

Uncued GMO Values

Before asking participants about the four values identified in the literature that likely guide evaluation of GMOs, it was important to capture an uncued response to assess the alignment of the values this audience uses to evaluate GMOs with the literature. Participants were asked in an open-ended question, "What is the most important reason influencing the way you feel about GMOs?" All responses were sorted into topical categories.

Cued GMO Values

To measure distribution of the four values identified in the literature that likely guide evaluation of GMOs, participants were presented with a ranked list of the four values determined by Funk and Kennedy (2016): (a) more affordable food, (b) potential health impacts, (c) potential environmental impacts and (d) feeding the growing

population, and asked to "rearrange the following reasons to show which are more or less important to you". These values were originally presented in random order.

Demographics

Demographic information was also collected: age (*M*=21.59, *SD*=1.99), gender (28.6% male, 70.1% female), population of hometown (*M*=26,476.25, *SD*=55,157.59) and political ideology on a scale from 1-5 with larger values representing more liberal ideologies (*M*=3.20, *SD*=.46) (Pew Research Center, 2017). The full pilot study survey can be found in Appendix C.

Pilot Study Results

The first research question asked what primary value-arguments participants use to form their evaluation of GMOs. As seen in Table 1, the most frequent uncued value-argument listed were related to health at 26%. The values of feeding the growing population and the environment were next most frequent at 19% and 12% respectively. More affordable food and a novel argument related to GMOs being either natural or unnatural were present, but listed infrequently. An "other" category included participants who gave specific examples of their experiences or people they knew, cited sources they trust but not what those sources said, or merely stated their support or opposition of GMOs with no clear reason why. This other category constituted 37% of the responses but was not relevant to the questions of interest.

A series of ANOVA analyses were conducted to compare the participants whose responses were coded as other and those whose response was coded to another category. There was no significant difference between the two groups on gender, age, political views or GMO support. Regarding caring about GMOs, the categorized coded group

(*M*=2.77, *SD*=.72) cared significantly more than the other group (*M*=2.41, SD=.66; *F*(1, 71)=4.22, p=0.04). Regarding certainty of GMO opinions, the categorized coded group (*M*=2.70, *SD*=.70) was significantly more certain of their opinions than the other group (*M*=2.35, *SD*=.60; *F*(1,71)=4.17, *p*=0.05).

Table 1 *Primary uncued GMO values*

Primary GMO values		
Variable	Frequency	Percentage
Potential health impacts	19	26%
Feeding the growing population	14	19%
Potential environmental impacts	9	12%
More affordable food	2	9%
Natural	2	9%
Other	27	37%

The second research question addressed the four cued GMO values of potential health impacts, feeding the growing population, potential environmental impacts and more affordable food and how they were ranked by participants. As shown in figure 1, potential health impacts and feeding the growing population were the highest ranked values with potential environmental impact and more affordable food most likely to be ranked second. The distribution between values in third and fourth place became more evenly distributed, showing less of a preference for least important values.

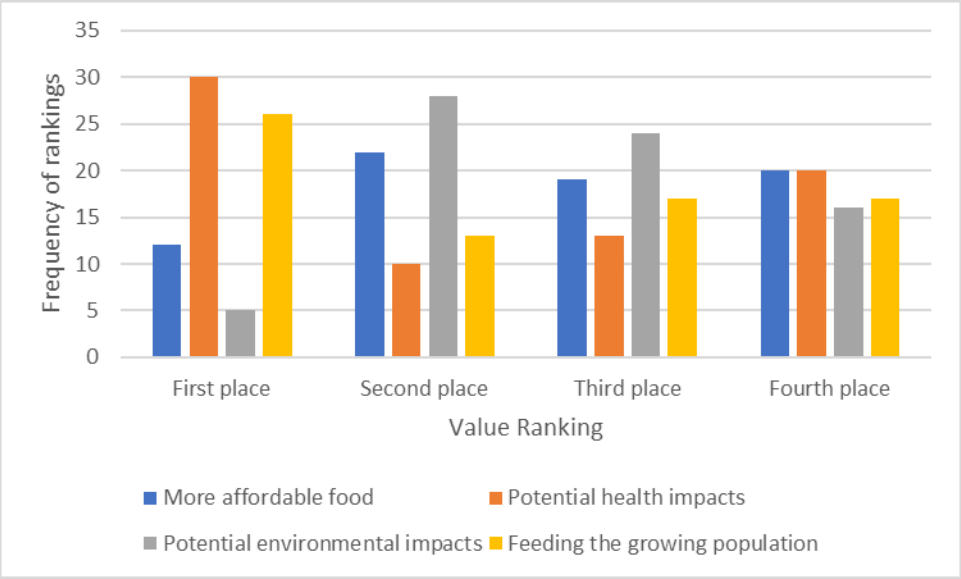

Figure 1 *Cued GMO value rankings*

The third research question asked what the distribution of GMO opinions for this population were regarding (a) caring about GMOs as an issue, (b) support of GMOs and (c) certainty of opinions about GMOs. As seen in figure 2, most of the participants expressed a modest degree of care about GMOs as an issue—very few felt strongly about the issue or did not care at all. Support for GMOs shows a preference towards a modest support of GMOs but again with very few expressing strong support or opposition. Certainty of opinions exhibited a similar distribution as the care variable, with most participants expressing a modest degree of certainty about their opinions about GMOs with few at the extremes.

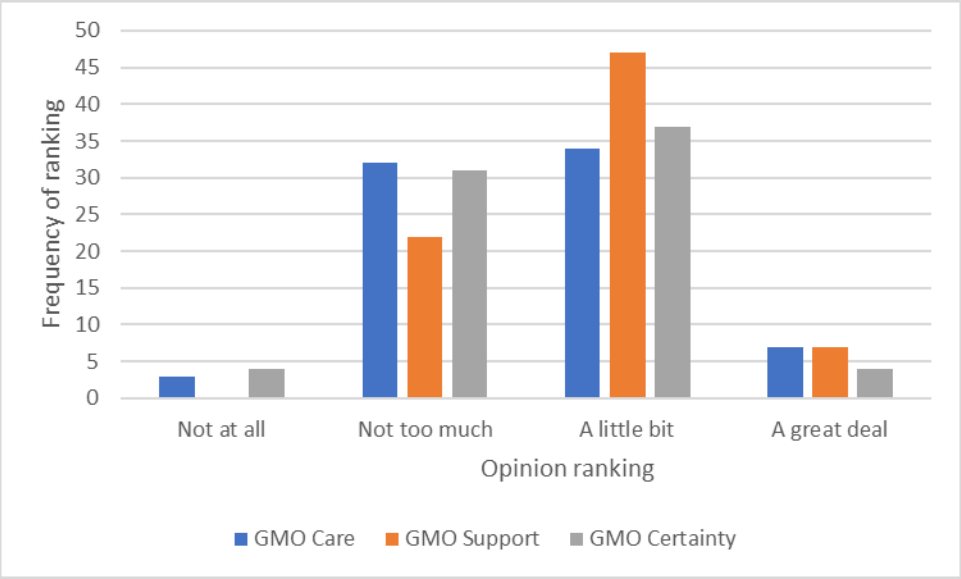

Figure 2 *GMO opinion rankings*

The fourth research question asked how participants evaluated the quality and credibility of the four stimulus messages. As seen in figures 3 and 4, participants perceived both quality and credibility of the stimuli as high. ANOVA analyses were conducted to compare measures across the stimuli, and neither quality ($F(3,73) = 0.73$, $p = .54$) or credibility ($F(3,71) = 0.52$), $p=.67$) differed across the treatments.

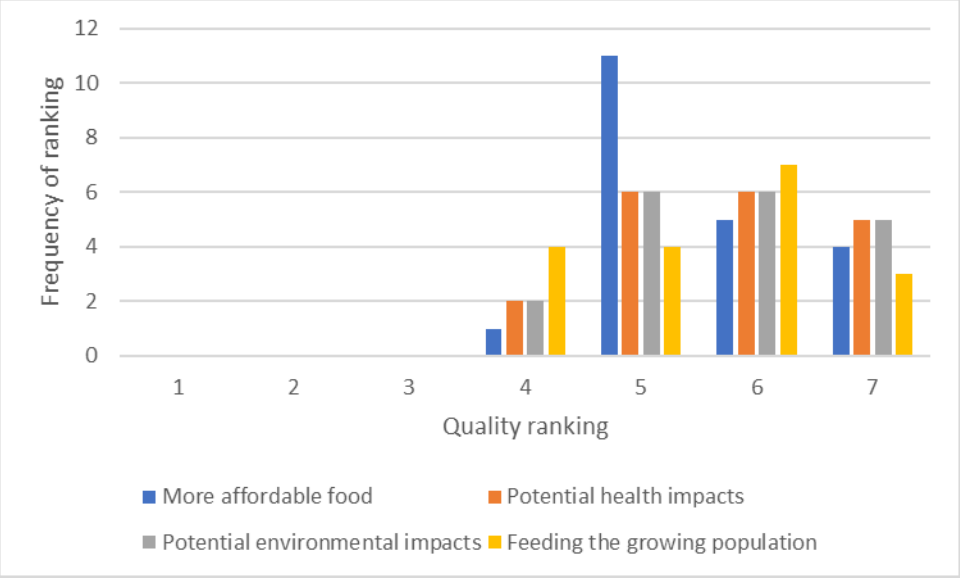

Figure 3 *Stimuli quality rankings*

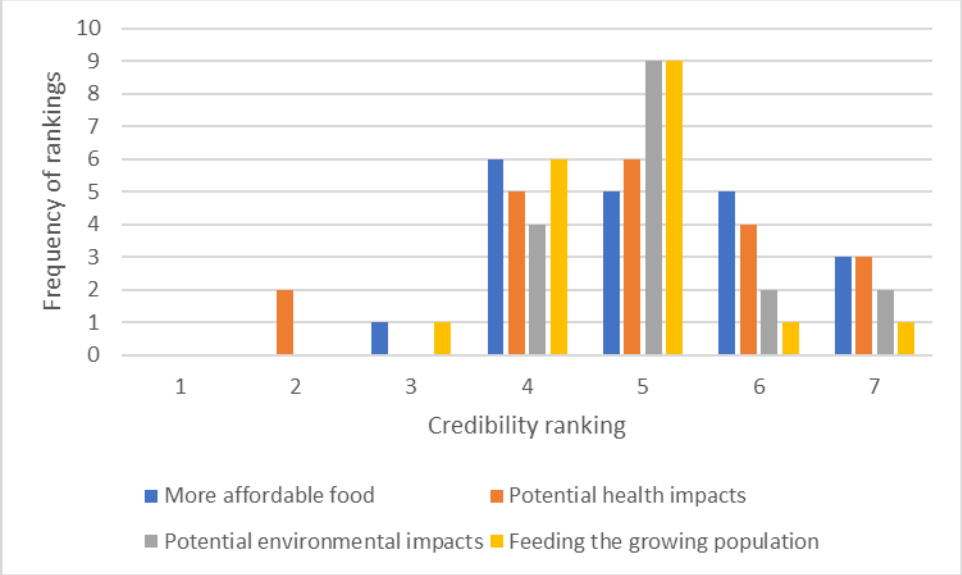

Figure 4 *Stimuli credibility rankings*

After ranking the expected values, participants were asked to provide specific suggestions about how to improve the blog post. Most comments were positive such as, "This is a real issue. The post was well-written in the sense that it covered both arguments (for and against) of the issue. It thoroughly explained the company's decision to use GMO soybeans in their products." Comments that offered suggestions focused mostly on the message being a realistic blog post. "I feel that all blog posts are strictly opinionated and therefore not generally realistic."

Pilot Study Discussion

The pilot study was conducted to ensure that the quality and credibility of the stimuli were strong and consistent across treatments. It was conducted to help determine if the four values determined by Funk & Kennedy (2016) were applicable to this audience and if the three GMO values of care, support and certainty would have enough variability among the population to find an effect for the full study.

All four of the expected values identified by Funk and Kennedy (2016) emerged through the uncued responses as well as one novel but infrequent value of naturalness. Potential health impacts was the dominant value while more affordable food was only infrequently mentioned. This supports that the four expected values are relevant to this audience but that more affordable food might not be important enough to include in the full sample.

The cued rankings once again put potential health impacts as the most important value with feeding the growing population also ranking high. Yet, affordably priced food ranked high for secondary importance, similarly with environmental impacts, suggesting that when primed, affordable food becomes important enough that there may be reason to include it moving forward. Therefore, all four values will remain as part of the final study.

All four stimuli were ranked high on quality and credibility with no significant difference between treatments. This suggests that any effects coming from these stimuli used in the final study will likely be due to the manipulations rather than differences in writing or argument strength between stimuli. Therefore, all four stimuli will be used in the final study with no modifications.

Regarding opinions related to GMOs, the majority of all three variables—care, support and certainty, were in the middle of the scale, suggesting the majority of the participants hadn't made up their minds regarding GMOs and may have been more open to a differing opinion. Therefore, even though a student sample is not representative of the larger population, the variance present in this particular sample appears to represent an ideal context to test the larger questions of interest.

Finally, one change to the survey instrument as a result of the pilot study was the term used to describe the stimulus. In the open-ended question, some participants commented that the article didn't seem like a blog post because it was too formal, wasn't opinionated or seemed more like an advertisement. Due to this feedback, in the final survey instrument the article will instead be referred to as a press release to account for these comments.

In summation, the results of the pilot study support that both the stimuli and sample characteristic are appropriate for the larger questions of interest in the final study.

CHAPTER 4. FINAL STUDY

Study Objectives

This study explores if aligning messages about GMOs with preexisting audience values will lead to a greater chance of central processing, and subsequently, greater alignment with message-congruent attitudes. The research proposed in this paper will not only contribute to the literature about communicating agricultural science and about the ELM but may also provide practical recommendations about how the agriculture industry should communicate with different audiences.

In contrast to the deficit model of communication, the ELM states that people use preexisting values and experiences to help determine how to process information. Because the context of the study focuses on GMOs, the first research question seeks to assess the distribution of values participants use when evaluating GMOs.

> RQ1. How do participants rank the importance of the following value-arguments regarding the evaluation of GMOs: (a) more affordable food, (b) potential health impacts, (c) potential environmental impacts and (d) feeding the growing population value-arguments?

The importance of these value-arguments is likely influenced by a larger set of relevant values and identities. According to ELM, participants will use predetermined values to screen the information presented in the stimuli. Understanding these values could help predict how they will respond. The second research question seeks to explore how the four value-arguments correlate with the three value orientations in the Norm

Activation Theory of Altruistic Behavior--egoistic, altruistic and biospheric—and an individual's agricultural identity.

RQ2. What patterns exist between the importance of GMO values and the larger egoistic, altruistic, biospheric value orientations and agricultural identity?

These larger value systems will also likely influence the initial evaluation and accessibility of attitudes related to GMOs. The third research question explores which of these values is most influential in predicting related constructs of GMO attitudes.

RQ3. Which of these prior value orientations are most influential in predicting (a) GMO attitude accessibility, (b) caring about GMOs as an issue, (c) support for GMOs and (d) certainty of opinions about GMOs?

The ELM predicts that the existence of relevant values will lead to greater motivation to process a message, which will lead to greater elaboration through the central processing pathway. Central processing does not guarantee attitude change in a message-consistent direction, however, it seems likely that careful elaboration on an issue like GMOs where attitudes are somewhat pliant will more often lead to alignment with the persuasive direction of the message. Therefore, aligning the message with existing values will likely lead to greater motivation to process the message centrally and possibly attitude change as well. The following hypothesis predicts these relationships.

H1. A message supporting GMOs that is aligned with a participant's preexisting value-argument will result in greater: (a) cognitive elaboration, (b) change in caring about GMOs as an issue, (c) change in support toward GMOs and (d) change in certainty of opinions about GMOs after exposure.

Because preexisting value-arguments are likely correlated to the larger value orientations as well as attitude accessibility, a moderation relationship is likely. The final research question seeks to explore if any of these relevant interactions are predictive.

RQ4. Will alignment with a participant's preexisting value ranking interact with egoistic, altruistic, biospheric value orientations, agricultural identity or attitude accessibility to moderate influence on (a) cognitive elaboration, (b) change in caring about GMOs as an issue, (c) change in support toward GMOs and (d) change in certainty of opinions about GMOs?

Methods

Participants

The participants in this research were students in several general education classes within the Greenlee School of Journalism and Mass Communication at Iowa State University. Participants were sent a link to an online survey through their Iowa State University email and were offered extra credit for participation. There were 685 total responses collected. Participants who did not rank the values, didn't answer the majority

of questions or spent less than 30 seconds or more than 10 minutes reading the stimuli were excluded. This resulted in 457 responses being removed with a final sample size of 228. The average age of participants was 19.73 with 73.7% of the participants being female.

Protocol

Data was collected for one week in a between-subjects experiment consisting of two treatments (value aligned or value unaligned). Participants were told the survey would ask them to evaluate opinions on various topics. After consenting to participate using the form presented in APPENDIX D, participants were asked a series of pre-test questions measuring attitude accessibility, GMO opinions and ranking value-arguments related to GMOs. Based on their ranking of the value-arguments, participants were randomly assigned to read a press release presenting a pro-GMO message focused on either their first-ranked value-argument (value aligned treatment) or their last-ranked value-argument (value unaligned treatment). After reading the stimulus, participants answered questions regarding the perceived persuasiveness of the message, post measures of GMO opinions, central processing and demographics.

Stimuli

The same stimuli used in the pilot study were used in this study. All four stimuli are available in APPENDIX B.

Variables

Attitude Accessibility

Attitude accessibility represents how easy it is for the participant to access their opinion. The quicker a person can recall this opinion, the more well-formed or solid the

opinion is for that person (Fabrigar, Priester, Petty & Wegener 1998; Fazio, 1990). This was measured by asking participants to indicate their support or opposition to statements about three different controversial topics: GMOs, nuclear weapons and immigration.

Participants saw three statements for each topic, for a total of nine statements, and the order presented was randomized. Participants were shown one question at a time and instructed to mark their responses as quickly as possible. Each question displayed a countdown timer limiting participants' answers to eight seconds. The speed at which participants are able to indicate their responses represents how accessible their attitude is for that issue.

The response speeds for the three statements of each issue were averaged. Following the method of Fabrigar, Priester, Petty & Wegener (1998), attitude accessibility for GMOs was calculated as the average speed of the three target issue questions (GMOs) subtracted from the average speed of the target issues (nuclear weapons and immigration). With this calculation, smaller values represent a shorter response time and greater accessibility for GMO attitudes (M=.27, SD=.93).

Value Orientations

Norm Activation Theory describes three general value orientations that guide how people evaluate issues. Altruistic, egoistic and biospheric value orientations were measured by asking participants to mark on a scale from 1 to 7 how important the potential consequences affecting a list of factors would influence their stance on a controversial issue. Factors included plants, marine life, whales, birds, trees and animals to represent biospheric values; children, humanity, people in the community and future generations to represent altruistic values; and my prosperity, my future, my lifestyle, my

health and me to represent egoistic values (Swami, Chamorro-Premuzic, Snelgar, & Furnham, 2010).

Larger values represent greater importance. The final variables were calculated by averaging each participant's rankings within each group representing biospheric (*M*=5.11, *SD*=1.30), egoistic (*M*=6.15, *SD*=.81) and altruistic (*M*=6.23, *SD*=.74) value orientations.

GMO Opinions

GMO opinions represent three related but distinct factors (Funk & Kennedy, 2016). How much participants care about GMOs as an issue was measured on a four-point scale from 1 (not at all) to 4 (a great deal) (*M*=2.67, *SD*=.78). GMO support was a combination of two questions asking if participants supported the production and the sale of GMO foods on a four-point scale from 1 (strongly oppose) to 4 (strongly support) (*M*=2.85, *SD*=.72, r_s=.92). How certain participants were of their opinions regarding GMOs was measured on a four-point scale from 1 (extremely uncertain) to 4 (extremely certain) (*M*=2.78, *SD*=.74). All of these measures were collected as part of the pre-test before participants were exposed to a stimulus message.

Alignment

Participants were asked to rank four value-arguments based on how important they are when evaluating GMOs: (a) more affordable food, (b) potential health impacts, (c) potential environmental impacts and (d) feeding the growing population. This ranking was used to randomly place each participant into either the aligned or unaligned condition

Participants in the aligned condition saw a stimulus based on their top ranked value-argument. Participants in the unaligned condition saw a stimulus based on their lowest ranked value-argument. Random assignment created close to a 50/50 spilt between aligned and unaligned placement, however, after removing outliers, this skewed the results to aligned at 24.1% and unaligned at 75.9%.

Perceived Persuasiveness

Perceived persuasiveness represents a cognitive measure of how much the participant thinks the message was convincing and was measured by asking participants to mark if they felt the message was persuasive, effective, convincing, compelling, straightforward and memorable, each on a scale of 1-7 where greater values represent more agreement (Dillard, Shen & Grillova, 2007). These factors were combined into one variable of persuasiveness (M=4.26, SD=.63, α=71).

GMO Attitude Change

GMO attitude change represents how the previous three factors of GMO opinions changed after reading the stimulus. The questions asked were the same as the ones asked before the stimuli was presented, and a difference score was calculated where the relevant pre-test score was subtracted from the post-test score such that positive values represent a change in an increasing direction.

How much participants care about GMOs as an issue after reading the stimulus (M=2.67, SD=.78) increased slightly ($Diff$=.14) as did GM support (M=2.85, SD=.72, $Diff$=.06) and GMO certainty (M=2.78, SD=.74, $Diff$=.12).

Elaboration

Elaboration represents how deeply participants thought about the information in the message and also represents a measure of central processing. One open-ended question asked participants to list any arguments they remembered from the press release. This question captured how much participants thought about what they were reading by whether or not they could identify key arguments (Neuman, 1976). A second open-ended question asked participants to list what they thought about while reading the release and encouraged them to write all thoughts including additional arguments or wandering ideas (Neuman, 1976).

To reliably code this measure of elaboration, two coders trained on a codebook and tested intercoder reliability on an initial 20% of the sample (n=40). All variables were reliable at a Krippendorff's Alpha of .714 or greater. After achieving reliability, a single coder finished the remainder of the responses. The codebook is included as APPENDIX E and the variables coded were as follows:

From the first open-ended question asking for recall:

Statements: The number of independent statements the participants recorded as coming from the stimulus (M=2.15, SD=1.24).

Arguments: The number of independent arguments the participant recorded as coming from the stimulus that were actually present in the stimulus (M=1.08, SD=1.11). This value is a subset of total statements.

Facts: The number of independent facts the participant recorded as coming from the stimulus that were actually present in the stimulus (M=.50, SD= .67). This value is a subset of total statements and independent of the number of arguments.

From the second open-ended question asking for additional thoughts during processing:

Thoughts: The number of independent relevant thoughts participants recorded as thinking while they read the stimulus (*M*=1.76, *SD*=1.27).

Support: Explicit mentions of support (+1) or opposition (-1) toward GMOs as additional thoughts (*M*=.44, *SD*=.65).

Irrelevant thoughts: The number of independent but irrelevant thoughts participants recorded as thinking while they read the stimulus (*M*=.14, *SD*=.34).

Drifting: The number of mentions of explicitly losing interest in stimulus (*M*=.05, *SD*=.21).

The codes from the second open-ended question were either infrequent or tangential and so elaboration was calculated from the responses from the first open-ended question. The number of arguments and facts were added together and divided by the total number of statements creating the proportion of correct statements recalled from the stimulus (*M*=.71, *SD*=.38). This number represents a continuous measure of elaboration used when processing the stimulus message.

Agricultural Identity

Agricultural identity represents how strongly an individual identifies with an agricultural lifestyle and was measured by combining four items. The first three items were taken from Alho (2015). Participants were asked whether or not the participant or a member of their immediate family works on a farm (24% said yes) and whether or not an extended relative works on a farm (71.1% said yes). They were also asked how often they interact with a farmer on a five-point scale from 1 (never) to 5 (on a weekly basis or more often) (*M*=3.69, *SD*=1.37).

College major also represents a self-selection process relative to agriculture and was expected to correlate with the previous measures of agricultural identity. College major was collected in an open-ended question and coded into two groups based on if the major was related to agriculture and life sciences (14.5%,) or not (85.5%).

In order to determine which majors belonged, listings from Iowa State University and the University of California Los Angeles were consulted (In the college of agriculture, 2017; Majors & Minors, 2017). Correlational analysis was conducted to ensure that college major did correlate to the other measures as expected. College major was significantly related to all three at 0.19 or above and all were at a significance level of 0.01.

All four factors were combined to create a measure of agricultural identity. The single five-point scale was split and converted into a dichotomous measure so it could be combined with the other dichotomous measures equally. The final combined variable was therefore on a scale of 0-4 with a higher number meaning greater agricultural identity (M=1.57, SD=1.05).

Demographics

Demographic information was also collected including age (M=19.73, SD=1.47), gender (female=73.7%), population of hometown (M=46,852.97, SD=171,019.26) and political ideology on a scale from 1-5 with larger numbers representing stronger liberal ideologies (M=3.02, SD=.98).

The full final study survey can be found in APPENDIX F.

Comparison to Pilot Study

A series of ANOVA analyses were conducted to compare the sample from the pilot study with the sample from the final study. There was no significant difference between samples on gender or the three GMO opinion variables of care, support and certainty. Regarding age, the pilot study sample (M=21.59, SD=1.99) was significantly older than the final study sample (M=19.73, SD=1.47; $F(1,301)=76.11$, $p<.01$). Regarding political ideology, the final study sample (M=3.62, SD=1.47) was significantly more liberal than the pilot study sample (M=1.73, SD=0.69; $F(1,301)=225.60$, $p<.01$).

Results

The first research question asked what values participants used to form their opinions on GMOs. As seen in Figure 5, feeding the growing population received 43% of the first-place rankings followed by potential health impacts with 38%. The other two values, more affordably priced food and potential environmental impacts, came in much lower for first place rankings but were dominant for second place.

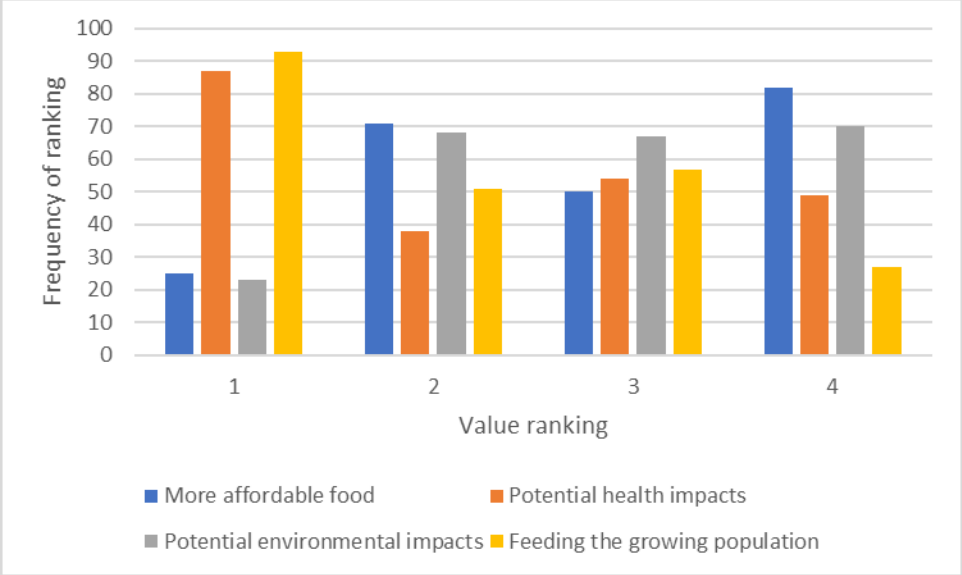

Figure 5 *GMO value-arguments rankings*

The second research question explored the correlations between the participant's chosen GMO value-argument and their larger values of egoistic, altruistic, and biospheric orientations and agricultural identity. A correlation analysis was conducted.

As seen in Table 2, and as expected, most of the value-arguments are negatively correlated with one another, such that ranking one value-argument as first makes it more likely that the others will be ranked lower. The egoistic, altruistic, and biospheric value orientations are all positively correlated, suggesting they are similar constructs. However, none of them correlate with agricultural identity, suggesting that it is independent from the other value orientations.

This difference continued in their relationships to the specific value-arguments related to GMOs. Within the egoistic, altruistic, and biospheric value orientations, only biospheric was correlated to any value-arguments. It is important to note that because the value-arguments are coded such that smaller numbers represent more importance (first place coded as 1), a negative correlation represents finding a value-argument more important.

In the case of increasing biospheric value orientation, these individuals found health to be less important of a value-argument and feeding the world to be more important. Agricultural identity correlated with different and a greater number of value-arguments than the biospheric value orientation. As agricultural identity increases, individuals found affordable food less important and potential health impacts more important.

Table 2 *Correlation of GMO value ranking compared to other values*

	Ego	Alt	Bio	Agriculture identity	More affordable food	Potential health impacts	Potential environmental impacts	Feeding a growing population
Egoistic	1							
Altruistic	.38**	1						
Biospheric	.26**	.53**	1					
Agriculture identity	.01	.02	.021	1				
More affordable food	-.06	.02	-.09	.26**	1			
Potential health impacts	.07	.01	.14*	-.18**	-.60	1		
Potential environmental impacts	.01	.07	.08	-.13	-.26**	-.19**	1	
Feeding a growing population	-.02	-.10	-.14*	.06	-.12	-.28**	-.56**	1

<.

05=*, <.01=**

The third research question explored which of the previous value orientations are most influential in predicting initial (a) GMO attitude accessibility, (b) caring about GMOs as an issue, (c) support for GMOs and (d) certainty of opinions about GMOs. This question was analyzed through a series of regression analyses where each of the previous variables from the pre-test served as the dependent variable and predictors were grouped into three blocks. The first block represented demographics and included gender, age and political ideology. The second block included the egoistic, altruistic, and biospheric value orientations. Finally, the third block included agricultural identity.

The results for the third research question are displayed in Table 3. Regarding attitude accessibility about GMOs, agricultural identity was the only significant predictor, and participants with greater agricultural identity exhibited greater attitude accessibility regarding GMOs. When it comes to caring about GMOs as an issue, a participant with a greater biospheric value orientation or a greater agricultural identity was significantly more likely to also care more about GMOs. For the measure of participant's support for GMOs, again a biospheric value orientation and agricultural identity were significant predictors but in opposite directions. A greater biospheric orientation was associated with less support for GMOs while a greater agricultural identity was associated with greater support for GMOs. Finally, regarding certainty of opinions about GMOs, a biospheric orientation was no longer significant, but agricultural identity remained significant and both age and gender became significant predictors. Greater agricultural identity was associated with greater certainty of opinions about GMOs as were older participants and male participants.

Table 3 *Attitude Accessibility, GMO opinions and values*

	Attitude Accessibility			GMO Care			GMO Support			GMO Certainty		
Predictors	B	SE	B	B	SE	β	B	SE	β	B	SE	β
Constant	-.54	1.13		.58	1.03		1.78	.81		-.44	.90	
Block 1				-	-	-	-	-	-	-	-	-
Gender	.27	.14	.13	.17	.13	.09	-.16	.10	-.1	-.24	.11	-.13
Age	.06	.04	.09	.06	.04	.10	.04	.03	.08	.10	.03	.18**
Political views	.05	.07	.05	-.06	.06	-.07	.05	.05	.07	.04	.06	.04*
R^2 change			.02			.04*			.01			.04*
Block 2				-	-	-	-	-	-	-	-	-
Egoistic	-.06	.09	-.05	.02	.08	.02	.06	.06	.07	.10	.07	.10
Altruistic	-.16	.11	-.12	-.09	.10	-.07	-.02	.08	-.02	.05	.09	.04
Biospheric	<.01	.06	<.01	.11	.05	.16*	-.10	.04	-.19*	-.01	.05	-.02
R^2 change			.02			.02			.02			.02
Block 3				-	-	-	-	-	-			
Agricultural identity	.39	.13	.21**	.46	.12	.26**	.53	.10	.37**	.39	.13	.21**
R^2 change			.04**			.12**			.12**			.04**

<.05=*, <.01=**

The first hypothesis proposed that a message supporting GMOs that aligned with a participant's preexisting value-argument would result in greater: (a) cognitive elaboration, (b) change in caring about GMOs as an issue, (c) change in support toward GMOs and (d) change in certainty of opinions about GMOs. Similarly, the fourth research question asked if alignment with a participant's preexisting value ranking interacted with egoistic, altruistic, biospheric value orientations, agricultural identity or attitude accessibility to moderate influence on the same four dependent variables.

Both this hypothesis and research question were analyzed through a series of regression analyses where each of the post-test or difference variables served as the dependent variable and predictors were grouped into seven blocks. Interaction terms were created by multiplying the two variables of interest into a new interaction variable.

The first block represented demographics and included gender, age and political ideology. The second block included the egoistic, altruistic, and biospheric value orientation. The third block included agricultural identity. The fourth block included attitude accessibility. The fifth block included the set of dummy variables representing which stimulus the participant read. The sixth block included the dichotomous treatment variable of alignment with a participant's preexisting value.

Finally, the seventh block included one of the interactions of interest. To avoid multicollinearity, only one of the interaction groups was included with each regression analysis. This resulted in three regression analyses--one including the interactions for the three value orientations, one including the interaction with agricultural identity and one including the interaction with attitude accessibility--for each of the four dependent variables for a total of 12 analyses. For ease of interpretation, all of the interactions for a single dependent variable will be reported in the same model.

As can be seen in Table 4, the predicted influence of alignment with preexisting values was not significant across all the dependent variables. Therefore, hypothesis 1 is not supported. Only two significant predictors were identified. Participants who saw the health stimulus and who had a greater altruistic value orientation were more likely to elaborate in the open-ended questions.

While the true random assignment was between aligned and unaligned stimuli, it may also be instructive to examine how the variables of interest were distributed across the four possible stimuli. A series of ANOVA tests were run testing if the variables differed between the four stimuli focused on more affordable food (N=59), potential health impacts (N=55), potential environmental impacts (N=58) and feeding the growing population (N=55).

Table 4 *GMO opinions and elaboration value alignment*

	Elaboration			GMO Care			GMO Support			GMO Certainty		
Predictors	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Constant	-.04	.69		.07	.93		-.21	.46		.62	.67	
Block 1	-	-	-	-	-	-	-	-	-	-	-	-
Gender	-.10	.09	-.11	-.11	.12	-.07	-.02	.06	-.02	.01	.08	.01
Age	.03	.03	.10	<-.01	.03	<-.01	.02	.02	.10	-.01	.03	-.01
Political views	<-.01	.04	-.01	.02	.06	.02	-.02	.03	-.06	<-.01	.04	-.01
R^2 change			.02			.01			.01			.02
Block 2	-	-	-	-	-	-	-	-	-	-	-	-
Egoistic	-.01	.05	-.02	-.03	.08	-.03	-.04	.04	-.08	.01	.06	.01
Altruistic	.01	.05	.02*	.07	.10	.07	-.01	.05	-.02	-.08	.07	-.11
Biospheric	.02	.03	.07	-.03	.05	-.05	.04	.03	.16	.03	.04	.08
R^2 change			.05			.01			.02			.01
Block 3	-	-	-	-	-	-	-	-	-	-	-	-
Agricultural identity	-.07	.06	-.09	.11	.11	.08	<.01	.05	<.01	-.13	.08	-.12
R^2 change			<.01			<.01			<.01			.03

Table 4 *continued…*

Predictors	Elaboration			GMO Care			GMO Support			GMO Certainty		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Block 4	-	-	-	-	-	-	-	-	-	-	-	-
Attitude accessibility	-.02	.03	-.05	.04	.06	.05	-.06	.03	-.15	-.01	.04	-.01
R^2 change			<.01			.02			.04			.01
Block 5	-	-	-	-	-	-	-	-	-	-	-	-
Health	.26	.11	.26*	.14	.20	.08	.13	.09	.16	.02	.15	.02
Environment	-.03	.11	-.03	-.08	.21	-.04	-.08	.09	-.09	-.29	.15	-.19
Feed population	-.02	.11	-.02	.01	.20	.01	-.13	.09	-.17	-.08	.15	-.06
R^2 change			.06			.01			.05			.03
Block 6	-	-	-	-	-	-	-	-	-	-	-	-
Alignment	1.17	.99	1.18	.78	1.57	.46	.05	.70	.06	-.66	1.18	-.49
R^2 change			<.01			<.01			.02			.02

Table 4 *continued…*

Predictors	Elaboration			GMO Care			GMO Support			GMO Certainty		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Block 7	-	-	-	-	-	-	-	-	-	-	-	-
Egoistic x alignment	-.03	.11	-.15	.15	.20	.52	.03	.09	.26	.15	.15	.67
Altruistic x alignment	-.23	.16	-1.43	-.28	.28	-1.05	-.01	.12	-.05	.10	.21	.48
Biospheric x alignment	.06	.09	.32	.02	.15	.07	-.07	.07	-.45	-.22	.12	-.84
R^2 change			.02			.01			.01			.03
	-	-	-	-	-	-	-	-	-	-	-	-
Agriculture identity x alignment	.01	.14	.02	.23	.24	.19	-.11	.12	-.19	-.07	.17	-.08
R^2 change			<.01			.01			.06			.03
	-	-	-	.-	-		-	-		-	-	-
Attitude accessibility x alignment	-.09	.07	-.11	-.27	.17	-.21	-.02	.08	-.03	-.30	.13	-.30
R^2 change			.01			.02			<.01			.04

<.05=*, <.01=**

There was no significant difference between stimuli on egoistic, altruistic, or biospheric value orientations, agricultural identity or care about GMOs as an issue. Attitude accessibility was significantly different with the feed the growing population stimuli (M=0.54, SD=0.77) significantly greater than the more affordable food stimuli (M=0.07, SD=0.99) and the potential environmental impacts stimuli (M=0.13, SD=0.89; $F(3,224)=3.13$, $p=0.03$).

GMO support was statistically different with more affordable food (M=2.54, SD=0.09) being statistically larger than potential environmental impacts (M=2.91, SD=0.09) and feeding a growing population (M=2.99, SD=0.09). Potential health impacts (M=2.69, SD=0.09) was also statistically larger than feeding a growing population ($F(3,224)=5.13$, $p<0.01$).

For GMO certainty, feeding a growing population (M=2.18, SD=0.79) was significantly larger than all three other stimuli; more affordable food (M=2.41, SD=0.72) potential health impacts (M=2.62, SD=0.78) and potential environmental impacts (M=2.66, SD=0.83; $F(3,224)=5.51$, $p<0.01$).

CHAPTER 5. FINAL STUDY DISCUSSION

This study explored how preexisting values would influence attitudes about GMOs and if aligning messages about GMOs with these values would lead to a greater chance of central processing, and subsequently, greater alignment with message-congruent attitudes. GMOs was chosen as the topic because of its relevancy in modern agriculture and because the social debate extends far beyond the science to often focus on more value-based arguments about morality, economics or justice.

The objectives in the study were analyzed from an ELM standpoint because ELM recognizes how an individual's personal values, previous experiences and opinions influence how they make decisions. When an individual receives new information, they rely on their values to help them screen the information and evaluate how to process it. Biospehric, altruistic or egoistic value orientations represent three ways individuals orient themselves to controversial topics. An agricultural identity represents yet another way individuals can orient themselves.

A pilot study was conducted prior to the final survey to identify the most relevant value-arguments individuals use to evaluate GMOs as well as to test the quality of the stimuli before using them in the final study. Data collected in both the pilot study and the final study showed potential health impacts and feeding the growing population as the two most important value-arguments for participants when evaluating GMOs. It is interesting to note that the second highest value-argument, feeding the growing population, cannot be addressed by communicating more science—it is based completely on the underlying values of how much of a responsibility there is to feed other nations. This again highlights the important role values play in how a scientific issue is evaluated.

Preexisting value orientation and agricultural identity influenced which of these value-arguments were more important. Potential health impacts are more important for individuals who hold high agricultural identities but less important for individuals who hold high biospheric value orientations. Instead, individuals with high biospheric value orientations found feeding the world's growing population to be more important. Likewise, individuals who hold high agricultural identities were less likely to find more affordable food an important value-argument.

Regarding the three value orientations, previous research found a biospheric orientation to be the most likely to have a statistically significant relationship with additional values and demographic variables, and that continues to be true with this research (Schultz, 2001; Swami, Chamorro-Premuzic, Snelgar & Furnham, 2010). The data suggests that these larger value orientations also influence the accessibility of attitudes about GMOs, how much they care about GMOs as a topic, support GMOs, and with what certainty they hold those opinions. Again, agricultural identity and biospheric value orientations were predictive of these opinions. Greater biospheric value orientations were related to greater care about the topic of GMOs but less support. This is not surprising because individuals with high biospheric values strongly weigh the impacts on the world itself, so participants with a high biospheric orientation may greatly care about the GMO issue but be against the production or sale of GMOs if they feel it will have large scale negative impacts on the world.

Agricultural identity had an even stronger and positive relationship to all four of the variables. Interestingly, the differences between the three value orientations and agricultural identity show that agricultural identity is an important orientation in its own

right and should be measured separately. The orientation of agricultural identity did not correlate with any of the predetermined value orientations, and the answers of participants with a high agricultural identity did not align with the answers of respondents with a high value orientation of any other kind. However, agricultural identity had a strong relationship with how much participants cared about and supported GMOs, how certain they were of those opinions, the participants' attitude accessibility and what value-arguments they selected. It is possible that agricultural identity may align with other value orientations not measured in this study, such as the New Ecological Paradigm (Dunlap, Van Liere, Mertig & Jones, 2000), yet the current data suggests it may also represent a unique source of variance and should be incorporated into future research related to values or agricultural communication.

Taken together, these results suggest that knowing something about the larger value systems held by the audience, especially their level of agricultural identity, can help identify their initial attitudes toward the topic of GMOs and which value-argument they already bring to the topic as important, both of which can be used to craft a more effective message.

The hypothesis of this study expected that aligning a message to discuss GMOs relative to the most important value-argument held by a participant would increase a number of outcomes related to attitude change, yet none of these main effects were significant. This suggests that the expectations may have been too simplistic. While the previous results support the tenant of ELM that preexisting values matter in how information is processed, they also suggest that these relationships are complex and that more research is needed.

Limitations and Future Research

A number of limitations exist for this study. The student sample used represented a useful distribution of relevant attitudes and identities, as measured in the pilot study. However, a student sample can never be representative of the larger population, and it is possible a general population sample would have had more of a range in value orientations and GMO opinions. Given that the university where this research was completed is a land-grant university known for its agricultural programs, there may have been a skew toward knowing more about GMOs prior to the survey and having a preexisting opinion on the topic.

Another limitation is in the measure of elaboration used in this study. Elaboration is a difficult construct to measure, especially after the fact, and while the measure used in this study has been used before and all coded constructs achieved inter-coder reliability, it is still unclear how well the measure used actually captured the depth of elaboration used when processing the stimuli.

One significant limitation is the number of participants who seemingly did not adequately participate. More than 67% of the full study sample was excluded for not spending a reasonable amount of time (more than 30 seconds or less than 10 minutes) reading the stimuli materials. This exclusion also significantly skewed the split between treatment groups, with more than 74% of the remaining sample being in the unaligned group. This skew was unexpected as the proportion of excluding individuals for the pilot study was only 18%. Some exclusion is expected from a student sample that is likely participating solely for extra credit, but this large percentage was unexpected and limited the effect sizes that are possible to measure.

Agricultural identity was one of the strongest and most consistent predictors in this study. Future research should take into consideration agricultural identity as an important value in determining a person's overall interpretation of any message that may activate such values, including GMOs. Other relevant topics could include other controversial topics in agriculture such as pesticide application or antibiotic use. Non-agricultural topics that may still find value in measuring agricultural identity include measuring political ideologies and consumption of certain goods such as hunting or fishing supplies.

The lack of significant results surrounding alignment with preexisting values emphasizes the complexity of how values intersect with attitude change. As such, more research needs to be done to start to refine some of these relationships. Are people who hold a certain value orientation more likely to experience an attitude change than those with a different value orientation? Does the topic in question have an influence on which value orientation could change? How does attitude accessibility intersect with attitude change for other research topics?

Incorporating agricultural identity in addition to the Norm Activation Theory value orientations would also be valuable in future ELM research. Because ELM recognizes a person's previous experiences and ideas in shaping their thoughts on a topic, measuring those values and incorporating them into relevant models could be valuable to ELM researchers.

In conclusion, the impact of values plays a significant, but complex, role in the opinions and effects of messages regarding GMOs. These results further exemplify the deficiencies in the deficit model of science communication that assumes controversies

about science are based on a lack of knowledge and that facts alone will reduce this variance. Instead, it is the existing variance of preexisting values that drives many of these controversies, and communicators cannot be effective without recognizing and addressing these underlying causes. More research needs to be done to determine what value orientations and factors influence the likelihood of a person cognitively processing information. This research supports ELM findings that previous experiences, knowledge and values impact opinion formation and confirmed agricultural identity as a value orientation worthy of more research.

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APPENDIX A: PILOT STUDY CONSENT FORM

You are invited to participate in a study about evaluating blog posts. This study is being conducted by Allison Arp from the Greenlee School of Journalism and Communication at Iowa State University. If you have any questions, you may contact Allison at aarp@iastate.edu.

The purpose of this study is to evaluate blog posts for their writing style and quality. During your participation, you will be shown a media story and asked several survey questions, most of which require checking boxes. Completing the study will take approximately 20 minutes and you will be compensated with extra credit in JL MC 460 for your participation in this study.

The risks of participating are considered minimal, as you are asked only to read a brief media story and share some of your thoughts.

Your participation in this survey is voluntary and all responses will be kept confidential. You may decline to answer any question and you have the right to withdraw from participation at any time.

This study has been reviewed and approved by the Iowa State University Institutional Review Board. If you have any questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact the Institutional Review Board by phone at 515-294-1516 or email at orrweb@iastate.edu.

IRB Approval Number: 17-323

If you consent to participate in this study, please click the next link below.

If you do not consent to participate in this study, please close this window and no information will be recorded.

APPENDIX B: STIMULI

(Affordably priced food)
How you're helping us improve the world, one latte at a time
In order to fulfill our goals of being a socially conscious company, we at Colombian Coffee LLC have made the decision to switch production of our creamers to include genetically modified soybeans.

We have put a lot of thought into this decision, and with help from the International Coffee Scientists Institute, (ICSI, pronounced I-Cy), we feel that this is the best way for our company to support the potential of genetically modified food to create more affordably priced food.

Genetically modified foods (often called GMOs) were first developed in the 1970s and soybeans were one of the first GMO foods to reach the market. The process to develop GMO soybeans involves analyzing DNA from a variety of soybean plants and identifying certain genes within that DNA that make a plant more beneficial to society. Those beneficial genes are then inserted into a different soybean plant to create a new type of soybean that exhibits more of those benefits.

Our customers will continue to enjoy the high quality, delicious coffee products they have come to expect and will likely not even notice this change. Yet we feel it is important to use our position as a successful business to support social causes we believe in. It is estimated that the average household in the U.S. spends between 35 and 42% of their monthly budget on food. If we can help the average cost of food decrease, families will have more income left to use on other things. For this reason, we have decided to endorse the movement to support GMOs toward creating more affordably priced food.

While making the decision to switch to GMO soybeans, we carefully considered the potential consequences of our choice. One of the major benefits of GMO crops is that they are cheaper for the farmer to grow and those reduced prices can be passed on to consumers. GMOs allow scientists to insert resistance to a variety of insects and diseases into the DNA of each plant, making the plant more able to deal with problems on its own. This leaves fewer problems that farmers need to spend money addressing in the field throughout the season.

One concern we discussed was the increased corporate control that comes with GMO crops. The markets for GMO crops are dominated by six seed and agrochemical companies and some advocacy groups worry this corporate concentration could lead to higher prices and limited choices for farmers. However, public universities and smaller breeders now have their own biotech genetic lines and varieties, which lessens the influence of corporations and their associated costs.

Another benefit is that each GMO plant has the ability to produce more food, reducing costs ever farther. In soybeans, this means that plants produce more pods with more

beans in each pod, multiplying production capacity. This increase in the supply of a product like soybeans would result in a drop in price globally.

The decision for us at Colombian Coffee LLC switch to GMO soybeans was made through collaboration with the Colombian Export Council and input from the Colombia Soybean Growers Association (CSGA). "The soybean farmers of the CSGA are in full support of Colombian Coffee LLC switching to GMO soybean plants," said Daniel Rodríguez, president of CSGA. "We look forward to continuing to provide good soybeans to improve the coffee experience of the customers of Colombian Coffee LLC."

We appreciate your support of Colombian Coffee LLC and look forward to continuing to serve you in the future. Thank you for supporting our business so we can continue to be a socially conscious company. If you have any comments or concerns regarding any of our products we welcome feedback at customerthoughts@colombiancoffee.com.

(Potential health impacts)
How you're helping us improve the world, one latte at a time
In order to fulfill our goals of being a socially conscious company, we at Colombian Coffee LLC have made the decision to switch production of our creamers to include genetically modified soybeans.

We have put a lot of thought into this decision, and with help from the International Coffee Scientists Institute, (ICSI, pronounced I-Cy), we feel that this is the best way for our company to support the potential of genetically modified food to improve worldwide health.

Genetically modified foods (often called GMOs) were first developed in the 1970s and soybeans were one of the first GMO foods to reach the market. The process to develop GMO soybeans involves analyzing DNA from a variety of soybean plants and identifying certain genes within that DNA that make a plant more beneficial to society. Those beneficial genes are then inserted into a different soybean plant to create a new type of soybean that exhibits more of those benefits.

Our customers will continue to enjoy the high quality, delicious coffee products they have come to expect and will likely not even notice this change. Yet we feel it is important to use our position as a successful business to support social causes we believe in. It is estimated that more than 60% of the world's population suffers the health effects of malnutrition, even in countries where access to food is readable available but not high in nutrition. If we can increase the nutrition available in foods people already eat, we will be able to reduce these health problems around the world. For this reason, we have decided to endorse the movement to support GMOs toward improving worldwide health.

While making the decision to switch to GMO soybeans, we carefully considered the potential consequences of our choice. One of the major benefits of GMO crops is the ability to increase the amount of vitamins and minerals available in the food itself. New technology allows scientists to insert the ability to grow additional vitamin C, iron or

other important vitamins into a plant. For people in third-world countries, this could mean getting the additional protein or vitamins they need to help stave off malaria and other deadly diseases.

One concern we discussed was that GMO technology hasn't been around long enough to know all the effects it could potentially have on human health. Some advocacy groups have worried that increased GMO consumption could lead to widespread antibiotic resistance or that eating GMO food could lead to immune problems over the long term. While unknowns will always exist, GMO foods have been around for nearly 50 years and there is still no scientific evidence to support any health problems associated with human consumption.

Another benefit is that GMO crops require less pesticides and other potentially unhealthy applications than non-GMO crops. Not only do farmers have less exposure to potentially unhealthy chemicals, but it also reduces the amount of trace pesticides used in the final food products. The decision for us at Colombian Coffee LLC switch to GMO soybeans was made through collaboration with the Colombian Export Council and input from the Colombia Soybean Growers Association (CSGA).

"The soybean farmers of the CSGA are in full support of Colombian Coffee LLC switching to GMO soybean plants," said Daniel Rodríguez, president of CSGA. "We look forward to continuing to provide good soybeans to improve the coffee experience of the customers of Colombian Coffee LLC."

We appreciate your support of Colombian Coffee LLC and look forward to continuing to serve you in the future. Thank you for supporting our business so we can continue to be a socially conscious company. If you have any comments or concerns regarding any of our products we welcome feedback at customerthoughts@colombiancoffee.com.

(Potential environmental impacts)
How you're helping us improve the world, one latte at a time
In order to fulfill our goals of being a socially conscious company, we at Colombian Coffee LLC have made the decision to switch production of our creamers to include genetically modified soybeans.

We have put a lot of thought into this decision, and with help from the International Coffee Scientists Institute, (ICSI, pronounced I-Cy), we feel that this is the best way for our company to support the potential of genetically modified food to protect the environment.

Genetically modified foods (often called GMOs) were first developed in the 1970s and soybeans were one of the first GMO foods to reach the market. The process to develop GMO soybeans involves analyzing DNA from a variety of soybean plants and identifying certain genes within that DNA that make a plant more beneficial to society. Those beneficial genes are then inserted into a different soybean plant to create a new type of soybean that exhibits more of those benefits.

Our customers will continue to enjoy the high quality, delicious coffee products they have come to expect and will likely not even notice this change. Yet we feel it is important to use our position as a successful business to support social causes we believe in. It is estimated that 3.2 million acres of natural habitat are lost every year and agricultural byproducts are one of the leading causes of environmental pollution. If we can reduce the environmental impact it takes to grow our food, we will be able to protect and repair our ecological landscapes. For this reason, we have decided to endorse the movement to support GMOs toward protecting the environment.

While making the decision to switch to GMO soybeans, we carefully considered the potential consequences of our choice. One of the major benefits of GMO crops is the ability to use less environmentally damaging chemical applications to grow the same product. GMOs allow scientists to insert resistance to a variety of insects and diseases into the DNA of each plant, making the plant more able to deal with problems on its own. This leaves fewer problems that farmers would otherwise need to spray herbicides or pesticides to address throughout the season, protecting the soil, waterways and larger ecosystem.

One concern we discussed was that GMO technology hasn't been around long enough to know all the effects it could potentially have on the environment. Some advocacy groups believe GMO plants may harm beneficial insects or, over the long term, leave toxic residues in soil or surrounding waterways. While unknowns will always exist, GMO foods have been around for nearly 50 years and there is still no scientific evidence to support any environmental problems associated with the GMO crops themselves.

Another benefit is that GMO crops open up the possibility for expanded conservation practices and increased environmental benefits. GMO crops allows farmers to grow more food on less land, meaning there would be more land available for the restoration of native habitat, better supporting diverse ecological communities.

The decision for us at Colombian Coffee LLC switch to GMO soybeans was made through collaboration with the Colombian Export Council and input from the Colombia Soybean Growers Association (CSGA).

"The soybean farmers of the CSGA are in full support of Colombian Coffee LLC switching to GMO soybean plants," said Daniel Rodríguez, president of CSGA. "We look forward to continuing to provide good soybeans to improve the coffee experience of the customers of Colombian Coffee LLC."

We appreciate your support of Colombian Coffee LLC and look forward to continuing to serve you in the future. Thank you for supporting our business so we can continue to be a socially conscious company. If you have any comments or concerns regarding any of our products we welcome feedback at customerthoughts@colombiancoffee.com.

(Feeding a growing population)

How you're helping us improve the world, one latte at a time
In order to fulfill our goals of being a socially conscious company, we at Colombian Coffee LLC have made the decision to switch production of our creamers to include genetically modified soybeans.

We have put a lot of thought into this decision, and with help from the International Coffee Scientists Institute, (ICSI, pronounced I-Cy), we feel that this is the best way for our company to support the potential of genetically modified food to feed the growing world population.

Genetically modified foods (often called GMOs) were first developed in the 1970s and soybeans were one of the first GMO foods to reach the market. The process to develop GMO soybeans involves analyzing DNA from a variety of soybean plants and identifying certain genes within that DNA that make a plant more beneficial to society. Those beneficial genes are then inserted into a different soybean plant to create a new type of soybean that exhibits more of those benefits.

Our customers will continue to enjoy the high quality, delicious coffee products they have come to expect and will likely not even notice this change. Yet we feel it is important to use our position as a successful business to support social causes we believe in. It is estimated that the world's population will reach 9.7 billion people by 2050 and much of that growth will be in countries where starvation is a constant fear. If we can grow more food with the same amount of resources, we will be able to meet this demand and help to feed the growing world. For this reason, we have decided to endorse the movement to support GMOs toward increasing production to feed the growing population.

While making the decision to switch to GMO soybeans, we carefully considered the potential consequences of our choice. One of the major benefits of GMO crops is the ability to produce a greater quantity of food using less land that can used to feed the hungry. In soybeans, this means that plants produce more pods with more beans in each pod, multiplying production capacity. This increase in production is especially important for farmers in third-world countries where space is limited and a good crop could mean the difference between feeding their family and going without.

One concern we discussed was the increased corporate control that comes with GMO crops. The markets for GMO crops are dominated by six seed and agrochemical companies and some advocacy groups worry this corporate concentration could lead to restrictions of access, limiting food for countries that need it most. However, public universities and smaller breeders now have their own biotech genetic lines and varieties, which lessens the influence of corporations and increases access to food worldwide.

Another benefit is that GMO crops can increase the amount of vitamins and minerals available in the food itself. This allows the hungry to meet their nutritional needs with less food. New technology allows scientists to insert the ability to grow additional vitamin C, iron or other important vitamins into a plant. For people in third-world

countries, this could mean getting the additional protein or vitamins they need to avoid starvation.

The decision for us at Colombian Coffee LLC switch to GMO soybeans was made through collaboration with the Colombian Export Council and input from the Colombia Soybean Growers Association (CSGA).

“The soybean farmers of the CSGA are in full support of Colombian Coffee LLC switching to GMO soybean plants,” said Daniel Rodríguez, president of CSGA. “We look forward to continuing to provide good soybeans to improve the coffee experience of the customers of Colombian Coffee LLC.”

We appreciate your support of Colombian Coffee LLC and look forward to continuing to serve you in the future. Thank you for supporting our business so we can continue to be a socially conscious company. If you have any comments or concerns regarding any of our products we welcome feedback at customerthoughts@colombiancoffee.com.

APPENDIX C: PILOT STUDY SURVEY

The purpose of this survey is to ask your help in evaluating blog posts that companies publish about their products. We have a collection of blog posts that we might use in a future study, but we expect some to be better than others and want your help to decide which to include. While most of the arguments in these blog posts are true, we have fictionalized the company name and specific case to try to limit any previous knowledge you may have from influencing your evaluation.

On the next page, one of these blog posts will be randomly selected and shown to you. Please read the posting and be ready to answer a few questions about the quality of the writing. Please do not let your personal opinion about any of the topics influence your ratings—we ask that you focus on the quality of the writing, not whether or not you agree with the arguments being made. You will have a chance to tell us more about your personal opinions later in the survey.

Please click the arrow when you are ready to read your blog post.

The stimuli were presented here. The full stimuli can be found in Appendix B.

Thank you. You will now be asked several questions about the quality of the blog post you just read. Please evaluate the article for its quality rather than on your opinion of its content.

We fictionalized some of the content of the blog post you just read for purposes of an online survey. We want to make sure the post still feels realistic and is readable. Compared to similar blog posts you have read, please rate the blog post you just read on whether you found it to be:

	1	2	3	4	5	6	7	
Unrealistic	○	○	○	○	○	○	○	Realistic
Hard to understand	○	○	○	○	○	○	○	Understandable
Poorly-written	○	○	○	○	○	○	○	Well-written

Please use this box to tell us why you feel this way or what could be done to improve the posting

Please rate the blog post you read just read on the following criteria.

	1	2	3	4	5	6	7	
Not credible	○	○	○	○	○	○	○	Credible
Untrustworthy	○	○	○	○	○	○	○	Trustworthy
Unfair	○	○	○	○	○	○	○	Fair
Biased	○	○	○	○	○	○	○	Unbiased
Did not tell the whole story	○	○	○	○	○	○	○	Did tell the whole story
Inaccurate	○	○	○	○	○	○	○	Accurate

In your own words, please tell us why you feel this way or what could be done to improve the posting.

Is there anything else you would like to tell us about the blog post you read?

Now we want to know more about your opinions. Since the blog post selected for you discussed genetically modified organisms (GMOs), please answer the following questions about your opinions about GMOs.

How much do you, personally, care about the issue of GMO foods?

- ○ Not at all
- ○ Not too much
- ○ A little bit
- ○ A great deal

How much do you support or oppose the production of GMO foods or foods containing GMOs?

- ○ Strongly oppose
- ○ Oppose
- ○ Support
- ○ Strongly support

How much do you support or oppose the selling of GMO foods or foods containing GMOs in stores?

- ○ Strongly oppose
- ○ Oppose
- ○ Support
- ○ Strongly support

Some opinions are based on a deep understanding of the issue and are unlikely to change. These opinions are held with high certainty. Other opinions are based on an initial reaction where more information may alter your thoughts. These opinions are held with low certainty. How certain are you of your opinions of GMOs?

- Extremely uncertain
- Uncertain
- Certain
- Extremely certain

What is the most important reason influencing the way you feel about GMOs?

People who support or oppose GMOs often do so for different reasons.
Please rearrange the following reasons to show which are more or less important to you, with the most important reason at the top. You can click and drag on each reason to move it up or down.

_____ Possibility for more affordably priced food (1)
_____ Possible health impacts (2)
_____ Possible environmental impacts (3)
_____ Produce more food to feed the world (4)

What is your gender?

- Male
- Female
- Prefer not to answer

What is your age?

What is the approximate population of your hometown growing up?

In general, would you describe your political views as

- Very conservative
- Conservative
- Moderate
- Liberal
- Very liberal
- Unknown
- Prefer not to answer

As of today, do you lean more toward the Republican Party or more toward the Democratic Party?

- Republican Party
- Democratic Party
- Other
- Unknown
- Prefer not to answer

Q65
Make sure you enter your name on the next page to ensure you get extra credit for your participation.

Thank you for participating in this survey.

APPENDIX D: FINAL STUDY CONSENT FORM

You are invited to participate in a study about student opinions. This study is being conducted by Allison Arp from the Greenlee School of Journalism and Communication at Iowa State University. If you have any questions, you may contact Allison at aarp@iastate.edu.

The purpose of this study is to evaluate student opinions on various topics. During your participation, you will be shown a media story and asked several survey questions, most of which require checking boxes. Completing the study will take approximately 20 minutes and you will be compensated with extra credit in one of your participating classes for your participation in this study.

The risks of participating are considered minimal, as you are asked only to read a brief media story and share some of your thoughts. Your participation in this survey is voluntary and all responses will be kept confidential. You may decline to answer any question and you have the right to withdraw from participation at any time.

This study has been reviewed and approved by the Iowa State University Institutional Review Board. If you have any questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact the Institutional Review Board by phone at 515-294-1516 or email at orrweb@iastate.edu.

IRB Approval Number: 17-323

- ○ I have read the above statement and agree to participate in the survey
- ○ I have read the above statement and do not wish to participate in the survey

APPENDIX E: CODING INSTRUCTIONS

Arguments from release

1.
    a. How many arguments does the participant state from the press release?
        i. (Enter number)
    b. How many of the arguments the participant stated are correct?
        i. (Enter number)
    c. How many facts, not arguments, does the participant state from the press release?
        i. (Enter number)

Thoughts during release

2.
    a. How many thoughts does the participant remember?
        i. (Enter number)
    b. Does the participant mention supporting or opposing GMOs in the comment?
        i. Yes supporting – 1
        ii. Yes opposing – 2
        iii. No does not mention either – 0
    c. Does the participant offer additional thoughts about GMOs?
        i. Yes – 1
        ii. No – 0
    d. Does the participant specifically mention losing interest in the press release?
        i. Yes – 1
        ii. No – 0

APPENDIX F: FINAL STUDY SURVEY

First we want to test how quickly you can share your opinions. We will display a number of statements about controversial issues and ask how much you agree or disagree with each. To ensure you move quickly, you will be limited to eight seconds for each response.

The next page will present a practice question so you can be better prepared. When you are ready for the practice question, click the arrow to progress.

Coffee improves the ability of people to focus

- ○ Completely disagree 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ Completely agree 7

Got it? Click on the arrow when you are ready to begin these type of timed questions.

Questions in this section were randomized.

Genetically modified organisms are unnatural

- Completely disagree 1
- 2
- 3
- 4
- 5
- 6
- Completely agree 7

Genetically modified organisms improve agricultural production

- Completely disagree 1
- 2
- 3
- 4
- 5
- 6
- Completely agree 7

Genetically modified organisms are unsafe for human consumption

- Completely disagree 1
- 2
- 3

- 4
- 5
- 6
- Completely agree 7

Illegal aliens have taken away jobs from hard-working Americans

- Completely disagree 1
- 2
- 3
- 4
- 5
- 6
- Completely agree 7

The United States needs stronger immigration laws

- Completely disagree 1
- 2
- 3
- 4
- 5
- 6
- Completely agree 7

Illegal aliens who have committed a felony should be allowed to try for citizenship

- Completely disagree 1
- 2
- 3
- 4
- 5
- 6
- Completely agree 7

If a war comes to an end after the use of nuclear weapons, the use was justified

- Completely disagree 1
- 2
- 3
- 4
- 5
- 6
- Completely agree 7

Nuclear weapons continue to be a global danger

- Completely disagree 1
- 2
- 3

- ○ 4
- ○ 5
- ○ 6
- ○ Completely agree 7

Q20 There is never a good justification for the use of nuclear weapons

- ○ Completely disagree 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ Completely agree 7

Thank you for your quick answers.

People often form their opinions about a controversial issue based on its potential positive or negative consequences. However, people differ in the consequences that concern them the most. Please rate the following items from 1 (not important) to 7 (very important) in response to the question:

When deciding to support or oppose a controversial social issue, how much does the possible consequences to the following categories influence your position?

	Not important 1	(2)	(3)	Neutral (4)	(5)	(6)	Very important 7
Plants	○	○	○	○	○	○	○
Children	○	○	○	○	○	○	○
Marine life	○	○	○	○	○	○	○
My prosperity	○	○	○	○	○	○	○
Whales	○	○	○	○	○	○	○
Humanity	○	○	○	○	○	○	○
My future	○	○	○	○	○	○	○
Birds	○	○	○	○	○	○	○
My lifestyle	○	○	○	○	○	○	○
People in the community	○	○	○	○	○	○	○
Future generations	○	○	○	○	○	○	○

My health	○	○	○	○	○	○	○
Trees	○	○	○	○	○	○	○
Animals	○	○	○	○	○	○	○
Me	○	○	○	○	○	○	○

Now we want to know more about your opinions regarding one of the controversial issues from earlier.

For you, we have selected the issue of genetically modified organisms (GMOs). Please answer the following questions about your opinions about GMOs.

How much do you, personally, care about the issue of GMO foods?

- ○ Not at all
- ○ Not too much
- ○ A little bit
- ○ A great deal

How much do you support or oppose the production of GMO foods or foods containing GMOs?

- ○ Strongly oppose
- ○ Oppose
- ○ Support
- ○ Strongly support

How much do you support or oppose the selling of GMO foods or foods containing GMOs in stores?

- ○ Strongly oppose
- ○ Oppose
- ○ Support
- ○ Strongly support

Some opinions are based on a deep understanding of the issue and are unlikely to change. These opinions are held with high certainty. Other opinions are based on an initial reaction where more information may alter your thoughts. These opinions are held with low certainty.

How certain are you of your opinions of GMOs?

- ○ Extremely uncertain
- ○ Uncertain
- ○ Certain
- ○ Extremely certain

People who support or oppose GMOs often do so for different reasons.
Please rearrange the following reasons to show which are more or less important to you, with the most important reason at the top. You can click and drag on each reason to move it up or down.

_____ Possibility for more affordably priced food
_____ Possible health impacts
_____ Possible environmental impacts
_____ Produce more food to feed the world

Companies often try to persuade audiences to agree with their views on controversial issues. On the next page, we will randomly select and show you a press release where a company tries to do this regarding GMOs.

While most of the arguments you read will be true, we have fictionalized the company name and specific case to try to limit any previous knowledge you may have from

influencing your opinions. Please read the following press release and be ready to answer a few questions afterwards.

Please click the arrow when you are ready to read your press release.

The stimuli were presented here. All the stimuli can be seen in their entirety in APPENDIX E.

Please evaluate the press release you just read on the following categories

- Not persuasive 1
- 2
- 3
- 4
- 5
- 6
- Persuasive 7

- Ineffective 1
- 2
- 3
- 4
- 5
- 6
- Effective 7

- ○ Convincing 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ Not convincing 7

- ○ Not compelling 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ Compelling 7

- ○ Straightforward 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ Misleading 7

- ○ Forgettable 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ Memorable 7

Often people can only remember a few details from what they read. What arguments from the press release can you remember? List any and all details that come to mind

Do you recall any of the thoughts you had while reading the press release?

These could represent your own arguments to either support or counter what you read, general thoughts about the topic or even random thoughts if your mind was wandering.

Maybe you were so focused on the text that you had no other thoughts at all—that is fine too. Please try to capture your thought process here.

Has anything you read or thought about had any impact on your original opinions? Please answer the following questions about your opinions about GMOs.

How much do you, personally, care about the issue of GMO foods?

- Not at all
- Not too much
- A little bit
- A great deal

How much do you support or oppose the production of GMO foods or foods containing GMOs?

- Strongly oppose
- Oppose
- Support
- Strongly support

How much do you support or oppose the selling of GMO foods or foods containing GMOs in stores?

- Strongly oppose
- Oppose
- Support
- Strongly support

Some opinions are based on a deep understanding of the issue and are unlikely to change. These opinions are held with high certainty. Other opinions are based on an initial reaction where more information may alter your thoughts. These opinions are held with

low certainty.

How certain are you of your opinions of GMOs?

- Extremely uncertain
- Uncertain
- Certain
- Extremely certain

Finally, we want to ask a few questions about yourself.

Do you or your immediate family currently work on a farm?

- Yes
- No
- Unsure

Do you have any relatives who have ever worked on a farm?

- Yes
- No
- Unsure

How frequently do you encounter a farmer in your normal routine?

- ○ On a weekly basis, or more often
- ○ Once a month
- ○ A couple times a year
- ○ Less frequently
- ○ Never

What is your gender?

- ○ Male
- ○ Female
- ○ Prefer not to answer

What is your age?

What is the approximate population of your hometown growing up?

What is your major?

In general, would you describe your political views as

- ○ Very conservative
- ○ Conservative
- ○ Moderate
- ○ Liberal
- ○ Very liberal

As of today, do you lean more toward the Republican Party or more toward the Democratic Party?

- ○ Republican Party
- ○ Democratic Party
- ○ Other

Make sure you enter your name on the next page to ensure you get extra credit for your participation.

Thank you for participating in this survey

APPENDIX G IRB APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
2420 Lincoln Way, Suite 202
Ames, Iowa 50014
515 294-4566

Date: 6/29/2017

To: Allison Arp
302 NW Cameo Lane
Ankeny, IA 50023

CC: Dr. Michael Dahlstrom
215 Hamilton Hall
Dara Wald
214 Hamilton Hall

From: Office for Responsible Research

Title: Communicating agricultural science: An Elaboration Likelihood Model

IRB ID: 17-323

Study Review Date: 6/29/2017

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

  Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.**