INTERACTIVE INFOGRAPHICS AS AN AGRICULTURAL COMMUNICATION STRATEGY

by

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(Under the Direction of Jessica Holt)

ABSTRACT

In public health, politics, and advertising, interactive content has created increased elaboration from those audiences that would otherwise be least likely to engage with a message. This study sought to examine interactivity as an agricultural communication strategy though the lens of the dual-process model of interactivity effects. Respondents were randomly assigned a static or interactive data visualization concerning the production of peaches and blueberries in Georgia then asked to list their thoughts. Pre-existing factors of involvement and internet ability were recorded. Respondents significantly elaborated more with an interactive message than the static and this held true when pair-wise comparison of elaboration means were higher for the interactive message across the board. However, these results indicated a departure from the dual-process model of interactivity effects in that this difference in elaboration became statistically insignificant when respondents were stratified into groups based on the model's framework.

INDEX WORDS: interactivity, involvement, internet ability, agricultural news, online news, interactive graphics, attitudes, elaboration

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INTRODUCTION

Infographics and Data Journalism

Media convergence and the constantly changing state of digital communication has led to increased adaptation and hybridization in communication strategies (Weber & Rall, 2012). The changing communication landscape has become increasingly reliant on visual graphics, with online journalism in particular turning to interactive information graphics to tell stories (Bounegru, Chambers, & Gray, n.d.; Weber & Rall, 2012). "News sites, such as nytimes.com, guardian.co.uk, elmundo.es, bbc.co.uk, and spiegel.de, use interactive information graphics to explain complex information clearly and intelligibly, e.g., the Fukushima nuclear disaster, the White House health care plan, the Iraq protocols, the euro crisis, Hurricane Irene" (Weber & Rall, 2012). The appeal of interactive infographics for both audiences and story-tellers is easy to understand. These infographics have the unique power of engaging the reader in data, pointing out relationships and patterns that would be difficult to explain through text alone (Weber & Rall, 2012). As Reilly states, "In a news environment where high story turnover is necessary, the strength of data visualization lies in the viewer's ability to process visual information more rapidly than verbal information" (2017).

The addition of interactive infographics can make an argument more persuasive and attractive to readers, but it also poses a dilemma to communicators. To better understand the power and limitations of interactive infographics to persuade and change attitudes, a basic understanding of cognition and persuasion is required. To this end, Petty and Cacioppo created the Elaboration Likelihood Model (ELM) (1986).

Elaboration Likelihood Model and the Dual-Process Model of Interactivity

The ELM is made up of two different routes of persuasion, which represent the two different ways humans form opinions based on persuasive communication (Petty & Cacioppo, 1986). The first route of persuasion is the central route, which includes thoughtful consideration of arguments central to the issue. This route requires more cognitive energy, but results in lasting attitude formation (Sundar, Kalyanaraman, & Brown, 2003; Petty & Cacioppo, 1986). The second route of persuasion is the peripheral route, which is tied to simple cues or affective association. The peripheral route requires less cognitive energy, but attitudes formed via this route are more ephemeral (Sundar, Kalyanaraman, & Brown, 2003; Petty & Cacioppo, 1986). The route of persuasion a reader uses to form his opinion is determined by his motivation and ability to evaluate the communication (Petty & Cacioppo, 1986). This motivation and ability were combined under the term elaboration likelihood. The ELM proposed that there are a limited number of ways to affect this elaboration likelihood (Petty & Cacioppo, 1986). The ELM's strength and ubiquity in cognition and communication research has been due to this ability to classify all communication variables into the relatively simple categories of argument, peripheral cue, or factor affecting argument scrutiny (Petty & Cacioppo, 1986). By containing the many possible variables into these distinct categories, the ELM provided a schema through which the persuasiveness of communication methods may be judged.

The presence of infographics increased the persuasiveness of messages for most audiences (Vanichvasin, 2013). Infographics create a broader appeal and foster better comprehension and retention of information as opposed to text or images alone (Vanichvasin 2013). Furthermore, the appeal seems universal, as infographics have been shown to lead to a higher level of elaboration among both visual and verbal learners (Atkinson & Lazard, 2015).

The broad appeal of infographics and the continued hybridization of digital communication has combined to create the ability to click, slide, or otherwise navigate multiple different visuals working together as a group to tell the story of a dataset. These hybrid forms are known as interactive infographics, which have become staples in online journalism of the aforementioned news sources (Weber & Rall, 2012).

Applying the ELM to interactive infographics showed that the presence of interactivity may serve as an argument, peripheral cue, or factor that affects the extent of elaboration (Petty & Cacioppo, 1986; Liu & Shrum, 2009). It also suggested that this role of interactivity and its effects will change according to the reader's level of motivation and ability to process information (Liu & Shrum, 2009). That is, for low-involvement individuals interactivity may act as a positive peripheral cue and for high-involvement individuals it may be considered an argument or factor that increases elaboration (Liu & Shrum, 2009).

The addition of interactivity to infographics presents a tempting opportunity to increase a message's persuasive power, but it can also be a deterrent for those readers not accustomed to navigating online spaces (Liu & Shrum, 2009). In this online context, "interactivity, like vividness, is a stimulus-driven variable, and is determined by the technological structure of the medium" (Steuer, 1992). Hybridization of communication strategies and advances in technology foster increased interactivity in messaging, which could in turn represent the potential of increasing attitudes and elaboration in most audiences (Weber & Rall, 2012; Rafaelli, 1986). Interactivity can not only increase attitudes and elaboration but can also foster other positive effects as well, including increased performance quality, motivation, sense of fun, cognition, learning, and sociability of a message (Rafaelli, 1986).

In ELM, the mere presence of interactivity acted as a positive peripheral cue to readers. This combined with its unique power to illustrate data has made it a popular method of science communication (Weber & Rall, 2012). The effects of interactivity on message persuasiveness have been examined in the realm of public health, advertising, and marketing in multiple studies (Liu & Shrum, 2009). The early results of these interactive infographic studies were often contradictory, despite the broad appeal of infographics and the positive peripheral cue of interactivity. Combining these two strategies created a new communication method that was more than simply the sum of its parts. In an attempt to reconcile past research and move forward with a model that accounted for the variables of involvement and ability put forth in the ELM, Liu and Shrum proposed the dual-process model of interactivity effects in 2009. In this model, the ability of consumers is defined by the amount of time they spend on the internet each week and motivation is defined by the consumer's level of involvement in the stimulus topic. Through application of the dual-process model, interactivity proved to affect low-involvement consumers positively, while it was moderated by ability in the case of high-involvement users. For low-involvement users, internet experience did not change the higher processing and increased attitudes resulting from the message's level of interactivity (Liu & Shrum, 2009). For high-involvement consumers, the ability to make use of the interactive elements allowed them to enhance their central processing and improved their attitudes towards the message (Liu & Shrum, 2009). However, the lack of internet experience of the novice user group of high involvement individuals led to reduced focus on central arguments and more negative attitudes as a result of the increased cognitive resources required (Liu & Shrum, 2009). In summary, under the dual process model, three of the four groups experienced the positive effects of increased message elaboration and positivity. The fourth group was inhibited due to their inability to make effective use of the interactive elements. That is, interactivity increased attitudes and elaboration for frequent internet users as well as infrequent users with little involvement in the message topic but resulted in negative attitudes and decreased elaboration for those high involvement individuals that used the internet infrequently. This dual-process model helped explain the small portion of the audience that exhibited lower attitude and elaboration scores towards interactive infographics (Liu & Shrum, 2009).

Need for Research

While several studies have been conducted on the effectiveness of interactive infographics in the realms of public health, advertising, and marketing, none have broached the topic of agriculture. With issues pertaining to genetically modified organisms, animal welfare, and seed propriety, agricultural science is one of the more divisive sciences to capture the public mind today (Brossard & Nisbet, 2006). With the introduction of opinions concerning conventional agriculture and its accompanying sciences propagated by many disparate interests including companies, politicians, farmers, scientists, and members of the general public, it can be difficult for a low-involvement consumer to form their own opinions about agriculture in the United States (Brossard & Nisbet, 2006). The public tendency is to take cognitive shortcuts whenever available, relying on attitudes and beliefs to help make sense of persuasive agricultural communications (Brossard & Nisbet, 2006). Therefore, the power of interactive infographics could be harnessed to work as a peripheral cue to increase the attitudes of these low-involvement individuals. In fact, Wojdynski states, "interactivity may specifically have an effect on those who are otherwise least likely to engage with a message" (2015). Besides acting as a positive peripheral cue, interactive infographics can be utilized in agricultural communication to combat opinion overload of the uninformed consumer by presenting factual data in a manner that is both engaging and easy to understand, which allows consumers to heuristically form their own opinions.

As technology has increased exponentially, so, too, has the amount of data to which communicators and their audience have access (Cairo, 2013). Much of the communication received by the general public is digital, now that 89% of the U.S. population uses the internet (Anderson, Perrin, & Jiang, 2018). In a time when companies, news outlets, and individuals are vying for the public's attention, communication that stands out amongst the crowd of information online has become increasingly important (Holt, 2016). Furthermore, the increase in the amount of information with which consumers are inundated has facilitated a commensurate decrease in attention span (McSpadden, 2015). This information overload also means that the more consumers use the internet, the more likely they are to encounter information with which they have low involvement. Rather than provide reassurance, too much information tends to overwhelm consumers, leaving them with negative attitudes towards the entire message (Spenner & Freeman, 2012). In this digital landscape, messages must stand out from the crowd and be quickly understood in order to be persuasive (McSpadden, 2015; Spenner & Freeman, 2012).

To keep pace with the exponential increase in internet use and its correlating increase in the number of low-involvement message consumers, it is imperative that agricultural communication adapt and better understand how best to communicate through interactivity. As the use of internet-connected devices increases, the number of low-ability consumers will decrease. This means that as more consumers turn to online sources for media consumption, the value of interactivity in communication will rise. With the exponential increase of internet users, interactive communication becomes an increasingly timely topic for research.

Aside from the need to stay relevant in a world of changing technology, the practical significance of a better understanding of interactivity in the agricultural communication field could create the opportunity for more persuasive communications. Interactivity could be included in online websites, news stories, newsletters and crisis communication, to name a few. Interactive infographics could give consumers more motivation to engage with the information, as well as the power to understand how overarching agricultural issues like drought, temperature increase, or use of pesticides personally affect them. Furthermore, practical use of interactive infographics could help communicate complicated agricultural processes more effectively to the low-involvement layman (Wojdynski, 2015).

Studies have not yet tested the dual-process model in the agricultural realm and it is possible that examination of this politically and personally divisive topic can make unique contributions to the standing literature. Although the majority of consumers are not part of the agricultural industry, every consumer interacts with food multiple times each day. More research is necessary to ascertain how this universal familiarity affects the "low-involvement" classification. Furthermore, applying the dual-process model of interactivity to agricultural communications poses an additional quandary: how does the model function when high-involvement consumers are disproportionately low ability, as is likely to occur in the rural agricultural population? A generally aging, rural, low-income population, agriculturalists are among the least likely to exhibit high internet ability scores (Salemink, Strijker, & Bosworth, 2017). This means that the highest involvement group (agriculturalists) is more likely to be low ability than the general public, resulting in an increased risk of negative attitudes and lower elaboration for interactive agricultural infographics than for communications on a different topic. How can interactivity be harnessed to stay relevant and reach new audiences without alienating this core group of disproportionately low ability devotees? This study sought to address current communication trends by identifying and discussing the significant moderators of attitude and elaboration for interactive agricultural infographics among the general public.

Despite current communication trends and research, the potential of interactive agriculture-based infographics to affect consumer attitudes and elaboration remains unclear, and laboring under the misconception that agriculture is no different from other message topics could risk the alienation of the science and industry's biggest supporters.

Definitions of Key Words

Prior to positing research hypotheses and questions, this study defined key words that form the basis of this study's contribution.

Data visualization: Data visualization is "the science of visual representation of 'data', defined as information which has been abstracted in some schematic form, including attributes or variables for the units of information" (Friendly, 2001). The purpose of data visualization is to function as a tool of exploration and discovery of data in a way that allows viewers to better understand patterns and trends (Friendly, 2001). As Cairo (2013) states, "The first and main goal of any graphic and visualization is to be a tool for your eyes and brain to perceive what lies beyond their natural reach." Most data visualizations, including the one used as a stimulus in this study, consist of either statistical graphics, thematic cartography, or both (Friendly, 2011).

Infographic: Past definitions of infographics have distinguished between infographics and data visualizations where, "infographics tell stories designed by communicators" and data visualization "helps readers discover stories by themselves" (Cairo, 2013). However, the purpose of data visualization and infographics are ultimately the same: to enable users to better understand data by study of a visual representation, and as hybridization of data visualizations has increased, the distinction between the two has become less sharp (Cairo, 2013; Weber & Rall, 2012). Throughout this study, the terms infographic and data visualization were used interchangeably as many current data visualizations are hybrids of infographics, text, illustrations, interactive tools, and many other media (Weber & Rall, 2012). Cairo (2013) contended that data visualization and infographics exist on a continuum. Where data visualization is a tool for data exploration by users, infographics trend more towards the presentation of information to users (Cairo, 2013). For example, where a data visualization is either a statistical graphic or thematic map, an infographic can be as simple as a bar graph. Graphics that simply present data in visual manner to a user without requiring further exploration or understanding of the data are therefore considered to exist closer to the infographic side of the continuum as opposed the data visualization (Cairo, 2013). Perhaps the simplest difference between the two is that infographics tend to merely present one aspect of data where data visualizations are tools to analyze the relationships and patterns within the data (Cairo, 2013). The entirety of the message stimuli used in this study should be considered a data visualization, but it is composed of elements that range across the presentation-exploration continuum of infographics and visualizations presented by Cairo (2013). This hybridization of infographics and visualization is common of most current data journalism (Weber & Rall, 2012).

Interactivity: This study defined interactivity as proposed by Steur (2009)

> "Interactivity is the extent to which users can participate in modifying the form and content of a mediated environment in real time. Interactivity in this sense is distinct from engagement or involvement as these terms are frequently used by communication researchers."

There are three different types of interactivity proposed by Weber & Rall (2012) including linear, explorative, and non-linear interactivity. Along with other elements, these interactivity types correspond to different levels of message interactivity observed as low, moderate, and high (Sundar, Kalyanaraman, & Brown, 2003; Weber & Rall, 2012). Liu (2003) proposed three main dimensions by which this level of interactivity may be perceived by users. The first is a user's ability to voluntarily participate in and instrumentally influence a communication, called active control (Liu, 2003). The second dimension is flow of information between the message and the user, called two-way communication (Liu, 2003). The third is the speed by which the interaction between the message and user occurred, called synchronicity (Liu, 2003). Liu defines interactive communication as, "a communication that offers individuals active control and allows them to communicate both reciprocally and synchronously," (2003).

Interactive Infographic: This study defined interactive infographics as, "an independent visual representation of information or knowledge with different modes: e.g., images (still and moving, diagrams, maps), written texts, audios, and design elements are combined in such a way that they create a new hybrid form" (Weber & Rall, 2012). In this study, interactive infographics are therefore considered data visualizations that make use of both infographics and interactivity.

Hybridization: By using the term hybridization, this study meant "the emergence of new media forms by adapting or transforming old patterns or combining different patterns to create a new one. Formerly separate areas and media are intertwined and connected to create a new cohesive whole" (Weber & Rall, 2012). In this sense, interactive infographics are considered a hybrid form of data visualization as they combine infographics and interactivity, often in conjunction with other media forms. As new platforms have emerged and the availability and speed of the internet has increased, so too, has the hybridization of data visualization and journalism (Weber & Rall, 2012). It is expected that this trend of hybridization of data visualizations will continue (Weber & Rall, 2012).

Elaboration: This study defined elaboration as, "a continuum of no thought concerning issue-relevant information presented to complete critical thought of every argument and integration of these elaborations into the person's attitude schema" (Petty & Cacioppo, 1986). A high level of elaboration likelihood engendered positive attitudes, deeper critical thinking, and more resilient beliefs and behavior changes, and is the goal of most persuasive communications (Petty & Cacioppo, 1986). A low level of elaboration likelihood engendered less message-relevant thoughts and belief and behavior resiliency but did not always indicate negative message attitude (Petty & Cacioppo, 1986). In low elaboration situations, user cognition followed the peripheral route of ELM in which the presence of peripheral cues determined user attitudes. When viewed from an interactive infographic perspective, interactivity functioned as a positive peripheral cue at lower elaboration likelihood levels, providing an overall positive effect on consumer message attitudes (Liu & Shrum, 2009; Wojdynski, 2015).

Involvement: Involvement was defined as "the extent to which an advocacy has 'intrinsic importance' or 'personal meaning'" (Petty & Cacioppo, 1986). This personal relevance is based on the consumer's needs, values, and interests and comprises both cognitive and affective messages (Zaichkowsky, 1994). Involvement occurred when a consumer expected the message topic to have serious consequences in their day-to-day lives (Petty & Cacioppo, 1986). That is, if a consumer considered the topic of the message important and personally relevant, he would be motivated to think critically in order to better understand the message (Petty & Cacioppo, 1986). This type of consumer was considered highly involved with said message topic. Consumers who consider the topic to be of trivial importance and are therefore unmotivated to critically examine the message were considered low involvement (Petty & Cacioppo, 1986). The level of a consumer's involvement determines whether his message attitudes and thoughts will occur via the peripheral or central route (Petty & Cacioppo, 1986). In this sense, involvement is a moderating factor of elaboration for both the ELM and the dual-process model of interactivity effects. For the purposes of this study, the ELM's "motivation to process" moderator should be considered the equivalent of the "involvement" moderator found in the dual-process model of interactivity effects (Liu & Shrum, 2009; Petty & Cacioppo, 1986).

Ability: This study defined ability as the extent to which a consumer could effectively make use of the interactive elements present within the interactive message stimulus (sliders, drop down menus, navigational bars, etc.) and other similar online interactive infographics. Users with high ability were able to effectively utilize the interactive elements as tools to communicate with interactive infographics (Liu & Shrum, 2009). Users with low ability struggled or were unable to use the interactive elements (Liu & Shrum, 2009). In their dual-process model of interactivity effects, Liu and Shrum (2009) posited that this ability could be equated with a user's internet experience and resulting competence and quantified this level of ability by the hours a respondent spent online each week. In an attempt to extend this study's findings to agricultural communication, the current study measured ability in the same way for the purpose of hypothesis testing. Online communication strategies are constantly evolving, however, and the researcher recognized from the literature review that hours spent online each week measure may no longer be the most accurate predictor of respondent ability (Anderson, Perrin, & Jiang, 2018; DiMaggio & Hargittai, 2001; Salemink, Strijker, & Bosworth, 2017). To best measure a user's ability to effectively use the interactive elements, which was equated by Liu and Shrum (2009) to a user's internet experience, the researcher attempted to gain a more detailed understanding of respondent's online experiences that extended past the original measure of hours spent online. To this end, respondents were asked to answer questions concerning their internet competence, purpose for going online, type of internet connection, and other topics related to a user's overall internet experience. These questions (Table 2) were selected as items of interest due to their presence in current internet connectivity research (Anderson, Perrin, & Jiang, 2018; Salemink, Strijker, & Bosworth, 2017). User responses to these selected internet ability items were used in post-hoc analyses to provide a deeper understanding of the dual-process model of interactivity effects within the agricultural communication realm. For the purposes of this study, the ELM's "ability to process" moderator should be considered the equivalent of the "internet ability" moderator found in the dual-process model of interactivity effects (Liu & Shrum, 2009; Petty & Cacioppo, 1986).

Statement of Purpose

The purpose of this study was to ascertain whether interactive infographics could be an effective agricultural communication strategy by exploring the effects of interactivity on the average consumer's elaboration of messages presented as agricultural infographics through the framework posited by the dual-process model of interactivity effects (Liu & Shrum, 2009).

LITERATURE REVIEW

Infographics

Infographics have become a ubiquitous tool of communication in many different disciplines including science, engineering, and even literature (Cairo, 2015; Ciaiti, Marchelli, Pretesi, Rapetti, Redavid, Vanuzzi, 2016; Cheng, Drewnowski, & Otten, 2015; Gebre & Polman, 2015). This is in part due to public preference. In the general public, an effective use of infographics creates a broader appeal, comprehension, and retention of information as opposed to only text or imagery (Vanichvasin, 2013). Infographics have been proven to help people make sense of a mass of scientific data in a quick and manageable way (Dur, 2014). Furthermore, infographics are not only the audience-preferred tool in science communication, but also lead to a higher level of elaboration among both visual and verbal learners (Atkinson & Lazard, 2015). Atkinson and Lazard's study compared attitudes and elaboration toward messages based on recycling, and, of particular interest in this study, genetically modified organisms. They found infographics created more critical thinking engagement than image or text cues alone, regardless of whether the subject exhibits a visual or verbal learning style. Although both groups responded more favorably and elaborated more when the message was presented as an infographic as opposed to text or image representations, surprisingly people with higher visual literacy exhibited significantly less elaboration than those with lower visual literacy (Atkinson & Lazard, 2015). In this study, visual literacy served as an implicit moderating factor of elaboration for both message stimuli.

Interactivity

Interactive online infographics differ from static, printed graphics in several ways. The information architecture, interactivity, dramaturgy, intermediality, and multimodality aspects of interactivity fundamentally change a user's perception, the production process of the graphic, and even the way the story is covered (Weber & Rall, 2012). Interactivity moderates a user's perception, the way in which he perceives, clicks, and navigates through information graphics on the web. Furthermore, due to the differences in the way in which designers, editors, or journalists produce information graphics, an entirely new set of skills or even professionals are required to create these interactive infographics. The advent of interactivity has even, in some ways, changed the way in which facts or stories are conveyed to the public (Weber & Rall, 2012).

The flashy graphics and bells and whistles of sliders, buttons, and pop-ups of interactive infographics certainly have their appeal. The New York Times devoted an entire office to data visualization and won several awards for their cutting-edge data journalism (Weber & Rall, 2012). As Rafaelli said, "Interactivity is a widely used term with an intuitive appeal, but it is an under-defined concept" (1986). Many studies have attempted to classify interactivity in different ways, because as technology changed, so too did the extent of interactivity. For the purposes of this study, interactivity was theoretically defined by Steur (1992).

There are three main types of interactivity present in contemporary data visualizations. These include explorative, which allows users to explore the data by themselves through manipulation via filtering, selecting, and searching the data; non-linear, which allows users the possibility of choosing their own navigation path within a given frame of data or facts through the navigation tools of timelines, sliders, and navigation menus; and linear, which enables the user to move between information sequences (forwards and backwards) through a predefined narrative frame (Weber & Rall, 2012). Most online visualizations make use of a combination of multiple interactivity types (Weber & Rall, 2012). If the different modes are combined successfully, the entire message benefits as, "the information graphic becomes a new emergent whole—greater than the sum of its parts" (Weber & Rall, 2012).

Increased technology has in turn led to a rise in hybridization in the realm of interactive data journalism. In this case, hybridization is not a mere static process but an ongoing evolution that intertwines many disparate elements in a dynamic way. Contemporary messages include elements of journalism and writing, of course, but also static graphic design, information design, motion graphics, animation, VFX, digital filmmaking, and computer science (Weber & Rall, 2012). A message this complex requires a new kind of journalistic team. As such, the relatively new field of "graphics editor," which combines data-driven journalism with the requirements of graphic design, animation, digital filmmaking, computer science, and more, emerged. Increased hybridization has also made imperative the cooperation and communication between classic journalists and computer scientists in the co-creation of these graphics (Cheng, 2015). Additionally, it has spurred new courses of study in communication (Weber & Rall, 2012). It is important to note that although the hybridization and combination of multiple different forms of media to tell a single story can create a more emotional or effective message, the reverse is also true. All these different forms of communication must be skillfully woven to describe a single, coherent message. Weber & Rall warned, "if the message of an information graphic is not clearly defined, the graphic remains a smorgasbord of different modes without any coherence" (2012). Therefore, it is incumbent upon the creators of interactive infographics to consider the target audience's ability to understand and use these hybrid forms of interactivity.

Weber & Rall posited that contemporary visualizations can be classified into the categories of low, medium, and high interactivity by the methods through which users interact with the information (2012). Low interactivity messages require users to click objects such as buttons, people, or images and are explored in a linear method. Medium interactivity messages exhibit a hierarchical, hyperlinked structure. Finally, high interactivity levels are exhibited by the user's ability to influence content or choose his own navigation path. It should be noted that under Liu and Shrum's dual-process model of interactivity, not all users present the same ability to use these increasingly complex methods of interactivity (2009).

A balance between interactivity and ability must be created in order to construct the message that will most positively affect elaboration and attitudes. Interactivity is useful in that it increases motivation in low-involvement individuals, but it also must be kept in mind that, for high-involvement individuals, interactivity requires more cognitive resources and can detract from relevant information or form frustration, making an interactive website appear worse than a less-interactive website (Liu & Shrum, 2009). The final effect of interactivity is determined by the balance between the cognitive resources available to participate and understand versus the cognitive cost of interactivity (Liu & Shrum, 2009). This means that higher levels of interactivity increase the attitudes of new audiences, but do not always function as intended for motivated information seekers (Wojdynski, 2015). Furthermore, at high levels, consumers exhibit little discrimination between levels of interactivity (Wojdynski, 2015). In fact, the perceptual effects of high interactivity were statistically indistinguishable from those of low or no interactivity (Sundar, Kalyanaraman, & Brown, 2003). As high interactivity presents the possibility of alienating high involvement consumers or frustrating those with low ability to use or understand the interactive elements, low or medium levels of interactivity are preferred. A study of the effects of interactivity on consumer preference of politicians found that, “Moderate interactivity seemed to enhance the candidate’s appeal as well as his character, but high interactivity seemed to detract from it. Similarly, the level of voter agreement with the candidate’s position on policy issues was enhanced with moderate interactivity but not with high interactivity” (Sundar, Kalyanaraman, & Brown, 2003). Of particular interest to the creator of these online messages, then, is the consumer’s perceived level of interactivity. In fact, a 2015 study found that interactivity led to more positive attitudes “only to the extent that users perceived the site as more interactive, suggesting that attempts by content producers to increase such perceptions may be worth the investment” (Wojdynski). Liu’s perceived interactivity scale proved a useful tool for measuring consumer perceptions of interactivity levels. This scale was designed to be used in academic research to understand the effect of perceived interactivity on a consumer’s response to online communication (Liu, 2003).

In sum, interactivity could prove a useful tool in agricultural communication because studies suggest interactive graphics in news content can generate favorable attitudes toward the stimulus, which may, in turn, have a positive effect on the perception of both the message content and the news organization. Interactivity is also particularly adept at engaging new audiences that were before the least likely to exhibit interest in the message (Wojdynski, 2015). However, increased interactivity also has the potential to alienate the high-involvement core audience when their level ability to use these interactive features is not considered in the creation of the message.

Elaboration Likelihood Model and the Dual-Process Model of Interactivity Effects

The effectiveness of an interactive message can be measured by the extent of a user’s attitudes toward and elaboration on its themes. The ELM posited that elaboration is “a continuum of no thought concerning issue-relevant information presented to complete critical thought of every argument and integration of these elaborations into the person's attitude schema" (Petty & Cacioppo, 1986). That is, a more effective or persuasive message engages the user in more issue-relevant thinking and behavior. The ELM serves to simplify the route of elaboration into two distinct routes, the central or peripheral, moderated by a limited number of variables including persuasiveness of an argument, presence of peripheral cues, or argument scrutiny, among others. By organizing and simplifying the elaboration process, the ELM provided a framework to evaluate message effectiveness (Petty & Cacioppo, 1986).

Dual-process models have long been a focus of cognitive psychology. Although there has been much research throughout the years seeking to understand the process to persuasion, most studies have focused on two distinct routes of attitude change and the factors that affect these routes (Petty & Cacioppo, 1986). In dual-process models of thought, ability and involvement are both moderating factors. When presence of ability and involvement create a high likelihood of elaboration, the central route of persuasion occurs (Petty & Cacioppo, 1986). In this central processing route, the expenditure of cognitive resources is required in addition to the aforementioned motivations. In absence of these motivations, the likelihood of elaboration is low, and the peripheral route occurs as it requires minimal cognitive resources (Sundar, Kalyanaraman, & Brown, 2003; Petty & Cacioppo, 1986). Elaboration through the central route is preferred as attitude changes created through the expenditure of cognitive resources are more persistent, resistant, and predictive of behavior change than those affected via the peripheral route (Petty & Cacioppo, 1986).

This central route spurs careful consideration and integration of relevant information to create attitude and position changes within the consumer (Petty & Cacioppo, 1986). The central route is characterized by careful consideration of justification of behavior against attitudes; increased comprehension, learning, and retention; the nature of cognitive responses; and how a user combines beliefs into an overall evaluative reaction (Petty & Cacioppo, 1986). Not only are these arguments more carefully evaluated in the central route, they are also "accessed, rehearsed, and manipulated more times, strengthening the interconnections among the components and rendering the schema more internally consistent, accessible, enduring, and resistant than under the peripheral route" (Petty & Cacioppo, 1986). The cognitive cost of these attitude changes was therefore much higher than those of the peripheral route which results in attitude shifts that are more predictive of future behavior (Petty & Cacioppo, 1986).

In contrast, the peripheral route of persuasion occurs when the likelihood of elaboration is low. The peripheral route is the method of persuasion of low-involvement individuals who have little motivation to consider arguments carefully and therefore often rely on external cues to determine their attitude towards the message. These cues can include source attractiveness, number of sources, presentation of message and more (Petty & Cacioppo, 1986). The overall attitude shift of the peripheral route is a simple inference based on the consumer's opinion of these cues rather than careful scrutiny of the argument (Petty & Cacioppo, 1986). The peripheral route may still prove useful in changing consumer attitudes towards a message, but these shifts are more ephemeral and less predictive of future behavior than those occurring in the central route (Petty & Cacioppo, 1986) (Figure 1).

In sum, persuasion occurring via the central route results in greater recall and accessibility of attitude-relevant information (Petty & Cacioppo, 1986). Therefore, central route persuasion yields consumers that are more consistent in their attitude shift over time, better able to defend their position, and more likely to act on their beliefs (Petty & Cacioppo, 1986).

Peripheral route persuasion is the result of simple inferences spurred by cues and, while less predictive of behavior, can also result in attitude shift (Petty & Cacioppo, 1986). The ELM serves as a useful tool for the evaluation of interactive messages because it shows that interactivity can be an argument, peripheral cue, or factor that affects extent of elaboration depending on the level of a reader's motivation and ability to process information.

The ELM was adapted to form the dual-process model of interactivity by Liu and Shrum in 2009. This model focused on involvement and ability as the main moderating factors of attitude change when consuming an interactive message. Through this framework, the mere presence of interactivity served as a peripheral cue that led to positive attitude changes regardless of user ability. Under high-involvement conditions, interactivity spurred positive attitudes for high-ability users, but led to more negative attitudes for inexperienced internet users (Liu & Shrum, 2009). This result may be due to the fact that high-involvement users are already motivated to give careful consideration to the message through the central route. Interactivity can increase the cognitive cost of understanding the message for low-ability users. Therefore, this group of users is more likely to consider the bells and whistles of interactivity as distraction or unnecessary complication of the information they are seeking. This can lead to frustration and decreased attitudes towards the message as a whole, regardless of the argument presented (Liu & Shrum, 2009).

Figures 1 and 2 were presented one after another in an effort to better illustrate the relationship between the Elaboration Likelihood Model (Petty & Cacioppo, 1986) and the dual-process model of interactivity (Liu & Shrum, 2009). The corresponding pairs of motivation/involvement and ability/internet ability were highlighted in yellow. Below each yellow block is a reference to the corresponding measure of the other scale as well as a short description of some of the considerations of the moderator written within the block. For example, in Figure 1's illustration of ELM, the "motivation to process" block corresponded with the dual-process model of interactivity's "involvement" block and took into consideration a message's relevance, the viewer's need for cognition, personality responsibility, and more. Figure 1's "ability to process" block corresponded with Figure 2's "internet ability" block and took into consideration viewer distraction, message repetition, viewer prior knowledge, and message comprehensibility.

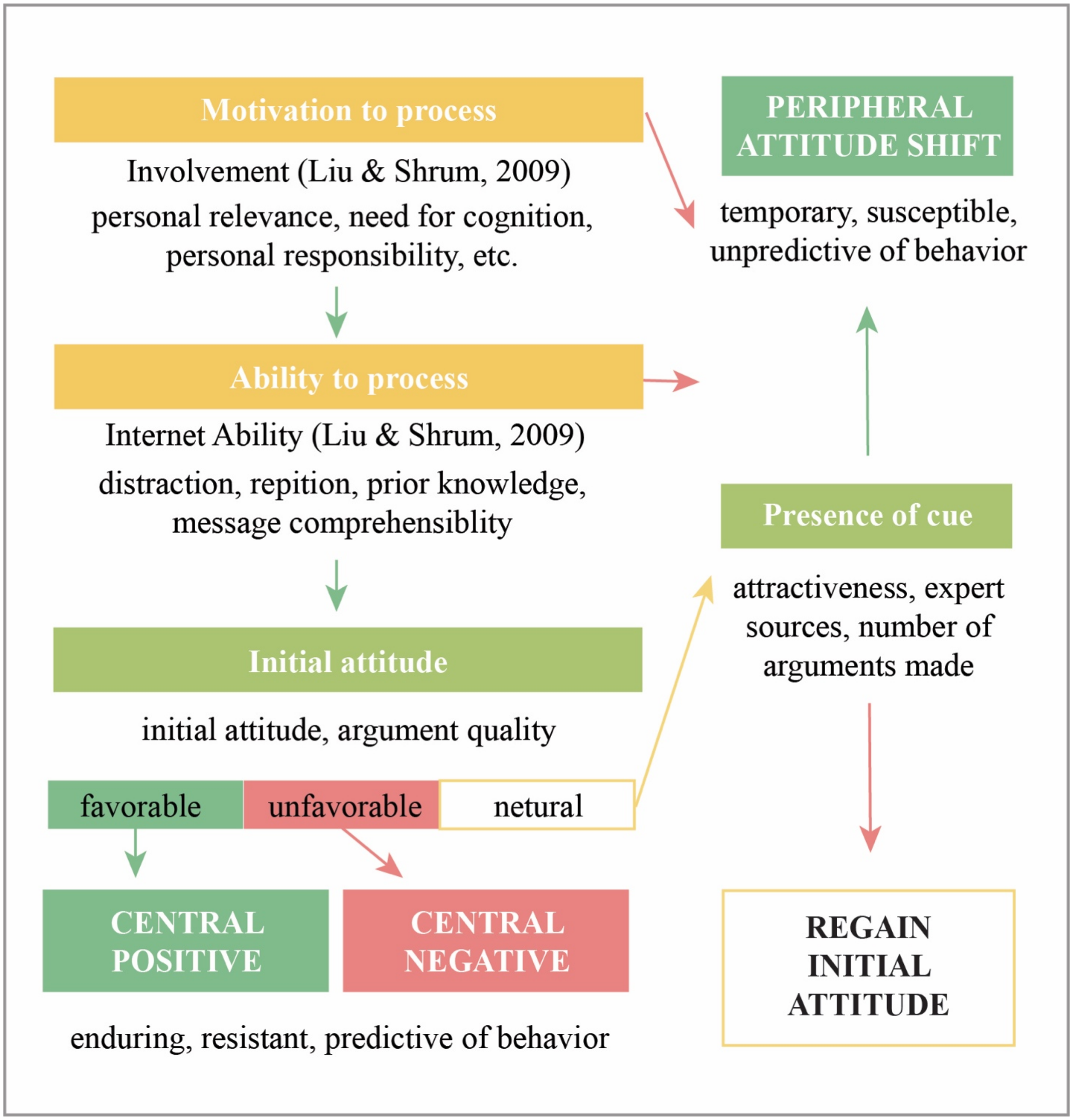

Figure 1. Elaboration Likelihood Model (Petty & Cacioppo, 1986). This figure shows the basis for the Liu and Shrum's (2009) adapted dual-process model of interactivity effects.

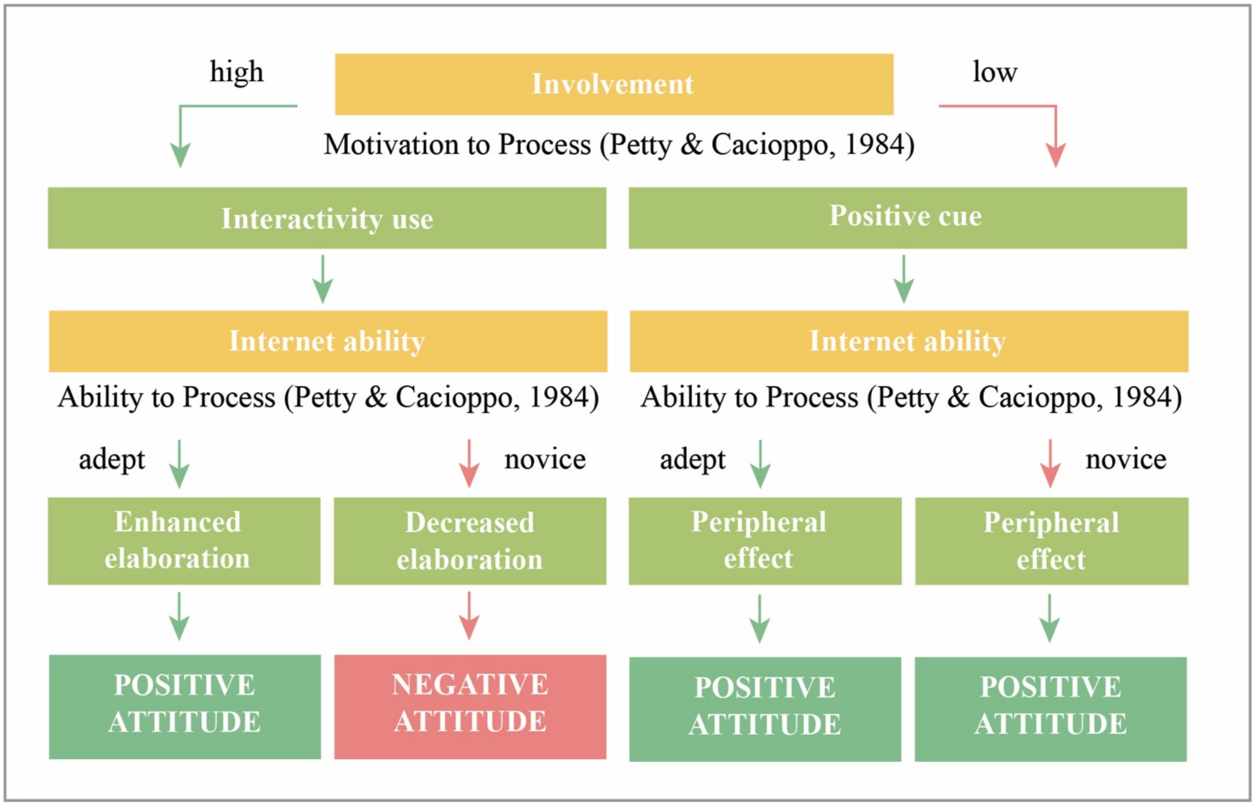

Figure 2. Dual-Process Model of Interactivity Effects (Liu & Shrum, 2009). This figure shows the dual-process model for interactivity's adaptation from the Elaboration Likelihood Model (Petty & Cacioppo, 1986).

The dual-process model of interactivity confirmed Wojdynski's assertion that interactivity can be a useful tool for increasing the attitudes of new audiences (2015). Liu and Shrum's 2009 study found "large numbers of interactive features present in high-interactivity websites may persuade low-involvement users, whether those features will prove relevant or beneficial to them or not." Interactivity increased the consumer's affective involvement with a website which resulted in a more enjoyable browsing experience. These attitude changes can extend to create positive attitudes not only towards the website but also the brand or news service (Liu & Shrum, 2009).

However, interactivity can prove a double-edged sword. Interactive message creators should pay special attention to their audience's ability so as not to alienate their high-involvement users with what they view as difficult to use interactive features. The ability of interactivity to simultaneously evoke positive brand attitudes for some and negative attitudes for others was confirmed in a 2003 study that found consumers with little political interest found a candidate with a medium or high-interactivity website to be significantly more caring and sensitive than those who viewed a low-interactivity website (Sundar, Kalyanaraman, & Brown). However, for politically savvy consumers, this effect was reversed with those viewing the high-interactivity site exhibiting negative attitudes towards the fictitious candidate. Savvy consumers viewing the medium-interactivity site still reported improved attitudes, however (Sundar, Kalyanaraman, & Brown, 2003). This follows the dual-process model of interactivity and also exhibits the moderating factor of involvement.

> "In sum, the central tenet of the proposed model is that interactivity can affect the effectiveness of persuasion through distinct processes, either by serving as a peripheral cue through its mere presence in a Web site or by directly interacting with central processing (through the facilitating and/or inhibiting effects and through interactivity serving as a central argument itself)" (Liu & Shrum, 2009).

Involvement

Because both involvement and ability are the most important variables of elaboration and attitude change when it comes to interactivity, they bear further investigation for the purposes of this study. There are intrinsic social, psychological, and functional risks for a high-involvement consumer to either be ill-informed or lack sufficient information (Dholakia, 2001). Therefore it follows that information seeking and dissemination are also indicative of high-involvement, as consumers strive to be well-informed on matters that affect their personal and professional well-being (Dholakia, 2001). The ELM contends that as an issue or product increases in personal relevance or consequences, it becomes more important and adaptive to forming an informed opinion. Thus, people are more motivated to devote the cognitive effort required to evaluate the true merits of an issue or product when involvement is high rather than low (Petty, Cacioppo, & Schumann, 1983). The moderating effect of involvement has been confirmed by a number of studies that find that high-involvement consumers are more likely to engage with and scrutinize the arguments of a relevant message (Sundar, Kalyanaraman, & Brown, 2003; Liu & Shrum, 2009; Petty, Cacioppo, & Schumann, 1983; Wodjynski, 2015; Wright, 1974). High-involvement consumers also exhibit increased recall and recognition of relevant information in addition to increased attitudes and changed behavior (Petty & Cacioppo, 1986).

From an interactive infographic perspective, involvement also determined whether a consumer was motivated to use the interactive elements or whether they functioned as a positive peripheral cue (Liu & Shrum, 2009). High involvement users were motivated to critically examine the message and therefore used the interactive elements. Low involvement users noticed the interactive elements but were not motivated to use them to explore the data. The presence of these interactive elements, however, did function as a positive peripheral cue to these low-involvement users.

This study measured consumer involvement by using the Personal Involvement Inventory (PII) (Zaichkowsky, 1994). The PII is a context-free, 10-item, dichotomous pair, 7-point Likert scale created to measure the motivational state of involvement by investigating the three factors affecting involvement: characteristics of the consumer, situation, and stimulus (Zaichkowsky, 1994). The PII is a simple measure proven to be successful in discriminating a consumer’s reactions to a particular message in relation to the message presentation and the consumer’s own characteristics (Zaichkowsky, 1994). Advertisements with the same message presented in different ways have received different scores, exhibiting the inventory's usefulness in the investigation of consumer preference when it comes to message presentation. Aside from its success in measuring advertising effectiveness, this inventory was created as a theoretical tool for academic research to measure and account for individual variation in the level of involvement of a consumer.

Ability

The second moderating factor for elaboration and attitude change formed via interactivity is user ability. This is the ability for the audience to use and understand the various buttons, sliders, filtering mechanisms, etc. present in all interactive online infographics. This ability can therefore be equated with a user's level of internet competence. Internet competence is the capacity of an individual to use the internet for the purposes they choose while experiencing the maximum amount of satisfaction and minimum amount of stress (DiMaggio & Hargittai, 2001). This competence is a self-perpetuating cycle as those users with high ability routinely gain more satisfaction from their experience, making them more likely to use the internet again and again, gaining further skills (DiMaggio & Hargittai, 2001). Ability to use internet is not equal across the general public, however. There are many groups of people who fall vulnerable to low-ability due to extenuating conditions (Salemink, Strijker, & Bosworth, 2017). The defining factor of most of these groups is their rural location (Salemink, Strijker, & Bosworth, 2017). Consider the ubiquity of remote location in the following list of low-ability populations composed in a 2017 meta-analysis of Internet access: rural children, rural youth, rural women, older people, rural patients, rural employees, rural entrepreneurs, and farmers (Salemink, Strijker, & Bosworth,).

Unfortunately, this spatial digital divide is growing (Salemink, Strijker, & Bosworth, 2017). Urban areas are digital hot-spots with pre-existing high-speed internet infrastructure and an incentivized market that encounters less barriers than in rural areas. In these rural areas, the issue is no longer access to the Internet, but rather their impeded ability to innovate, consume, and interact with the modern-day information society on the same level as their urban compatriots (Salemink, Strijker, & Bosworth, 2017). The introduction of greater speed and reliability of next generation access networks and increased mobile and mobile broadband coverage in urban areas has further exacerbated this divide as, similar to broadband, these innovations are not present in rural communities due to the increased barriers of little existing information infrastructure, lack of incentives, increased area, and lower income (Salemink, Strijker, & Bosworth, 2017). Federal, state, and local governments have taken notice of this divide and begun to institute policy to minimize these regional disparities. These policies have progressed from simply focusing on providing a connection for all to providing next generation access for all (Salemink, Strijker, & Bosworth, 2017). However, due to the fact that rural areas have missed out on earlier innovations in information infrastructure these policies must now work at a double pace to not only make sure these areas are no longer falling behind, but also provide the opportunity for rural areas to keep pace with burgeoning innovations in connectivity (Salemink, Strijker, & Bosworth, 2017).

In both policy and research, the definition of user ability is no longer confined to simple access to the internet but must be redefined by an internet user’s skills and success in their online pursuits. As internet penetration has increased, the quality of use has become the most important dimension by which to classify user ability (DiMaggio & Hargittai, 2001). Internet access has been redefined in social and technological terms to progress from “who can find a connection?” to “what are people doing and able to do when they go online?” (DiMaggio & Hargittai, 2001).

"The debate is no longer about 'haves' and 'have nots'; instead, it has started to focus on the degree of usage and different usage patterns" (Salemink, Strijker, & Bosworth, 2017).

Despite the current increased internet penetration and progressive policy, there are still several barriers to increasing the ability of rural inhabitants. These include a lack of financial resources, unemployment, lower education levels, and conservative attitudes (Salemink, Strijker, & Bosworth, 2017). Importantly, the high-involvement audience of this particular study are agriculturalists which are, of course, majority rural, with 99% of the nation's 2.1 million farms owned and operated by rural families (American Farm Bureau, 2017). "Rural Americans are more than twice as likely as those who live in urban or suburban settings to never use the internet" (Anderson, Perrin, & Jiang, 2018). With their rural location and aging population in mind, it could be inferred that agriculturalists likely exhibit lower ability scores than the population average.

The first barrier that inhibits rural ability is income (Salemink, Strijker, & Bosworth, 2017). Although the United States Department of Agriculture said that, "Farm households in general are neither low-income nor low-wealth," stating that the median operator household income of farmers ($76,700) is "practically the same" as the median for households with a self-employed head ($78,400), it is important to consider the vast income stratification of participants in the agriculture industry (2016). The National Agricultural Statistic Services lists only three agricultural professional categories out of eight that make over $37,000 each year on average. The next highest average salary is $28, 940 with the "farmworkers and laborers: crop, nursery, and greenhouse" and "graders and sorters" categories just barely earning over $20,000 each year. These farmworkers also experience above average unemployment rates, 13.5% in 2012 as compared to the 8.1% national average in the same year (cite).

High-involvement agriculturalists also suffer from the ability barrier of low education. There is a split between laborers and supervisors versus the farm managers. 25% of managers have some college education with 6% having less than a 9th grade education. 20% of farm laborers have had some college education and nearly a third, 31%, have less than a 9th grade education. Despite the stark contrast of these two groups, they are both indicative of far lower education levels than the United States average of 64% of people earning some college education and 3% having less than a 9th grade education. The 2017 meta-analysis also found that conservative values could present a barrier to internet ability (Salemink, Strijker, & Bosworth). Rural areas are more likely vote conservative with 67.1% of rural voters classifying themselves as Republican in "red" states and 56.5% in "blue" states during the 2000-2004 election term (McKee, 2008). This voting behavior indicated rural tendencies towards conservative values and behaviors (McKee, 2008).

The meta-analysis also listed "older people" as a low-ability group (Salemink, Strijker, & Bosworth, 2017). According to the United States Department of Agriculture census of 2012, agriculturalists are a disproportionately aging group. The average age of farmers in the United States is 58, with Georgia farmers being 65 years-old on average, fitting the common American definition of senior citizen. "Seniors are the age group most likely to say they never go online. Although the share of non-internet users ages 65 and older decreased by 7 percentage points since 2016, about a third today do not use the internet, compared with only 2% of 18- to 29-year-olds" (Anderson, Perrin, & Jiang, 2018). This means the core group of high-involvement users are likely low-ability because not only are the majority of agriculturalists rural with all the accompanying barriers of low education, low income, and low-incentive markets, they are also aging.

The digital divide has come to encompass much more than simple access (Salemink, Strijker, & Bosworth, 2017). DiMaggio and Hargittai recognized three dimensions of inequality: technical, autonomy, and skill (2001). Those who suffer from technical inequality have slow connections, older software and hardware, and decreased bandwidth (DiMaggio & Hargittai, 2001). These are all common issues in rural areas (Salemink, Strijker, & Bosworth, 2017). Those who exhibit technical inequality are likely to find their online experiences less gratifying and are therefore less likely to use the internet often and gain further "skills that enable users to derive the full benefits that access can provide" (DiMaggio & Hargittai, 2001). The second dimension of inequality focuses on the autonomy of internet use, that is how much control a user exercises over his online experience. An important facet of this dimension is the question of where a user is accessing the internet. If they are accessing it via a community lab, a common occurrence in rural areas, users have less autonomy over their online experience (DiMaggio & Hargittai, 2001). The final dimension is the inequality of skill. Internet-competent people have the "capacity to respond pragmatically and intuitively to challenges and opportunities in a manner that exploits the Internet's potential" (DiMaggio & Hargittai, 2001). This includes the knowledge required to log on, search, download files, and even troubleshoot inevitable hardware or software issues. These skills are often learned through using the Internet on a regular basis, which often pairs this type of inequality with either or both of the former (DiMaggio & Hargittai, 2001). Because rural, older populations are less likely to be on the internet they therefore are also less likely to possess the internet competency they need to receive satisfaction from their online experience (DiMaggio & Hargittai, 2001). An additional dimension that affects user ability is the level of social support a user receives. This social support can be comprised of formal technical assistance from people employed to provide it, like the Geek Squad, for instance, assistance from friends and family, and emotional reinforcement from friends and family. The presence of a group that not only socially encourages internet use but may also offer assistance for those lacking in skill or access influences a user's ability level (DiMaggio & Hargittai, 2001).

As aforementioned, the digital divide has now been redefined to account for variation in internet usage. Public policy is encouraging uses that extend past entertainment, and instead focusing on fostering economic development through online entrepreneurial programs and increasing access to public health and education (DiMaggio & Hargittai, 2001; Salemink, Strijker, & Bosworth, 2017). The internet can be used for the enhancement of human and social capital and foster political participation, and use past pure consumption is a strong predictor of positive life outcomes (DiMaggio & Hargittai, 2001). Unfortunately, not every person has the access and ability to take advantage of these opportunities. "Developments so far indicate that telecommunication companies will not provide every rural household or business with a high-speed Internet connection comparable to those in urban areas. Rural areas are served last, if they are served at all" (Salemink, Strijker, & Bosworth, 2017).

Hypotheses

Based on a review of past studies concerning elaboration, ability, and involvement, this study put forth four hypotheses:

H1: Users will perceive the interactive infographic as more interactive than the static.

H2: Interactive message elements will produce an overall positive effect on user elaboration.

H3: The high involvement group of agriculturalists will be disproportionately low ability.

H4: Three of the four respondent groupings: adept, high involvement respondents and respondents in both low involvement categories, will elaborate more with the interactive message when compared with the static message. The fourth, the high-involvement, novice group, will exhibit decreased elaboration when viewing the interactive infographic compared to the static infographic.

Previous research supported these hypotheses. The aim of this study was to add to this pre-existing understanding of interactive communication strategies by presenting a relevant agricultural message to a general populace, in this case a message about blueberry and peach production in Georgia during the year 2017 to Georgia residents. This closely replicated the manner in which citizens are exposed to journalism in their daily lives. This study thereby aimed to use these hypotheses to explore the feasibility of interactive infographics as a method of agricultural communication with the goal of increased elaboration.

METHODOLOGY

Stimulus Design

Respondents were divided randomly between interactive and static message stimuli. Both messages explained the economic impact of poor blueberry and peach production in the state of Georgia in 2017. Both versions of the messages were made as similar as possible to avoid incidental confounds. That is, the two conditions were identical in content and differed only in their levels of interactivity. This includes information including introductory text and charts as well as message presentation elements. Each message had three data visualizations: a map and two charts. The map included color-coded locations of peach and blueberry farms in the state of Georgia. Farm location data was provided by the Georgia Department of Agriculture. These locations were overlaid on maps made from the National Oceanic and Atmospheric Administration's temperature data for Georgia regions during the months of January through June 2017. The next data visualization was a scatterplot of Georgia's peach and blueberry yield compared against the price received per pound from 2008-2016. This map showed a fairly linear progression of peach prices as compared to a higher but unpredictable and widely variable price per pound of blueberries. The final data visualization illustrated the quality of peach and blueberry yields for the months of April and May from 2015-2017. The quality was measured by the percent of the total month's yield graded as either excellent, good, fair, poor, or very poor. This visualization illustrated the extremely poor quality of fruit during 2017 in comparison to the past two years.

Where the data visualization components were identical in both stimuli, so too were the message presentation elements of fonts, and images. Both messages used the same four images of frost-damaged blueberries and blooms and peach trees in the snow found on the Georgia Department of Agriculture's website (See Appendices A and B to compare the two stimuli).

The control group was shown the static stimulus: an infographic published in the Georgia Department of Agriculture's newspaper publication, The Farmers and Consumers Market Bulletin, in May of 2017 (See Appendix A to view the static stimulus). This data visualization appeared as an embedded .png image within the Qualtrics survey, therefore respondents were not required to navigate away from the survey to view the static stimulus.

In their 2012 meta-analysis of interactive infographics, Weber and Rall found that many interactive infographics are the result of increased hybridization of three different types of interactivity. This hybridization allowed users to explore the data or story in a way unique to their sensibilities and was followed in the creation of the interactive stimulus used in this study. Treatment groups were shown an interactive version of the message that featured all three types of interactivity: explorative, non-linear, and linear (Weber & Rall, 2012) (See Appendix B for more information about the specific uses of interactive tools within the interactive stimulus). Linear interactivity most commonly functions as a guided tour of the data visualization or story, allowing viewers to move backwards and forwards, progressing through a message step by step (Weber & Rall, 2012). Common navigation tools for linear interactivity include progress bars, start buttons, and forward and back buttons (Weber & Rall, 2012). This study's interactive message used forward and backward buttons to establish linear interactivity (Appendix B). Explorative interactivity is based on data visualization, and is non-linear in character (Weber & Rall, 2012). This means users must explore data by themselves and are able manipulate the graphic by filtering, selecting, and searching the data (Weber & Rall, 2012). This study's interactive message established explorative interactivity through the use of a dropdown menu in the chart exploring peach and blueberry quality (Appendix B). The third type of interactivity, non-linear, offers users the possibility of choosing their own navigation path within a given frame of data or fact. However, non-linear interactivity differs from explorative in that users may not manipulate the graphic or generate a new setting of data (Weber & Rall, 2012). The most common navigation tools for non-linear interactivity include timelines, sliders, or navigation menus (Weber & Rall, 2012). This study's interactive stimulus established non-linear interactivity through the use of a timeline slider on the map data visualization that allowed respondents to toggle through the temperature data of the months of January through June of 2017 (Appendix B).

This study's interactive stimulus was created to follow recommendations of effective interactivity use. Studies indicated low to moderately interactive messages provided the best chance for elaboration in groups moderated by involvement and ability (Liu & Shrum, 2009; Sundar, Kalyanaraman, & Brown, 2003; Weber & Rall, 2012). This study's interactive stimulus followed guidelines to establish low and moderate interactivity from two different studies (Sundar, Kalyanaraman, & Brown, 2003; Weber & Rall, 2012).

The linear interactivity type was preferred to create low interactivity conditions (Weber & Rall, 2012). Most interactive infographic authors and readers "prefer traditional 'step-by-step navigation' because linear storytelling ensures clear user guidance. In the experts' opinions, users can perceive all aspects of the story and therefore catch the message easily; they are not overwhelmed by information or even lost in the data" (Weber & Rall, 2012). Although each type of interactivity was present in this study's interactive stimulus to replicate the common hybridization found within the communication strategy, the predominant type of interactivity was linear, controlled by the navigation bar and forward and back arrows. This followed Weber and Rall's (2012) recommendations for low interactivity conditions as it allowed users to only view and interact with one figure at a time.

Moderate interactivity was established through the use of hyperlinks (Sundar, Kalyanaraman, & Brown, 2003). A hyperlink to the Georgia Department of Agriculture's press release on the 2017 freeze damage to peaches and blueberries (Appendix C) was used to establish moderate interactivity conditions as hyperlinks were a common type of interactivity that create a hierarchical linear flow of information (Sundar, Kalyanaraman, & Brown, 2003).

Research Design

The purpose of this study was to better understand elaboration of an interactive agricultural message. The technique of thought-listing was used to gauge the audience's attitudes and elaboration (Cacioppo & Petty, 1981). The message audience was then asked to list their thoughts on the topic after viewing the message. This technique of writing a list of thoughts is a useful measure, as it can be administered in a manner that does not restrict dimensions, is easily administered over web survey, and is perceived as private and nonthreatening (Cacioppo & Petty, 1981). Importantly, thought listing does not affect reported behavior and is proven to be non-reactive (Cacioppo & Petty, 1981). It is sensitive to distraction, repetition, social loafing, and changes in cognitive response when a person's motivation or ability has been manipulated (Cacioppo & Petty, 1981). Furthermore, the thought-listing technique allows for the self-generation of arguments, which has been found to be a direct result of high-cognitive cost activities (Cacioppo & Petty, 1981). Realizing the number of thoughts elicited by each subject will vary, Cacioppo and Petty (1981) suggested controlling for this variable by calculating a ratio score where (favorable thought- unfavorable thought)/(favorable thought + unfavorable thought), which was observed in this study. The thought listing measure was reliable both internally through split-half testing and on retesting (Cacioppo & Petty, 1981). Because the measure is reliable, valid, and non-reactive, it has been shown to tap into a consumer's thoughts that moderate their affective and behavioral responses (Cacioppo & Petty, 1981).

Following the thought-listing exercise was the elaboration validation model created by Reynolds (1997). Reynolds created this measure in order to improve upon past inconsistencies when it came to measuring elaboration (1997). The measure was included in the current study to lend validation to the more complicated process of scoring open-ended responses. The measure has proven to be reliable, with over several studies. Confirmatory factor analytic procedures support the structure of the scale (Reynolds, 1997).

The third measure used in this study is Zaichkowsky's Personal Involvement Inventory (PII) (1994). The PII was used in this study to help segment consumers into high and low-involvement groups used for comparison through the dual-process model of interactivity (Zaichkowsky, 1994). The PII was selected for this study as it is successful not only in discriminating different subject's reactions to the same message, but also in discriminating between advertisements by way of measuring subject responses. This proves useful in a study of this nature where the variable of interest is the moderating factor of ability which will vary from respondent to respondent, and the treatment is the mode in which the message is delivered. While the PII can successfully discriminate different subject's responses to the same ad, it can also discriminate between responses to two different ads with the same message, similar to the treatment and control messages of this study (Zaichkowsky, 1994).

Furthermore, the PII is not biased between affectational or informational messages like the one presented in this study (Zaichkowsky, 1994). This means that the PII proved an effective tool for evaluating message response on both an emotional and cognitive level. The internal scale reliability of PII was over .9 with Cronbach's alpha ranging from .91-.95 in one study and .94-.96 in another (Zaichkowsky, 1994). Validity has been studied in a number of ways. Validity was first was proven by expert, independent reviewers who rated subjects' open-ended responses as to why they responded the way they did to the scale. These reviewers were kept blind to the message and asked to read the response and categorize the subject as low, medium, or high levels of involvement. Data indicated a significant ($p < .01$) relationship between the PII scale scores and the judges' perceptions of the open-ended responses (Zaichkowsky, 1994). Further validity was proven in that a subject's selections on the PII exhibited discrimination between messages selected for airing and those rejected (Zaichkowsky, 1994).

The fourth measure this study used was Liu's Perceived Interactivity Scale (2003). This scale was a stable measure of interactivity for both low and high-ability users and, therefore, not only functions as a tool of measuring perceptions but also as a manipulation check (Liu, 2003). Liu posited, "Results from the studies showed that interactivity comprises three correlated but distinct dimensions: active control, two-way communication, and synchronicity" (Liu, 2003). These categories have been proven to be reliable with a Cronbach's alpha above .7 with an average Cronbach's alpha of .75 for active control, .86 for two-way communication, and .86 for synchronicity (Liu, 2003). The reliability of the Perceived Interactivity Scale was further corroborated through structural equation modeling and extracting average variances. Reliability calculated through structural equation modeling was .81 for active control, .90 for two-way communication, and .89 for synchronicity (Liu, 2003).

The scale also demonstrated discriminant, known group, and content validity. Discriminant validity is proven in that all three average variances extracted were larger than the squared pairwise correlations for all three studies, meaning that each measure of active control, two-way communication, and synchronicity were independent measures (Liu, 2003). Furthermore, in the chi-square statistics comparison among the different models, each constrained model resulted in a significantly improved chi-square from the less constrained models, again suggesting discriminant validity (Liu, 2003). Validity was further confirmed by testing correlations between each pair of factors using a 95% confidence interval. In this study, "the confidence intervals were (.09, .37) for active control-two-way communication correlation, (.41, .63) for active control- synchronicity correlation, and (.19, .42) for two-way communication-synchronicity correlation" (Liu, 2003). Known group validity was suggested as the website intentionally designed to be more interactive scored higher on the perceived interactivity scale and vice versa (Liu, 2003). Content validity was demonstrated as independent reviewers showed a significant ($p < .01$) correlation for all three factors including .40 for active control, .43 for two-way communication, and .54 for synchronicity (Liu, 2003).

Population

Because the current study sought to investigate the moderating effect of interactivity on agricultural communications to the general public, a broad population was selected. The experimental messages presented in this study were based on blueberry and peach production in Georgia. In order to ensure that all respondents had the same base level of involvement due to location, the sample was comprised of Georgia residents. Furthermore, the selection of Georgia residents as a sample best replicated the manner in which stories like this are likely to be communicated to the public outside experimental conditions. For instance, the static graphic shown to the control group was printed in *The Georgia Farmers and Consumers Market Bulletin*, a statewide newspaper published by the Georgia Department of Agriculture, with over 42,000 subscribers at the time of publication. The sample selected sought to replicate the state of Georgia's general population. It comprised 460 respondents over the age of 18, divided evenly between the treatment and control with 230 in each group. In order to match the U.S. Census Bureau's population estimates for July 1, 2017 this sample was 50% male and 50% female with a racial profile of 55.9% Non-Hispanic white, 30.6% black, 6% Hispanic, 3.2% Asian, and 4.3% other. All respondents were recruited through Qualtrics via crowdsourcing techniques and received remuneration as outlined in Qualtrics' terms.

The online survey presented to respondents was created by adhering to the techniques of thought-listing, perceived interactivity, and the personal involvement inventory in combination with questions concerning ability, recall, and demographic information. The survey was administered to a total of 464 different respondents in which the treatment and control messages were assigned randomly. 269 respondents viewed the static control message stimulus and 195 viewed the experimental interactive.

Survey Administration

Due to a technical issue with the method in which respondents viewed the interactive message, a small adjustment to the survey was made after 353 respondents completed the survey. Of these first 353 respondents, 153 of these were randomly assigned the interactive experimental condition. These 153 respondents were all asked to navigate away from the survey in order to view the message on a blank browser tab. However, due to an increased dropout rate of respondents after being asked to navigate away and return to the survey, the method of viewing was modified so that respondents using a desktop would view a version of the interactive message embedded within the survey in much the same way the static graphic visualization used for the static experimental condition was embedded in the survey. Respondents taking the survey with their mobile phone were still asked to navigate away from the survey with the exact same question as the prior version of the survey, as the embed code for the interactive message did not prove mobile-friendly when inserted into the Qualtrics survey software. In order to assure this modification did not affect the validity of responses, a Mann-Whitney *U* test was conducted between the first group of 147 responses to the interactive experimental condition recorded prior to the survey edit and the following group of 48 responses to the same condition that may not have been required to navigate away from the survey in order to view the message based on their device. The two groups exhibited no significant difference in elaboration (Mann-Whitney U = 3317, n_1 = 147, n_2 = 48, p = .668). After viewing the message, respondents were given instructions and proceeded to the thought-listing portion of the survey.

In this study, the thought-listing technique was carried out in the manner recommended by Cacioppo and Petty including topic instruction, time limits, and post-message survey as opposed to pre and post (1981). During the topic instruction portion, participants were asked to list all thoughts that occurred to them while viewing the message in order to avoid the dubious assumption that participants are able to discriminate the cognitive effect of the message. This topic instruction produces experimental demand for subject to report relevant responses and compels them to show their “open mindedness” and “intelligence” by generating thoughts on both sides of the issue (Cacioppo & Petty, 1981). A time limit of five minutes was instituted to increase the chance that responses were easily accessible and directly evinced by the message. Participants were asked to list their thoughts directly after viewing the message to best replicate the affective and cognitive responses present in normal conditions (Cacioppo & Petty, 1981).

While measuring after the message has occasionally led to some loss of retention of cognitions, this is the preferred method as it least distorts naturally elicited responses (Cacioppo & Petty, 1981). Participants were presented with a total of 18 blanks to fill within the allotted five minutes, though respondents were instructed that they were neither required nor expected to fill all the blanks.

Reynold's elaboration validation measure followed the thought listing procedure in the survey. Respondents were asked to indicate on a seven-point Likert scale their level of agreement with 12 phrases created to gauge the cognitive effort they expended while viewing the stimulus. These 12 phrases consist of "six phrases descriptive of cognitive effort and six phrases descriptive of a lack of cognitive effort" (Reynolds, 1997). The twelve phrases were placed in a random order, consistent with Reynold's research (1997).

The next portion of the survey gathered respondent's perceptions of message interactivity using Liu's Perceived Interactivity Scale (2003). This is a seven-point Likert scale with 15 total statements. Respondents were asked to indicate their level of agreement with the statements divided among three categories so that active control contains four statements, two-way communication contains six, and synchronicity contains five.

After recording the respondent's perceptions of interactivity, the survey proceeded to four simple recall questions. These questions were multiple choice with three options. One question was asked based off each of the three charts presented and one question was based on the title of the overall message. These questions were written to be easily answered by any respondent who paid close attention to the message. These questions served not only as a test of recall for the control and experiment, but also a manipulation check for the attention the respondent paid to the message.

Next, respondents answered questions pertaining to their internet ability. First, they answered an open-ended question about the hours they spend online each week. This is a common way to define a respondent's internet ability (Liu & Shrum, 2009; Liu, 2003). However, to paint a more complete picture of a user's ability, respondents were also asked by a multiple-choice question for what purposes they used the internet in the past week and what kind of connection they used (DiMaggio & Hargittai, 2001). Finally, respondents were asked to indicate the level to which they agreed with a block of four seven-point Likert scale statements pertaining to their online autonomy, skill, speed, and social network (DiMaggio & Hargittai, 2001).

Respondents then proceeded to fill out Zaichkowsky's Personal Involvement Inventory. This scale consists of 10 dichotomous word pairs measured on a seven-point Likert scale. Finally, respondents were asked for demographic information including their age, household income, education, and whether they considered themselves rural or urban and conservative or liberal.

Data Analysis

After receiving responses, the data were coded in a number of different ways including coding thoughts and creating a summed score for perceived interactivity, involvement, and ability. In the thought listing method, "independent judges have demonstrated a high degree of agreement in their classification of responses along the polarity dimension" (Cacioppo & Petty, 1981). Open-ended responses were polarity coded by two independent judges. Polarity was judged to be negative if statements involving the referent that mention specific undesirable attributes or negative associations, challenges to the validity of the stimulus or situation and statements of negative effect (Cacioppo & Petty, 1981). Positive polarity is evident in statements in favor of the referent (advocation or self) that mention specific desirable attributes or positive associations, statements that support validity or value of situation/stimulus and statements of positive effect about the referent (Cacioppo & Petty, 1981). Thoughts were coded as neutral or irrelevant when they expressed no effect with regards to the referent (Cacioppo & Petty, 1981). No weighting mechanism was used as a measure of how strongly assertions were made as this has shown to have a null effect, neither altering nor strengthening the effect (Cacioppo & Petty, 1981). Judges were hypothesis-blind graduate students familiar with scoring categories. These judges were trained and then tested for agreeance of 5% of the responses (n = 23). The Krippendorff's alpha test was used to estimate the inter-judge reliability (Krippendorff, 2011). Judges showed high reliability, with *a*=.8261.

Limitations

It is acknowledged there are limitations of this study that are a direct result of the frameworks used. All of these frameworks including the ELM, personal involvement inventory, perceived interactivity scale, and ability scores exist on a continuum. Sorting groups based on these scores simplifies this continuum into two groups which does not acknowledge the variance between individuals within each group. The researcher acknowledges this is an inherent limitation in all dual-process models and that both central and peripheral persuasion often work together to yield the affective and behavioral responses exhibited (Petty & Cacioppo, 1986). There are also variables that are uncontrollable in this study but are known to affect elaboration including level of distraction, an individual's personal need for cognition, and prior knowledge or opinion (Petty & Cacioppo, 1986). It is further understood that ability, one of the most important moderating factors of the dual-process model of interactivity exists not only on a continuum but one that is ever-changing. Access and use of the internet is continually transformed by multiple factors including choices of corporations, individual users, and government regulations (DiMaggio & Hargittai, 2001). In order to limit this effect stemming from the rapid change of technology, the researcher attempted to use the most current data available at the time of this study concerning internet reach and use data. It is acknowledged that it is unlikely that these ability scores would remain unchanged were this study to be replicated at a later date. The aforementioned limitations are present due to the nature of the frameworks used and variables measured.

Sample limitations are also acknowledged by the researcher. By nature of the recruitment of this Qualtrics panel, it is likely that these respondents are higher ability than the general population. It is also unlikely that many farmers or other agriculturalists are Qualtrics online survey respondents, an important note for this study. It is also possible that this type of survey is excluding almost all of the lowest ability Georgians as it is unlikely that they will be taking online surveys for credit remuneration. Additionally, it is likely that, despite the fact that 43% (n = 202) respondents self-reported as living in a rural area, many rural Georgians highly involved with agriculture are excluded from this sample due to the unavailability of a reliable internet connection in rural areas (Salemink, Strijker, & Bosworth, 2017).

As is the nature of most internet surveys, respondents to this study were required to self-report the majority of their responses including their level of involvement with agriculture, how often they are online, and their reasons for going online, among many other questions. One limitation of self-reporting is that the researcher may fail to adequately define a term or concept in a way the respondent understands, resulting in a miscommunication error between what is being asked and what the respondent perceives as the question. Self-reporting not only requires respondents to have an accurate understanding of the question, but also assumes respondents are able to judge themselves and their emotions without bias. This assumption has been proven incorrect as past cognitive research has demonstrated a significant bias when respondents self-report and is therefore considered a limitation of the current study (Petty & Cacioppo, 1981).

FINDINGS

Overview

The original hypotheses of this study were all rejected as the results did not follow the expected framework put forward by Liu and Shrum (2009). In the 2009 study, Liu and Shrum measured internet ability as the amount of time a participant spent online each week. This measure was recreated along with two others in an effort to better understand the moderating effect of internet ability on elaboration for interactive messages. This study used an alpha level of significance of .05 for all statistical tests.

Sample

A crowd-sourced sample of 466 respondents, with an even gender split and racial makeup matching 2017 predicted U.S. census numbers for the state of Georgia, was used to represent the population of the state in this study. 43% (n = 202) respondents described their location as "rural," with the remaining 57% (n = 264) identified as residing in an "urban" location. Of this sample, 42% (n = 195) were exposed to the interactive experimental condition and 58% (n = 271) to the static condition, through random assignment.

Reliability

The reliability for all scales was over .7 and recognized as an acceptable level for Cronbach's alpha (n = 466) (Nunnally, 1978; Santos, 1999). Reliability of the elaboration validation measure was verified with a Cronbach's *a* = .825. This was in comparison with Reynold's findings of *a* = .86 to .94 over several studies (1997). Reliability of the researcher-created internet autonomy 7-point Likert scale (Table 1) was *a* = .754. Reliability for

Zaichkowsky's Personal Involvement Inventory was *a* = .929. This was in line with Zaichkowsky's reports of the scale's overall reliability to be *a* = .91- .95 in one study and *a* = .94 - .96 in another (1994).

The perceived interactivity measure proposed by Liu (2003) was measured for reliability based on the experimental condition. The active control measure did not meet the .7 Cronbach alpha standard. Implications are discussed in Chapter Five. For the interactive condition, Cronbach's alpha was *a*= .373 for active control, *a* = .915 for two-way communication, and *a* = .75 for synchronicity. For the static condition, Cronbach's alpha was *a* = .486 for active control, *a* = .925 for two-way communication, and *a* =.713 for synchronicity. This is in comparison to Liu's 2003 reported reliability of the overall scale of *a* = .75 for active control, *a* = .86 for two-way communication, and *a* = .86 for synchronicity

Inter-coder reliability for the thought-listing measure was acceptable, calculated by the Krippendorff's alpha of *a* = .8261 (Krippendorff, 2011). Attitude scores were calculated by favorable thought - unfavorable thought)/(favorable thought + unfavorable thought) in order to avoid weighting attitudes by the number of thoughts as recommended by Cacioppo and Petty (1981).

After reliability of the survey measures was established, an in-depth statistical analysis was conducted to explore the relationship between interactivity and elaboration of an interactive agricultural infographic and to determine the feasibility of interactivity as an agricultural communication strategy.

Analysis

Nonparametric Tests

A Shaprio-Wilk's test ($p > .05$) (Shapiro & Wilk, 1965; Razali & Wah, 2011), and an inspection of the skewness and kurtosis measures and standard errors (Cramer, 1998; Cramer & Howitt, 2004; Doane & Seward, 2011), and a visual inspection of their histograms, normal Q-Q plots and box plots showed the sample data were not approximately normally distributed. A non-parametric Levene's test was used to verify the equality of variances in the samples (homogeneity of variance) ($p > .05$) (Nordstokke & Zumbo, 2010; Nordstokke, Zumbo, Cairns, & Saklofske, 2011). As such, all statistical tests conducted with the overall thought listing attitude scores were non-parametric. This inspection of normality and homogeneity of variances was carried out for all scales listed in these results. This means that although much of the data from this study exhibited non-normal distributions, the homogeneity of variances in each of these cases allowed for non-parametric statistical tests to be conducted.

These non-parametric tests account for non-normally distributed data by assessing the location and range of the lowest group's distribution within the overall sample range and contrasting this against a theoretical ranked distribution approaching normal. That is, due to the homogenous variances, nonparametric tests can redistribute data normally through the use of ranking. The nonparametric tests used in this data analysis included the Kruskal-Wallis test, a one-way ANOVA analysis of rank; the Mann-Whitney test, considered the nonparametric equivalent of a t-test; and Spearman's correlation, a bivariate correlation that is the nonparametric equivalent to Pearson's correlation.

Elaboration Measure

Thoughts were coded based on attitudes as recommended by Cacioppo and Petty (1981). Thoughts were coded as positive if they were, “in favor of the referent that mention specific desirable attributes or positive associations, statements that support validity or value of situation/stimulus and statements of positive effect” (Cacioppo & Petty, 1981). Examples of thoughts scored as positive included, “I am from Ga, but didn't realize that the blueberry industry was as profitable in Ga” and “Blueberries and peaches suffered due to odd weather patterns in 2017.” These thoughts were considered positive as they support the value and validity of the stimulus message. Thoughts were coded as neutral or irrelevant if they, “express no affect with regards to the referent,” (Cacioppo & Petty, 1981). Examples of thoughts scored as neutral included, “I love to make dessert from both,” and “I like UGA because it is a good university to be at.” All other thoughts were coded as negative as they, “mention specific undesirable attributes or negative associations, challenges to the validity of the stimulus or situation, and statements of negative affect,” (Cacioppo & Petty, 1981). Examples of thoughts scored as negative included, “information laid out in a really boring unnatractive [*sic*] way,” and “I think they're downplaying the importance of the peaches.” Overall attitude scores were calculated by (favorable thought - unfavorable thought)/(favorable thought + unfavorable thought) as recommended by Petty and Cacioppo (1981). The computed attitude scores were then converted to *z* and *t* scores in order to enhance interpretation.

Elaboration validation scores from the Reynolds (1997) measure also exhibited a non-normal distribution with homogeneity of variance. A very weak correlation of $r_s = .147$, $p < .001$ was found between the thought-listing attitude score and elaboration validation score. A composite score was created through simple averaging of *z* scores. This elaboration composite score did not exhibit significant discrimination between experimental conditions elaboration (Mann-Whitney *U* = 24,687, n_1 = 271, n_2 = 195, *p* = .280). The *t*-scored thought listing attitude score, however, did exhibit significant discrimination between experimental conditions (Mann-Whitney *U* = 23564.5, n_1 = 271, n_2 = 195, *p* = .022). This finding was consistent with Cacioppo and Petty's findings that, "The most consistent finding in cognitive-response research has been that there is a relationship between the favorableness of the responses elicited by the referent and the evaluation of the referent…" Due to this, and the fact that this score most closely replicates the Liu and Shrum's dual-process model of interactivity elaboration measure, the researcher chose the *t*-scored thought listing attitude measure to represent elaboration in the following calculations.

The dual-process model posits that involvement is a significant moderator of message elaboration (Liu & Shrum, 2009). This elaboration measure exhibited a very weak correlation with Zaichkowsky's involvement scores of r_s = .10, *p* = .023. Liu and Shrum's (2009) model also stated that internet ability is the other significant moderator of message elaboration. In their 2009 study, Liu and Shrum defined internet ability as the number of hours a respondent spent online each week. The hours respondents of this study spent online were not significantly correlated with elaboration (r_s = -.038, *p* = .411). Internet autonomy scores, discussed in further detail below, exhibited a very weak correlation of r_s = .112, *p* = .016. The composite ability score of both internet autonomy and hours spent online was also not significantly correlated with elaboration (r_s = .042, *p* = .367). The significance of this lack of correlation between elaboration and internet ability is discussed at length in the following chapter and conclusions.

Perceived Interactivity Measure

A measure of perceived interactivity served as both an experimental condition manipulation check and a method of confirming or rejecting H1. Perceived interactivity of both static and interactive messages was scored using Liu's perceived interactivity scale (2003) (Table 1). A Mann-Whitney U Test showed that respondents could not significantly discriminate between the two experimental conditions (Mann-Whitney $U = 24{,}479.5$, $n_1 = 29$, $n_2 = 195$, $p = .220$), thus failing the manipulation check and rejecting H1. Implications of the non-significance of these scores were discussed in the following chapter.

Table 1
Perceived Interactivity Measure Means

Message	Active Control	Two-way Communication	Synchronicity
Static Message	4.86	4.986	5.2
Interactive Message	4.45	5.02	4.69

Note. Results were found to be non-significant by a Mann-Whitney U with a $p = .209$.

Involvement Measure

When completing Zaichkowsky's Personal Involvement Inventory based on the prompt "agriculture," respondents involvement scores exhibited a very non-normal distribution (Figure 2). This means respondents self-reported higher involvement with the topic agriculture than with most message topics measured by the PII (Zaichkowsky, 1994). This was not unanticipated, as mentioned in the introduction to this study. Implications of the skewness of respondent involvement with agriculture were discussed in both the next chapter and conclusions.

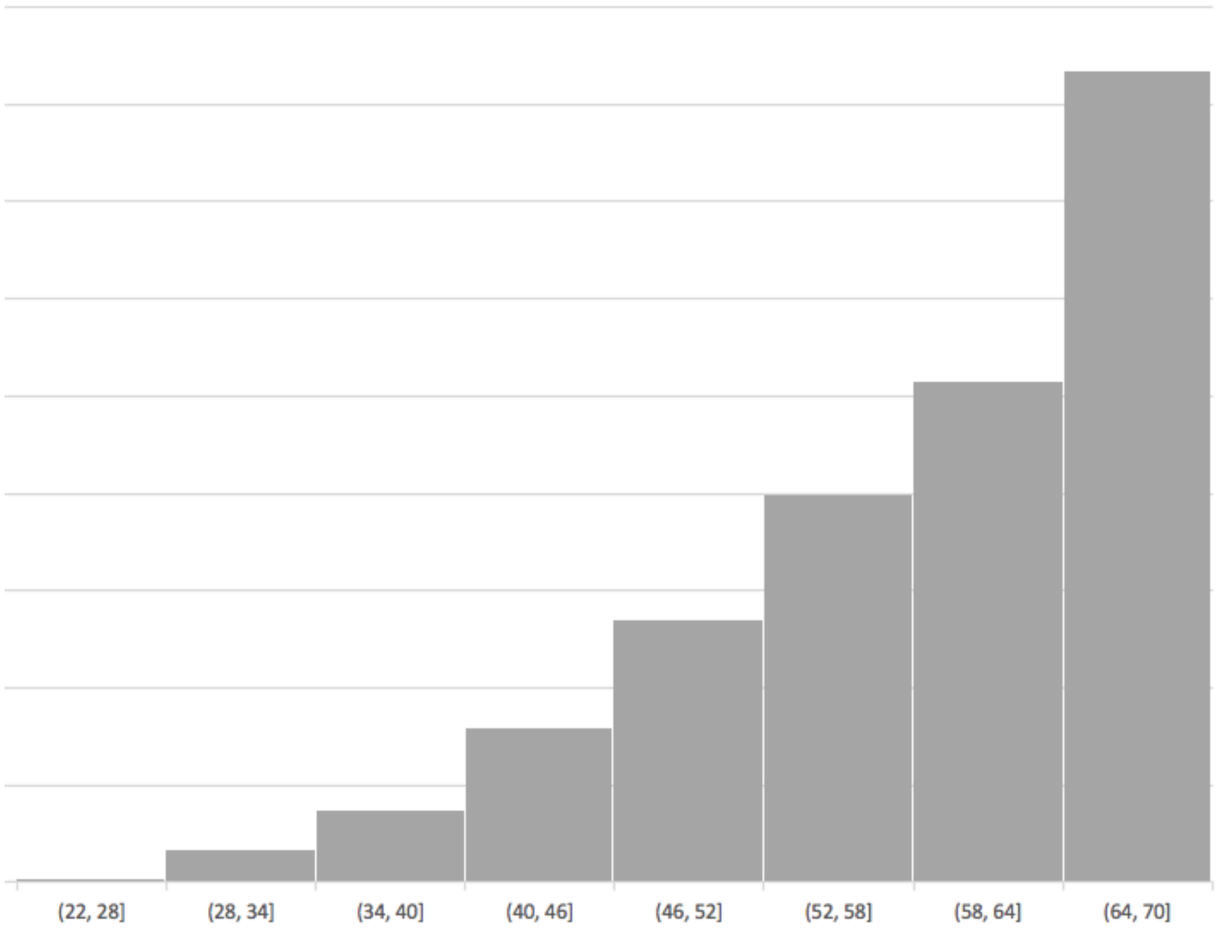

Figure 3. Involvement Score Frequencies. This figure illustrates the non-normal distribution of respondent involvement scores.

Zaichkowsky recommended 40 as the center involvement score for splitting respondents into low and high involvement categories (1994). However, due to the non-normal distribution of scores, only 30 respondents of the 466 scored below 40. Should this split recommendation be observed, this group of 30 respondents would have been further subdivided into four groups to account for the experimental condition and ability grouping measures. The small number of respondents in these low-involvement groupings could potentially result in poor statistical comparison.

In the case of Liu & Shrum's dual-process model of interactivity effects study, the moderating effect of ability was grouped by a median split (2009). The researcher therefore also conducted a median split on the moderating measure of involvement to ensure that each respondent grouping contained enough respondents to conduct statistical tests. For the purposes of this study, a median split was conducted for grouping purposes with those respondents scoring 60 or below considered relatively low involvement and those of 61 or higher considered relatively high involvement.

Internet Ability Measures

This study asked respondents the following questions found in Table 2 concerning their internet ability. The first, free-response measure of hours spent online each week was selected for the purpose of recreating the 2009 study by Liu and Shrum. The researcher recognized that what may be considered an accurate internet ability measure in 2009 may no longer be as significant of an indicator of elaboration moderation nine years later and therefore included additional questions based on digital equality research (Anderson, Perrin, & Jiang, 2018; DiMaggio & Hargittai, 2001; Salemink, Strijker, & Bosworth, 2017). Table 2 illustrates both the respondent frequency and Spearman's correlation *r* values of the internet ability questions asked in this survey. From these questions, two different measures were created with an additional composite measure for comparison with the elaboration measure.

Table 2

Internet Ability Measure Item Frequencies and Correlations with Elaboration

About how many hours do you spend online each week?

free response value

For what purposes have you gone online in the past week? Check all that apply.

	Entertainment	Information-seeking	Job-seeking	Education	Healthcare
Item correlation	$r_s = .057$	$r_s = .097^{**}$	$r_s = .021$	$r_s = -.037$	$r_s = .017$
Frequency	79% (n = 366)	81% (n = 376)	25% (n = 116)	27% (n= 125)	24% (n = 111)

If you have access to the internet, what kind of connection do you use? Select one.

Item correlation	Wireless	Broadband	I do not have regular internet access.
$r_s = .040$	63% (n = 294)	35% (n = 160)	2% (n = 10)

Indicate the level to which you agree with the following statements by selecting a single bubble.

	Item correlation	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I can access the internet whenever and wherever I want.	$r_s = 0.064$	2% (n = 10)	3% (n = 12)	4% (n = 18)	7% (n = 29)	11% (n = 52)	31% (n = 145)	43% (n = 198)
When I access the internet, I can quickly find the information or sites for which I am searching.	$r_s = .115^{*}$	1% (n = 3)	1% (n = 4)	2% (n = 7)	6% (n = 29)	18% (n = 85)	35% (n = 162)	38% (n = 174)
My internet speed is fast.	$r_s = .105^{*}$	2% (n = 9)	1% (n = 4)	5% (n = 23)	9% (n = 40)	21% (n = 97)	34% (n = 156)	29% (n = 135)
Most of my friends use the internet often.	$r_s = .093^{*}$	2% (n = 7)	1% (n = 4)	1% (n = 3)	11% (n = 51)	14% (n = 63)	31% (n = 143)	42% (n = 193)

Where n = number and r_s is Spearman's correlation to the elaboration measure

Note. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

The first measure created was a simple *t*-scored measure of hours that each respondent spends online during the week. This measure was created for the purpose of recreating the 2009 Liu and Shrum study. The 2009 study found that respondents (n = 80) spent an average of 12.17 hours online and conducted a median split (*median* = 7.50) (Liu & Shrum). The current study (n = 466) found the average hours respondents spent online each week to be 26.11 hours. The hours spent online were not normally distributed and exhibited a large standard deviation of 23.54, indicating that the self-reported number of hours respondents spent online was widely variable. A median split was also conducted for this study's adept and novice internet ability groups at 21 hours online per week. The second measure created was a simple averaged *t*-scored measure of all other autonomy questions. This score, called autonomy, was not significantly correlated with the number of hours spent online (r_s = -.005, p = .923). A third, composite measure was created by averaging of the *t*-scored hours online and autonomy score. This measure, called ability composite, was then *t*-scored for enhanced interpretation in post-hoc analyses.

All three internet ability measures were tested for correlation with the elaboration measure. Both the hours online score (r_s = -.038, p = .411) and ability composite score (r_s = -.045, p = .339) were not significantly correlated with elaboration. The autonomy score exhibited a very weak correlation of r_s = .112, p = .016. Respondent grouping was created by each internet score in order to gain a better understanding of the moderating factor of internet ability within the dual-process model of interactivity. The number of hours respondents spent online each week best replicates the measure used in the Liu and Shrum (2009) study, and therefore was used to group respondents in order to test H4 through a Kruskal-Wallis test. Kruskal-Wallis scores of groupings by the two other ability measures created (autonomy and ability composite scores) were conducted as part of post-hoc analyses.

Respondent Grouping

Following a similar protocol as the dual-process model of interactivity study (Liu & Shrum, 2009), grouping of respondents was conducted by median splits of both involvement scores and hours online scores. This created eight distinct groups categorized by experimental condition, involvement, and ability with which to compare mean elaboration and conduct hypothesis testing (Table 3).

Table 3

Hours Online Respondent Grouping: Frequencies and Mean Elaboration

	Experimental Condition							
	Static				**Interactive**			
	High involvement		Low involvement		High involvement		Low involvement	
Ability	*n*	*M*	*n*	*M*	*n*	*M*	*n*	*M*
Novice	73	49.86	64	48.05	39	53.11	55	50.44
Adept	78	50.27	54	47.09	54	52.49	47	49.81

Note. These means were found to be non-significant by a Kruskal-Wallis H = 10.726, $p = .151$.

Hypothesis Testing

H1: Users will perceive the interactive infographic as more interactive than the static. H1 was rejected by the perceived interactivity scale manipulation check in which respondents exhibited no significant discrimination between the interactive and static experimental messages (Mann-Whitney $U = 24479.5$, $n_1 = 269$, $n_2 = 195$, $p = .209$) (Table 1).

H2: Interactive message elements will produce an overall positive effect on user elaboration. H2 was confirmed where mean elaboration for the interactive condition (n = 195) was 51.39 and mean elaboration for the static condition (n = 269) was 48.99 (Mann-Whitney $U = 23564.5$, $n_1 = 269$, $n_2 = 195$, $p = .022$). This hypothesis was further supported across the two other respondent groupings used in post-hoc analyses where the mean elaboration was higher for the interactive stimulus than the static in every pair-wise comparison.

H3: The high involvement group of agriculturalists will be disproportionately low ability. H3 was rejected as the hours spent online score in fact exhibited a very weak positive correlation of $r_s = .135$, $p = .004$. Furthermore, involvement also exhibited a very weak positive correlation with both other ability measures including autonomy ($r_s = .161$, $p < .001$) and ability composite ($r_s = .192$, $p < .001$). These positive correlations may be related to the skewness of the involvement measure exhibited in Figure 1.

When the median split grouping of involvement was conducted ($n_1 = 244$, $n_2 = 222$), Mann-Whitney U tests revealed a significant difference among all three measures when compared to ability (Table 4).

Table 4
Ability, Involvement Mann-Whitney U Results

Measure	Low Involvement Median	High Involvement Median	*U*	*p*
Hours Online	47.41	49.11	23272	.013
Autonomy	49.38	50.94	23079.5	.009
Ability Composite	48.14	50.69	22406.5	.002

H4: Three of the four respondent groupings: adept, high involvement respondents and respondents in both low involvement categories will elaborate more with the interactive message when compared with the static message. The fourth, the high-involvement, novice group will exhibit decreased elaboration when viewing the interactive infographic compared to the static infographic. This hypothesis was rejected when no significant difference in elaboration was found among hours online respondent groups (Kruskal-Wallis $H = 10.726$, $p = .151$) (Table 3). Kruskal-Wallis H tests were also conducted on autonomy and ability composite groupings in post-hoc analyses.

Post-hoc Analyses

Post-hoc Respondent Groupings

Respondent groups exhibited a significant difference in elaboration when grouped by autonomy scores (Kruskal-Wallis $H = 17.014$, $p = .017$). This effect size was small where Cohen's $d = .299$. Post-hoc pair-wise comparisons revealed that the significantly different groups were the static, novice, low involvement group and the interactive, adept, high involvement group. The adjusted significance for this pair is $p = .045$. Respondent groupings by composite scores revealed no significant difference in elaboration (Kruskal-Wallis $H = 13.734$, $p = .056$) (Table 5).

Table 5
Post-Hoc Respondent Grouping Frequencies and Mean Elaboration

Autonomy Respondent Grouping

	Experimental Condition							
	Static				**Interactive**			
	High involvement		Low involvement		High involvement		Low involvement	
Ability	*n*	*M*	*n*	*M*	*n*	*M*	*n*	*M*
Novice	67	49.33	65	45.61	49	52.07	55	48.58
Adept	84	50.67	53	50.05	44	53.52	47	51.99

Note. These means are significant where $H = 17.014$, $p = .017$.

Ability Composite Respondent Grouping

	Experimental Condition							
	Static				**Interactive**			
	High involvement		Low involvement		High involvement		Low involvement	
Ability	*n*	*M*	*n*	*M*	*n*	*M*	*n*	*M*
Novice	67	50.14	60	45.779	44	52.67	59	49.26
Adept	84	50.01	58	49.5	49	52.82	43	51.37

Note. These means were found to be non-significant where $H = 13.734$, $p = .056$.

Other post-hoc analyses

Perceived interactivity and elaboration scores exhibited no significant correlation (r_s = .082, *p* = .079). Elaboration scores did, however, exhibit a very weak positive correlation of r_s = .16, *p* = .001 when compared to recall scores. This correlation was also significant when tested with a Mann-Whitney where *U* = 23115.5, *p* = .02. Median recall scores for both static and interactive were both 2, so means were calculated. The mean recall for the static message (n = 269) was 2.11. Mean recall score for the interactive message (n = 195) was slightly higher at 2.32. The effect size of this correlation was small, where Cohen's *d* = .204.

DISCUSSION

Overview

The findings of this study did not replicate the dual-process model of interactivity put forth by Liu and Shrum (2009). Most of the hypotheses posed in this study were based from this theoretical framework and were therefore rejected. A few major differences between this study and Liu and Shrum's, on which the dual-process model of interactivity was based were the sample size, year in which the study was conducted, and stimulus subject. It is possible that these were contributing factors in the failure to extend the findings through the current study.

The sample size was n = 80 of undergraduate business students (Liu & Shrum, 2009). The researcher attempted to extend the findings of this 2009 study to a more general population, the state of Georgia, and as such increased the sample size to n = 466. Internet use has also changed drastically since 2009. In fact, internet adoption among American adults has increased 13% since 2009, from 76% to 89% (Anderson, Perrin, & Jiang, 2018). In the discussion of results of the 2009 study, it is suggested this study could be extended to different messages or moderating factors (Liu & Shrum). The message stimulus of the 2009 study was directed toward selling an MP3-player, not only a very different message topic, but one that is also a sign of the nine years that have passed between these two studies (Liu & Shrum). The attempt to extend the findings of the dual-process model of interactivity to an agricultural news message were unsuccessful. This differing stimulus topic certainly affected the involvement of the sample, skewing it significantly which, in turn, created another barrier toward the recreation of Liu & Shrum's findings (2009).

Elaboration

Two different elaboration measures were used in this study. The first, a judge-coded thought listing exercise in which thoughts were coded according to polarity, and the second an elaboration validation measure (Reynolds, 1997). These two measures exhibited a very weak correlation $r_s = .147$, $p < .001$. It is possible that further scoring of respondent thoughts on the dimensions of origin, target, etc. could affect this correlation. These two measures differ in the fundamental way of who is judging the level of elaboration. For this study's thought listing measure, respondents were simply asked to provide thoughts. It was the responsibility of trained judges to assign value to these thoughts, and this method could present the possibility of a judge misrepresenting a subject's thoughts. In contrast, the elaboration validation measure required respondents to self-report their own elaboration, something respondents are not always able or willing to do accurately, especially when asked to classify their thoughts along several different dimensions (Cacioppo & Petty, 1981). Another difference between these two measures is the elaboration validation measure requires respondents to rate their level of agreement with certain statements, whereas in the polarity coding of thought-listing, weighting of scores by the extremity of the view is discouraged (Cacioppo & Petty, 1981).

An elaboration composite was created by simple averaging of elaboration validation and thought-listing t-scores scores and then *t* scoring once more for enhanced interpretation, and of these three measures, only the thought-listing score exhibited significant discrimination between the interactive and static messages (Mann-Whitney $U = 23564.5$, $n_1 = 271$, $n_2 = 195$, $p = .022$). This measure is also the one that most closely replicated the measure used by Liu and Shrum and was therefore selected for hypothesis testing and respondent grouping.

Perceived Interactivity Measure

It is possible that, as people spend more time online, perceptions of what constitutes interactivity have changed. Distributions of perceived interactivity scores for both stimuli were non-normal with medians of 5 and standard deviations of .96 with a range of 5.13 for the interactive stimulus and 5.2 for the static. Furthermore, respondents failed to significantly discriminate between the interactive and static messages (Mann-Whitney $U = 24479.5$, $n_1 = 269$, $n_2 = 195$, $p = .209$).

This could be due to the researcher's attempt to keep the level of interactivity within the interactive experimental condition no higher than medium interactivity, as recommended by past research (Sundar, Kalyanaraman, & Brown, 2003; Weber & Rall 2012). The interactive stimulus exhibited low interactivity through its linear, storyboard-like progression and medium interactivity through the inclusion of hyperlinks as recommended by Weber & Rall (2012). Given that these recommendations were made six years ago, it is possible that both perception and preference of level of interactivity has changed as internet ability has changed.

A more recent study by Wojdynski stated that interactivity, "led to more positive attitudes toward the article only to the extent that users perceived the site as more interactive, suggesting that attempts by content producers to increase such perceptions maybe worth the investment," (2015). The current study, however, indicated no significant correlation between perceived interactivity scores and the elaboration measure ($r_s = -.008$, $p = .865$). It is possible that part of this lack of correlation could be due to the non-reliability of the active control measure within the perceived interactivity scale for this particular study ($a = .373$) for the interactive condition and $a = .486$ for the static). No single item within the measure contributed to this low Cronbach's score, although this active control measure only contained four questions.

Other explanations for respondents failing to significantly discriminate between experimental conditions could include survey administration obstacles. After 347 responses had been recorded, Qualtrics, the survey administrator, reported to the researcher that a larger than normal number of respondents were leaving the survey unfinished after being required to navigate to a different browser tab to view the interactive stimulus. Respondents were required to navigate to a tab where they could view the interactive message. This message was embedded into a blank web page stored on the Georgia Department of Agriculture server, in order to closely simulate the way respondents might encounter interactive agricultural messages outside of experimental conditions. However, it seemed that many respondents were either unable or unwilling to navigate back to the browser tab where they could finish the survey. This created an issue for Qualtrics to obtain the required number of responses and therefore an edit was made to the survey where desktop users could view the interactive message embedded within the Qualtrics survey. Due to coding requirements, respondents using mobile devices were still required to navigate away from and back to the survey tab in order to view the interactive message. Although there was no significant difference in elaboration between the groups of respondents who viewed the interactive message prior to the survey administration edit and those that viewed the interactive message embedded within the survey, it is possible this large drop-off rate that occurred when viewing the interactive message contributed to the failed perceived interactivity manipulation check and the rejection of H1 (Mann-Whitney $U = 3317$, $n_1 = 147$, $n_2 = 48$, $p = .668$).

Involvement Measure

The introduction to this thesis stated, “Although the majority of consumers are not part of the agricultural industry, every consumer interacts with food multiple times each day. More research is necessary to ascertain how this universal familiarity affects the "low-involvement" classification." This rings true after examination of the results presented in Chapter 4. When creating the measure, Zaichkowsky recommended that 40 be the midpoint of the scale (1994). However, this assumes a normal distribution, which was not present in this study. In fact, had only the scores ranging from 10 – 40 on the PII scale been categorized as low involvement, this study would only have had 30 of the 466 respondents in the low involvement category, spread across four different groupings.

Therefore, it was necessary to create a median split as was conducted for the internet ability moderating factor in Liu and Shrum's 2009 study. The median used for this split was 61, far greater than the assumed normality of 40. If this study had replicated the results of the Liu and Shrum study (2009), this unusually high level of involvement could have been a detriment to agricultural communicators wishing to use interactivity as a method to improve attitudes and elaboration, as it would have increased the possibility of the negative attitudes from the high involvement, low ability group just by virtue of frequency of the respondents in the high involvement group. This proved not to be the case in the current study, however, so it cannot be concluded that an agricultural topic has a significant effect on the relationship between elaboration and involvement.

It is interesting to consider why the topic of agriculture produced such skewed results within the PII. There are a number of possibilities as to why this is; only two of which could include be the ubiquity of agriculture and the importance of agriculture to the state of Georgia. This stimulus message made a point of highlighting the importance of blueberry and peach production to the state's economy. This may also have affected responses to the PII as respondents were asked their opinions after viewing the message as opposed to before.

Examining the high and low involvement populations demographically, there is a significant difference between rural and urban location between high and low involvement groups, as may be expected (U = 23127, p = .019). The effect size was small, Cohen's d = .217. In terms of frequencies, the high involvement group was 46.7% rural (n = 114) and 53.3% urban (n = 130), as compared to the low involvement group that was 40% rural (n = 88) and 60% urban (n = 132). There is little other difference between these two groups demographically; they share similar makeups when it comes to age, education level, political ideology, and household income.

Despite the non-normal distribution, PII scores were still positively correlated with elaboration, although very weakly, confirming the assumption that a higher level of involvement increases the likelihood of elaboration (r_s = .10, p = .023). However, when groupings were divided at the 61 median score and this correlation was retested with a Mann-Whitney U test, there was no significant difference between the two groups. This suggests that, in the case of agricultural messages, a more discriminatory involvement measure is necessary in order to predict elaboration through the dual-process interactivity model.

Internet Access and Ability

As mentioned in the limitations of this study and the Liu and Shrum study (2009), creating an accurate measure of internet ability that stands the test of time is difficult, if not impossible, due to the ever-changing relationship of consumers and the internet. For research that includes internet ability, this may make recreation of study results exponentially more difficult as more years pass between both studies. At the time of publication of Liu's Perceived Interactivity Scale, 2003, no more than 15% of respondents of any of the three studies conducted had used the internet for over six years, a statistic that has certainly changed. At the time this research was conducted, the offline American population has “declined substantially since 2000,” dropping from a non-adoption rate of 48% to just 15% over the past six years (Anderson, Perrin, & Jiang, 2018; Liu & Shrum, 2003; Zickuhr, 2013). For example, in the 2009 dual-process model of interactivity study, Liu and Shrum’s respondents reported spending an average of 12.17 hours online each week where the median = 7.50. As is to be expected, that number is much larger in this current study, where the average number of hours respondents spend online each week equaled 26 and the median = 21. However, what is most concerning about the validity of this question as a measure of ability is the standard deviation of 23.52 among respondents. A standard deviation this large, along with the non-normal distribution of data raises concerns about how respondents conceptualize “time online.” Do they consider using mobile applications like Facebook being “online” or strictly online activity via a web browser? Again, this study finds necessary a more discriminatory measure through which to measure ability in order to recreate the dual-process model findings.

The researcher anticipated this issue and intended to create an autonomy score based on digital inequality research from which to create a composite internet ability score that would prove a more accurate measure of true internet ability (Anderson, Perrin, & Jiang, 2018; DiMaggio & Hargittai, 2001; Salemink, Strijker, & Bosworth, 2017). However, the hours a respondent spent online was not significantly correlated with the autonomy measure (r_s = -.005, p = .923). The hours spent online measure was used to define ability in hypothesis testing as it most closely followed the dual-process model framework put forth by Liu and Shrum (2009).

However, the number of hours a respondent spent online each week did not prove to be a moderating factor in this study as evidenced by the non-significant correlation between the hours a respondent spent online and their level of elaboration (r_s = -.038, p = .411). In post-hoc analyses, the researcher-created autonomy score exhibited a very weak correlation to elaboration of $r_s = .112$, $p = .016$. The composite score created from averaging hours spent online and measured autonomy exhibited also exhibited no correlation with elaboration. The lack of significant correlation with hours spent online and the very weak correlation of the internet autonomy scores to elaboration could indicate that the measure of internet ability defined as a moderator of the dual-process model of interactivity effects requires modern adjustment in order to be used as an accurate grouping measure.

CONCLUSIONS

Conclusions

The failure of this study to extend the results of the dual-process model of interactivity to a larger population based on an agricultural message, while also observing an overall positive effect of interactivity on elaboration creates interesting implications for the field of agricultural communication. The dual-process model of interactivity and other research presented the possibility of alienating the core group of high-involvement agriculturalists by investing in interactive agricultural communication strategies. By testing this dual-process interactivity model for an agricultural message based on a general population and finding no significance, this study found that the risk of alienating any group is minimal, so long as interactivity conditions are not high. In fact, mean elaboration was significantly higher for respondents who viewed the interactive stimulus as opposed to the static. After respondent were stratified by involvement and ability through the dual-process model of interactivity effects framework, this elaboration correlation lost its significance. Though the elaboration correlations for most groupings were not found to be statistically significant, mean elaboration for the interactive message was higher in every pair-wise comparison. It should be noted that this non-significance by no means disproved the dual-process model of interactivity, but instead called for a more modern modification of moderating factors measures.

Implications

Theoretical

The failure of this study to prove the hypotheses based on the dual-process model of interactivity presents several theoretical implications. First, it exhibits a need for improved discrimination between ability scores on topics as ubiquitous as agriculture. As the distribution of these involvement scores were non-normal with a median of 61 as opposed to 40 within the range of 10-70, a different measure of involvement may be required to accurately group respondents into low and high involvement categories. Further investigation is required as to the reason why these scores were so high. Possible explanations include the importance of agriculture to Georgia or the fact that respondents viewed the message prior to reporting their involvement. Due to the relevance of the message and its topic of the importance of blueberry and peach production to the state’s economy, it is possible respondents self-reported higher than normal involvement scores. Involvement could potentially be more accurately self-reported as a moderating factor in a message stimulus study, should respondents be asked to rank their opinions prior to viewing the message as opposed to afterwards. However, it is also possible that respondents are accurately reporting their level of involvement and are simply more highly involved with the topic of “agriculture” as opposed to a specific brand or product. If the latter case, this study exhibited a need for a different involvement measure when attempting to discriminate between high and low involvement groups in a topic that has the potential to be ubiquitous or highly relevant.

Secondly, the respondent’s failure to discriminate on the perceived interactivity scale between static and interactive messages carries its own theoretical implications. This study could suggest this scale may need further testing with more contemporary data in order to maintain its relevance. In the same way that internet use is constantly evolving, so too may perceptions of what constitutes interactivity. Comparing modern interactive and static messages on the scale could support the scale's continued use. An alternative explanation could be that the recommended levels of interactivity should be changed as internet ability continues to rise. It is possible the reason that the interactive message was not significantly perceived as more interactive was due to the fact that respondents are more accustomed to increased interactivity as internet adoption has increased. Correlating elaboration with differing levels of modern interactive messages could change past recommendations of low to medium interactivity levels (Sundar, Kalyanaraman, & Brown, 2003; Weber & Rall 2012).

Third, this study suggests that should the dual-process model of interactivity effects framework be followed, a more current and discriminatory measure of internet ability is required. Due to the lack of significant correlation between hours spent online and elaboration, this study suggested that hours spent online are no longer a significant moderating factor for elaboration of interactive messages. Furthermore, it also raised the issue of validity of self-reporting hours spent online due to the non-normal distribution and very large standard deviation of this free response field. The only measure that even very weakly correlated with elaboration was one based in internet connectivity and literacy research rather than a quantitative measure of hours spent online. It should be noted that this autonomy measure was not significantly correlated with the number of hours respondents self-reported that they spent online. Liu and Shrum mention that the dual-process model of interactivity is flexible to different measures and is merely a model of elaboration in response to the interactivity cue (2009). This could allow for a more modern interpretation of the moderating factors of both ability and involvement. Interactivity proved to have an overall positive effect on message elaboration. This significance was lost, however, when the respondents were grouped according the moderators used by Liu and Shrum (2009). This further impresses the need for a better measure for these moderating factors as it demonstrated that there is an effect, but that the dual-process model of interactivity effects framework, used with these measures did not explain this effect.

Furthermore, the overall positive effect of interactivity on message elaboration calls for further research on the effects of interactivity on agricultural communications. Though the effects did not follow the hypotheses based in the dual-process model of interactivity effects, mean elaboration for the interactive stimulus was higher than the static, even when respondents perceived no significant difference between interactivity levels of the two. This bears further investigation not only to be understand respondent perceived interactivity but also to identify other potential moderators of elaboration on interactive agricultural messages.

Practical

Though this study by no means disproves the dual-process model of interactivity effects as much as it calls for a modern reinterpretation of its moderating factors, it does encourage agricultural communicators to pursue more interactive communication strategies. This study found that the likelihood of creating negative attitudes or elaboration affects through the use of interactive messages is minimal, so long as messages are kept to medium or low interactivity levels. It also found that despite consumers not perceiving the interactive stimulus as more interactive than the static, they still elaborated significantly more in the experimental interactive condition. Because greater elaboration is the path to increasing positive attitudes, deeper critical thinking, and more resilient beliefs and behavior changes, this was an important realization that encourages agricultural communicators to increase the interactivity of their messages, if only slightly, to in turn increase message persuasiveness (Petty & Cacioppo, 1986).

Past research also confirmed that interactivity can be a useful tool for enhancing elaboration and pairwise comparisons show that the mean elaboration score for the interactive agricultural message was also greater in every grouping, despite the statistical insignificance created by the moderating measures (Sundar, Kalyanaraman, & Brown, 2003; Weber & Rall, 2012; Wojdynski, 2015). This means that agricultural communicators should move forward with interactive strategies based on the recommendation of past research, the inability of this study to prove that a high involvement in agriculture will result in decreased elaboration, and the overall positive effect of interactivity on message elaboration.

Another practical significance of this study is that, in this inability to prove that a high involvement in agricultures risks decreased elaboration while also finding an overall positive effect of interactivity, it supported the call for greater cross-training of communicators in digital and interactive strategies and more accessible software programs for data visualization (Reilly, 2017; Weber & Rall, 2012). Reilly particularly focused on the need for smaller, local news outlets to remain relevant through increased use of data visualization and digitalization of content (2017). This study supports the notion that interactive strategies could help communicators even in both rural and urban areas. As professional agricultural communicators are often crisis communicators, public relations managers, social media experts, writers, and graphic designers all rolled into one, training in interactive strategies and the software needed to create interactive data visualizations will not only pay dividends currently but will also continue to increase in value as both internet adoption and literacy increase. This notion presents the pedagogical implication that interactivity training should be provided to agricultural communicators within college curriculums in order to provide students the tools they will need to stay relevant within the quickly-changing communication realm.

Limitations

A few possible limitations of this study that have not yet been discussed in Chapters Three and Five include the general negativity of the topic of the message topic and its possible implications for polarity coding, the effect of the UGA branding on the Qualtrics survey pages, and general sample limitations. The topic of the message presented to respondents was the loss of revenue incurred by Georgia's economy due to strange weather patterns that killed or otherwise ruined many peaches and blueberries during the 2017 growing season. As this message was inherently negative, polarity coding was likely more difficult than that of a message with a more optimistic or neutral tone. However, coder instruction and training resulted in a high inter-coder reliability of a = .826 (Krippendorff, 2011).

A second limitation was the effect of University of Georgia branding of a respondent's level of trust in the message. It is possible that having the UGA academic logo on each page of this study led respondents to place more trust in this message than they would normally, resulting in increased elaboration both from a polarity standpoint in the thought listing measure and as a reliable message source (Petty & Cacioppo, 1986). The term "UGA" and city of "Athens" were both mentioned seven times whereas "university" was mentioned eight and "school" three, exhibiting that the university branding did play some role in respondent reaction to the message stimulus.

Suggestions for future research

Through the course of this thesis, the researcher recognized several avenues for future research. The first and most important recommendation of this study is for investigation into different, more current ways to measure the moderating factors of ability and involvement that more strongly correlate with elaboration than those used in this study based on the dual-process model research conducted by Liu and Shrum (2009).

Next, the researcher recommends that the thought-listing responses for this study be coded on target and origin dimensions and then re-tested for correlation with the elaboration validation measure. These additional codings could contribute to the theoretical understanding of elaboration and thought-listing procedures. The thought-listing method is a time-consuming measure of elaboration that requires coordination with other judges and experimental condition blindness (Petty & Cacioppo, 1981). A measurement like Reynold's elaboration validation would be a preferred measure as it precludes the need for additional judges and their possibility of misinterpreting a thought, while also keeping respondents from being required to judge their own thoughts (1997). In short, it is a much more convenient measure of elaboration for both respondents and researchers and a further investigation of this dataset could provide more support for the measure.

The next set of recommendations involves re-running the experiment with different manipulations. The first recommended manipulation is the increase of interactivity to the high levels defined by Weber & Rall (2012). It is possible that increased interactivity will lead to a statistically significant manipulation check and results that more closely replicate Liu and Shrum's 2009 study. It is also possible, though unlikely, that novice internet users' tolerance of interactivity has increased to the point that no group will exhibit decreased elaboration of an average interactive message regardless of interactivity level. It is more likely that novice interactivity has increased at a level commensurate with ability and therefore the dual-process model of interactivity would remain intact. Replicating this study with a more interactive message could lead to more statistically significant results and a better understanding of the modern consumer's relationship with interactivity.

The second recommended replication could be conducted by changing the message stimulus to a more neutral or optimistic agricultural topic. Other additional dimensions on which to manipulate the stimulus could include relevance, for example a Georgia-focused message versus a nationally focused message, or timeliness. For example, one respondent wrote, "old news" in the thought-listing exercise of this study in response to the data from 2017. Replicating the study with a message less than a year old could increase the perceived relevance.

The researcher also recommends that future studies similar to this one actively include more farmers and agriculturalists. Due to the sample limitations, it is likely that few agriculturalists took this survey despite the high involvement scores exhibited and fairly high percentage of rural respondents. As these are the people that will likely comprise the group hypothesized by the dual-process model of interactivity and other research to exhibit the most negative elaboration towards increased interactivity, they are an important group to include in studies like this one. Practical rather than experimental hypothesis testing could be carried out through publications like the Farmers and Consumers Market Bulletin, which boasts a large subscription base of agriculturalists.

A final interesting avenue of research could be the effect of pre-screening respondents based on cookies or a pre-screening question pertaining to internet ability prior to presenting an audience a particular web page. For instance, if a person's cookies indicate they are a novice internet user, they could be automatically routed to a less-interactive web page, or perhaps a pre-screening question indicates an adept user who is then shown a more interactive message. The implications these pre-screening conditions could have on message elaboration and trust could provide a new application of the dual-process model of interactivity.

An overall positive effect of interactivity was found in this study despite the fact respondents did not recognize the experimental stimulus to be more interactive than the static. This means that people responded more favorably and thought more critically about an interactive message without recognizing the potential cause of this increased elaboration. The dual-process model of interactivity effects used with the stated measures of ability and involvement also did not explain this positive effect. In fact, the power of this effect was diluted into statistical insignificance by grouping respondents by these ability and involvement measures. This should be recognized as both a theoretical call for modernization of the dual-process model of interactivity moderation measures, and a practical push for agricultural communicators to pursue more interactive communication strategies.

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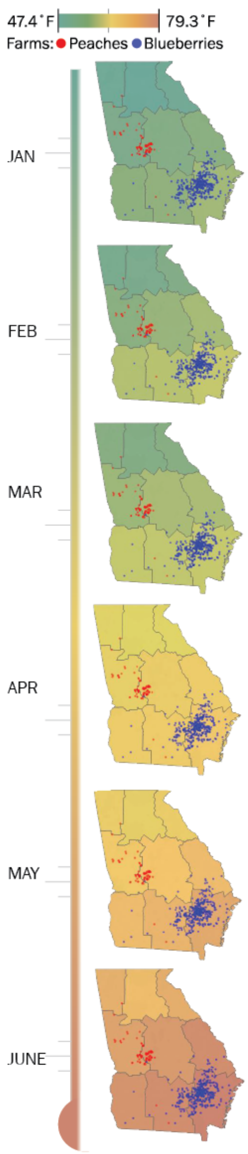
Appendix A

Static stimulus

2017 temperatures

Temperature trouble: How it was both too cold and too hot

Peaches require a certain number of cooling days with temperatures below 45 degrees to flourish while blueberries flourish in warmer weather. Usually, this isn't a problem in Georgia, due to the locations of blueberry and peach farms. However in 2017, temperature shifts resulted in a warmer winter in North Georgia and a cooler spring in South Georgia.



How Georgia lost millions on blueberries and peaches in 2017

How a 2017 Spring freeze brought Georgia blueberries and peaches to their knees

"Georgia was poised to be the largest blueberry producing state for 2017," read a Georgia Department of Agriculture press release. However, a late March freeze blew through the state, killing a large portion of the year's crop. "The annual blueberry farm gate value is over $255 million with a significantly greater economic impact. The peach crop coud be down as much as two thirds," the release continued.

In previous years, blueberries have contributed over $330 million and peaches have contributed $53 million to the state's economy annually. Find out why this year's unusual temperatures mean big losses for Georgia's produce industry.

Many blooms died as a result of the freeze's harsh temperatures late in the season.

A blueberry's growth is stopped in its tracks by the freeze.

Even those that were almost ripe did not escape the freeze. These will be marked as poor quality due to the freeze damage.

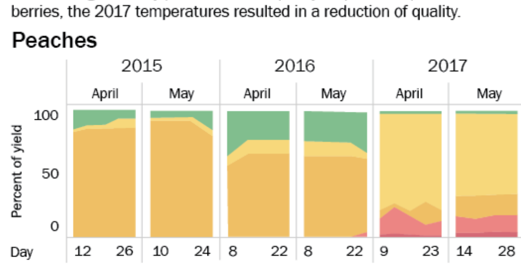
Peach trees in the snow in Fort Valley, GA.

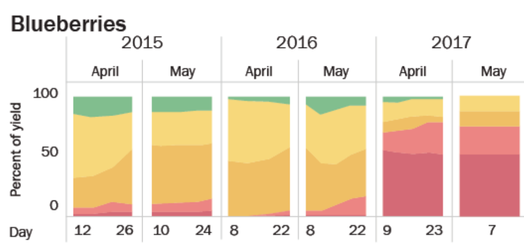
Fruit Condition

Excellent | Good | Fair | Poor | Very Poor

Poor quality: How blueberry and peach quality suffered

While Georgia usually produces a fair quality crop of both peaches and blueberries, the 2017 temperatures resulted in a reduction of quality.



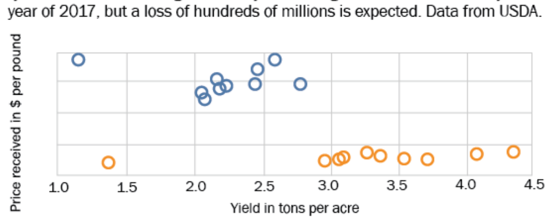


Yield to price received by farmers

Blueberries | Peaches

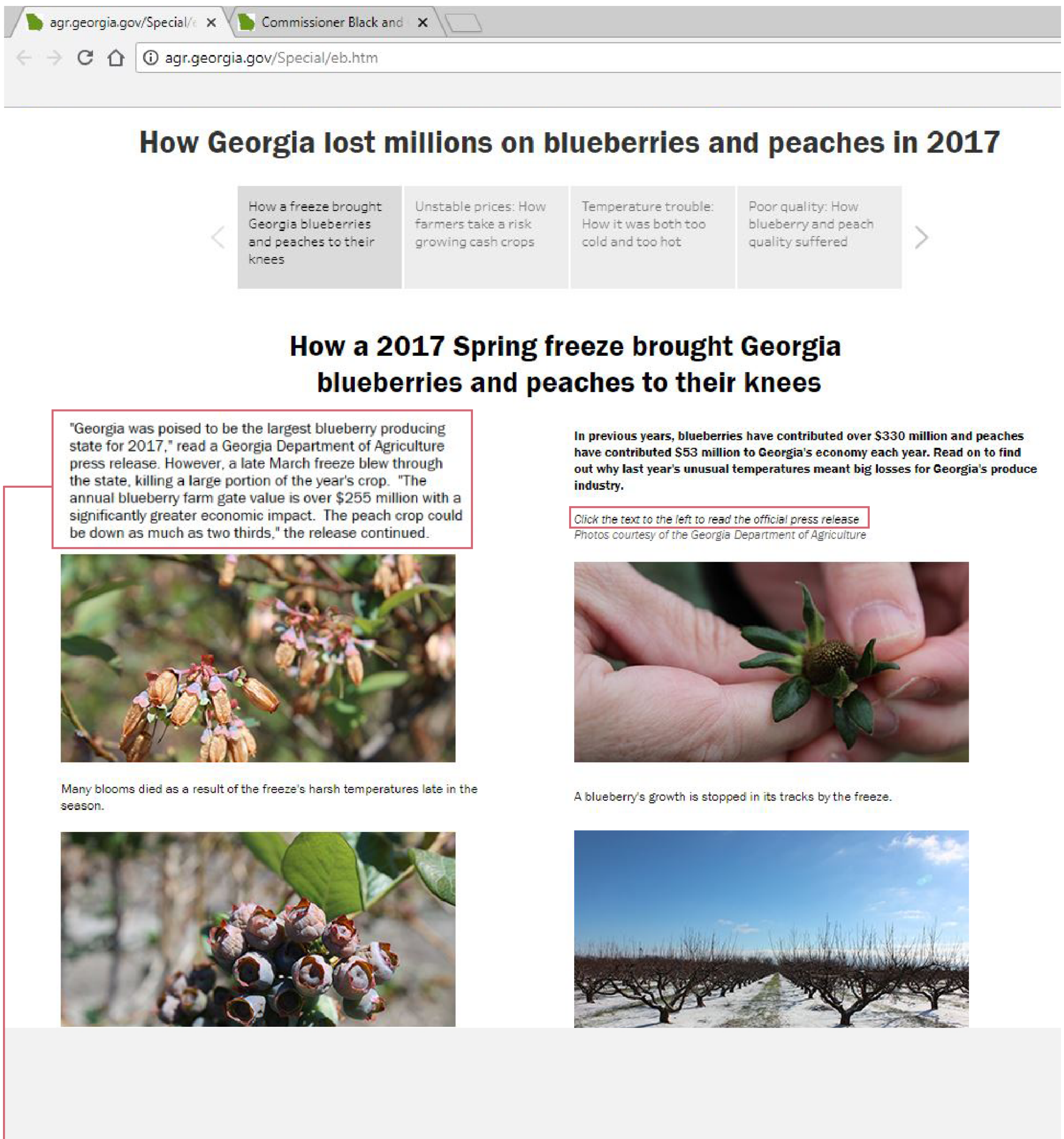
Unstable prices: How farmers take a risk growing cash crops

While peaches are most often sold at a fairly consistent price each year, blueberries yield higher payouts to farmers, but at much larger risks. In a year like 2017, blueberry farmers and the Georgia economy take a large hit. Sales data is not yet in for the year of 2017, but a loss of hundreds of millions is expected. Data from USDA.

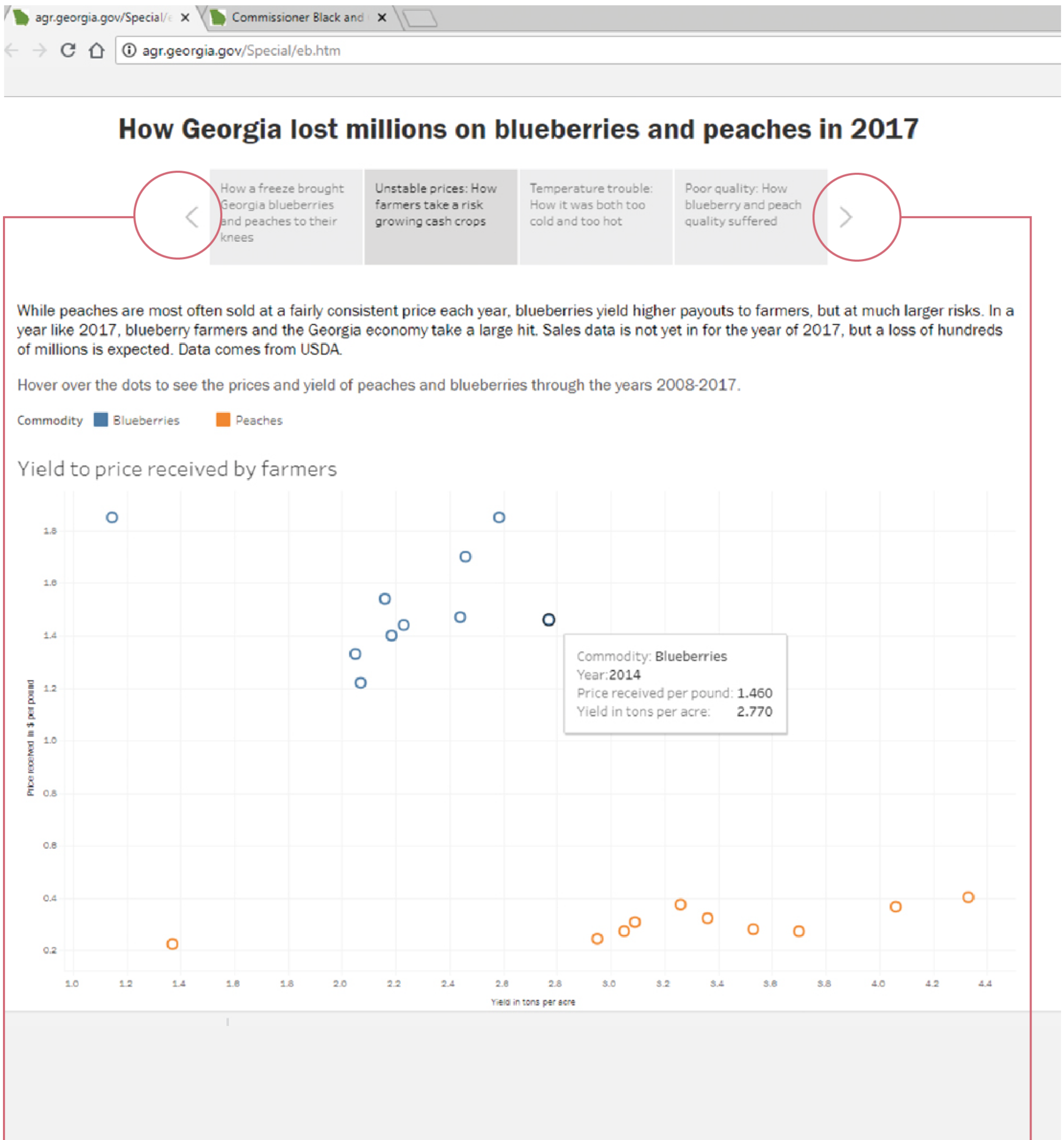


Appendix B

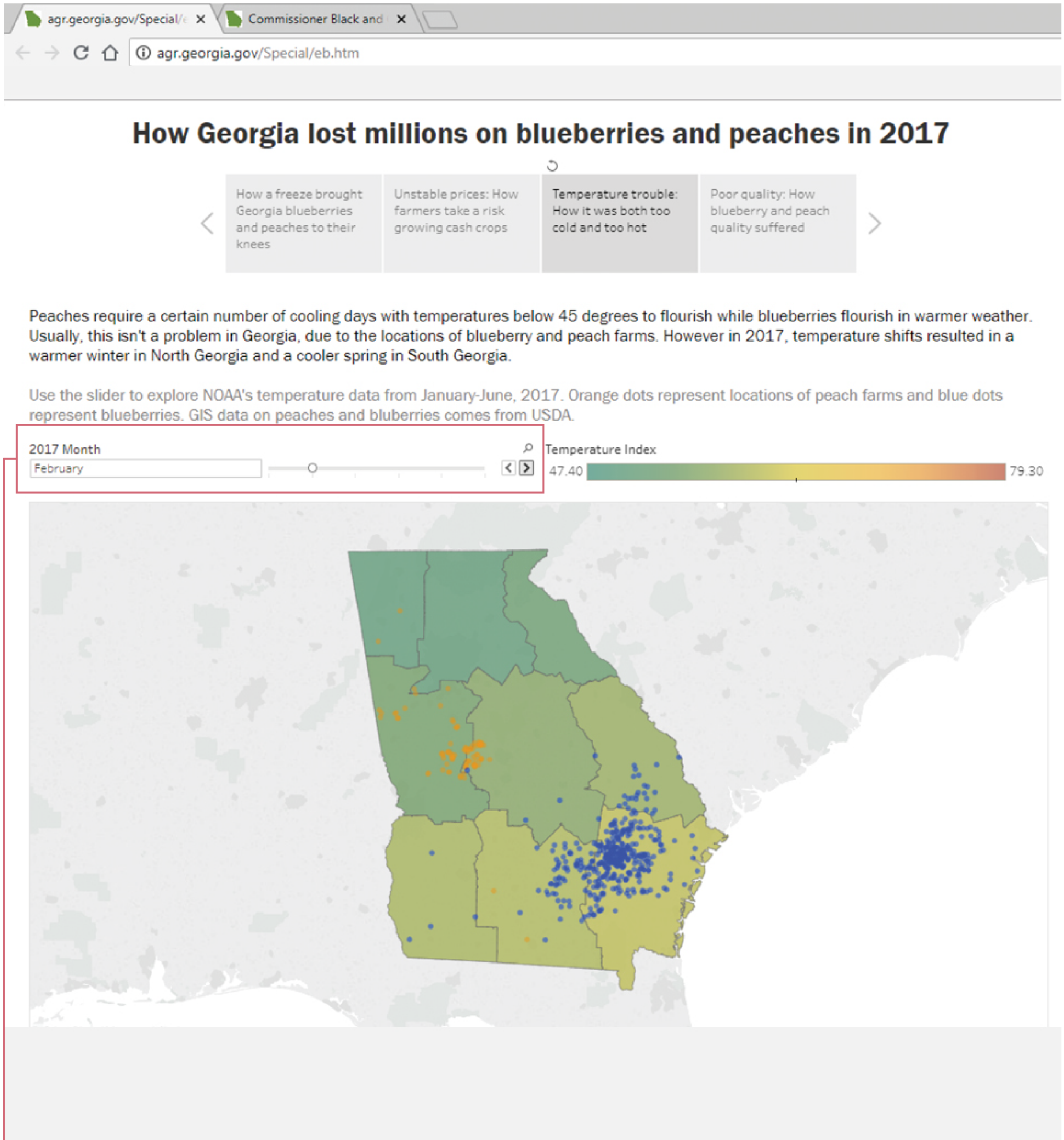
Interactive Stimulus



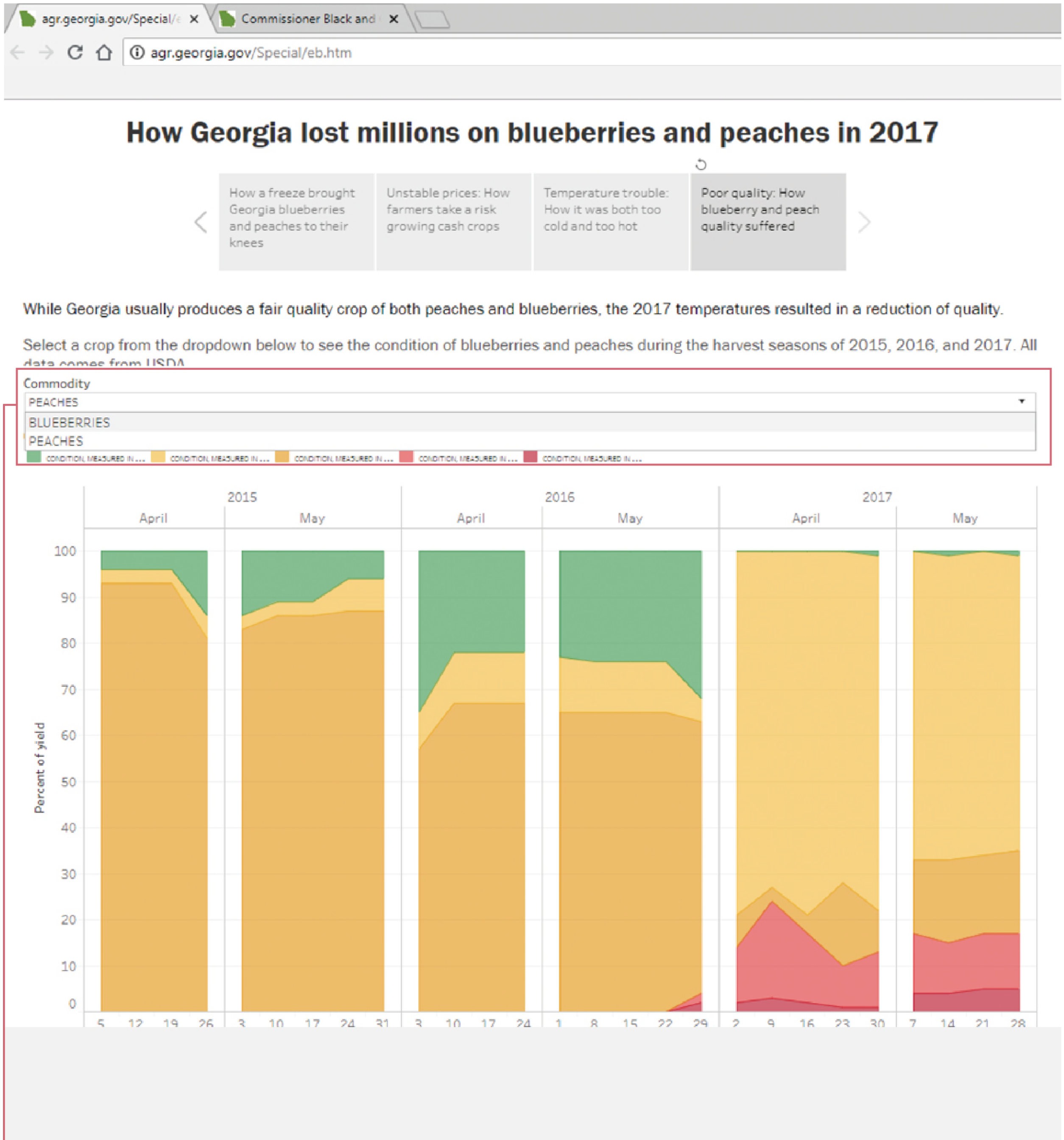
Moderate interactivity was established through the use of hyperlinks (Sundar, Kalyanaraman, & Brown, 2003).



This study's interactive message used forward and backward buttons to establish linear interactivity.



This study's interactive stimulus established non-linear interactivity through the use of a timeline slider on the map data visualization that allowed respondents to toggle through the temperature data of the months of January through June of 2017.



This study's interactive message established explorative interactivity through the use of a drop-down menu in the chart exploring peach and blueberry quality.

Appendix C

Georgia Department of Agriculture press release concerning 2017 freeze effects on blueberries and peaches

Georgia Department of Agriculture

Gary W. Black, Commissioner

19 Martin Luther King Jr. Dr. SW

Atlanta, GA 30334

www.agr.georgia.gov

Find us on Facebook • Follow on Twitter: @GDAFoodSafety •@GeorgiaGrown

Press Release

FOR IMMEDIATE RELEASE

Monday, March 20, 2017

Office of Communications

404-656-3689

julie.mcpeake@agr.georgia.gov

Photos available at http://agr.georgia.gov/freeze.aspx

Commissioner Black and Chairman McCall Tour Freeze Damage

Atlanta - Commissioner Gary W. Black joined House Ag Committee Chair Tom McCall late last week to survey the damage to fruit and vegetable crops from freezing temperatures that hit the state on Wednesday, March 15 and Thursday, March 16. The extreme temperatures were felt border to border, with farmers experiencing temperatures as low as 22 degrees as far south as Homerville, Georgia , located on the Florida state line.

“It is still a little early to predict just how great the loss will be for some of the crops, but there is no denying the financial strain on these families caused by this event,” Commissioner Black said. “I think it is safe to say that the losses will be in the hundreds of millions of dollars”

The South Georgia blueberry crop was hit in the hardest. Early estimates predict losses as much as 80 percent of expected production.

“This is the tornado or hurricane of many of our growers lives,” Commissioner Black said. “We saw blueberry fields that had the potential to be the biggest and best crop of Georgia’s production history that you would now not be able to find enough blueberries that survived the cold to make one pie,”

The mild winter and early spring the Southeast has experienced this year has compounded the damage as much of the produce crop is ahead of the state’s average blooming dates by a couple of weeks.

“As a farmer myself, the turmoil these folks are experiencing is gut-wrenching, “Chairman McCall said. “Our job now is to listen and support these farmers as a united Legislature.”

Georgia was poised to be the largest blueberry producing state for 2017. The annual blueberry farm gate value is over $255 million with a significantly greater economic impact. Other crops affected by the freeze include peaches, strawberries, watermelons, peppers and other tabletop vegetables. The peach crop could be down as much as two thirds.

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About the GDA The Georgia Department of Agriculture (GDA) is the voice of the state's agriculture community. The department's mission is to provide excellence in services and regulatory functions, to protect and promote agriculture and consumer interests, and to ensure an abundance of safe food and fiber for Georgia, America, and the world by using state-of-the-art technology and a professional workforce. For more information, visit www.agr.georgia.gov.

Julie McPeake