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MISINFORMATION AND INFORMATION GATHERING IN CREATIVE PROBLEM-SOLVING

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Abstract

Information gathering is a critical process in creative problem-solving. An important feature of successful information gathering is scanning for discrepant information and attending to such discrepancies to understand the nature of information better. However, the rapid spread of information can make it more difficult to discern accurate from inaccurate information. Misinformation is false or inaccurate information, the spread of which can have real consequences on behavior. While there has been much study of misinformation, including what makes people susceptible and the negative effects it can have on judgments and decision making, little empirical research has explored how exposure to misinformation influences creative problem-solving processes. Therefore, the present study explored how misinformation impacts search strategies used during information gathering and the viability of solutions resulting from the creative problem-solving process. Undergraduate participants were asked to assume the role of a marketing manager of a company wishing to rebrand itself and were exposed to accurate and misinformation relevant to the rebrand before being asked to generate ideas and a final plan. Source credibility and post-exposure misinformation warnings were manipulated. The impact of misinformation on the creative process and, ultimately creative solutions, is complicated. While misinformation gathering is associated with worse idea generation and final plan outcomes, post-exposure warnings about possible misinformation seem to constrain some information gathering behaviors and creative output. Findings and implications are discussed.

Introduction

The prevalence and variety of online social networks has greatly influenced the spread of information (Nguyen, Yan, Thai, & Eidenbenz, 2012). Online social networks such as Twitter and Facebook represent a consistent source of news and other happenings in the world for many users. While increased access to information can be beneficial in many respects, the information circulated is not always truthful or accurate (Nguyen et al., 2012). Misinformation is false or inaccurate information that becomes disinformation when it is purposefully spread in an attempt to mislead (Wu, Morstatter, Carley, & Liu, 2019). Though social media companies have created policies meant to curb the intentional and unintentional spread of misinformation, it nonetheless proliferates. According to a report by Gallup and the Knight Foundation, 92% of U.S. adults are either concerned or very concerned about the spread of misinformation on the internet.

The spread of misinformation can have serious consequences. Brainard and Hunter (2020) found that health misinformation can worsen disease outbreaks, especially if the misinformation incorporates emotion or conspiracy. Denying the existence of AIDS during the human immunodeficiency virus (HIV) epidemic resulted in greater avoidable morbidity and mortality (Jaiswal, LoSchiavo, & Perlman, 2020). Along similar lines, several researchers have examined the role of misinformation in influencing the response to the Covid-19 pandemic (Bursztyn, Rao, Roth, & Yanagizawa-Drott, 2020; Tasnim, Hossain, & Mazumder, 2020; Khan, 2021). The spread of misinformation during Covid-19 has contributed to an increase in detrimental health behaviors, such as deaths related to unapproved treatments, a lack of preventative behaviors, and a discontinuation of healthy behaviors (Tasnim, Hossain, & Mazumder, 2020). In addition, the same week that a study demonstrating the effectiveness of mask use on reducing morbidity and mortality from Covid-19 was published, the Federal Bureau

of Investigation had to thwart an attempt to kidnap the governor of Michigan for issuing a statewide mask mandate that was deemed unconstitutional in an online forum (Agley & Xiao, 2021). If many believe in something that is inaccurate, the misinformation can start to form the basis for decisions that are not in the best interest of individuals or society at large (Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012).

While there has been much study of misinformation, including what makes people susceptible and the negative effects it can have on judgments and decision making, little empirical research has explored how exposure to misinformation influences creative problem-solving processes, processes that are a key part of developing plans and innovations in organizational settings (Mumford, Hunter & Byrne, 2009). Information gathering during the creative problem-solving process is critical to the production of creative solutions. Yet, little is known about the strategies information gatherers use and how well-crafted misinformation ultimately influences the solutions produced. The present paper will therefore explore how misinformation impacts search strategies used during information gathering and the viability of solutions resulting from the creative problem-solving process.

Misinformation Effects

In the realm of eyewitness testimony, much attention has been paid to the effects of misinformation on memory for words, faces, and details of witnessed events (Frenda, Nichols, & Loftus, 2011). The misinformation effect describes the shortcomings in memory people have after being exposed to misleading information surrounding a given event. Misinformation can cause people to believe that they witnessed events that were only later suggested to them, and once those false memories have been embraced, people can recall them with confidence and detail (Loftus, 2005). This is important because similar effects can be noted in the way

individuals process other types of non-event related information. Aside from outcomes on memory, there are various ways misinformation can affect cognitive processes such as problem-solving.

After reading false information, Rapp and Salovich (2018) found that people can become confused and doubtful of knowledge they previously believed to be true. Further, the inaccurate information encountered may be used to aid in subsequent tasks if the reader is not aware they have come across bad information (Marsh, Meade, & Roediger, 2003; Rapp, 2016). In an experiment by Marsh et al. (2003), subjects were exposed to misinformation and asked to answer questions following exposure. Fewer questions were answered correctly overall, with many of the incorrect answers reflecting the misinformation participants were exposed to. Being able to decipher relevant, high-quality information from irrelevant, low-quality information is critical to successful problem-solving (Brand-Gruwel, Wopereis, & Vermetten, 2005). As such, searching and processing information requires problem solvers to identify information needs, locate information sources, gather and organize relevant information, and synthesize the diverse information they have gathered (Walraven, Brand-Gruwel, & Boshuizen, 2008). The creative process model is one area of research concerned with problem-solving.

Creative Process Model

Creativity is a complex phenomenon involving the generation of novel, useful ideas (Mumford, 2003; Runco & Jeager, 2012). It is important to understand not only how creativity is defined, but also the ways in which individuals are able to generate such ideas. Various models of the processes creative thinkers utilize to achieve their ideas have been proposed (e.g., Besemer & O'Quin, 1999; Christiaans, 2002; Mumford, Mobley, Reiter-Palmon, Uhlman, & Doares, 1991). Identifying the cognitive processes people use in the production of creative solutions is

one approach to understanding the creative process and how people generate creative ideas and outcomes (Mumford & McIntosh, 2017). One predominant model of creative processes developed by Mumford et al. (1991) posits that creative problem solving involves the production of high quality, original and elegant solutions to complex, novel and ill-defined problems (Mumford & McIntosh, 2017).

This creative process model describes eight key cognitive processes involved in creative problem solving. Problem definition begins the creative problem-solving process. Given that creative solutions can only result from complex, novel, and ill-defined problems, a creative problem solver must find ways to identify and frame the question or questions that will drive the rest of the creative process. This includes pinpointing the nature of the problem at hand and the steps that will be necessary for later problem-solving (Csikszentmihalyi, 1988; Dillon, 1982; Mumford et al., 1996). More effective problem definition, including the ability to generate various conceptions of a problem and advanced problem-finding abilities, has been shown to facilitate creativity (Mumford et al., 1996). Information gathering, or the search and encoding of information relevant to a creative problem, is the next step in the process and influences the success of the creative solution. Next, information organization and conceptual combination are important because once they're completed, a creative problem solver can begin to generate ideas and evaluate whether those ideas are viable for the circumstance at hand (Illies & Reiter-Palmon, 2004). After an idea or set of ideas has been generated, the evaluative process follows. Anticipating the implementation of an idea, a creative problem solver will scrutinize several aspects of the idea (Vincent, Decker, & Mumford, 2002). Mumford et al. (2002) found that forecasting, the prediction of likely outcomes or consequences following the execution of an idea, is foundational to the evaluative stage of creative problem-solving (Lonergan et al., 2004).

Implementation planning involves the selection, organization, and execution of steps necessary to achieve stated goals related to the creative problem solution (Osburn & Mumford, 2006). Once the planning phase is complete and an idea has been applied, the final stage of the creative process is to monitor the solutions that have been enacted; evaluation allows for remediation of idea deficiencies (Lonergan, Scott, & Mumford, 2004). Prior research has confirmed that people are indeed able to make distinctions about independent facets of new ideas, such as popularity or originality (Runco & Chand, 1994; Runco & Smith, 1992; Runco & Vega, 1990).

This model is based on multiple assumptions (Mumford et al., 1991). First, for problem-solving to be considered creative, solutions must be high quality, original, and elegant and in response to novel, ill-defined problems. Second, in order to creatively solve a problem, a person must have sufficient expertise of the topic. Third, the cognitive processes outlined in the model are broadly applicable across fields. Notably, the eight processes involved in the production of creative problem solutions are not always sequential – failure in any one step can lead to the revisitation of earlier steps in the process (Mumford & McIntosh, 2017). While a large body of research for several of these processes has accumulated in the past two decades, information gathering has received considerably less empirical study.

Information Gathering

Strategies used in information gathering during creative problem solving are not well understood (Mumford et al., 1996) and research has not focused on the role that misinformation could play in this important early-stage creative process. The search and encoding of information relevant to a creative problem influences the success of the creative solution. While gathering and encoding misinformation might result in generating novel solutions, the quality and utility of these solutions will likely be low. Various search strategies can be used in this stage of the

creative problem-solving process, and those who can identify relevant information and discount irrelevant information tend to produce much higher quality solutions (Davidson & Sternberg, 1984). In addition, scanning for discrepant information and attending to such discrepancies to understand the nature of the information better is critical to successful information gathering (Dunbar, 1995). This doesn't mean that the information search is narrow; rather, successful information gatherers collect a wide range of information, are able to effectively identify the information that is discrepant or irrelevant, and incorporate the information that is most meaningful to the creative problem to aid in future steps of the creative problem-solving process (Mumford, Baughman, Supinksi, & Maher, 1996). Without specific attention to expanding existing information and searching for new information, solutions produced will closely resemble those already generated for prior problems (Weisberg, 1988).

Godoy and Cavino (2003) found that information gathering strategies relate to differences in the objective of the problem solver, and these differences impact the search for information. As hypothesized, the authors found a relationship between search strategy used and type of information gathered. However, a specific investigation of the use of inaccurate information related to gathering strategies was not included. Since information relevant to a decision is available from multiple sources, an information gatherer must decide which information to use. Unfortunately, misleading information is not often presented as such and the ability to distinguish factual information from misinformation when creatively solving problems is important because this could influence the usefulness of ideas and solutions generated.

As an example, Statista notes that almost 80% of consumers in the United States have reported coming across fake news about the coronavirus pandemic, yet only 26% of those surveyed feel comfortable recognizing bad information (Watson, 2021). Given the ease of access

to misinformation to individuals seeking information and resources on the internet, the need for examining the impact of misinformation on information gathering is underscored (Gebel, 2021; Brennen, Simon, Howard, & Nielsen, 2020).

Information Gathering and Misinformation

Before exploring how misinformation may impact information gathering, it is important to acknowledge the factors that make one better or worse at information gathering. Those who are more successful at information gathering tend to have prior knowledge about a topic or domain expertise on that topic. Existing knowledge is used to assess whether information pulled is relevant and will create the foundation for the rest of the creative solution (Illies & Reiter-Palmon, 2004). Having prior knowledge can offset susceptibility to bad information, as prior knowledge about a topic allows for greater evaluation of information pertaining to that topic. This is evident in creative problem-solving as well, where prior knowledge plays a critical role in the successful resolution of ill-defined problems (Amabile, 1983; Weisberg, 1999). Expertise is also related to the use of appropriate search strategies during information gathering (Mumford et al., 1996). Expertise is important because it assists the information gatherer in identifying, organizing, and understanding the information needed to solve complex problems (Chi, Glaser, & Rees, 1982; Siegler & Richards, 1982). Additionally, having expertise related to a problem leads to more rapid and accurate processing of relevant information (Halff, Hollan, & Hutchins, 1986).

Yet, misinformation has become crafty and sophisticated, and it is unclear whether prior knowledge and domain expertise are sufficient to combat its effects during the creative problem-solving process. This comes into question because there are four other factors that people consider when assessing the "truthfulness" of information: 1) Is the information compatible with

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other things a person encountering the information believes to be true? 2) Is the information part of a plausible story, evidencing coherence? 3) Does the information come from a credible source? and 4) Do other people believe the information? (Lewandowsky et al., 2012). If information is presented in such a way that it satisfies these criteria, even though it may be inaccurate, will information gatherers be able to decipher "good" or accurate information from bad or "inaccurate" information?

People are more likely to accept information when it is consistent with other things they believe to be true (McGuire, 1972; Wyer, 1974). Rather than confirming the accuracy of new information, individuals will assess whether it is logically compatible with prior beliefs, as processing messages that are inconsistent with prior beliefs takes more cognitive effort than messages that are consistent with prior beliefs (Winkielman, Huber, Kavanaughm & Schwarz, 2012). Additionally, one may assess how well a piece of information fits into a broader story to make judgements about its truthfulness. This is especially true when the meaning of one piece of information depends on another piece of information, supporting that it fits into a larger narrative (Lewandowsky et al., 2012). A believable story is one that is organized without internal contradictions and is compatible with assumptions about human motivation and behavior. Yet again, coherent stories are easier for one to digest than incoherent stories, and people use judgments about what they believe to be coherent (Topolinski, 2012).

In addition to assessing consistency with prior beliefs and coherence, source credibility and the extent to which others endorse the same information are important factors in accepting information as true. The persuasiveness of a message increases along with the perceived credibility and expertise of those communicating the message (Eagly & Chaiken, 1993; Petty & Cacioppo, 1986). Source credibility can be understood as a combination of expertise and

trustworthiness (Pornpitakpan, 2004). A speaker's expertise is judged based on whether the speaker is deemed capable of making a correct assertion about something, while trustworthiness relates to whether the assertions made by a speaker are deemed to be valid (Hovland, Janis, & Kelley, 1953). Social consensus, the idea that the thoughts, feelings and actions of others are similar to one's own, also plays a large role in whether one accepts new information (Krech, Crutchfield, & Ballachey, 1962). In a social media context, the echo chambers that are created with online networks reinforce the truthfulness of information that is circulated in these networks. However, shared belief in a piece of information does not necessarily have any bearing on whether it is true and accurate. As a result, perceived social consensus can easily solidify and maintain one's belief in misinformation (Lewandowsky et al., 2012). The pervasiveness of bad information presented as accurate necessitates an exploration into how various presentations of misinformation impact the information gathering stage of the creative problem-solving process.

> *H1: Information seekers will perceive a greater amount of misinformation as relevant when it comes from a credible source.*

The search for information relevant to the problem solution is directly linked to problem construction and the cues that a problem solver takes from their understanding of the issue at hand (Mumford et al., 1991). The amount and type of information retrieved also influences the quality, originality, and elegance of solutions (Mumford et al., 1996). Given this, how will the use of misinformation impact the quality, originality, and elegance of creative solutions? Considering that misinformation is likely to contain factual inaccuracies unbeknownst to the consumer of the information, it is plausible that the quality and elegance of creative solutions will be lower when misinformation is used in the information gathering process. Originality, on

the other hand, may increase because the misinformation being utilized is unique from factual sources of information about the problem.

> *H2: Selection of misinformation during the information gathering stage of the creative problem-solving process will be associated with a) lower quality and b) lower elegance problem solutions.*

> *H3: Selection of misinformation during the information gathering stage of the creative problem-solving process will be associated with more original problem solutions.*

Considering that information gathering occurs early in the creative problem-solving process, it is important to measure performance at a different stage of the process as well. Just because a person may successfully define a problem and gather information, deficiencies in later stages can impact the final solution unrelated to behavior in early stages. Once information has become available to them and they have organized and combined concepts, individuals begin moving towards the idea generation process (Basadur, 1995; Lubart, 2001; Runco & Chand, 1995). Divergent thinking in idea generation has been shown to relate to creative performance (Illies & Reiter-Palmon, 2004), and can be captured using measures of flexibility. Flexibility describes the extent to which an individual breaks with a set when generating ideas (Runco, 1999). Given that misinformation contains inaccurate information which may incorporate disparate concepts, exposure to misinformation may increase the flexibility and originality of ideas a creative problem solver generates. On the other hand, the quality of ideas generated is likely to decrease when misinformation is used to inform ideas generated, as factual flaws may be used to inform the generation of ideas.

H4: Selection of misinformation during the information gathering stage of the creative problem-solving process will be associated with a) more flexible and b) more original ideas generated.

H5: Selection of misinformation during the information gathering stage will be associated with lower quality ideas generated.

Countering Misinformation

Information inconsistent with one's beliefs produces negative feelings or cognitive dissonance (Festinger, 1957). As a result of the above, people often do not recognize information as misleading until they receive a correction or retraction pertaining to it (Lewandowsky et al., 2012). Unfortunately, the initial exposure to and repetition of misinformation appears to influence subsequent cognition more than the retractions that follow this exposure (Ecker, Lewandowsky, Swire, & Chang, 2011). However, there is still room to alleviate some of the impact of misinformation by repeating retractions, timing them, and creating them as a part of an alternative, coherent story. If told that the information they are about to encounter may be misleading, people are less likely to become attached to misinformation (Chambers & Zaragoza, 2001; Ecker et al., 2010; Jou & Foreman, 2007). This method of reducing the impact of misinformation is most effective when the ongoing and long-term effects of the bad information are explained, rather than simply acknowledging that the information is inaccurate. There is also a temporal element to countering misinformation. When warned prior to exposure, those encountering misinformation are less susceptible to its allure (Chambers & Zaragoza, 2001; Ecker et al., 2010). In application, this would mean giving pre-exposure warnings about misinformation to those encountering it. However, given that information gathering is a complex process that involves multiple sources of information and considerations, it is not feasible to

warn an information gatherer about every piece of misinformation and create a plausible alternative to counter it. In a meta-analysis examining the impact of post-exposure warnings at reducing the misinformation effect, Blank and Launay (2014) found that post-exposure warnings are also highly effective. Therefore, it is important to explore whether post-exposure warnings could impact the use of misinformation in creative solutions.

> *H6: A post misinformation exposure warning will result in higher quality, higher elegance, and lower originality problem solutions than no warning.*

> *H7: A post misinformation exposure warning will be more effective at reducing the search for consistent misinformation than no warning.*

Finally, given that misinformation is frequently believable because it tells a coherent story, creating retractions to misinformation requires telling an equally believable story. Research has shown that misinformation beliefs persist less when an account of why the information was inaccurate is provided (Johnson & Seifert, 1994; Tenney, Cleary, & Spellman, 2009). The alternative to misinformation must be presented as a plausible story, account for the causal relationships present in the misinformation, and provide explanation as to why the initial misinformation was believable in the first place (Rapp & Kendeou, 2007; Schul & Mazursky, 1990). This is where domain expertise may aid in the effort to counter misinformation. Domain expertise allows for the evaluation of the relevancy of information in addition to guiding the search for information, assuming that one's level of expertise isn't so high that they have tunnel vision regarding constructing and solving a problem (Basadur, 1994; Hoover & Feldhusen, 1994). Although misinformation may be expertly concealed as plausible and accurate, a person with an in-depth understanding of the topic at hand will be better equipped to accept a retraction because they can more readily construct plausible alternatives to the misinformation.

H8: Domain expertise will decrease the amount of misinformation selected as relevant during the information gathering process.

H9: Domain expertise will increase the effectiveness of misinformation retractions, such that those with high domain expertise will use less misinformation in their creative solution.

Method

Design

To explore the above hypotheses, an experiment with four conditions and a control group was conducted. The experiment was a 2 (warning) by 2 (credibility) where all participants besides those in the control group were exposed to misinformation regarding the same topic, but credibility and warning were manipulated. The control group did not contain any warning, sources for the information, or misinformation. Participants were randomly assigned to conditions and the control group.

Participants

Participants were recruited from undergraduate classes at a large southwestern university. A total of 263 (71.1% female) undergraduates participated in this study. Participants were recruited through the online database for research being performed at the university and received class credit for participation. The average age of the participants was 19, with an average ACT score of 26.

Procedure

Subjects read and signed an informed consent and told they were participating in a study about marketing. After consent, participants completed a personality inventory and an intelligence test. Next, they were presented an adapted version of the Charamousse creative

problem-solving scenario developed by Gibson and Mumford (2013) (see Appendix A), wherein the new director of marketing is tasked with generating an advertising plan for a clothing store that is trying to rebrand itself as environmentally sustainable. Participants were given a brief background on Charamousse and the nature of the task before being told to review information about environmental sustainability. Participants in the four conditions were then shown 10 pieces of information related to environmental sustainability. Five of the items presented accurate information, while the other five were misinformation. The length of the pieces of information was roughly consistent and did not exceed three sentences (see Appendix B). While all participants were exposed to the same 10 pieces of information about sustainability, post-exposure warning and credibility of information varied depending on condition. Participants in the post-exposure warning condition received a warning about the information they just read prior to idea generation and drafting of their final plan which said,

> "Mr. Foster looked over the background information I gathered to inform your marketing plan. He noticed that some of the material on sustainability is not accurate and wanted me to give you a heads up. He did not give any additional info and he is unreachable for the next few days due to his travel schedule. Sorry about this!"

In terms of the credibility manipulations, information source and social network endorsement served as markers of credibility. Out of the list of 10 pieces of information, participants were asked to place a check next to the ones they find relevant in creating their final plan. Additionally, they were asked if there was any other information they'd like to know before making the final plan. If they indicated yes, they were directed to a text box to enter the additional information they would gather if given the opportunity. Next, they were shown another email which contained examples of advertising campaign ideas. Following this email,

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they were asked to generate their own ideas based on the information gathered thus far. The idea generation instructions specified that participants would have an opportunity to go into greater detail in the final plan and to simply list ideas at this stage. Then, they were asked to complete the final advertising plan. After completing the final plan, additional covariate measures of prior knowledge about sustainability, prior beliefs about sustainability, expertise about marketing and epistemic curiosity were completed. Finally, they rated credibility of the sources of information they were given about environmental sustainability and completed a demographics questionnaire.

Those in the control group followed identical procedures, but the information presented in the control group did not contain any sources or misinformation (see Appendix C).

Manipulations

Participants were told that Charamousse is trying to rebrand itself as an environmentally sustainable company in an expansion effort. After reviewing a description of the company, participants in the four conditions were presented with the same 10 pieces of information about environmental sustainability in organizations. The topics addressed in the pieces of accurate information and misinformation were similar, to ensure that neither accurate information nor misinformation disproportionately addressed one facet of environmental sustainability in organizations. Misinformation statements contained incorrect information regarding environmental sustainability in organizations and reflected features of misinformation, such as appeals to emotion and allusions to alternative explanations (Conti, Lain, Lazzeretti, Lovisotto, & Quattrociocchi, 2017). The accurate information statements were primarily based off information from reputable sources such as *Harvard Business Review*, though some pieces of

accurate information reflected a debunking of common sustainability myths. The control group

received a similar set of 10 statements, but all the misinformation was removed.

Credibility. For the high credibility condition, 8 pieces of information came from

credible sources while 2 came from non-credible sources. The credible pieces of information

were shown as coming from well-known, nationally recognized news outlets such as *The New*

York Times. For the low credibility condition, 8 pieces of information came from non-credible

sources while 2 pieces of information came from credible sources. The non-credible pieces of

information were shown as coming from unknown, unvetted sources. Those in the high

credibility condition were also told that their colleagues have successfully used the pieces of

information in prior presentations. Those in the low credibility condition received no mention of

colleagues using the information in prior presentations. (see Appendix D).

Post-exposure to Misinformation Warning. Those in the warning condition received a

warning after exposure to the information and selection of relevant pieces of information, but

prior to answering whether they'd like to know more information about environmental

sustainability in organizations. The warning indicated that the founder of the company had

looked over the background information and noticed that some of the information was not

accurate, but no additional details were provided.

Dependent Variables

The dependent variables evaluated in this study were misinformation gathering (two

forms), misinformation use, idea generation flexibility, quality, and originality and final plan

quality, originality, elegance, and final plan stance

Misinformation gathering. To measure misinformation gathering, two factors were

considered. First, participants were asked to place a check mark next to the excerpts they thought

would be relevant to the advertising plan they were being asked to create. Each participant was assigned a sum of misinformation based on the number of misinformation statements they checked as relevant. Next, they were asked to indicate (Yes or No) if they would like to search for any additional information about sustainability before crafting their final plan. If they indicated they would like to know more information, they were provided a text box and asked to list the types of information they would search for if given the option. The information listed in the text box was content coded to address whether the information participants indicated they would search for related to each of the 5 accurate and 5 misinformation statements they initially reviewed.

Three trained raters evaluated the extent to which the participant's responses in the text box reflected wanting more information from each quote using the following scale (1 = disagree—did not want more information about this statement, 2 = moderately agree, 3 = agree—did want more information about this statement). Reliabilities for these ratings was assessed using the $r*_{WG (J)}$ interrater reliability index (Lindell, Brandt, & Whitney, 1999) and values ranged from .88 to .95. To interpret the means for this outcome more easily, values were recoded after ratings were complete so that 0 would indicate disagree instead of 1. Therefore, the final ratings reflect a scale of (0 = disagree—did not want more information about this statement, 1 = moderately agree, 2 = agree—did want more information about this statement).

Misinformation use. To assess misinformation use, participants' final plans were rated on the nature of the information used in the final plan as it relates to the 10 statements presented to them. The plans were manually coded to assess whether and how much misinformation was used. Three trained raters evaluated the extent to which the participant's responses reflected information from each quote, using the following scale (1 = disagree—did not use information

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from this statement, 2 = moderately agree, 3 = agree—did use information from this statement).

Reliabilities for these ratings was assessed using the r*$_{WG (J)}$ interrater reliability index (Lindell, Brandt, & Whitney, 1999) and values ranged from .83 to .99. To interpret the means for this outcome more easily, values were recoded after ratings were complete so that 0 would indicate disagree instead of 1. Therefore, the final ratings reflect a scale of (0 = disagree—did not want more information about this statement, 1 = moderately agree, 2 = agree—did want more information about this statement).

Although participants may have incorporated misinformation in their final advertising plan, this doesn't necessarily mean that the quality, flexibility, or originality of their initial idea generation was affected or that the quality, originality, or elegance of the final advertising plan was impacted. Since prior research has established that these elements reflect desirable features of idea generation and creative problem solutions, three trained raters coded for these variables. (Todd, Higgs, & Mumford, 2019).

Idea generation flexibility, quality, and originality. Idea generation responses were rated for flexibility, quality, and originality. Flexibility was rated for number of unique categories or themes in ideas. Quality was rated for completeness, coherence, and logic. Finally, originality was rated for the extent to which ideas were original, novel, or surprising. Three trained raters evaluated these variables for ideas generated using a scale of 1 (low) – 5 (high). Benchmark examples were provided for low, average, and high points on the scale. Reliabilities were assessed using the r*$_{WG (J)}$ index and they were high, with quality at .81, originality at .84 and elegance at .80.

Final plan quality, originality, and elegance. The definition of quality and originality used to rate final plan responses remained consistent from the idea generation ratings. Elegance

was rated based on the degree to which the participant's plan was articulately arranged in a succinct way. Three trained raters evaluated these variables for the final plans using a scale of 1 (low) – 5 (high). Benchmark examples were provided for low, average, and high points on the scale. Reliabilities were assessed using the $r^*_{WG\,(J)}$ index and they were high, with quality at .81, originality at .84 and elegance at .80.

Final plan stance. The last piece of information evaluated by trained raters was whether the participant incorporated or endorsed the strategy of Charamousse becoming environmentally sustainable moving forward. Raters initially completed the stance ratings with a scale of (1 = yes, 2 = no) but this was recoded to (0 = yes, 1 = no). The reliability of this rating was assessed using the $r^*_{WG\,(J)}$ index and was .97.

Covariates

Covariates measured relate to creative problem-solving and susceptibility to misinformation. To address factors that influence creative problem-solving, intelligence, personality, expertise, and prior knowledge were measured (Todd et al., 2019; Vincent, Decker & Mumford, 2002).

Verbal intelligence was measured with the Employee Aptitude Survey (Grimsley, Ruch, Warren, & Ford, 1985), a 30-item scale where participants view 6 sets of 5 conclusions bearing on a problem. They indicate whether each conclusion is true, false or uncertain. Test-retest reliabilities for this scale have been shown to be above .80 (Grimsley et al., 1985). In this sample, the internal consistency coefficient for this measure was .82.

Personality was measured with Gill and Hodgkinson's (2007) five factor model questionnaire (FFMQ) that measures personality traits relevant to creativity. Participants were asked to indicate on a scale of 1 (highly inaccurate) – 9 (highly accurate) the extent to which a

list of adjectives describes them as a person. Each personality facet of agreeableness, conscientiousness, openness, extraversion, and neuroticism is represented by sixteen adjectives. For example, the adjective "sensitive" maps onto agreeableness. Internal consistency for agreeableness, conscientiousness, openness and neuroticism ranged from .73 - .93, so these were retained for analyses. However, the internal consistency of extraversion was .51, so it was excluded from any analyses.

Expertise was measured using a background data questionnaire developed by Scott, Lonergan, and Mumford (2005). The questions were adapted to address expertise in marketing, which is the nature of the Charamousse task. The measure included six items which asked participants to choose the response that best described them from 1 (never) – 5 (very frequently) on questions such, "How often do you think about current advertisements and marketing trends in commercials, magazine ads, etc.?" Internal consistency for this measure was .82.

Prior knowledge was measured with the Assessment of Sustainability Knowledge (ASK) Scale (Zwickle & Jones, 2018). This is a 12-item measure meant to capture knowledge relating to environmental, economic, and social domains of sustainability. An example question is, "Which of the following is an example of sustainable forest management?", followed by 4 multiple choice options. However, the internal consistency for this measure was very low at .06. Therefore, it could not be used in the analyses.

Given that prior beliefs have a strong bearing on one's openness to believing misinformation, prior beliefs around sustainability were measured (Sharrer, Bromme, & Stadtler, 2021). To capture prior beliefs, participants indicated the extent to which they agreed with 8 items pertaining to environmental sustainability in organizations, ranging from 1 (don't believe at all) – 7 (strongly believe). 4 of the items were written in favor of sustainability in

organizations, and 4 were written in opposition to sustainability in organizations. An example item in support of sustainability in organizations is, "Becoming environmentally sustainable can be a great way for an organization to reach socially conscious customers." An example item in opposition to sustainability in organizations is, "There's no benefit to an organization becoming more environmentally sustainable in terms of customer growth, as most customers don't worry about social issues when choosing who to buy from." Internal consistency for this measure was .73.

Considering that epistemic curiosity describes the motivation to seek information based on the desire to know, see, or experience (Litman, 2008), it was an important measure to capture for an information seeking experiment. Participants completed the epistemic curiosity (EC) scale, a 10-item measure that asks participants to indicate how they generally feel regarding each item. Ranging from 1 (almost never) – 4 (almost always), 5 of the items map onto epistemic curiosity diversive (EC/D) and 5 map onto epistemic curiosity specific (EC/S) (Litman & Spielberger, 2003). An example item is, "I enjoy exploring new ideas." Internal consistency for this measure was .87.

Analyses

Means, standard deviations, and correlations for all dependent variables and covariates were computed. See Table 1 below for the descriptive statistics and correlations among significant covariates and dependent variables. The correlation matrix also highlights several associations hypothesized, specifically pertaining to misinformation gathered and idea generation flexibility, quality, and originality, and final plan quality, originality, and elegance. Next, a series of analysis of covariance tests (ANCOVAs) was conducted to test the main and interaction effects of credibility and warning on misinformation gathered. Only significant covariates were

included in analyses. Another series of ANCOVAs was conducted to test the main and interaction effects of credibility and warning on final plan quality, originality, and elegance, final plan use of misinformation and stance. Next, a chi-square test of independence was used to determine if there were differences in request for additional information (Yes, No) between warning and non-warning groups, followed by an independent samples t-test to determine if the information requested in the warning conditions contained less requests related specifically to misinformation statements. Finally, two moderation analyses were performed using Hayes (2022) PROCESS macro to evaluate whether expertise impacted the gathering and use of misinformation. Given the limitations of the expertise measure, similar moderation analyses were performed using prior beliefs about sustainability, rather than expertise, as a moderator.

Insert Table 1 Here

Results

Manipulation Check

To assess the credibility manipulation, participants rated each statement source on a scale of 1 (not at all credible) – 5 (very credible) before completing demographics and finishing the survey. Results of a paired samples t-test indicate that the mean credibility ratings for the credible sources ($M = 3.5$, $SE = .03$) was statistically significantly higher than the mean credibility scores for the uncredible sources ($M = 2.77$, $SE = .03$), $t(262) = 19.12$, $p < .001$. This indicates that the source credibility manipulation was successful.

Hypotheses Tests

   Credibility and Misinformation gathered. Hypothesis 1 predicted that information

seekers would perceive a greater amount of misinformation as relevant when it comes from a

credible source. To test this hypothesis, an ANCOVA was completed on misinformation

gathered, with prior beliefs as a significant covariate. This hypothesis was not supported, as there

was no main effect of credibility. Additionally, there was no interaction effect of credibility and

warning on misinformation gathered. Results from this ANCOVA can be seen in Table 2.

Insert Table 2 Here

   Misinformation and Final plan quality, originality, elegance, and stance. Hypothesis

2 posited that misinformation gathered during the information gathering stage of the creative

problem-solving process would be associated with a) lower quality and b) lower elegance

problem solutions. To examine whether these variables are related, correlations between

misinformation gathered and final plan quality and elegance were reviewed for significance.

Misinformation gathered was significantly negatively correlated with both final plan quality ($r =$

-.15, $p < .05$) and final plan elegance ($r = -.18$, $p < .05$). This demonstrates support for hypothesis

2 (see Table 1).

   Hypothesis 3 stated that misinformation gathered during the information gathering stage

of the creative problem-solving process would be associated with more original problem

solutions. The correlation between misinformation gathered and final plan originality was

significant and negative ($r = -.15$, $p < .05$). Though this association was not significant in the

predicted direction, it provides another piece of evidence that screening misinformation as relevant is associated with creative solutions (see Table 1).

In addition to assessing these correlations, several ANCOVAs were run to assess the impact of credibility on final plan quality, originality, elegance, and misinformation used in the final advertising plan. The ANCOVAs did not return significant main or interaction effects on final plan outcomes (see Table 3). While not hypothesized, final plan misinformation use was significantly, positively correlated with final plan quality ($r = .44$, $p < .01$), originality ($r = .40$, $p < .01$), and elegance ($r = .49$, $p < .01$). Given that final plan stance did not show any significant correlations with covariates, an ANOVA was performed for final plan stance. This ANOVA showed a significant main effect of warning ($F (1,209) = 9.692$, $p < 0.01$). Those in warning conditions endorsed the concept of becoming sustainable in their final plans more ($M = .28$, $SE = .04$) than those who did not receive a warning ($M = .46$, $SE = .04$). See Table 4 below.

Insert Tables 3 and 4 here

Idea Generation. Hypotheses 4 and 5 predicted that misinformation gathered during the information gathering stage of the creative problem-solving process would be associated with more flexible, lower quality, and more original ideas generated. Correlations between misinformation gathered and idea generation flexibility, quality and originality were assessed for significance. Misinformation gathered was significantly, negatively related to idea generation quality ($r = -.17$, $p < .05$) and idea generation originality ($r = -.15$, $p < .05$). This means there is partial support for hypothesis 2, as misinformation gathered was related to lower quality idea generation. The direction of the significant correlation for idea generation originality is not as

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predicted, but still indicates a meaningful association between misinformation gathered and the originality of ideas proposed (see Table 1). While not hypothesized, final plan misinformation use was significantly, positively correlated with idea generation flexibility ($r = .17$, $p < .01$), quality ($r = .26$, $p < .01$), and originality ($r = .22$, $p < .01$).

ANCOVAs were also run to test the main and interaction effects of credibility and warning on idea generation flexibility, quality, and originality. For idea generation flexibility, prior beliefs and EAS scores were significant covariates, with a main effect of warning (F $(1,209) = 6.20$, $p < 0.05$). Those in the warning conditions showed less idea flexibility ($M = 2.39$, $SE = .088$) than those who did not receive a warning ($M = 2.45$, $SE = .088$). See Table 2 for idea generation flexibility results. For idea generation quality, prior beliefs and EAS were significant covariates, with a main effect of warning (F $(1,209) = 5.84$, $p < 0.05$). The warning conditions generated lower quality ideas ($M = 2.41$, $SE = .077$) than the non-warning conditions ($M = 2.67$, $SE = .077$). See Table 5 for idea generation quality results. Idea generation originality, with prior beliefs as a significant covariate, showed a main effect of warning (F $(1,209) = 3.83$, $p = 0.052$). Those in the warning conditions exhibited less originality in their ideas generated ($M = 2.63$, $SE = .079$) than those who did not receive a warning ($M = 2.84$, $SE = .079$). See Table 5 for idea generation originality results. Taken together, these ANCOVAs suggest that warnings may serve as a damper to idea generation, as participants may be unsure of which information to trust (see Table 5).

Insert Table 5 Here

Post-exposure to misinformation warning. Hypothesis 6 argued that warning would result in higher quality, higher elegance, and lower originality problem solutions for the final plan than no warning. To test this hypothesis, an ANCOVA with significant covariates was run for each final plan outcome of quality, elegance, and originality. The ANCOVAs indicated neither main effects of warning, nor interaction effects, on final plan outcomes (see Table 3).

Hypothesis 7 argued that misinformation warning would be more effective at reducing the search for additional misinformation than no warning. To assess this, a chi-square test of independence was run between request of additional information (yes/no) and warning condition. The chi-square indicated significant differences between warning conditions in whether information was requested $X^2(1, N = 209) = 6.37, p < .05$. More participants in the warning conditions ($n = 45$) requested additional information than in the non-warning conditions ($n = 28$), so it was important to assess the nature of the information requested. Therefore, mean differences of average misinformation in additional information requested between warning conditions and non-warning conditions were tested using an independent samples t-test. The mean of additional misinformation requested was approaching significance, with lower means in the warning conditions ($M = .21, SD = .21$) than in the no warning conditions ($M = .30, SD = .22$), $t(71) = 1.58, p = .059$. This provides support for hypothesis 7. In addition, additional misinformation requested was significantly, positively correlated with final plan quality ($r = .24, p <.01$), originality ($r = .24, p <.01$), and elegance ($r = .21, p <.01$).

Domain Expertise. Hypothesis 8 argued that domain expertise would decrease the amount of misinformation selected as relevant during the information gathering process. The environmental sustainability expertise measure was not reliable in this sample, therefore, marketing expertise was used for these analyses. Using marketing expertise as a moderator, a

PROCESS macro (Hayes, 2022) was performed with misinformation requested as the outcome variable, warning as the independent variable, and expertise as the moderator. This moderation analysis did not return significant results. One consideration to keep in mind is that the expertise measured here relates to the nature of the task (marketing) and not the nature of the information (sustainability). It is possible that sustainability expertise, when reliably assessed, could moderate the relationship between warning and selection of misinformation as relevant.

Finally, hypothesis 9 predicted that domain expertise would increase the effectiveness of misinformation warnings, such that those with high domain expertise would use less misinformation in their creative solutions. Using marketing expertise as a moderator, a PROCESS macro (Hayes, 2022) was performed with average misinformation used in final plan as the outcome variable, warning as the independent variable, and expertise as the moderator. This moderation analysis did not return significant results. As mentioned above, it should be taken into consideration that the expertise measured here relates to the nature of the task (marketing) and not the nature of the information (sustainability).

Recognizing the limitations of using marketing expertise as a moderator as opposed to a variable directly related to sustainability, two further post hoc moderation analyses were conducted. Using prior beliefs about sustainability as a moderator, a PROCESS macro was performed with misinformation requested as the outcome variable and warning as the independent variable. This moderation analysis did not return significant results.

The final moderation analysis was performed using prior beliefs about sustainability as a moderator, average misinformation used in the final plan as the outcome variable and warning as the independent variable. The results of moderation analysis indicate that warning demonstrated a main effect on final plan misinformation use ($\beta = -.42$, $\beta se = .15$, $t = -2.85$, $p < .01$; C.95 = -.70,

-.13), with prior beliefs moderating the effect of warning on average use of misinformation in final plan ($\beta = .07$, βse $= .03$, $t = -2.55$, $p < .05$; C.95 $= .02, .13$). Given that warning has a negative impact on final plan misinformation use, the positive coefficient for the interaction with prior beliefs indicates that prior beliefs strengthen this negative relationship. The more strongly you support environmental sustainability in organizations, the more effective a post-exposure warning about misinformation is at reducing the use of misinformation.

Control group means. Table 6 below shows cell means for all 5 conditions across the primary outcomes of idea generation flexibility, originality, and quality as well as final plan quality, originality, and elegance. Given that the control group did not encounter misinformation, the means from this condition were not used in any hypothesis testing.

Insert Table 6 Here

Discussion

Limitations

Before exploring the findings and implications of this study, it is important to note several limitations. To begin, information gathering is a difficult concept to study experimentally due to the nature of this stage of the creative process. During the creative process, the information search is quite broad. Successful information gatherers collect a wide range of information, identify the information that is discrepant or irrelevant, and incorporate the information that is most meaningful to the creative problem to aid in future steps of the creative problem-solving process (Mumford, Baughman, Supinksi, & Maher, 1996). In execution, this

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means that creative problem solvers have freedom to collect and attend to information as they see fit. However, this experiment constrained information gatherers to pre-selected pieces of information so the true essence of information gathering was not fully captured in this design.

Additionally, it may be beneficial to have a measure of the extent to which statements reflect misinformation or not. The accurate and misinformation statements were primarily constructed using trustworthy sources and research on features of misinformation, but a subject matter expert review of statements to get feedback on extent of accuracy or misinformation would add an additional layer of validity to the experimental conditions.

Also, given that participants were asked to generate ideas prior to constructing final plans, there was variation in the length of responses between idea generation and final plan such that idea generation responses were longer and contained more detail overall. Although participants were specifically instructed otherwise, there was a trend to put more effort into the idea generation question as it came before the final plan. Perhaps spacing out the idea generation question more from the final plan question could have prevented some of the fatigue participants likely felt when arriving at the final plan.

The next limitation concerns the subjective ratings of misinformation requested and misinformation used in the final plan. Given that all of the statements participants read contained information about the same topic, raters were asked to judge whether specific tidbits of misinformation were present in responses, so subtle uses of misinformation may have been lost in this approach.

The final limitation is that this experiment is only exploring one type of creative problem solving in the marketing/advertising domain. Expertise impacts performance on creative tasks, so it possible that those participants without marketing expertise would perform differently in

other domains (Illies & Reiter-Palmon, 2004). Even taking these considerations into mind, the present study helps to illuminate how misinformation relates to information gathering and creative problem solutions.

Findings and Implications

The present paper explores how encountering misinformation impacts search strategies used during information gathering and the viability of solutions resulting. Given that information gathering during the creative problem-solving process is critical to the production of creative solutions, this research is an important step to begin unpacking the factors which may influence strategies used during information gathering (Mumford et al., 1996).

The first set of findings concern the creative process. Specifically, how those exposed to misinformation during the information gathering stage of the creative process respond to the information and whether they produce less viable solutions after exposure. Beginning with idea generation, the amount of misinformation gathered was associated with lower quality and lower originality ideas. It's likely that when information gatherers are attending to inaccurate information, they are directing attention away from material that could be useful to producing viable solutions. During information gathering, scanning for discrepant information and attending to those discrepancies helps one to better understand the nature of information, which is a critical component of the process (Dunbar, 1995). In terms of final plans, misinformation gathered was negatively associated with final plan quality, originality, and elegance. However, misinformation use was positively associated with final plan quality, originality, and elegance and idea generation flexibility, quality, and originality. This could reflect that those who incorporated more information overall, be it misinformation or accurate, produced superior ideas and final plans to those who attended to less information overall. Given that the use of more

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misinformation in final plans is rated as higher quality, more original, and more elegant than the use of less misinformation, this may be one way in which misinformation proliferates. Perhaps if it is presented cohesively, readers do not question it as much.

The second set of findings concerns features of misinformation and the impact these features have on the creative process. Although perceived source credibility, along with the expertise of those communicating the message, can increase the persuasiveness of a message (Eagly & Chaiken, 1993; Petty & Cacioppo, 1986), this study saw no impact of source credibility on misinformation outcomes. The credibility manipulation check showed that the credibility manipulation was effective, yet credibility of sources seems to be less influential than the warning about potentially inaccurate information for the information gatherers in this study. The significant effect of warning on the idea generation outcomes, coupled with the t-test approaching significance on additional misinformation requested, demonstrates that warnings impact the use of information. For idea generation flexibility, those in the warning conditions showed less idea flexibility than those who did not receive a warning. Participants in the warning condition may have felt uncertain about what information was accurate and therefore used less of the information during idea generation. This would account for fewer unique themes. For idea generation quality, the warning conditions generated lower quality ideas than the non-warning conditions. Here again, use of less information appears to have affected the thoroughness, completeness, and utility of the ideas generated. For idea generation originality, which goes hand in hand with idea flexibility, those in the warning conditions exhibited less originality in the ideas they generated than those who did not receive a warning. The warning in this study was not targeted to specific information, so it may have put participants on high alert, but they were not able to decipher which information to trust and which information to disregard. This may make

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information gatherers more cautious and could hamper creativity in as a result. Consistent with this idea, additional misinformation requested was significantly, positively correlated with final plan quality, originality, and elegance. While more participants in the warning conditions requested additional information than in the non-warning conditions, the mean of additional misinformation requested was lower in the warning versus no warning conditions. This is an important finding because it provides another piece of evidence that post-exposure warning impacted the information gathering of those who received them.

The final set of findings pertains to the role of expertise and prior beliefs in how information gatherers respond to misinformation exposure. Though expertise should be helpful in identifying inaccurate information, that was not the case in this study. This may be due to the fact that the expertise measured pertained to the nature of the task (marketing) and not the content of the information (sustainability). Regardless, prior beliefs about sustainability in organizations did have a bearing on the impact of warnings about misinformation on use of misinformation in the final plan. Prior beliefs supporting environmental sustainability increased the effect of warning on use of misinformation in the final plan, suggesting that prior beliefs facilitated less use of misinformation. This is in line with the notion that individuals have an easier time processing messages that are consistent with prior beliefs than those that are inconsistent (Winkielman, Huber, Kavanaughm & Schwarz, 2012). Perhaps adding in a post-exposure warning enhanced the inclination of those with strong prior beliefs to not use or attend to misinformation in their final plans.

Future Directions

To continue exploring the impact of misinformation on information gathering and the creative process, several future directions can be explored. First, identifying a more concrete way

to capture misinformation use when evaluating responses could help illuminate more nuanced differences in misinformation-related outcomes. Additionally, separating the idea generation task from the final plan task experimentally and providing more explicit directions for the final plan could help increase participant effort on that part of the task. Finally, given that a general post-exposure warning hampered creativity, it would be interesting to explore whether adding detail to a targeted post-exposure warning in the future would improve creativity instead.

Misinformation could also have effects on other creative processes that were not examined in this study. For example, conceptual combination with inaccurate information could hinder the ways in which participants work with ideas and concepts to combine and reorganize information. Likewise, misinformation could interfere with solution monitoring if certain implementation parameters or constraints go unrecognized due to misinformation.

Conclusion

The impact of misinformation on the creative process and, ultimately creative solutions, is complicated. On the one hand, misinformation gathering is bad for idea generation and final solution quality, originality, and elegance. On the other hand, post-exposure warnings about possible misinformation seem to constrain some information gathering behaviors and creative output. This implies that other approaches to managing misinformation may be needed in directing information gathering for creative work. Perhaps non-specific pre-exposure warnings would be helpful or reminders to check the validity of all information gathered would be helpful. These could be fruitful avenues for future research.

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Appendix A: Charamousse Marketing Task

General Instructions

In this portion of the experiment, you will take the role of the Director of Marketing at Charamousse Clothing Company. Charamousse sells a highly unique type of clothing. After reading the company background, your first assignment as Charamousse's head of advertising is to review information about an idea currently on the table and create a final advertising campaign to be used by Charamousse as it attempts to rebrand itself.

You will work through this exercise at your own pace.

Charamousse Clothing Corporation

Company History

Charamousse Clothing is a Chicago-based specialty retailer providing a unique product to the consumer who wants to be an individual. Founded in 1998 by Montgomery Foster, Charamousse was a reaction to what Montgomery saw as an increasing mechanized and anonymous culture of consumerism. Foster fulfilled his goal by creating original clothing in limited numbers. A new shirt would only be created in limited runs ranging from as large as 100 to as few as 1. Each piece is individually numbered showing that you possess a unique product rather than the same shirt that everybody else wears. Charamousse has 14 stores across the Midwest, typically operating in malls and high-profile locations in metropolitan areas.

Charamousse is structured in such a way that positions are below Mr. Foster in a clearly defined chain of command. Store representatives report to managers who report to branch managers who report to the greater corporate office of Charamousse Clothing. However, individual workers are the most important resource to Charamousse, which is to say that the company owns few machines and typically produces its clothing domestically by leasing the necessary tools closer to the individual stores. Along similar lines, employee input is highly valued in this company.

Current Situation

Due to several high-profile celebrity converts in the early 2000s, Charamousse's revenue grew by double digits each year-on-year until 2007 when growth slowed to a halt. **To reverse this trend, Foster has decided that it is time for Charamousse to rebrand itself as an environmentally sustainable organization. You were recently hired to look over current development plans and help create a final advertising campaign to promote the company as environmentally sustainable.** As Foster is convinced that rebranding is an important goal, failure to accomplish this goal would significantly affect the functioning of the company. You will be provided information about environmental sustainability to help craft a plan for the marketing campaign.

To begin, you will be given information about the profile of a typical Charamousse customer. Then, you will be given information about environmental sustainability and aspects of a proposed marketing plan so you can make informed decisions about the best way to proceed.

Customer Profile: Charamousse has typically been popular with both males and females. Primary purchasers are typically younger and affluent. Stores are located only in populated Midwestern towns, so no geographic data is known. Students seem to like our products but may have trouble affording them.

Environmental Sustainability Statements: *Participants are randomized to experimental conditions with credibility and warning manipulated*

After reviewing information about Charamousse and environmental sustainability in organizations, the following email arrived in your inbox:

From: Colleen.Anderson@Charamousse.com
To: advertising@Charamousse.com
Subject: Ad Campaign
CC: M.Foster@Charamousse.com

Thank you for reviewing background information before generating an advertising plan. Below is a list of potential aspects of our ad campaign rebranding Charamousse as environmentally sustainable. This list is extensive but should not be considered exhaustive:

•   Blanket television/radio/print campaign

•   Road shows featured at colleges or concerts

•   Discount programs (i.e. 10% off for members)

•   Larger social networking presence

•   Hire popular celebrities to wear Charamousse clothing

•   Fashion shows

Colleen Anderson
Senior Vice President Charamousse Clothing Company
104 E Roosevelt Road
Wheaton, IL 60187
Telephone: 630.248.0589

Idea Generation

Now that you have gathered information from Charamousse, you will have the opportunity to freely generate as many ideas as you can to rebrand their environmental image. For example, to advertise that Charamousse is now an environmentally sustainable company, you might have the following ideas:

- Hire Instagram influencer to promote Charamousse
- Put on a sustainable fashion show

Of course, there are many other ideas that can be used around this advertising plan. Please use the space below to generate your own ideas (and do not use those from the example).

You will have the opportunity to go into greater detail in the final plan, so just list ideas in this exercise.

Final Plan

It is now time to create a final advertising plan.

Take the information you've learned about environmental sustainability, the list of ideas from Colleen, and any new ideas that you have had, and make a clear plan for how we as a company can successfully rebrand ourselves

Appendix B: List of Accurate and Misinformation Statements

Accurate Statements:

1. "A survey by Nielsen shows that millennials are twice as likely as baby boomers to say they are changing habits to reduce environmental impact. This demonstrates that corporate brands can increase their value tremendously by focusing on sustainability, and many of the world's leading brands are doing just that. Companies that embed sustainability into their business models and corporate governance can have a lasting competitive advantage."

2. "Business sustainability is the practice of operating a business without impacting the environment negatively. A green business functions in the best interests of the local and global environment, meaning it supports the community and economy dependent on a healthy planet. An environmentally aware business considers more than just profits — it considers its impact on society and the environment."

3. "People view sustainability as a plus, and companies with green values are eager to showcase them because of that fact. Going green shows the world you care about more than just making money. You can use this to your advantage when marketing your business and developing your brand identity."

4. "Every company has a connection to the environment, and any business consultant will tell you that can't profit without a planet. Destroying the environment comes with severe financial costs, and it is in the best interest of every corporation to preserve resources and the environment through business sustainability strategies."

5. "Research is finding that 21st century employees are focusing more on mission, purpose, and work-life balance. Companies that invest in sustainability initiatives tend to create sought-after culture and engagement due to company strategy focusing more on purpose and providing value to society. In addition, companies who embed sustainability in their core business strategy treat employees as critical stakeholders, just as important as shareholders."

Misinformation Statements:

6. "Many companies are buying their electricity from renewable energy, which saves them money in addition to emitting fewer carbon emissions. But environmentalists are never satisfied and have made it difficult for those companies to claim they are sustainable since rare materials used in solar panels are mined unsustainably, the panels themselves are not recyclable and solar energy companies do not effectively track their carbon emissions. In the end, those businesses who have tried to become sustainable end up in a worse position."

7. "Companies large and small are learning that sustainable business practices don't really help the environment and can decrease profitability. What should be improved efficiency turns into massive delays in production, which upsets customers and leads to a loss in

business. Though environmentalists would like organizations to believe good environmental and social stewardship is now front and center in fundamental business strategies, there aren't many examples where this is the case."

8. "Employees are less likely to be engaged when working for eco-friendly organizations. Environmental companies are a major red flag to employees looking to make a livable wage, since sustainability efforts can be so expensive for an organization. In fact, one out of every four employees would look for a new job if they discovered their employer planned on becoming more environmentally sustainable."

9. "Sometimes social motivators, such as becoming sustainable, can backfire. If only a few people are engaging in a sustainable behavior, it may appear to be not socially approved of, thus discouraging adoption. In such instances, companies can run the risk of seeming out of touch for trying to advocate for the positive elements of becoming sustainable."

10. "It's too expensive for a corporation to go green, as the cost reduction in energy savings gained by becoming more sustainable will never be enough to offset the initial upfront conversion costs. In some states, switching to sustainable practices can also increase taxes, as politicians have a motivation to keep oil and gas companies satisfied and sustainability can hurt the oil and gas industry."

Appendix C: Control Group Statements with no Misinformation

1. "A survey by Nielsen shows that millennials are twice as likely as baby boomers to say they are changing habits to reduce environmental impact. This demonstrates that corporate brands can increase their value tremendously by focusing on sustainability, and many of the world's leading brands are doing just that. Companies that embed sustainability into their business models and corporate governance can have a lasting competitive advantage."

2. "Business sustainability is the practice of operating a business without impacting the environment negatively. A green business functions in the best interests of the local and global environment, meaning it supports the community and economy dependent on a healthy planet. An environmentally aware business considers more than just profits — it considers its impact on society and the environment."

3. "People view sustainability as a plus, and companies with green values are eager to showcase them because of that fact. Going green shows the world you care about more than just making money. You can use this to your advantage when marketing your business and developing your brand identity."

4. "Every company has a connection to the environment, and any business consultant will tell you that can't profit without a planet. Destroying the environment comes with severe financial costs, and it is in the best interest of every corporation to preserve resources and the environment through business sustainability strategies."

5. "Research is finding that 21st century employees are focusing more on mission, purpose, and work-life balance. Companies that invest in sustainability initiatives tend to create sought-after culture and engagement due to company strategy focusing more on purpose and providing value to society. In addition, companies who embed sustainability in their core business strategy treat employees as critical stakeholders, just as important as shareholders."

6. "Many companies are buying their electricity from renewable energy, which saves them money in addition to emitting fewer carbon emissions. But there are concerns that rare materials used in solar panels are mined unsustainably, the panels themselves are not recyclable and solar energy companies do not effectively track their carbon emissions. In the end, it can be very difficult for a firm to have accountability for being sustainable."

7. "Companies large and small are learning that sustainable business practices help the environment and can increase profitability. Development of sustainable business practices lends itself to efficient operations that streamline efforts and conserve resources, which enhances employee productivity and reduces cost. Reducing cost can also encompass energy conservation strategies that can be as simple as turning off unnecessary lights and insulating walls to more sophisticated efforts such as installation of geothermal heating and cooling systems."

8. "People like to be associated with the positive, especially younger generations raised on a steady diet of environmental protection messages. They do not want to be linked to companies implicated in ecological disasters and social welfare scandals. Show your company as respectful of the environment and of its employees and it will attract the caliber of people whom you want to employ and the funds your business needs to expand."

9. "Sometimes social motivators, such as becoming sustainable, can backfire. If only a few people are engaging in a sustainable behavior, it may appear to be not socially approved of, thus discouraging adoption. In such instances, companies can enlist advocates to promote the positive elements of the product or action. Advocates are most compelling when they themselves have undertaken the behavior."

10. "Though shifting business practices to be more environmentally friendly can be expensive in up-front costs, going green can actually save money for you and your business. Helping your company become more environmentally conscious can be a lot easier than you might think: A move as simple as installing solar panels can cut your taxes by nearly a third of the installation cost — and could cut your energy bills in half."

Appendix D: Credibility Manipulations

Instruction for information selection in credible condition:

Below are facts about environmental sustainability in organizations. **Your colleagues have successfully used these pieces of information in previous presentations**. Please place a check mark next to the information you think will be relevant for your final plan.

Credible sources:

1. *Forbes*
2. *The Chicago Tribune*
3. *Reuters*
4. *The Wall Street Journal*
5. *The Washington Post*
6. *The New York Times*
7. *MSNBC*
8. *Wired*

Instructions for relevant information selection in non-credible condition:

Below are facts about environmental sustainability in organizations. Please place a check mark next to the information you think will be relevant for your final plan.

Non-credible sources:

1. *Marketing Miracles Blog*
2. *The Breakfast Tribune*
3. *The Plain Observer*
4. *Vista News*
5. *Curious Curator Blog*
6. *Patriot Weekly*
7. *Mona's Marketing Minute*
8. *The Everyday Voice*

Table 1

Correlation Matrix for Dependent Variables and Covariates

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Final Plan Quality	2.68	0.95	-																	
2. Final Plan Originality	2.72	0.96	.87**	-																
3. Final Plan Elegance	2.71	0.96	.91**	.83**	-															
4. Final Plan Stance	0.37	0.45	-0.47*	-.47**	-.49**	-														
5. Idea Generation Flexibility	2.43	0.92	.49**	.50**	.49**	-.29**	-													
6. Idea Generation Quality	2.55	0.82	.57**	.56**	.56**	-.40**	.81**	-												
7. Idea Generation Originality	2.75	0.80	.43**	.50**	.42**	-.30**	.67**	.69**	-											
8. Misinformation Gathered	1.26	1.45	-.15*	-.15*	-.18**	.19**	-0.12	-.17*	-.15*	-										
9. Final Plan Misinformation Use	0.16	0.21	.44**	.40**	.49**	-.52**	.17**	.26**	.22**	-0.07	-									
10. Additional Misinformation Requested	0.08	0.17	.24**	.24**	.21**	-0.05	0.12	.14*	.15*	-0.07	0.02	-								
11. Agreeableness	105.17	18.77	0.11	0.11	0.10	0.03	0.11	0.1	0.05	-0.06	0.00	0.11	-							
12. Conscientiousness	88.56	11.00	.13*	0.10	.15*	-0.09	0.08	0.12	0.06	-0.13	.14*	0.04	.23**	-						
13. Openness	90.2	13.55	.21**	.21**	.15*	-0.11	.18**	.20**	.13*	-0.02	0.06	0.03	.19**	0.11	-					
14. Neuroticism	78.77	14.19	0.03	0.04	0.00	0.07	-0.02	-0.04	0.00	-0.01	-0.08	0.09	0.00	-.21**	-0.02	-				
15. Epistemic Curiosity	13.49	2.90	0.05	0.11	0.03	-.12*	0.12	0.11	.16**	-0.01	0.07	-0.05	-0.01	0.01	.37**	-0.03	-			
16. Expertise	2.43	0.77	0.01	0.01	0.02	0.06	0.03	0.00	-0.01	.15*	0.01	-0.1	-0.08	-.14*	-0.04	-0.02	.24**	-		
17. Prior Beliefs	5.01	0.80	.27**	.22**	.24**	-0.11	.18**	.26**	.21**	-.19**	.15*	.14*	.19**	.15*	.26**	0.04	.14*	-.21**	-	
18. Intelligence	22.5	7.23	.24**	.21**	.19**	-0.12	.17**	.19**	0.05	-.14*	0.04	0.1	0.12	.15*	0.11	0.09	-0.02	-0.01	.21**	-

*p < .05. **p < .01.

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Table 2.

ANCOVA Results for Misinformation Gathered

	SS	df	MS	F	Sig.	η_p^2
Prior Beliefs	16.34	1	16.34	**8.28**	**0.00**	0.04
Credibility	1.07	1	1.07	0.54	0.46	0.00
Warning	2.72	1	2.72	1.38	0.24	0.01
Credibility * Warning	0.69	1	0.69	0.35	0.56	0.00

Note. n = 209. Significant effects are highlighted in bold.

Table 3.

ANCOVA Results for Final Plan Quality, Originality, and Elegance

	Final Plan Quality						Final Plan Originality						Final Plan Elegance					
	SS	df	MS	F	Sig.	η_p^2	SS	df	MS	F	Sig.	η_p^2	SS	df	MS	F	Sig.	η_p^2
Intelligence	7.62	1	7.62	**8.86**	**0.00**	0.04	6.56	1	6.56	**7.41**	**0.01**	0.04	4.96	1	4.96	**5.78**	**0.02**	0.03
Prior Beliefs	13.35	1	13.35	15.52	<.001	0.07	8.68	1	8.68	**9.80**	**0.00**	0.05	11.64	1	11.64	**13.56**	**<.001**	0.06
Credibility	0.13	1	0.13	0.15	0.70	0.00	0.03	1	0.03	0.03	0.87	0.00	0.02	1	0.02	0.02	0.89	0.00
Warning	0.08	1	0.08	0.09	0.76	0.00	0.28	1	0.28	0.32	0.57	0.00	0.87	1	0.87	1.02	0.31	0.01
Credibility * Warning	2.79	1	2.79	3.24	0.07	0.02	1.85	1	1.85	2.09	0.15	0.01	2.26	1	2.26	2.63	0.11	0.01

Note. n = 209. Significant effects are highlighted in bold.

Table 4.

ANOVA Results for Final Plan Stance

	SS	df	MS	F	Sig.	η_p^2
Credibility	0.02	1	0.02	0.10	0.75	0.00
Warning	1.87	1	1.87	**9.69**	**0.00**	0.05
Credibility * Warning	0.05	1	0.05	0.26	0.61	0.00

Note. n = 209. Significant effects are highlighted in bold.

Table 5.

ANCOVA Results for Idea Generation Flexibility, Quality, and Originality

	Idea Generation Flexibility						Idea Geneartion Quality						Idea Generation Originality					
	SS	df	MS	F	Sig.	η_p^2	SS	df	MS	F	Sig.	η_p^2	SS	df	MS	F	Sig.	η_p^2
Intelligence	7.04	1	7.04	**8.86**	**0.00**	0.04	4.87	1.00	4.87	**7.93**	**0.01**	0.04	-	-	-	-	-	-
Prior Beliefs	3.10	1	3.10	**3.90**	**0.05**	0.02	5.18	1.00	5.18	**8.42**	**0.00**	0.04	5.97	1	5.97	**9.21**	**0.00**	0.04
Credibility	0.15	1	0.15	0.19	0.66	0.00	0.04	1.00	0.04	0.07	0.80	0.00	0.27	1	0.27	0.41	0.52	0.00
Warning	4.93	1	4.93	**6.20**	**0.01**	0.03	3.57	1.00	3.57	**5.81**	**0.02**	0.03	2.49	1	2.49	**3.83**	**0.05**	0.02
Credibility * Warning	0.00	1	0.00	0.00	0.95	0.00	0.01	1.00	0.01	0.01	0.93	0.00	0.01	1	0.01	0.01	0.91	0.00

Note. n = 209. Significant effects are highlighted in bold.

Table 6.

Condition Means on Idea Generation and Final Plan Outcomes

	c1: C*W		c2: C*NW		c3: C*NW		c4: NC*NW		c5: control	
	M	SD	M	SD	M	SD	M	SD	M	SD
Final Plan Quality	2.74	0.97	2.54	0.97	2.59	1.06	2.80	0.97	2.77	0.81
Final Plan Originalty	2.69	0.92	2.55	1.02	2.61	1.11	2.80	0.89	2.94	0.82
Final Plan Elegance	2.71	0.99	2.56	1.02	2.67	1.03	2.89	0.86	2.86	0.89
Idea Generation Flexibility	2.21	0.94	2.33	0.88	2.55	0.88	2.62	0.99	2.48	0.89
Idea Generation Quality	2.40	0.84	2.42	0.84	2.68	0.80	2.68	0.81	2.60	0.80
Idea Generation Originality	2.57	0.84	2.69	0.82	2.82	0.86	2.89	0.76	2.82	0.73

Note n = 263. c = condition, C = credibility, W = warning.