HAVE YOU HEARD OF CELL-CULTURED MEAT? ATTITUDE CERTAINTY'S EFFECTS ON CONSUMER INFORMATION SHARING ABOUT INNOVATION

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So whether you eat or drink or whatever you do, do it all for the glory of God.
1 Corinthians 10:31

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ABSTRACT

Among the factors influencing consumer innovation acceptance in the context of health, interpersonal communication is highly understudied. This project focuses on one dimension of interpersonal communication by exploring how attitudinal differences between communicators influence information sharing. Two studies are reported using a diffusion chain framework to explore the effects of attitude strength on the amount and type of information shared about an innovation. Study 1 identified a tendency for those with greater certainty to share more than those without certain attitudes. There was also a tendency for those with unfavorable attitudes and those with extreme attitudes to share a greater proportion of attitudinally consistent information. These findings were not found to be significant. Study 2 failed to support the hypotheses that the first chain member's attitude or message influences the amount or type of information shared by the second chain member. Results suggest that the relationship between attitudes and information sharing may be more complex than suggested by previous research.

Keywords: attitude certainty, information sharing, interpersonal diffusion chains

HAVE YOU HEARD OF CELL-CULTURED MEAT? ATTITUDE CERTAINTY'S EFFECTS ON CONSUMER INFORMATION SHARING ABOUT INNOVATION

> *"With a greater knowledge of what are called hormones, i.e. the chemical messengers in our blood, it will be possible to control growth. We shall escape the absurdity of growing a whole chicken in order to eat the breast or wing, by growing these parts separately under a suitable medium."*
> - Winston Churchill, 1931

Churchill was correct in his prediction that science would advance to the point when meat could be grown. Cell-cultured meat, also known as clean, lab-grown, and in vitro meat, is grown under controlled conditions outside of an animal's body. Given this meat production method's innovative nature, we expect consumers to perceive cell-cultured meat as controversial once it is available in the consumer market. Recent studies found that consumers recognize the positive benefits on animal welfare and the environment (Bryant & Barnett, 2018; Hocquette et al., 2015; Mancini & Antonioli, 2019; Tucker, 2014; Weinrich et al., 2020); however, also raise concerns considering the product's unnaturalness, taste, and feelings of disgust (Bryant & Barnett, 2018; Laestadius & Caldwell, 2015; Siegrist et al., 2018; Egolf et al., 2019; Tucker, 2014; Verbeke et al., 2015a; Verbeke et al., 2015b; Wilks & Phillips, 2017). With these considerations in mind, most respondents in the US market indicated they would try cell-cultured meat, but only a third were willing to eat it regularly as a replacement for farmed meat (Wilks & Phillips, 2017). Once innovators bring cell-cultured meat to market, consumers will need to consider their attitudes and decide whether they feel comfortable serving lab-grown meat to their families.

This project explores the impact of interpersonal social influence on consumer attitudes and choices in the context of food innovation. When considering innovation adoption, a significant portion of scholarly research focused on the effects of expert communication mediated through the

mass media on non-expert risk perception (for a review, see McComas, 2006). For example, some evidence, which used expert communicated information about cell-cultured meat, suggests increased familiarity is associated with consumer acceptance (Bekker, et al., 2017; Wilks & Phillips, 2017). However, interpersonal communication is an important source of influence on innovation adoption (Newman, 2019). Specifically, in the context of food choices, people are influenced by those they share a table with, such as their family, friends, and coworkers (Christakis & Fowler, 2007; Connors et al., 2001; Sobal & Bisogni, 2009). Conversations among these close ties influence the more extensive social network, at times leading to a systemic amplification of judgments (Helbing et al., 2015).

One way to study this interpersonal influence is through experimental interpersonal diffusion chains, which have been used in other contexts such as medical innovations. As described by Moussaïd et al. (2015), these chains consist of a series of unique people who attempt to inform one another about a topic of interest, therefore replicating people's experiences talking about new information to others within their social network. Moussaïd et al. (2015) used diffusion chains to study the adoption of medical innovation and observed that original information becomes increasingly fewer and more inaccurate while people's judgments shift to align with the presented information. The proposed studies aim to add to this line of research by focusing on the role of attitude strength, specifically attitude certainty, valence, and extremity, which have been shown to affect information sharing and innovation adoption in other social contexts, such as in the context of small, interacting groups (Forsyth, 2018).

An attitude is a summative evaluation of some object – person, thing, group, or idea (Eagly & Chaiken, 2007; Fazio & Olson, 2003; Fazio & Petty, 2008). Variation in attitude strength allows people to prioritize consequential attitudes from inconsequential ones in behavioral and

communicative contexts (Krosnick & Abelson, 1992; Krosnick et al., 1993; Krosnick & Petty, 1995). Attitude strength comprises an assortment of distinct dimensions that are moderate or lowly correlated (see Krosnick & Abelson, 1992 for an overview of studies). One dimension of attitude strength, *attitude certainty*, refers to the subjective sense of confidence a person has in their attitude. For example, one may feel certain, neither certain nor uncertain, or not certain in their attitude (Budd, 1986; Krosnick & Schuman, 1988). Another dimension, *attitude valence*, refers to a person's preference to like or dislike something. Lastly, *attitude extremity* refers to the degree a person feels positive or negative toward an object (Judd & Johnson, 1981; Tannenbaum, 1956; Krosnick et al., 1993). Across diverse literature, measures of attitude strength are related to the adoption of new technologies (Johnson & Reimer, 2021; Khalifa & Cheng, 2002; Kim et al., 2009; Sarker et al., 2005; Tormala & Rucker, 2007). We extend this line of research by using an interpersonal diffusion chain framework to identify the effects of attitudes on the features of a recollection message and the attitude of others within a chain.

Theoretical underpinnings of this approach are informed by literature highlighting information sharing in the context of innovation and the role of attitudes in the adoption and acceptance of technological innovations. Following this overview, two studies investigate attitude strength's influence on information sharing. Study 1 proposes and tests hypotheses about the impact of specific measures of attitude strength on the amount and type of information shared. Study 2 builds on Study 1 by determining if the amount and type of information shared in an interpersonal diffusion chain mediate the relationship between Chain Member 1's attitude strength and the features of Chain Member 2's message.

Information Sharing about Innovation

A large body of work explored the role of expert communication in non-expert risk perception when information is filtered through the mass media. Experts use all media types to communicate health innovation and new technology, including print media, broadcast media, outdoor media, and the internet. However, mediated information is not always used as intended. A lay audience typically considers other factors, such as their attitude, which is beyond that communicated by experts (McComas, 2006). Given the influence of attitudes and the increased opportunity for consumers to share information through social media, exploring interpersonal communication about innovation is important.

Evidence in interpersonal communication literature suggests that information within social networks does not spread independently of opinions. Instead, attitudes are weaved into the messages shared between consumers, and attitude-laced messages influence behavior. For example, Campbell and Salathé (2013) and Salathé and Bonhoeffer (2008) report that when people with a negative attitude toward vaccinations communicate, the negative attitude propagates well. During conversations, new information about the safety of vaccines is often absent; instead, antivaccination attitudes are reinforced. These conversations can result in clustered networks with a large proportion of unvaccinated people. This phenomenon, as defined in the Social Amplification of Risk Framework (SARF), can explain why minor risks, as assessed by experts, sometimes evolve into amplified risks when interpreted and shared by laypeople (Burns et al., 1993; Kasperson, 1992; Kasperson & Kasperson, 1996; Kasperson et al., 1988). Diffusion of innovation research describes how information spreads through large communities by way of the mass media. This proposal focuses on situations where people come across information about an innovation and decide which information they want to share with others.

Diffusion chains, a subset of diffusion of innovation research, broaden the scope of communication research by making it possible to identify how a message evolves after people take in novel information and share it with others within an interpersonal setting (Bartlett, 1932). Diffusion chains work similarly to the children's 'Telephone' game and provide a simulation model of how information may propagate through social networks. In diffusion chain studies, the first chain member reads a text and recollects the information for the succeeding chain member. The second chain member reads the first member's recollection, and the third member reads the second member's recollection before providing their recollection. This transmission framework continues throughout the length of the chain (Mesoudi et al., 2006).

Moussaïd et al.'s (2015) interpersonal diffusion chains replicate a situation when someone uses newly acquired information to communicate about a medical innovation generally. Moussaïd et al. (2015) observed that as messages flow through a diffusion chain, the information changes greatly; it becomes degraded and distorted, in other words, shorter and less accurate (Bonito, 2007; Carlson, 2019; Moussaïd et al., 2015). As the information changes, it aligns more closely with the risk assessment of the prior speaker and influences the messages shared by succeeding chain members. For example, when a chain member shares a greater proportion of negative information about an innovation, the succeeding chain members also share negative information. Additionally, in Moussaïd et al.'s study (2015), participants changed their risk assessment to become increasingly risky compared to their assessment before participating in the information-sharing task. Considering the observed information and judgment changes, this project builds on Moussaïd et al. (2015) by seeking to understand how attitudes, precisely attitude certainty, valence, and extremity, affect information sharing and innovation acceptance. We highlight measures of attitude strength because research in other domains indicates attitudes influence consumers' willingness to

accept an innovation like cell-cultured meat (Hocquette et al., 2015; Wilks & Phillips, 2017). Further, research on interacting groups demonstrates that individuals' attitudes and preferences affect how much and which information they share in social contexts (Reimer et al., 2010; Johnson & Reimer, 2020).

The Role of Attitudes in Innovation Acceptance

Attitudes can be defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly & Chaiken, 2007, p. 598). The entity under evaluation is referred to as an attitude object. It may be abstract (animal cruelty) or concrete (cell-cultured meat) and individual (Tyson Foods), or collective (factory farms) (Eagly & Chaiken, 2007). Attitudes toward objects are formed, maintained, and modified over time as one engages with their environment and social context (Katz, 1960; Smith et al., 1956). Once formed, attitudes help interpret new information (Jonas et al., 1997) and guide our behavior (Fazio & Zanna, 1978b).

Previous research suggests that when responding to a stimulus such as innovation information shared with others depends on a communicator's attitude strength (Krosnick & Abelson, 1992; Krosnick & Petty, 1995; Krosnick et al., 1993). Attitude strength has frequently been studied as a single concept; however, it comprises an assorted set of unique dimensions, including certainty, valence, and extremity. It is reasonable to assume these dimensions would be highly correlated, but Krosnick and Abelson (1992) reference several studies which identify low to moderate positive correlations across these dimensions. The dimensions are conceptually and empirically distinct (Allport & Hartman, 1925; Fazio & Zanna, 1978a; Johnson, 1940; McDill, 1959; Mehling, 1959). Considering how differences in attitude strength may influence information

sharing and the adoption of controversial new technologies such as cell-cultured meat, this study identifies three dimensions: attitude certainty, valence, and extremity.

One reason for differences in effects between various measures of attitude strength across contexts may be related to how attitudes are formed. Specifically, affective attitudes may influence innovation adoption even if knowledge or experience shaping cognitive attitudes are limited (Eagly & Chaiken, 1993, 1998, 2007). In the context of cell-cultured meat, we assume that people can form attitudes quickly or already hold an attitude even though they have relatively little knowledge. The topic, *cell-cultured meat,* may trigger values in a respondent's value system. This value system then leads people to pay attention to and prefer information that confirms their overall values and general attitudes (Graf & Aday, 2008; Knobloch-Westerwick & Meng, 2011). Confirmatory information helps form an affective attitude quickly (Ajzen, 2012; Yang & Yoo, 2004). Therefore, it may well be that even though deciders did not think much about the attitude object, they can establish an attitude and even strong attitudes that may inform their technology adoption (Prislin, 1996). For example, there is evidence that even without prior experience or much knowledge, women tend to feel strongly about contraceptives and indicate their willingness to use contraceptives upon their availability (Valente et al., 1998). In the current context, previous research revealed that attitudes influence a person's willingness to accept cell-cultured meat (Hocquette et al., 2015; Wilks & Phillips, 2017).

Attitude Certainty's Influence on Information Sharing

Attitudes can influence all phases of the communicative process, including information evaluation, selection, and sharing. Previous information sharing research like Moussaïd et al. (2015) highlighted the influence of values but did not explicitly test to what extent attitudes influence information sharing and innovation adoption. We build on Moussaïd et al. (2015) by

considering the impact of attitude certainty, valence, and extremity on the amount and type of information shared about cell-cultured meat. First, we consider if attitudes influence the amount and type of information shared. Second, we determine if the first chain member influences the information shared by those further down the chain. Unlike Moussaïd et al.'s (2015) studies, we aimed to identify how much information people share and the proportion of it, which is consistent with their attitude. In other contexts, a person's attitude strength has been shown to influence the amount and type of information they share (Cheatham & Tormala, 2015; 2017; Van Strien et al., 2016).

The relationship between attitude certainty and information sharing in previous research is inconclusive. Most studies supported the hypothesis that the more certain people are of their attitudes, the more likely they are to share more information and advocate for their attitude (Cheatham & Tormala, 2015). However, some evidence suggests low certainty can increase information sharing for different reasons (Cheatham & Tormala, 2017). On the one hand, Cheatham and Tormala (2015) asked participants to report their attitude toward various controversial policy issues and to indicate how likely they would be to share their views on these issues with others. They found that attitude certainty increased information sharing and persuasion intentions across policy issues, including GMOs, school prayer, flag burning, school vouchers, and gun control. These effects were largely independent of attitude valence.

On the other hand, evidence suggests that the relationship between certainty and information sharing is not linear but best represented as a J-shaped curve. For example, Cheatham and Tormala (2017) built upon Cheatham and Tormala (2015) by including an information-sharing task. Participants were asked to think of an issue they felt either very uncertain, somewhat certain, or very certain about and then write a topical message to someone who did not necessarily hold

the same views. They found that people without certain attitudes shared more information than those with moderate certainty to resolve feelings of uncertainty. Individuals with certain attitudes shared more information than those who were neither certain nor uncertain and those who were not at all certain. In this case, those with certain attitudes included informative and persuasive messaging about the attitude object. Alternatively, those without a certain attitude shared more information than those who were neither certain nor uncertain. For these individuals, the shared information was informative rather than persuasive. Cheatham and Tormala (2017) identified variations in motives as a mediator of information sharing among those with varying attitude certainty to explain the curvilinear relationship.

According to this motive-based explanation, the type of information individuals with high certainty choose to share is motivated by a desire to defend their existing attitude, while those with low certainty are motivated to reduce doubt in their attitudes. Research supports that those with certain attitudes are motivated to defend their evaluations and share information supporting the attitude's legitimacy (Cheatham & Tormala, 2015). Alternatively, those who lack certain attitudes are motivated to increase their certainty by forming an accurate evaluation. One way to bolster an attitude is by sharing pro-attitudinal information. By sharing information, those with uncertain attitudes can compensate for their uncertainty and reduce undesired feelings of uncertainty (Cheatham & Tormala, 2017). Feeling motivated to form certain attitudes explains why those with low attitude certainty shared more information than those who were neither certain nor uncertain in Cheatham and Tormala (2017).

It is essential to recognize that the motive and context of the information-sharing task, including the familiarity of the attitude object and similarity in attitudes between the message sender and receiver, are closely tied to the observed study effects. For example, in a context where

the public held a range of attitudes, Cheatham and Tormala (2017) specified that the audience held a different attitude towards a familiar issue than the participant. The context of the information-sharing task motivated participants to share information that either maintained or strengthened their attitude toward the object. It is unclear whether people are similarly motivated given a situation when the audience's characteristics are undefined and the attitude object is novel, like in Moussaïd et al.'s (2015) studies. This study explored if the relationship between attitude certainty and the quantity of information shared is best represented linearly or curvilinearly when participants are presented with novel information about an unfamiliar attitude object and are then prompted to share what they believe is relevant to an unfamiliar audience.

Two competing hypotheses are proposed to test the relationship between attitude certainty and the quantity of information shared. Hypothesis 1_a asserts that those with a certain attitude will share more pieces of information than those who are moderately certain or not at all certain in their attitude. These individuals may be motivated to influence the following chain members by selecting and sharing as much confirming information as possible. Hypothesis 1_b differs by introducing a potential curvilinear relationship. Those with a certain or not at all certain attitude will share more information than those who are moderately certain in their attitude. This assertion is rooted in the premise that even if participants are unfamiliar with an innovation, they will use the information-sharing task to form and strengthen their attitude toward cell-cultured meat. Uncertain information sharing is driven by the desire to bolster one's attitude and manage how one is perceived by others. By sharing information, participants can reduce undesired feelings of uncertainty and seem more certain.

Hypothesis 1_a: Those with high levels of attitude certainty will share more information than those with moderate or low levels of attitude certainty.

Hypothesis 1_b: Those with high or low levels of attitude certainty will share more information than those with moderate levels of attitude certainty.

In addition to the quantity of information shared, we predict attitude certainty will affect whether the information people share is consistent or inconsistent with their preexisting attitudes after receiving a set of information about an innovation. Humans can prioritize new information based on their preexisting knowledge and attitudes (Clark et al., 2008; Hart et al., 2009; Sawicki et al., 2011). This preference referred to as selective exposure, a congeniality bias (e.g., Eagly & Chaiken, 1993, 1998, 2005), and a confirmation bias (e.g., Jonas et al., 2001), allows people to consider their attitudes and seek out specific types of information over others (Sears & Freedman, 1967; Zillman & Bryant, 1985). We expect that depending on their attitude, participants prefer certain information types over others during an information-sharing task.

Similar to findings related to the quantity of information shared, people, review the available information with varying aims. In general, people prefer pro-attitudinal information compared to counter-attitudinal information to avoid cognitive and behavioral dissonance (see Hart et al., 2009). However, other researchers reported that those with strong attitudes prefer more confirming information, whereas those without strong attitudes prefer a more comprehensive range of topical viewpoints (Jonas et al., 2001; Knobloch-Westerwick & Meng, 2011; Knobloch-Westerwick et al., 2014; Sawicki et al., 2011; Sawicki et al., 2013; Yin et al., 2016).

Although people generally prefer pro-attitudinal information, they pay attention to various information types. For example, using eye-tracking software Van Strein et al. (2016) found that participants with extremely positive or negative attitudes spend an equal amount of time reviewing information that confirms and contradicts their attitude when presented with an equal number of arguments in favor of and opposing organic foods. Except when a participant reported high levels

of prior knowledge, in which case they spent more time reviewing counter-attitudinal information. Additionally, the study found that when someone lacks an extreme attitude, they spend more time reviewing counter-attitudinal information rather than pro-attitudinal information.

Although those with varying attitudes spend time reviewing information consistent and contradicting their attitude, differences exist in how they use the information. For example, studies that generate ad hoc information about a familiar controversial topic reveal that after reviewing a controlled number of confirming and contradicting information units, those with extreme attitudes write messages in line with their preexisting attitudes, whereas those with ambivalent attitudes describe the inconclusive nature of the topic (Van Strien et al., 2014; Van Strein et al., 2016). People are motivated to gain an accurate overview of a topic by remaining open to reviewing a range of information. Still, the preference for attitudinally consistent information plays a central role in memory after reading multiple texts on a scientific controversy (Van Strien et al., 2016).

These findings highlight how attitude strength influences the selection of specific types of information over others during information sharing. Hypothesis 2 proposes a replication hypothesis to confirm that attitude extremity leads to a preference for including pro-attitudinal information in messages. In several studies, when participants could choose what media sources to expose themselves to, participants with strong attitudes selectively exposed themselves to attitude consistent information, leading them to form an even stronger attitude (Kim, 2015; Knobloch-Westerwick et al., 2015; Stroud, 2010). Further, in addition to observing the time spent on specific argument types, Van Strien et al. (2016) found that those with extreme attitudes write attitude consistent messages about a well-known controversial topic. Therefore, even if people are open to reviewing information that contradicts their attitude, attitudinally consistent information is preferred after reading and sharing about the attitude object.

Participants may not have thought much about the attitude object in this study before participating. However, even when the attitude object is novel, we expect that it may trigger strong values leading some people to form a strong attitude after reviewing information in favor of, opposed to, and neutral toward cell-cultured meat. Those with a valanced and extreme attitude are expected to select more attitude-consistent information to share than individuals with moderate attitudes.

Hypothesis 2: Those with valanced and extreme attitudes will share proportionately more attitude-consistent information than those who are not.

Quite a bit of research exists on attitude strength and its influence on the social amplification of judgments. We seek to extend the understanding of attitudes by highlighting a specific measure of strength. This effect has not been tested regarding attitude certainty; however, given the influence of attitude certainty on the amount of information shared, it is reasonable to assert certainty will motivate a person to share specific types of information. During information sharing, variation in attitude certainty may influence the proportion of pro-attitudinal information shared, independent of valence. As previously discussed, people of varying certainty are willing to read a range of information, but when they choose what to share, they select information confirming their attitude. Given our understanding of confirmation bias, we expect those with greater certainty to share more pro-attitudinal information. Those with low certainty will be motivated to understand the topic accurately and thus select a greater variety of information to share.

Hypothesis 3: Those with high levels of attitude certainty will share proportionately more attitude-consistent information than those with moderate or low levels of attitude certainty.

STUDY 1

This study highlights a situation when information about an innovation enters the social setting and the first subsequent retelling. Before participating, we expect participants will have little experience or knowledge of cell-cultured meat. However, once they receive information, it will impact their attitude and information sharing. Prior research found that the type of information people receive influences their perceptions of cell-cultured meat (Bekker et al., 2017; Siegrist et al., 2018; Verbeke et al., 2015b). Building on these findings, Study 1 explores how attitude strength affects the amount and type of information shared about a health innovation in an interpersonal context. The first set of hypotheses compete. Hypothesis 1_a predicts a linear relationship such that those with certain attitudes share more information than those who are moderately certain or not at all certain. Hypothesis 1_b predicts a curvilinear relationship such that those who are moderately certain share the least amount of information compared to those with certain or not at all certain. Hypothesis 2 predicts that those with valanced and extreme attitudes share proportionately more attitude consistent information than those who are not extreme in their attitude. Hypothesis 3 predicts that those with certain attitudes share proportionately attitude consistent information than those who are moderately certain or not at all certain in their attitudes.

Method

Participants

Study 1 involved 289 participants recruited from Amazon's Mechanical Turk (197 men, 91 women, and 1 undisclosed). The respondents' ages ranged from 20 to 71; $M = 36.68$, SD = 9.52.

Participants were offered 1.80 USD for their participation in the study. A detailed profile of participant sociodemographic characteristics is found in Table 1.

Table 1. Sociodemographic Characteristics of Participants

Factor	*N*	% Of Total Sample
Race	289	
American Indian or Alaskan Native	24	8.3
Asian	36	12.5
Black or African American	22	7.6
Hispanic, Latino, or Spanish	31	10.7
Middle Eastern or North African	5	1.7
Native Hawaiian or Other Pacific Islander	4	2.1
White	205	70.9
Other	2	0.1
Education	289	
Some High School	5	1.7
High School diploma or equivalent	9	3.1
Vocational Training	5	1.7
Some College	26	9.0
Associate degree	14	4.8
Bachelor's degree	196	67.8
Some post-undergraduate work	7	2.4
Master's degree	50	17.3
Specialist degree	3	1.0
Applied or Professional Doctorate	4	1.4
Doctorate Degree	3	1.0
Employment	288	
Full-time	256	88.6
Part-time	10	3.5
Unemployed	2	0.7
Student	1	0.3
Retired	6	0.3
Homemaker	1	1.0
Self-employed	3	3.1
Residence	284	
Midwest	70	24.2
Northeast	48	16.6
South	101	34.9
West	63	21.8
Puerto Rico or other U.S. territories	2	0.7
Social Class	288	
Poor	7	2.4
Working-class	54	18.7
Middle class	208	72.0
Affluent	19	6.6

Procedure and Design

Participants were presented with a survey that introduced a novel meat production method, asked questions about their attitude toward cell-cultured meat, and participated in an information-sharing task. Participants reviewed a media article that presented varying views on manufacturing and consuming cell-cultured meat. This article was comprised of information found in five media articles gathered from the first three pages of results returned by Google with the search term "cell-cultured meat" (accessed in the fall of 2021). After the reading phase, participants were asked to write a message for the next participant using the following instructions: "While you now have read different statements about cell-cultured meat, we would like to provide other study participants with your personal account of the matter. Considering all information regarding cell-cultured meat you are familiar with, what are the critical points someone would need to know to understand cell-cultured meat? Please describe exactly what you would share" (adapted from Moussaïd et al., 2015). Participants wrote their messages without access to the reading material. A complete outline of the instructions and questions used in Study 1 are provided in Appendix A.

Measures

Attitude Certainty

Attitude certainty is measured in an innovation-specific way, adapting two well-cited measurements in the literature. Measured on a five-point scale, these items range from "Not at all certain" to "Extremely certain" with "Neither certain nor uncertain" in the middle. Participants responded to the items before (Cronbach's $\alpha = .89$) and after (Cronbach's $\alpha = .86$) reviewing the informative article. The general item was adapted from Fazio and Zanna (1978a) and asked, "How certain are you of your opinion toward cell-cultured meat?" Additional questions were adapted

from Petrocelli et al. (2007). The items are "How certain are you that you know what your true attitude on cell-cultured meat really is?" "How certain are you that the attitude you expressed toward cell-cultured meat really reflects your true thoughts and feelings?" "To what extent is your true attitude toward cell-cultured meat clear in your mind?" "How certain are you that the attitude you just expressed toward cell-cultured meat is really the attitude you have?" "How certain are you that your attitude toward cell-cultured meat is the correct attitude to have?" "To what extent do you think other people should have the same attitude as you on cell-cultured meat?" and "How certain are you that of all the possible attitudes one might have toward cell-cultured meat, your attitude reflects the right way to think about the issue?"

Attitude Valence

Using an eight-item semantic differential scale, participants indicated their attitude valence toward cell-cultured meat before (Cronbach's $\alpha = .91$) and after (Cronbach's $\alpha = .90$) reviewing the informative article. These items included "unsafe and safe"; "unnatural and natural"; "unethical and ethical"; "unhealthy and healthy"; "immoral and moral"; "cruel and kind"; "unappetizing and appetizing"; and "irresponsible and responsible." For analyses, the mean score across all eight items was used.

Attitude Extremity

One item adapted from Tormala and Petty (2002) assesses participants' attitude before and after reviewing the informative article. Using a five-point scale ranging from "Extremely positive" to "Extremely negative." participants respond to "What is your attitude toward cell-cultured meat?"

Message Variables

Following data collection, researchers conducted a content analysis to identify and classify each information unit participants shared in the messages. Two coders independently reviewed all sentences written by the participants, identified each information unit, and labeled them using a coding scheme outlined in Moussaïd et al. (2015). An information unit includes any statement that makes a claim, such as, "stem cells are taken from an animal's muscle." Sentences may include more than one information unit. The two coders independently classified each information unit as positive, negative, or neutral. Positive statements correspond to any positive aspect of cell-cultured meat, including suggestions that the use of cell-cultured meat is safe or under control. Negative statements correspond to any information unit highlighting the actual or suspected dangers of cell-cultured meat. Neutral statements express neither a positive nor negative assessment. Two independent coders conducted this procedure after receiving the same instructions (Appendix B).

Amount of Information Shared

The total amount of information shared was determined for each participant by summing the number of information units included in their message.

Proportion of Attitudinally Consistent Information Shared

Each participant was assigned a favorable or unfavorable attitude using the single attitude extremity item. Depending on if the participant held a favorable or unfavorable attitude, the number of attitudinally consistent information units was divided by the total number of information units they shared. The quotient is considered the proportion of attitudinally consistent information shared.

Results

We first established inter-rater reliability with the amount and the type of information included in participant messages. Next, we tested the hypotheses. We determined if attitude certainty would influence the amount of information shared. We further explored the data by testing whether attitude certainty and extremity influenced the proportion of attitudinally consistent information in participant messages. Table 2 displays the means and construct item reliabilities for pre and post-test measures of attitudes. Tables 3 and 4 display the frequencies and means of the primary dependent variables.

Table 2. Psychometric Properties for Attitude Scales and Subscales

Factor		Pre-Test				Post-Test			
	Range	*n*	*M*	*SD*	Cronbach's α	*n*	*M*	*SD*	Cronbach's α
Attitude Certainty Average	1-5	284	3.97	0.67	.889	285	4.04	0.58	.861
Item 1	1-5	289	4.03	0.83		289	4.11	0.73	
Item 2	1-5	287	3.99	0.89		288	4.03	0.86	
Item 3	1-5	288	3.97	0.87		288	4.11	0.79	
Item 4	1-5	289	4.03	0.91		289	4.07	0.80	
Item 5	1-5	288	4.00	0.90		289	4.04	0.77	
Item 6	1-5	289	3.95	0.90		289	3.99	0.84	
Item 7	1-5	289	3.87	0.92		288	3.91	0.88	
Item 8	1-5	288	3.88	9.95		288	4.01	0.84	
Attitude Valence Average	1-5	284	3.92	.084	.910	285	3.93	0.81	.897
Item 1 Safety	1-5	289	3.92	1.04		289	3.98	1.03	
Item 2 Naturalness	1-5	286	3.63	1.25		289	3.78	1.22	
Item 3 Ethics	1-5	289	4.02	1.07		288	3.98	0.96	
Item 4 Health	1-5	288	3.89	1.07		288	3.94	1.07	
Item 5 Morality	1-5	289	4.03	0.99		288	3.95	1.02	
Item 6 Kindness	1-5	289	4.02	0.97		289	4.04	0.99	
Item 7 Appetite	1-5	288	3.80	1.15		288	3.82	1.11	
Item 8 Responsible	1-5	289	4.03	0.99		289	3.97	1.02	
Attitude Extremity	1-5	285	4.00	0.85		287	3.99	0.85	

Table 3. Descriptive Statistics of Total and Type of Information Units Shared by Participants Who Shared At least One Information Unit and Answered All Attitude Items

	Total Units	Positive Units	Negative Units	Neutral Units
N	237	237	237	237
M	6.47	2.76	1.41	2.30
Median	6.00	2.00	1.00	2.00
SD	3.08	2.30	1.92	2.17
Minimum	1	0	0	0
Maximum	18	15	12	10
Sum	1534	654	335	545

Table 4. Descriptive Statistics of Proportion of Attitudinally Consistent Information Shared by Participants Who Shared At least One Information Unit and Answered All Attitude Items

	Proportion of Attitudinally Consistent Information Shared		
	n	*M*	*SD*
Total	237	0.4161	0.31
Low/Moderate Certainty	79	38.33%	0.28
High Certainty	158	43.26%	0.32
Negative Valence	31	46.93%	0.32
Positive Valence	206	40.81%	0.30
Low Extremity	50	34.69%	0.32
High Extremity	187	43.47%	0.30

Content Analysis

Coders first independently identified all the information units shared within a pre-selected set of 65 messages to conduct the content analysis. Messages were randomly selected to determine inter-coder reliability. Overall, 494 information units were identified in the selected messages by the two coders. Of those, 98.38% were identified by each coder. Given the similarity between counts, the first coder's counts were subsequently used in the classification step. Each of the two coders independently classified each information unit as positive, negative, or neutral during the classification step. Cohen's κ was run to determine if there was an agreement between the two coders' judgments on whether the 494 information units within 65 messages were positive, neutral, or negative. Using guidelines from Altman (1999) and Landis and Koch (1977), there was high

agreement between the two coders' judgments, κ= .85 (95% CI, .81 to .89), $p < .001$. Given the reliability between coders, the first coder completed coding the remaining messages, and the coder's counts and classifications were used in the analyses. In total, 1578 information units were shared by 289 participants. Of those units, 681 were positive, 343 were negative, and 554 were neutral.

Amount of Information Shared

Analyses were conducted using participants who shared at least one information unit and answered all attitude items ($N = 237$). To test $H1_a$ and $H1_b$, participants were classified as holding a low, moderate, or high certainty score. Using the average score across the eight certainty items measured on a five-point scale, K-means clustering determined 7 participants were not certain ($M = 2.04$; SD = 0.52), 83 moderately certain ($M = 3.56$; SD = 0.25), and 147 ($M = 4.38$; SD = 0.29) highly certain in their attitude toward cell-cultured meat. Given the unexpectedly low number of participants who were not certain in their attitude, H1b, which predicted a curvilinear relationship between attitude certainty and the amount of information shared, cannot be tested. Likewise, $H1_a$ cannot be tested as it also requires participant attitude certainty scores to be described using three levels. We instead describe the relationship between attitude certainty and the total amount of information shared by assigning participants to one of two attitude certainty levels based on their average attitude certainty score across the eight items using K-means clustering. An independent samples t-test found a significant difference in the attitude certainty score for participants classified as having low/moderate ($n = 79$, $M = 3.30$, $SD = 0.72$) and high certainty ($n = 158$, $M = 4.35$, $SD = 0.31$; $t(235) = -18.26$, $p = .01$; $d = 2.33$). Next, we tested the relationship between attitude certainty and the amount of information shared. An independent-samples t-test found an insignificant difference in the amount of information shared for low/moderate certainty ($M = 6.16$,

SD= 2.67) and high certainty ($M = 6.63$, $SD = 3.27$; $t(235) = -1.01$, $p = .28$; $d = 0.16$). Results were replicated when the analysis was run, excluding low certainty participants and classifying participants as moderately or highly certain. A Pearson's correlation coefficient was computed to assess the linear relationship between attitude certainty and the total number of information units shared. The two variables did not systematically correlate, $r(235) = .02$, $p = .81$; for those with negative attitudes, $r(48) = -.18$, $p = .20$; for those with positive attitudes, $r(185) = .06$, $p = .43$.

Proportion of Attitudinally Consistent Information Shared

To test Hypotheses H2 and H3, participants were classified into one of two groups based on their attitude certainty, valence, and extremity. As in the analyses of H1, 79 participants were classified as low/moderately certain ($M = 3.30$, $SD = 0.72$) and 158 ($M = 4.35$, $SD = 0.31$) as highly certain. Next, using the average score across eight attitude valence items, 31 participants were unfavorably valanced ($M = 2.34$, $SD = 0.67$), and 206 ($M = 4.15$, $SD = 0.55$) favorably valanced in their attitude toward cell cultured meat ($t(235) = -16.66$, $p < .001$; $d = 2.95$). Lastly, using the single attitude extremity item, 50 participants lacked an extreme attitude ($M = 2.60$, $SD = 0.61$) and 187 were extreme in their attitude ($M = 4.34$, $SD = 0.48$) toward cell cultured meat ($t(235) = -21.64$, $p < .001$; $d = 2.93$). Using the classification strategy of the attitude valence and extremity measures, 204 participants (86.08%) were consistently classified into either the high or low group for both measures. The three attitude measures are positively correlated (Table 5).

Table 5. Descriptive Statistics of Proportion of Attitudinally Consistent Information Shared by Participants Who Shared At least One Information Unit and Answered All Attitude Items

Variable	*M*	*SD*	1	2
1. Certainty	4.03	0.60		.
2. Valence	3.92	0.83	.463** [.36 .56]	
3. Extremity	3.97	0.87	.391** [.28 .49]	.734** [.67 .79]

Note. Values in square brackets indicate the 95% confidence interval for each correlation.
** indicates p < .01 (2-tailed).

Following variable classification, a three-way factorial ANOVA was conducted to compare the main effects of *attitude certainty* (low/moderate vs. high), *attitude valence* (unfavorable vs. favorable), and *attitude extremity* (low vs. high) as well as their interaction effects on the proportion of attitude consistent information shared. Results indicate that Hypothesis 2 and Hypothesis 3 were not supported by the data. Hypothesis 2 predicted that those with valanced ($F(1,230) = 3.22$, $p = .07$) and extreme ($F(1,230) = 1.33$, $p = .25$) attitudes would share proportionately more attitude consistent information than those who are not extreme in their attitude. Although insignificant, results do indicate those who hold an unfavorable attitude toward the innovation share proportionately more attitude consistent information (46.93%, SD= 0.32) than those who are favorable (40.81%, SD= 0.30). The potential two-way interaction effects and the three-way interaction effect were not significant, indicating no combined effect for attitude valence, extremity, and/or certainty on the proportion of attitude consistent information shared, see Table 6. An additional ANOVA analysis using only consistently classified participants into either the high or low group for both attitude valence and extremity measures confirmed the findings.

Table 6. Three-Way Analysis of Variance of Proportion of Attitudinally Consistent Information Shared by Attitude Certainty, Extremity, and Valence

Source of Variation	*df*	*SS*	*MS*	*F*	*p*	Partial η^2
Total	237	63.01				
Main effects						
Certainty	1	0.04	0.00	0.04	.843	.000
Valence	1	0.29	0.29	3.22	.074	.014
Extremity	1	0.12	0.12	1.33	.251	.006
2-way interactions						
Certainty*Valence	1	0.11	0.11	1.262	.262	.005
Certainty*Extremity	1	0.05	0.05	0.52	.471	.002
Valence*Extremity	1	0.23	0.23	2.58	.110	.011
3-way interactions						
Certainty*Valence*Extremity	1	-	-	-	-	.000
Error	230	20.78	0.09			

R Squared = .054 (Adjusted R Squared = .029)

Study 1 Discussion

Study 1 sought to test how attitude influences the amount and type of information participants share after reading about an innovation. In this study, participants were provided a New York Times style article which included 79 information units (34 neutral units, 21 positive units, and 24 negative units). In $H1_a$ and $H1_b$, we sought to identify the relationship between certainty and the amount of information shared, similarly to findings outlined in Cheatham and Tormala (2015) and Cheatham and Tormala (2017) respectively. However, given the attitude certainty measure distribution, participants were unable to be classified into three groups. This ceiling effect limited our ability to test for a curvilinear relationship between attitude certainty and the amount of information shared, as in Cheatham and Tormala (2017). Participants were instead classified into one of two certainty groups. Although the relationship was not significant, findings corroborate those outlined in Cheatham and Tormala's (2015) paper, such that participants with high certainty shared more total information than those with uncertain attitudes.

In addition to testing attitude certainty's effect on information sharing, H2 and H3 explored the influence of certainty, extremity, and valence on the type of information shared. Similar hypotheses were tested in Van Strien et al. (2016). They found that when a message sender holds a valanced attitude, they share a greater proportion of attitudinally consistent information. Similarly, in Study 1, those with an unfavorable attitude shared a greater proportion of unfavorable information compared to the proportion of favorable information shared by those with a favorable attitude. However, this relationship was not significant. In addition, we found those with an extreme attitude shared more proportionately attitudinally consistent information than those without, and those with certain attitudes shared more than those without certainty, although these results were also insignificant. Although the hypotheses are unsupported, they shed light on the complex relationship between attitudes and information people share with others. The following study sought to identify if the message sender's attitude or message influences the message written by the second person in a diffusion chain.

STUDY 2

This study extends Study 1 by identifying message features that may mediate the relationship between Chain Member 1's attitude and Chain Member 2's message using an interpersonal diffusion chain framework. Interpersonal diffusion chains provide a theoretical and methodological opportunity to observe social influence processes within a simple network. Originally referred to as serial reproduction, as Bartlett (1932) proposed, diffusion chains make it possible to initiate message and attitude propagation while studying the factors that influence information sharing within a network of people (Mesoudi et al., 2006). Diffusion chains allow researchers to analyze the relative reliability with which messages and attitudes propagate (Bonito, 2007; Carlson, 2018; Moussaïd et al., 2015). In this study, we use them to observe how Chain Member 1's attitude and message influence the message written by Chain Member 2.

Attitude Strength's Influence on Information Sharing Between Chain Members

In Study 1, hypotheses predict that the attitude strength of the first chain member will influence the amount and type of information they share. Study 2 extends this work by hypothesizing that the first chain member's attitude strength (certainty and extremity) will influence the amount and type of information shared by the following chain member. Study 2 builds on Study 1's procedure by introducing the second chain member to explore this influence.

Moussaïd et al. (2015) made two key observations during their study of diffusion chains. First, they found that information became less and gradually inaccurate. Participants framed information to fit their preconceptions, resulting in messages that included increasingly favorable or unfavorable information. Second, along with observable changes in the information, Moussaïd et al.'s (2015) participants modified their risk perception to align more closely with the information

shared by the preceding individual. When participants received information that contradicted their preexisting risk perceptions, they shifted their risk assessment to align with the presented information. Alternatively, there was no change if the presented information affirmed the participant's risk assessment. These findings confirm that information undergoes significant changes as it flows through a chain and that chain members are influenced to modify their risk assessments.

Further evidence supports that the message sender's attitude strength influences the receiver's willingness to share attitudinally consistent information and form a stronger attitude. In the case of vaccinations, when someone with an extreme negative attitude talked with neighbors, the neighborhood became more extreme in their attitude and refused to adopt the behavior. In these conversations, the sender excluded information contradicting their attitude. This resulted in attitudinally consistent information propagating, leaving message receivers with a limited set of information to share with someone else. This trend in information sharing resulted in chain members strengthening their attitude toward the direction of the message sender (Campbell and Salathé, 2013 & Salathé and Bonhoeffer, 2008).

The findings related to innovation in medicine illustrate the effects of a message sender's attitude extremity on those with whom they share their message. This study seeks to determine if another measure of attitude strength, attitude certainty, similarly influences the second chain member's information sharing. It can be expected that the extent to which Chain Member 1's attitude systematically affects the information they select to share their attitude also affects the succeeding chain member's message. As this novel hypothesis has not been tested before, the scope is limited to a situation in which chain members share the same attitudes (that is, Chain Members 1 and 2 both have either a favorable or unfavorable attitude).

Hypothesis 4: Chain Member 1's attitude certainty will influence the amount (a) and type (b) of information shared by Chain Member 2.

Hypothesis 5: Chain Member 1's attitude extremity will influence the amount (a) and type (b) of information shared by Chain Member 2.

Message Features as Mediators

Not only does Study 2 seek to test the influence of the message sender's attitude on the message written by the second chain member, but also the influence of their message. Two potential mediators are identified, including information amount and proportion of attitudinally consistent information shared, which are expected to shape the message written by the succeeding chain member. Before participating in an interpersonal diffusion chain task, participants can use their preexisting attitudes and values to form an attitude toward the object. Research suggests that, in a context like innovation, when people have little knowledge and experience with the attitude object, they rely on their general attitudes and values to contextualize new information. During the task, chain members can strengthen their attitude using the provided information. People prefer information that confirms their existing beliefs because it strengthens their attitudes (Hart et al., 2009).

When considering the influence of message features, it is important to note the differences between the information available to participants in Study 1 versus Study 2. Given the communication protocol of diffusion chains, Chain Member 1 may become more knowledgeable about the innovation by reviewing pro-attitudinal and counter-attitudinal information. The information a message sender chooses to share creates a different experience for the next information-sharing task participant. Once the information undergoes an initial retelling, it is significantly transformed. Previous research shows that this transformation becomes more

attitudinally consistent as the chain increases in length (Burns et al., 1993; Kasperson, 1992; Kasperson & Kasperson, 1996; Kasperson et al., 1988).

In Study 2, participants learn about cell-cultured meat from another participant. These participants cannot select from a wide range of pro-attitudinal information like the New York Times style article provided to Study 1 participants. Instead, the provided information in Study 2 is a selection of information made by a prior chain member. We expected the information would become less and more consistent with the attitude of the previous chain member. Since the information is no longer that which experts shared, it changes how the participant may process the information.

Hypothesis 6 claims that the effect of Chain Member 1's attitude strength (certainty and extremity) on the amount and type of information written by Chain Member 2 is mediated by the amount of information provided by Chain Member 1. It is necessary to recognize that people do not select everything they know when sharing a message with someone else in diffusion chains. Moussaïd et al. (2015) asked participants to share what they knew about a medical innovation's benefits and harms. Within a ten-person chain, Chain Member 1 shared 49% of the information provided to them within various articles. The information erosion results in Chain Member 2 constructing a message to share using only half of the initially available information. Moussaïd et al. (2015) found Chain Member 2 shared 21% of the original information, and the tenth member shared 4% of the information. As the diffusion chain increased in length, members had access to less and less of the original information.

Although Moussaïd et al. (2015) found that messages become smaller as more chain members are added, we expect message senders with a stronger attitude will share more information than those without (see Hypothesis 1). This assertion is supported by several studies

which found that stronger attitudes result in a greater amount of information shared by a single participant (Cheatham & Tormala, 2015; 2017; Van Strien et al., 2016). The greater amount of information shared by the message sender will allow the next chain member to select from a larger pool of information when constructing their message.

Hypothesis 6: The effects of Chain Member 1's attitude strength (certainty and extremity) on Chain Member 2's message (information amount and type) is mediated by the amount of information provided by Chain Member 1.

Hypothesis 7 claims that the effect of Chain Member 1's attitude strength (certainty and extremity) on the amount and type of information written by Chain Member 2 is mediated by the type of information provided by Chain Member 1. Moussaïd et al. (2015) found participants shared information that fit their risk assessments, resulting in messages that included increasingly favorable or unfavorable information. Even when researchers injected neutral information into a chain of people with neutral risk assessments, information became increasingly valenced in one direction. A similar prediction is made by Hypotheses 2 and 3, which states that when people have strong attitudes, they will share proportionally more attitudinally consistent information while withholding information that contradicts their attitude.

When those with strong attitudes share relatively more attitudinally consistent information, it allows the message receiver an attitudinally consistent pool of information to write their message. Participants prefer attitudinally supportive information, especially when they lack experience or knowledge of the attitude object (Hart et al., 2009). Those further down the diffusion chain can use the attitudinally consistent information to construct an attitudinally consistent message.

Hypothesis 7: The effect of Chain Member 1's attitude strength (certainty and extremity) on Chain Member 2's message (information amount and type) is mediated by the proportion of attitudinally consistent information provided by Chain Member 1.

Method

Participants

Study 2 involved 342 participants recruited from Amazon's Mechanical Turk (212 men, 127 women, 2 non-binary, and 1 undisclosed). To prevent Study 1 participants from also enrolling in Study 2 we opted to hide the study from Study 1 participants using their M-Turk IDs. The respondents ages ranged from 19 to 75; M = 36.85, SD = 10.16. Participants were offered 1.80 USD for their participation in the study. A detailed profile of participant sociodemographic characteristics is found in Table 7.

Table 7. Sociodemographic Characteristics of Participants

Factor	*n*	% Of Total Sample
Race	342	
American Indian or Alaskan Native	12	3.5
Asian	26	7.6
Black or African American	33	9.6
Hispanic, Latino, or Spanish	24	7.0
Middle Eastern or North African	5	1.5
Native Hawaiian or Other Pacific Islander	2	0.6
White	267	78.1
Other	1	0.3
Education	342	
Some High School	2	0.6
High School diploma or equivalent	16	4.7
Vocational Training	1	0.3
Some College	22	6.4
Associate degree	14	4.1
Bachelor's degree	229	67.0
Some post-undergraduate work	8	2.3
Master's degree	62	18.1
Specialist degree	1	0.3
Applied or Professional Doctorate degree	2	0.6
Doctorate Degree	3	0.9
Employment	342	
Full-time	305	89.2
Part-time	17	5.0
Unemployed	8	2.4
Student	1	0.3
Retired	2	0.6
Homemaker	2	0.6
Self-employed	7	2.0
Residence	342	
Midwest	94	27.5
Northeast	69	20.2
South	111	32.5
West	64	18.7
Puerto Rico or other U.S. territories	2	0.6
Other	2	0.6
Social Class	342	
Poor	5	1.5
Working-class	93	27.2
Middle class	214	62.6
Affluent	30	8.8

Procedure and Design

As in Study 1, participants were presented with a survey introducing them to an innovation. At the beginning of the study, participants were informed that they were volunteering to participate in a survey examining their perceptions of a new meat production method and provided with a brief description of cell-cultured meat. Each participant answered questions related to their attitude toward cultured meat. Following the questions, participants were classified into one of three attitudinal categories: positive, neutral, or negative toward cell-cultured meat. The classification was based on the participant's response to the question, "What is your attitude toward cell-cultured meat?" Response items include a 5-point Likert scale ranging from "Extremely positive to Extremely Negative." Based on the participant's classification, they were asked to read a message written by a participant in Study 1 who shared the same positive or negative attitude. We exclude situations when participants do not have the same attitude. Messages were selected from a message pool in random yet balanced order within each attitudinal category. The pool included 237 messages written by participants included in Study 1 analyses. Thus, they answered all attitude measures and included at least one information unit in their message. After the Study 2 participant read a message, they were asked to write a new message without character limitations using the exact instructions presented to Study 1 participants. Lastly, participants were asked to indicate their cell-cultured meat perceptions, including attitude, motive, knowledge, behavior, and demographic information. A complete outline of the instructions and questions provided in Study 2 are found in Appendix C. A detailed description of message assignment and coder instructions are found in Appendix D.

Measures

Attitude Certainty

Attitude certainty was measured using the same questions and scales as in Study 1. Participants responded to the items before (Cronbach's α = .86) and after (Cronbach's α = .85) reviewing the message. Descriptive statistics for all Study 2 attitudinal measures are provided in Table 8. Correlations are provided in Table 9.

Table 8. Psychometric Properties for Attitude Scales and Subscales

Factor	Range	Pre-Test				Post-Test			
		n	*M*	*SD*	Cronbach's α	*n*	*M*	*SD*	Cronbach's α
Attitude Extremity	1-5	341	3.84	1.02		340	3.91	0.97	
Attitude Valence Average	1-5	339	3.77	.80	.880	331	3.79	0.84	.896
Item 1 Safety	1-5	342	3.77	1.07		339	3.75	1.12	
Item 2 Naturalness	1-5	342	3.56	1.28		340	3.54	1.24	
Item 3 Ethics	1-5	342	3.84	1.04		342	3.93	1.06	
Item 4 Health	1-5	342	3.79	1.08		337	3.81	1.11	
Item 5 Morality	1-5	342	3.91	1.00		342	3.87	1.06	
Item 6 Kindness	1-5	341	3.89	0.99		342	3.90	0.99	
Item 7 Appetite	1-5	341	3.56	1.16		341	3.67	1.20	
Item 8 Responsible	1-5	341	3.85	1.04		341	3.91	1.03	
Attitude Certainty Average	1-5	336	3.88	0.66	.861	340	3.98	0.62	.845
Item 1	1-5	342	3.96	0.79		342	4.00	0.62	
Item 2	1-5	341	3.93	0.92		342	4.01	0.82	
Item 3	1-5	341	3.91	0.92		341	3.97	0.88	
Item 4	1-5	341	3.89	0.94		342	4.01	0.84	
Item 5	1-5	340	3.97	0.88		342	4.06	0.89	
Item 6	1-5	341	3.87	0.94		341	4.04	0.90	
Item 7	1-5	341	3.75	1.00		342	4.01	0.88	
Item 8	1-5	342	3.80	0.98		341	3.85	0.97	

Table 9. Descriptive Statistics of Proportion of Attitudinally Consistent Information Shared by Participants who Shared at Least One Information Unit, Answered All Attitude Items and Held an Extreme Attitude Before Reading the Message

Variable	*M*	*SD*	1	2
4. Certainty	4.00	0.63		.
5. Valence	3.78	0.89	.521** [.42 .61]	
6. Extremity	3.93	1.01	.460** [.36 .55]	.761** [.70 .81]

Note. Values in square brackets indicate the 95% confidence interval for each correlation.
** indicates $p < .01$ (2-tailed).

Attitude Valence

Attitude valence was measured using the same questions and scales as in Study 1. Participants responded to the items before (Cronbach's $\alpha = .88$) and after (Cronbach's $\alpha = .90$) reviewing the message.

Attitude Extremity

Attitude extremity was measured using the same question as in Study 1.

Mediators

Amount of Information

The total amount of information shared in the message written by a Study 1 participant was determined by summing the number of information units included in the message.

Proportion of Attitudinally Consistent Information Shared

The proportion of attitudinally consistent information shared was determined using the same strategy in Study 1. The number of attitudinally consistent information units was divided by the total number of information units they shared.

Results

Coders established inter-rater reliability before testing the hypotheses with the amount and type of information included in participant messages as in Study 1. Upon reaching an agreement, we determined if Chain Member 1's attitude certainty and extremity would influence the attitude extremity of Chain Member 2. Next, we explored whether the amount or proportion of attitudinally consistent information shared by Chain Member 1 mediated that relationship.

Content Analysis

Coders replicated the Study 1 strategy to conduct the content analysis in Study 2. First coders identified all the information units in 78 messages, 404 overall information units were identified. Of those, 98.51% were identified independently by each coder. Next, coders classified each unit as positive, negative, or neutral using the first coder's counts. Cohen's κ was run to determine if there was an agreement between the two coders' judgments on whether the 404 information units within the 78 messages were positive, neutral, or negative. There was high agreement between the two coders' judgments, $\kappa = .82$ (95% CI, .77 to .87), $p < .001$. Given the reliability between coders, the first coder's counts and classifications are used in analyses. In total, 1955 information units were shared by 342 participants. Of those units, 845 were positive, 472 were negative, and 638 were neutral.

Influence of Attitudes and Message Qualities on a Succeeding Chain Member

To test the total, direct, and indirect effects outlined in H4, H5, H6, and H7, four parallel mediation analyses (Model 4) were run using Hayes Process Macro. A parallel multiple mediator model identifies how variable X influences variable Y directly and indirectly through two or more mediators, assuming that the mediators are not causally related (Hayes, 2017). Analyses were conducted using participants who shared at least one information unit, answered all attitude items, and held an extremely positive or negative attitude before reading the message (n = 247) (Table 10). Before reading the message, 41 participants held an extreme negative attitude toward cell-cultured meat (M = 1.70, SD = .46) and 206 held an extremely positive attitude (M = 4.34, SD = .47).

Table 10. Descriptive Statistics of Information Units from Participants who Shared at Least One Information Unit, Answered All Attitude Items and Held an Extreme Attitude Before Reading the Message

	Total Units	Positive Units	Negative Units	Neutral Units
N	247	247	247	247
M	6.72	2.79	1.70	2.23
Median	6.00	2.00	0.00	2.00
SD	3.62	2.47	3.01	2.30
Minimum	1	0	0	0
Maximum	26	11	18	12
Sum	1662	690	420	552

Attitude Certainty

Two parallel mediation analyses were run to assess the effect of Chain Member 1's attitude certainty on the amount (a) and type (b) of information shared by Chain Member 2 (H4) and the potential mediating effects of the amount (H6) and proportion of attitudinally consistent information shared by Chain Member 1 (H7).

First, we test the effect of Chain Member 1's attitude certainty on the amount of information shared by Chain Member 2 and the potential mediating effects of the amount and type of information units shared by Chain Member 1. Results from a parallel mediation analysis indicated that Chain Member 1's attitude certainty was not directly or indirectly related to the amount of information shared by Chain Member 2 through its relationship with Chain Member 1's information amount or type, as shown in Figure 1. 95% bias-corrected confidence interval based on 10,000 bootstrap samples indicated that the indirect effect through Chain Member 1's amount and type of information were not different from zero (-0.11 to 0.22 and -1.24 to 2.18), respectively; see Figure 1 for the effects associated with these pathways. Moreover, Chain Member 1's attitude certainty did not predict the total amount of information shared by Chain Member 2 even when taking into account the indirect effect through both features of Chain Member 1's message (c' = 0.08, $t(244) = 0.22$, p =.82).

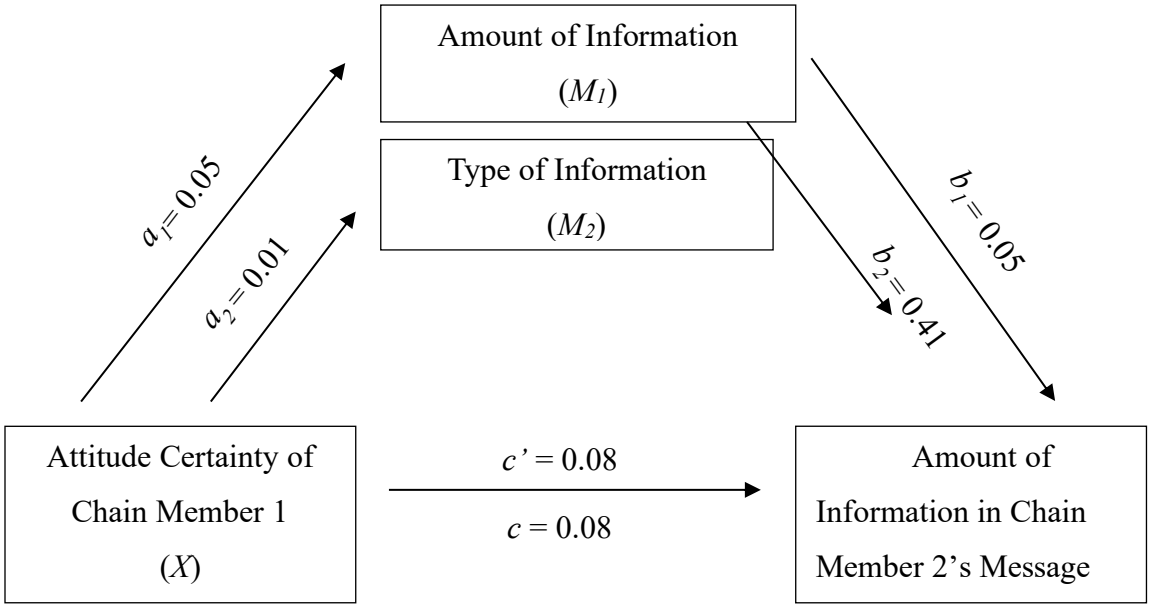

Figure 1. Relationship between Attitude Certainty of Chain Member 1 and Amount of Information in Chain Member 2's Message as Mediated by the Amount and Type of Information included in Chain Member 1's message.

Second, we test the effect of Chain Member 1's attitude certainty on the proportion of attitudinally consistent information shared by Chain Member 2 and the potential mediating effects of the amount and type of information units shared by Chain Member 1. Results from a parallel mediation analysis indicated that attitude certainty does not directly or indirectly relate to the proportion of attitudinally consistent information shared, as can be seen in Figure 2. 95% bias-corrected confidence interval based on 10,000 bootstrap samples indicated that the indirect effect through both Chain Member 1's amount and type of information was not different than zero (-0.01 to .00 and -0.14 to 0.01), respectively; see Figure 2 for the effects associated with these pathways. Moreover, Chain Member 1's attitude certainty did not predict the proportion of attitudinally consistent information shared by Chain Member 2 even when taking into account the indirect effect through both features of Chain Member 1's message (c' = 0.01, $t(244) = 0.80$, p =.43).

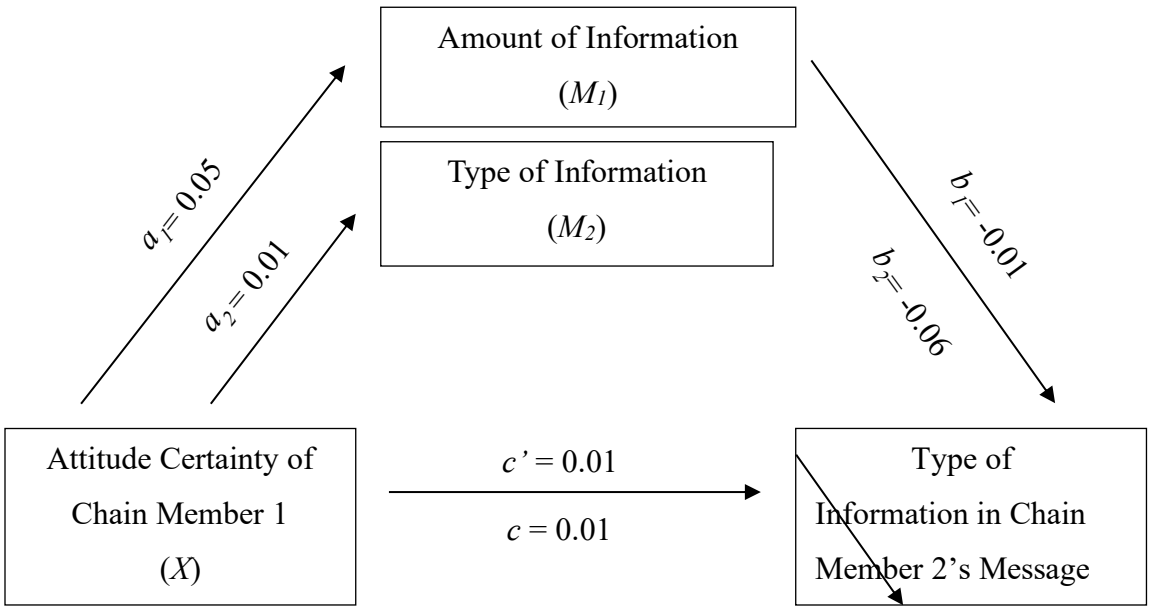

Figure 2. Relationship between Attitude Certainty of Chain Member 1 and Type of Information in Chain Member 2's Message as Mediated by the Amount and Type of Information included in Chain Member 1's message.

Attitude Extremity

In addition to understanding the effect of Chain Member 1's attitude certainty on the information shared by Chain Member 2, we also test the influence of Chain Member 1's attitude extremity. Two parallel mediation analyses were run to assess the effect of Chain Member 1's attitude extremity first on the amount (a) and second on the type (b) of information shared by Chain Member 2 (H5) and the potential mediating effects of the amount (H6) and proportion of attitudinally consistent information shared by Chain Member 1 (H7).

First, we test the effect of Chain Member 1's attitude extremity on the amount of information shared by Chain Member 2 and the potential mediating effects of the amount and type of information units shared by Chain Member 1. Results from a parallel mediation analysis indicated that attitude extremity is not directly or indirectly related to the amount of information shared, as can be seen in Figure 3. A 95% bias-corrected confidence interval based on 10,000

bootstrap samples indicated that the indirect effect through both Chain Member 1's amount and type of information was not different than zero (-0.11 to .22 and -1.33 to 2.13), respectively; see Figure 3 for the effects associated with these pathways. In sum, Chain Member 1's attitude extremity did not predict the total amount of information shared by Chain Member 2 even when taking into account the indirect effect through both features of Chain Member 1's message ($c' = 0.05$, $t(245) = 0.20$, $p = .83$).

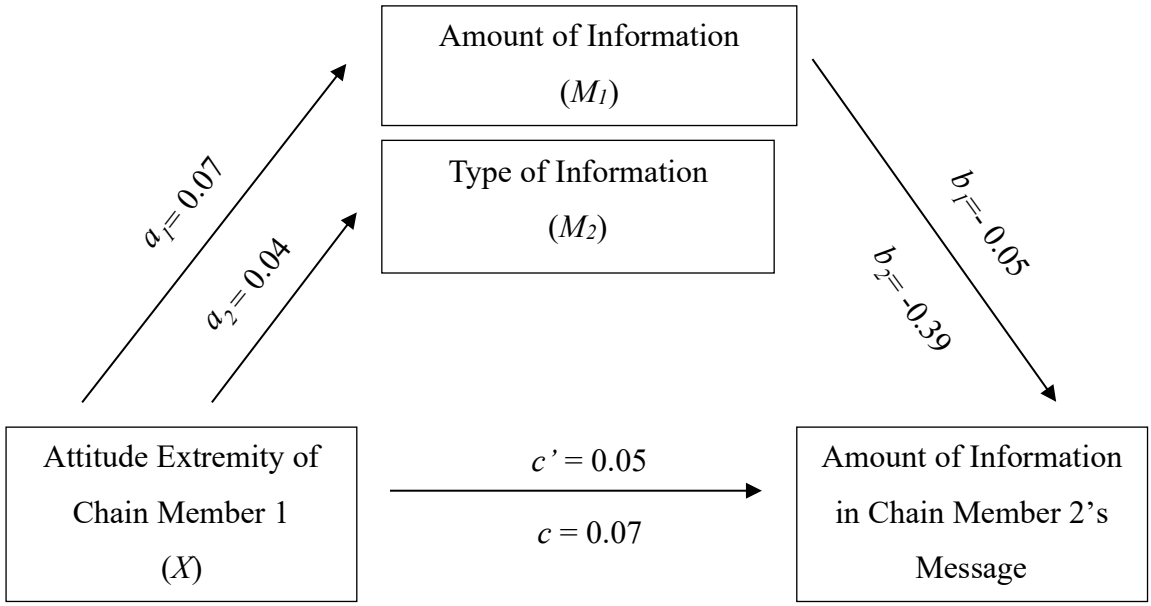

Figure 3. Relationship between Attitude Extremity of Chain Member 1 and Amount of Information in Chain Member 2's Message as Mediated by the Amount and Type of Information included in Chain Member 1's message.

Second, we test the effect of Chain Member 1's attitude extremity on the proportion of attitudinally consistent information shared by Chain Member 2 and the potential mediating effects of the amount and type of information units shared by Chain Member 1. Results from a parallel mediation analysis indicated that attitude extremity is not directly or indirectly related to the proportion of attitudinally consistent information shared, as can be seen in Figure 4. 95% bias-

corrected confidence interval based on 10,000 bootstrap samples indicated that that the indirect effect through both Chain Member 1's amount and type of information were not different than zero (-0.01 to .00 and -0.12 to 0.01), respectively; see Figure 4 for the effects associated with these pathways. Moreover, Chain Member 1's attitude extremity did not predict the proportion of attitudinally consistent information shared by Chain Member 2 even when taking into account the indirect effect through both features of Chain Member 1's message (c' = 0.01, $t(244) = 0.80$, p =.43).

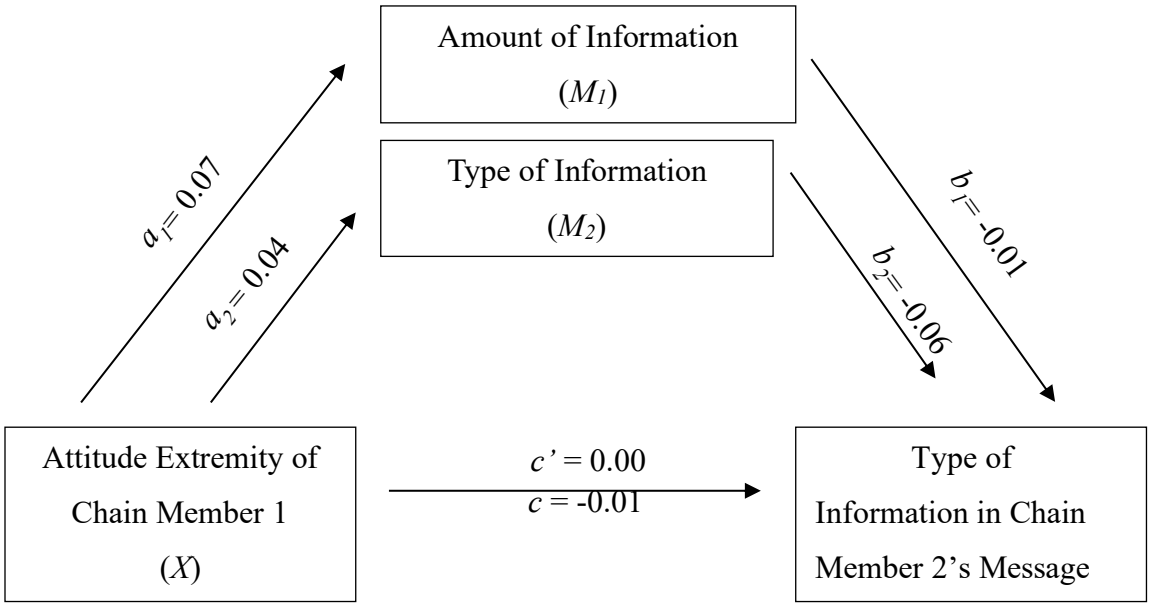

Figure 4. Relationship between Attitude Extremity of Chain Member 1 and Type of Information in Chain Member 2's Message as Mediated by the Amount and Type of Information included in Chain Member 1's message.

Study 2 Discussion

Study 2 sought to test how the attitude and message provided by the first person in a diffusion chain influence the message written by the second chain member. Unlike in Study 1, when participants were provided a New York Times style article that included 79 information units, Study 2 participants were provided a message written by a Study 1 participant. Messages written

by Study 1 participants with extreme attitudes shared an average of 7.01 information units. Of those, 43.47% were attitudinally consistent. In comparison, those without an extreme attitude shared an average of 6.47 information units, 34.69% of which were attitudinally consistent. This initial message transformation drastically changed the information available for Study 2 participants. In Study 2, messages written by participants with an extreme attitude shared 5.50 information units, of which 8.20% were attitudinally consistent, and those without an extreme attitude shared 6.47 information units, 10.66% of which were attitudinally consistent.

Study 2 sought to tease apart how the message sender's attitude and message features might influence the message written by the following chain member. Specifically, we hypothesized there would be differences in the amount and type of information shared by Chain Member 2 based on the attitude certainty (H4) and extremity (H5) of Chain Member 1. Further, we identified two potential mediators that would help describe this relationship, including the amount (H6) and type (H7) of information shared in Chain Member 1's message. None of the hypothesized relationships were supported. These findings do not support prior research by Moussaïd et al. (2015). They found participants framed information to fit their preconceptions, resulting in messages that included increasingly positive or negative information. A key difference between the present research and Moussaïd et al. (2015) is that they identified changes in information across a 10-person chain. Further, they did not limit their study to only chains with attitudinally similar members.

GENERAL DISCUSSION

Interpersonal diffusion chain research promises to contribute to a greater understanding of innovation acceptance, increasing the ability of experts to introduce new technology to the consumer market successfully. Interpersonal diffusion chains allow for replicating conversations people would likely have with others in their social network (Moussaïd et al., 2015). The current studies aimed to discern if attitudinal measures including certainty, extremity, and valence influence the amount and type of information shared with other consumers using a diffusion chain framework. The results reveal that attitudes share a complex relationship with information in the context of innovation.

In Study 1, findings demonstrate that attitude certainty, extremity, and valence do not significantly predict the amount or type of information shared by a consumer after reading a variety of favorable, unfavorable, and neutral statements about an innovative meat production method. Although insignificant, there are two findings of interest. First, those with greater certainty tended to share more information than those with lesser certainty, replicating Cheatham and Tormala (2015). Second, those with unfavorable attitudes and those with extreme attitudes shared a greater proportion of attitudinally consistent information than those without. These findings were insignificant but did help explain why negative attitudes toward innovative technology such as vaccinations propagate through interpersonal networks well (Campbell and Salathé, 2013 & Salathé and Bonhoeffer, 2008). Study 2 found that neither the first chain member's attitude nor message influences the message written by the second chain member in this context. These results did not replicate a similar study by Moussaïd et al. (2015), which found messages became increasingly valanced. Although our key hypotheses regarding attitude and information sharing

failed to replicate and extend research in this area, it is still plausible that there is an unidentified effect.

Considering the described findings, the remaining section describes important considerations related to the attitude measures and messages. First, the information provided to Study 1 participants may have read in an optimistic tone even though various favorable, unfavorable, and neutral information types were within the article. When constructing the reading material, researchers compiled articles written by industry experts, often with a vested interest in the success of the cell-cultured meat industry. Although the articles did outline the current technical hurdles to overcome, they framed the impact of cell-cultured meat on mainstream societal issues like climate change and animal cruelty positively. Given that industry experts hold a favorable attitude toward the innovation, it could help explain why many more participants in Study 1 and 2 held a favorable attitude toward cell-cultured meat than an unfavorable one after reading the material. I future studies, it would be ideal if there was a greater distribution of attitude scores across participants.

Upon investigating the three attitude measures, it was determined they were positively correlated in both studies. Of particular note, attitude valence and extremity were strongly correlated. Attitude valence was measured using a semantic differential scale, while extremity was measured using a single item. Prior research suggested we could expect attitude items would be moderately or lowly correlated (Krosnick & Abelson, 1992). However, these two attitude measures were interpreted similarly by participants. Further, an overwhelming majority of participants held a favorable and certain attitude toward the stimuli, cell-culture meat in both studies. Researchers expected participants

Consistent with the protocol used in other diffusion chain studies, the material provided to Study 2 participants was contingent on the information Study 1 participants included in their message. Considering findings by studies that used a similar protocol, we expected considerable degradation of information shared. For example, Moussaïd et al. (2015) found that Chain Member 1 shared about half of the provided information within a ten-person chain, Chain Member 2 20%, and the final tenth chain member shared only 4% of the original material. In the current study, the degradation of information occurred much quicker. Messages written by Study 1 participants with extreme attitudes shared an average of 7.01 information units. Of those, 43.47% were attitudinally consistent. In comparison, those without an extreme attitude shared an average of 6.47 information units, 34.69% of which were attitudinally consistent. In Study 2, messages written by participants with an extreme attitude shared 5.50 information units, of which 8.20% were attitudinally consistent, and those without an extreme attitude shared 6.47 information units, 10.66% of which were attitudinally consistent. This initial message transformation drastically changed the information available for Study 2 participants. As the diffusion chain increased in length, members had access to less and less of the original information.

With these points of interest related to attitudes and messages, future studies could consider the information sharing protocol to understand better the influence of information sharing in an interpersonal setting. For example, one reason for the quick degradation of information could be participants typing their responses versus orally sharing. Manipulating the information-sharing platform could be of interest. Another potential factor to consider is that, unlike Moussaïd et al. (2015), we did not compare if the shared information matched the original article's included information. Future studies could introduce further manipulations to the amount and type of

information the first participant shares to discover if this influences the message shared by the second chain member.

Next, it is important to consider possibilities related to the Amazon M-Turk sample. Both studies required a high level of involvement of participants. So long as participants answered all attitude questions and included at least one information unit about cell-cultured meat in their message they were included in analyses. Participants were not screened for satisficing. Future studies could consider using an alternative sample while still asking participants type their responses. Further the studies could be replicated inside a lab setting where instead of typing responses participants share their message with other participants orally.

APPENDIX A. STUDY 1 SURVEY

This study seeks to understand your perception of cell-cultured meat. This animal flesh product has never been part of a living animal but is grown in a laboratory using muscle stem cells. Cell-cultured meat is also referred to as clean, lab-grown, and in vitro meat. Currently, it is not commercially available, though research is being conducted to introduce it as a new meat production technique for the future. To help you gain a more robust understanding of cell-cultured meat, you will have the opportunity to review a media article. While reviewing the article, consider what critical points someone may need to know to understand cell-cultured meat. You will answer questions and write a message overviewing your perception of cell-cultured meat for another potential consumer to read.

I am over 18.

Yes No

I currently live in the United States of America.

Yes No

Please enter your M-Turk ID.

Open-ended

Please describe the scene above in two to three complete sentences.

Open-ended

The following questions seek to capture your attitude toward cell-cultured meat.

Attitude Valence

Please rate cell-cultured met using the following topics.

Unsafe…Safe

Unnatural…Natural

Unethical…Ethical

Unhealthy…Healthy

Immoral…Moral

Cruel…Kind

Unappetizing…Appetizing

Irresponsible…Responsible

5-point Semantic differential scale

Attitude Extremity

What is your attitude toward cell-cultured meat?

5-point Likert scale Extremely positive… Extremely negative

Attitude Certainty

How certain are you of your opinion toward cell-cultured meat?

How certain are you that you know what your true attitude on cell-cultured meat really is?

How certain are you that the attitude you expressed toward cell-cultured meat really reflects your true thoughts and feelings?

To what extent is your true attitude toward cell-cultured meat clear in your mind?

How certain are you that the attitude you just expressed toward cell-cultured meat is really the attitude you have?

How certain are you that your attitude toward cell-cultured meat is the correct attitude to have?

To what extent do you think other people should have the same attitude as you on cell-cultured meat?

How certain are you that of all the possible attitudes one might have toward cell-cultured meat, your attitude reflects the right way to think about the issue?

5-point Likert scale Not at all certain … Extremely certain

You will now be given the opportunity to review one media article that presents different views and information on manufacturing and consuming cell-cultured meat. While reviewing the article, consider what critical points someone may need to know to understand cell-cultured meat. Once you review the article and click next, you will write a message without access to the original information.

Cell-Cultured Meat Article

In 1932, Winston Churchill predicted that within 50 years, "we shall escape the absurdity of growing a whole chicken in order to eat the breast or wing, by growing these parts separately under a suitable medium." He added, "the new foods will be practically indistinguishable from the natural products from the outset, and any changes will be so gradual as to escape observation." Churchill's timeline didn't pan out, but rapid advances in technology have begun to bridge the gap between fiction and reality and bring the future of food into daily life.

The first cell-cultured meat patty was unveiled for human consumption in 2013 on television by Mark Post, Ph.D. professor at Maastricht University. Seven years later, in 2020, Eat Just made history as the first company to get regulatory approval for the sale of cell-cultured meat. The company's chicken is now on the menu at 1880, a restaurant in Singapore. The current product isn't mimicking animal-grown chicken texture just yet. After tasting the chicken, a Bloomberg writer concluded "The texture still needs work—it's a bit too smooth and not quite fibrous enough, closer to Play-Doh or a firm tofu." Alternatively, Israel's then Prime Minister Benjamin Netanyahu became the first head of state to taste cell-cultured meat publicly. After savoring a bite of steak cultured by Aleph Farms, the politician declared it "delicious and guilt-free," adding that "I can't taste the difference." The company has since vowed to make its cultured meat products publicly available in 2022. Singapore likely won't be the last country to approve this novel food. American consumers may also soon have similar opportunities: "Meat Growing in Israeli Bioreactors Is Coming to American Diners," *Bloomberg* reported in June 2021.

Such announcements piqued the appetites of celebrity moguls hoping to snatch a share of the $1.4 trillion global meat industry, including Bill Gates, Richard Branson, Kimbal Musk, Sergey Brin, Peter Thiel, and John Mackey, the founder of Whole Foods. Conventional meat giants Tyson and Cargill have also hedged their bets on the future of carnivory by investing in cell-based startups, and Swiss processed-food giant Nestle has announced plans to do the same. As the investments continue to rise, so do the companies that have publicly announced a business line in cultivated meat. Investors poured $350 million into the cultured meat space in 2020, nearly double what had been invested into the industry up to that point, according to a recent report from the Good Food Institute, which promotes alternatives to animal agriculture.

The novel foods have been called by several names: in-vitro meat, lab-grown meat, cell-based meat, and even "clean" meat. Currently, "cell-cultured" is the preferred term, although this may change as the industry matures. And the movement isn't limited to meat. Entrepreneurs worldwide are also working on animal-free versions of eggs, seafood, and dairy products. By any name, it's quickly moving from the lab to the factory, from prototype portions that cost thousands of dollars to make to products that are coming close to competing with the prices of slaughtered animals. Although not quite yet.

It turns out mimicking the complex biological processes that generate what eaters know as meat is mind-bogglingly difficult, and massive technological hurdles to doing it at scale remain. Rebecca Vaught, a founder of Van Heron Labs, a biotechnology company that works with medical and cell-meat companies to streamline their cell-growth process, argues the engineering challenges associated with cultured meat "are nearly on par with the engineering challenges with taking a man to the moon." Scientists could extract animals' cells and keep them alive and growing in a lab setting since the 1950s. In the 1980s, the technology blossomed into tissue engineering—growing material in a lab to replace damaged or diseased tissue in people. Today's cell-based meat companies apply those techniques to the task of generating animal flesh. But moving from the synthesis of small amounts of human tissue to mass production of food-grade beef, chicken, and pork requires a vast scaling up—a challenge that still hangs over the cell-meat industry. The regulatory caveats aren't trivial, either -- these novel products have yet to pass safety and ethical

inspection with the U.S. Food and Drug Administration and agriculture department-- which in 2019 agreed to oversee the regulation of cell meat jointly.

The process of creating cultured proteins looks nothing like raising animals for food, and that's exactly the point. Instead of using an entire animal, cell-cultured products start with just a few cells. For cultured meat, stem cells are used as they can divide indefinitely and be differentiated into different lineages—just like meat from different organs. A single stem cell can grow up to 1 trillion muscle cells, which then grow into muscle tissue strands. Most of this process happens inside bioreactors which provide a controlled culture environment such as temperature, pH, and even mechanical motion to optimize cell growth. They are an essential element in the cultured meat industry to achieve scalable production to meet consumer demand. Inside the reactor, growth factors including a mixture of fats, amino acids, carbohydrates, vitamins, and minerals are required for cells to divide and grow. The combination of ingredients in the liquid culture prompts cells to differentiate into muscle, fat, and connective tissue. Companies that want to produce something other than nuggets or burgers go one step further and use what's known as scaffolding: a three-dimensional structure to what naturally gives meat its shape and texture. At the end of the growth process, cells are harvested and turned into products whose proteins are molecularly identical to those in animal meat.

There are still significant scientific challenges, including developing quality cell lines, lowering the costs of growth media components, and designing bioreactors for growing thick tissue layers before cultured meat can become a common food product.

First, it can be costly and time-consuming to develop quality stem cell lines suitable for cultured production. It remains challenging to deliver reliable genes into cells that confer desirable traits like fast biomass accumulation. Unstable cell lines can adversely affect quality control. When cells divide more rapidly, there is a higher probability that their genetic content is not stable, creating a safety concern. For instance, during DNA replication, there can be copy number variations and large insertions or deletions that can lead to undesirable phenotypic and functional changes.

Second, while cultured meat is purported as an animal-free meat alternative, its production may still require animal-sourced materials such as fetal bovine sera creating an ethical issue. Sera is a complex mixture of multiple types of amino acids, lipids, inorganic minerals, and growth factors. As cell lines divide rapidly, growth media needs to supply them with high concentrations of essential nutrients. There are currently research groups that develop growth culture media that is entirely void of serum. However, commercial growth media is costly, and a lack of better alternatives has kept the prices of cultured meat high.

Third, scaffolds are extracellular matrix materials that support the anchorage and physiological activities such as the differentiation of stem cells. Smaller, less complex scaffolding effectively cultivates ground meat, such as meat used for burgers, sausages, and nuggets. More complex scaffolding is needed for cultivating meat with a specific structure and thickness, like steak. There are two types of scaffold materials—naturally derived or synthetic. Naturally derived scaffolds are edible, biodegradable, food-safe, and cheap, but their properties have greater variation. On the other hand, synthetic scaffolds can be chemically programmed into desirable materials with defined properties like porosity and ligand availability. However, the cost is higher, and getting regulatory approval is also expected to be more challenging. A proposed solution is a hybrid model where naturally derived biomaterial is coupled with a small amount of synthetic material to enhance the compatibility with cultured cells.

Despite the number of hurdles yet to be overcome, immense progress has been made over the last decade, and there are some positives to growing meat from cells. Cultured meat provides a hope that our society can become less reliant on animals for meat, thus reducing the environmental and health impact of animal farming. Global production of meat is expected to be 460-570 million tons by 2050; at the high end, that would be double what it was in 2008. Proponents of switching from factory-farmed meat to cultured meat assert the change would dramatically reduce land, water, and fuel use and result in a dramatic reduction in greenhouse gas emissions. However, some studies suggest long term-benefits wouldn’t be as extensive as were first hoped. Further, bioreactors are cleaner environments than factory farms, so there’s little risk of contamination with dangerous diseases and microorganisms into the meat like E. coli, salmonella, and zoonotic diseases like coronavirus. No antibiotics are needed in the production process, and it’s much easier to trace final

products back to their origins-- unlike conventional products like ground beef, which may contain meat from many different animals.

Cell-cultured meat could help fill a need in the supply chain. According to Mosa Meat, one of the leading companies in the cell-cultured space, 10 tons of meat could potentially be produced from a single tissue sample. However, some supporters of a shift to cell-cultured products envision the future of meat as a combination of plant-based and cell-based, which may be necessary to make any significant impact. At only 9% of the total meat market, these two industries have a long way to go in the quest to replace animal meat.

Many consumers remain in the dark about cell-cultured meat, although probably not for much longer. Eat Just shared with us preliminary results of a survey of U.S. and Singapore consumers taken by "a leading management consulting firm." It found 72% of U.S. chicken consumers and 83% of Singapore chicken consumers said they would consider purchasing. Further, 91% of restaurant operators polled were open to selling cultured meat. Consumer acceptance is just one of many hurdles cell-cultured products face in going to market. Whether challenges related to safety and responsibility can be addressed in a way that allows cell-cultured meat to become a household staple remains to be seen.

The sophisticated technology in genetic engineering, biomaterial design, and sequencing methods can offer adequate technical solutions. Greater scientific solutions are also expected with increasing investments in the science of alternative food. Importantly beyond the science, for cultured meat to become a common market commodity, challenges in regulations and consumer acceptance must still be overcome.

While you now have read different statements about cell-cultured meat, we would like to provide other study participants with your personal account of the matter. Considering all information regarding cell-cultured meat you are familiar with, what are the critical points someone would need to know to understand cell-cultured meat? Please describe exactly what you would share.

Textbox entry with unlimited characters

Thank you for sharing your perception of cell-cultured meat. Please reflect on the information-sharing task and related instructions.

Motive

What did the instructions ask you to do? Select all that apply.

Inform Persuade

How did you decide what to include in your message to another consumer? Select all that apply.

I included the information I remembered

I included the information I believe to be important

I included the information I used to form my personal opinion on the topic

To what extent did you try to inform another consumer about cell-cultured meat when sharing information?

To what extent did you try to persuade another consumer about cell-cultured meat when sharing information?

I have enough information to form an attitude toward cell-cultured meat.

The information provided offered a comprehensive overview of cell-cultured meat.

5-point Likert scale Definitely yes … Definitely not

Knowledge

How knowledgeable are you of cell-cultured meat?

5-point Likert scale Extremely knowledgeable … Not knowledgeable at all

The following questions seek to capture your attitude toward cell-cultured meat now that you have read more about it.

Attitude Valence

Please rate cell-cultured met using the following topics

5point Semantic differential scale

Unsafe…Safe

Unnatural…Natural

Unethical…Ethical

Unhealthy…Healthy

Immoral…Moral

Cruel…Kind

Unappetizing…Appetizing

Irresponsible…Responsible

Attitude Extremity

What is your attitude toward cell-cultured meat?

5-point Likert scale Extremely positive … Extremely negative

Attitude Certainty

How certain are you of your opinion toward cell-cultured meat?

How certain are you that you know what your true attitude on cell-cultured meat really is?

How certain are you that the attitude you expressed toward cell-cultured meat really reflects your true thoughts and feelings?

To what extent is your true attitude toward cell-cultured meat clear in your mind?

How certain are you that the attitude you just expressed toward cell-cultured meat is really the attitude you have?

How certain are you that your attitude toward cell-cultured meat is the correct attitude to have?

To what extent do you think other people should have the same attitude as you on cell-cultured meat?

How certain are you that of all the possible attitudes one might have toward cell-cultured meat, your attitude reflects the right way to think about the issue?

5-point Likert scale Not at all certain … Extremely certain

Behavior

What are your eating habits?

Meat-eating Eat white meat only Pescatarian Vegetarian Vegan

Other (please specify)

How likely are you to incorporate cell-cultured meat into your diet?

5-point Likert scale Extremely likely … Extremely unlikely

What types of meat would you be willing to eat if they were produced using cell-cultured methods?

Fish and/or seafood Poultry Bacon, ham and/or pork Beef Horse

Dog and/or cat None

Demographics

What is your gender?

Male Female Non-binary/third gender

What is your year of birth?

Textbox entry

In political matters, values are generally considered either "conservative" or "liberal." Which set of ideas most closely suits your own opinions?

Scale 1 (conservative) - 10 (liberal)

How would you describe yourself? Select all that apply to you.

American Indian or Alaska Native—For example, Navajo Nation, Blackfeet Tribe, Mayan, Aztec, Native Village of Barrow Inupiat Traditional Government, Nome Eskimo Community

Asian—For example, Chinese, Filipino, Asian Indian, Vietnamese, Korean, Japanese

Black or African American—For example, Jamaican, Haitian, Nigerian, Ethiopian, Somalian

Hispanic, Latino, or Spanish Origin—For example, Mexican or Mexican American, Puerto Rican, Cuban, Salvadoran, Dominican, Columbian

Middle Eastern or North African—For example, Lebanese, Iranian, Egyptian, Syrian, Moroccan, Algerian

Native Hawaiian or Other Pacific Islander—For example, Native Hawaiian, Samoan, Chamorro, Tongan, Fijian, Marshallese

White—For example, German, Irish, English, Italian, Polish, French

Some other race, ethnicity, or origin, please specify

Which categories describe you? Select all that apply to you.

- Some high school
- High school diploma or equivalent
- Vocational Training
- Some college
- Associate's degree (e.g., AA, AE, AFA, AS, ASN)
- Bachelor's degree (e.g., BA, BBA BFA, BS)
- Some post-undergraduate work
- Master's degree (e.g., MA, MBA, MFA, MS, MSW)
- Specialist degree (e.g., EdS)
- Applied or professional doctorate degree (e.g., MD, DDC, DDS, JD, PharmD)
- Doctorate degree (e.g., EdD, PhD)
- Other, please specify

What is your employment status?

- Employed full time (40 or more hours per week)
- Employed part-time (up to 39 hours per week)
- Unemployed and currently looking for work
- Unemployed not currently looking for work
- Student
- Retired
- Homemaker
- Self-employed
- Unable to work

Where do you live?

- Midwest—Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, North Dakota, South Dakota, Wisconsin
- Northeast—Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
- South—Arkansas, Alabama, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia

West—Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming

Puerto Rico or other U.S. territories

Other, please specify

What social group do you identify with?

Poor Working-class Middle class Affluent

Feedback

Did you experience any problems filling out this survey?

Open-ended

If you have any additional comments about the survey, please write them here.

Open-ended

APPENDIX B. STUDY 1 CODER INSTRUCTIONS

In step one, each coder counts and records each unit of information related to cell-cultured meat found within the study stimuli, a media article written at an 11th grade reading level.

In step two, you will help code participant data. Participants completed a task during which they read a media article about cell-cultured meat, answered questions related to their perceptions, and wrote a message on the subject to share with another consumer. Upon reviewing the message transcripts, we seek assistance in identifying and classifying the information participants chose to include in their messages. First, coders one and two will collaborate to identify the total number of information units found in a subsample of the total messages shared.

During steps one and two, coders use the following coding scheme to classify each information unit. An information unit includes any statement that makes a claim. Sentences may include more than one piece of information. Below are five examples of information units that may be included in the transcripts.

- The first cell-cultured meat patty was unveiled for human consumption in 2013.
- Eat Just made history as the first company to get regulatory approval for the sale of cell-cultured meat.
- The current product isn't mimicking animal-grown chicken texture just yet.
- Cultured meat provides a hope that our society can become less reliant on animals for meat.

Upon agreeing on the total number of information units shared each coder will independently classify individual information units as positive, negative, or neutral using the coding scheme described.

Negative statements. This category corresponds to any information unit that highlights the manufacturing or regulatory hurdles, ethical and safety concerns, or negative attributes of cell-cultured meat and contains any of the following elements:

- Mention any negative consequence that cell-cultured meat can have for people, animals, or the environment. Examples are "It tastes bad," "It is harmful to the animal," "It may leave a significant environmental footprint."
- Any expression of a personal feeling or judgment suggesting the danger of cell-cultured meat, as well as the report of someone else's negative judgment about it. Examples are "You should keep your hands away from it," I'm scared about it," or "National Chicken Counsel takes a position against it."

Positive statements. This category corresponds to any information unit highlighting the manufacturing or regulatory progress, ethical and safety benefits, positive attributes of cell-cultured meat, and contains any of the following elements:

- Any terms mentioning that cell-cultured meat is safe or minimizing its danger. Examples are "as long as you do not overdo it, it is not dangerous" or "It is not that bad compared with other things."
- Any report of someone else's favorable judgment. An example is "The Good Food Institute said eating it is safe."
- Any terms suggesting that higher authorities are protecting the consumers. An example is "At NASA, there are strict regulations."

Neutral statements. Information units that express neither a positive nor negative assessment are neutral.

Upon coding each information unit as positive, negative, or neutral, you will count and record the number of each type of information unit included in each article and message. Please document the number of positive, negative, and neutral information units.

APPENDIX C. STUDY 2 SURVEY

This study seeks to understand your perception of cell-cultured meat. This animal flesh product has never been part of a living animal but is grown in a laboratory using muscle stem cells. Cell-cultured meat is also referred to as clean, lab-grown, and in vitro meat. Currently, it is not commercially available, though research is being conducted to introduce it as a new meat production technique for the future. To help you gain a more robust understanding of cell-cultured meat, you will have the opportunity to review a message written by another consumer. You will answer questions and write a message overviewing your perception of cell-cultured meat for another potential consumer to read.

I am over 18.

Yes No

I currently live in the United States of America.

Yes No

Please enter your M-Turk ID,

Open-ended

Please describe the scene above in two to three complete sentences.

Open-ended

The following questions seek to capture your attitude toward cell-cultured meat.

Attitude Valence

Please rate cell-cultured met using the following topics.

Unsafe…Safe

Unnatural…Natural

Unethical…Ethical

Unhealthy…Healthy

Immoral…Moral

Cruel…Kind

Unappetizing…Appetizing

Irresponsible…Responsible

5-point Semantic differential scale

Attitude Extremity

What is your attitude toward cell-cultured meat?

5-point Likert scale Extremely positive… Extremely negative

Attitude Certainty

How certain are you of your opinion toward cell-cultured meat?

How certain are you that you know what your true attitude on cell-cultured meat really is?

How certain are you that the attitude you expressed toward cell-cultured meat really reflects your true thoughts and feelings?

To what extent is your true attitude toward cell-cultured meat clear in your mind?

How certain are you that the attitude you just expressed toward cell-cultured meat is really the attitude you have?

How certain are you that your attitude toward cell-cultured meat is the correct attitude to have?

To what extent do you think other people should have the same attitude as you on cell-cultured meat?

How certain are you that of all the possible attitudes one might have toward cell-cultured meat, your attitude reflects the right way to think about the issue?

5-point Likert scale Not at all certain … Extremely certain

You will now be given the opportunity to review a message informing you of cell-cultured meat written by another potential consumer before sharing your own account. While reviewing the message, consider what critical points someone may need to know to understand cell-cultured meat. Once you review the message and click next, you will write a message without access to the original information.

Message about cell-cultured meat

While you have read a statement about cell-cultured meat, we would like to provide other study participants with your personal account of the matter. Considering all information regarding cell-cultured meat you are familiar with, what are the critical points someone would need to know to understand cell-cultured meat? Please describe exactly what you would share.

Textbox entry with unlimited characters

Thank you for sharing your perception of cell-cultured meat. Please reflect on the information-sharing task and related instructions.

Motive

What did the instructions ask you to do? Select all that apply.

Inform Persuade

How did you decide what to include in your message to another consumer? Select all that apply.

I included the information I remembered

I included the information I believe to be important

I included the information I used to form my personal opinion on the topic

To what extent did you try to inform another consumer about cell-cultured meat when sharing information?

To what extent did you try to persuade another consumer about cell-cultured meat when sharing information?

I have enough information to form an attitude toward cell-cultured meat.

The information provided offered a comprehensive overview of cell-cultured meat.

5-point Likert scale Definitely yes … Definitely not

Knowledge

How knowledgeable are you of cell-cultured meat?

5-point Likert scale Extremely knowledgeable … Not knowledgeable at all

The following questions seek to capture your attitude toward cell-cultured meat now that you have read more about it.

Attitude Valence

The manufacturing/consumption of cell-cultured meat is

Unsafe…Safe

Unnatural…Natural

Unethical…Ethical

Unhealthy…Healthy

Immoral…Moral

Cruel…Kind

Unappetizing…Appetizing

Irresponsible…Responsible

5-point Semantic differential scale

Attitude Extremity

What is your attitude toward cell-cultured meat?

5-point Likert scale Extremely positive … Extremely negative

Attitude Certainty

How certain are you of your opinion toward cell-cultured meat?

How certain are you that you know what your true attitude on cell-cultured meat really is?

How certain are you that the attitude you expressed toward cell-cultured meat really reflects your true thoughts and feelings?

To what extent is your true attitude toward cell-cultured meat clear in your mind?

How certain are you that the attitude you just expressed toward cell-cultured meat is really the attitude you have?

How certain are you that your attitude toward cell-cultured meat is the correct attitude to have?

To what extent do you think other people should have the same attitude as you on cell-cultured meat?

How certain are you that of all the possible attitudes one might have toward cell-cultured meat, your attitude reflects the right way to think about the issue?

5-point Likert scale Not at all certain … Extremely certain

Behavior

What are your eating habits?

Meat-eating Eat white meat only Pescatarian Vegetarian Vegan

Other (please specify)

How likely are you to incorporate cell-cultured meat into your diet?

5-point Likert scale Extremely likely … Extremely unlikely

What types of meat would you be willing to eat if they were produced using cell-cultured methods?

Fish and/or seafood Poultry Bacon, ham and/or pork Beef Horse

Dog and/or cat None

Demographics

What is your gender?

Male Female Non-binary/third gender

What is your year of birth?

Textbox entry

In political matters, values are generally considered either "conservative" or "liberal." Which set of ideas most closely suits your own opinions?

Scale 1 (conservative) - 10 (liberal)

How would you describe yourself? Select all that apply to you.

American Indian or Alaska Native—For example, Navajo Nation, Blackfeet Tribe, Mayan, Aztec, Native Village of Barrow Inupiat Traditional Government, Nome Eskimo Community

Asian—For example, Chinese, Filipino, Asian Indian, Vietnamese, Korean, Japanese

Black or African American—For example, Jamaican, Haitian, Nigerian, Ethiopian, Somalian

Hispanic, Latino, or Spanish Origin—For example, Mexican or Mexican American, Puerto Rican, Cuban, Salvadoran, Dominican, Columbian

Middle Eastern or North African—For example, Lebanese, Iranian, Egyptian, Syrian, Moroccan, Algerian

Native Hawaiian or Other Pacific Islander—For example, Native Hawaiian, Samoan, Chamorro, Tongan, Fijian, Marshallese

White—For example, German, Irish, English, Italian, Polish, French

Some other race, ethnicity, or origin, please specify

Which categories describe you? Select all that apply to you.

Some high school

High school diploma or equivalent

Vocational Training

Some college

Associate's degree (e.g., AA, AE, AFA, AS, ASN)

Bachelor's degree (e.g., BA, BBA BFA, BS)

Some post-undergraduate work

Master's degree (e.g., MA, MBA, MFA, MS, MSW)

Specialist degree (e.g., EdS)

Applied or professional doctorate degree (e.g., MD, DDC, DDS, JD, PharmD)

Doctorate degree (e.g., EdD, PhD)

Other, please specify

What is your employment status?

Employed full time (40 or more hours per week)

Employed part-time (up to 39 hours per week)

Unemployed and currently looking for work

Unemployed not currently looking for work

Student

Retired

Homemaker

Self-employed

Unable to work

Where do you live?

Midwest—Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, North Dakota, South Dakota, Wisconsin

Northeast—Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont

South—Arkansas, Alabama, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia

West—Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming

Puerto Rico or other U.S. territories

Other, please specify

What social group do you identify with?

Poor Working-class Middle class Affluent

Feedback

Did you experience any problems filling out this survey?

Open-ended

If you have any additional comments about the survey, please write them here.

Open ended

APPENDIX C. STUDY 2 CODER INSTRUCTIONS

You will help code participant data. Participants completed a task during which they read a media article about cell-cultured meat, answered questions related to their perceptions, and wrote a message on the subject to share with another consumer. Upon reviewing the message transcripts, we seek assistance in identifying and classifying the information participants chose to include in their messages. First, coders one and two will collaborate to identify the total number of information units found in a subsample of the total messages shared.

Coders use the following coding scheme to classify each information unit. An information unit includes any statement that makes a claim. Sentences may include more than one piece of information. Below are five examples of information units that may be included in the transcripts.

- The first cell-cultured meat patty was unveiled for human consumption in 2013.
- Eat Just made history as the first company to get regulatory approval for the sale of cell-cultured meat.
- The current product isn't mimicking animal-grown chicken texture just yet.
- Cultured meat provides a hope that our society can become less reliant on animals for meat.
- Upon agreeing on the total number of information units shared each coder will independently classify individual information units as positive, negative, or neutral using the coding scheme described.

Negative statements. This category corresponds to any information unit that highlights the manufacturing or regulatory hurdles, ethical and safety concerns, or negative attributes of cell-cultured meat and contains any of the following elements:

- Mention any negative consequence that cell-cultured meat can have for people, animals, or the environment. Examples are "It tastes bad," "It is harmful to the animal," "It may leave a significant environmental footprint."
- Any expression of a personal feeling or judgment suggesting the danger of cell-cultured meat, as well as the report of someone else's negative judgment about it. Examples are "You should keep your hands away from it," I'm scared about it," or "National Chicken Counsel takes a position against it."

Positive statements. This category corresponds to any information unit highlighting the manufacturing or regulatory progress, ethical and safety benefits, positive attributes of cell-cultured meat, and contains any of the following elements:

- Any terms mentioning that cell-cultured meat is safe or minimizing its danger. Examples are "as long as you do not overdo it, it is not dangerous" or "It is not that bad compared with other things."
- Any report of someone else's favorable judgment. An example is "The Good Food Institute said eating it is safe."
- Any terms suggesting that higher authorities are protecting the consumers. An example is "At NASA, there are strict regulations."

Neutral statements. Information units that express neither a positive nor negative assessment are neutral.

Upon coding each information unit as positive, negative, or neutral, you will count and record the number of each type of information unit included in each article and message. Please document the number of positive, negative, and neutral information units.

REFERENCES

Ajzen, I. (2012). Martin Fishbein's legacy: The reasoned action approach. *The Annals of the American Academy of Political and Social Science*, *640*(1), 11-27. doi: 10.1177/0002716211423363

Allport, F. H., & Hartman, D. A. (1925). The measurement and motivation of atypical opinion in a certain group. *The American Political Science Review*, *19*(4), 735-760. doi: 10.2307/2939163

Altman, E. (1999). *Constrained Markov decision processes* (Vol. 7). CRC Press.

Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology*. Cambridge University Press.

Bekker, G. A., Fischer, A. R., Tobi, H., & van Trijp, H. C. (2017). Explicit and implicit attitude toward an emerging food technology: The case of cultured meat. *Appetite*, *108*(1), 245-254. doi: 10.1016/j.appet.2016.10.002

Bonito, J. A. (2007). A local model of information sharing in small groups. *Communication Theory*, *17*(3), 252-280. doi: 10.1111/j.1468-2885.2007.00295

Bryant, C., & Barnett, J. (2018). Consumer acceptance of cultured meat: A systematic review. *Meat Science*, *143*(1), 8-17. doi: 10.1016/j.meatsci.2018.04.008

Budd, R. J. (1986). Predicting cigarette use: The need to incorporate measures of salience in the theory of reasoned action. *Journal of Applied Social Psychology*, *16*(8), 663-685. doi: 10.1111/j.1559-1816.1986.tb01752.x

Burns, W. J., Slovic, P., Kasperson, R. E., Kasperson, J. X., Renn, O., & Emani, S. (1993). Incorporating structural models into research on the social amplification of risk: Implications for theory construction and decision making. *Risk Analysis*, *13*(1), 611–623. doi: 10.1111/j.1539-6924.1993.tb01323.x

Campbell, E., & Salathé, M. (2013). Complex social contagion makes networks more vulnerable to disease outbreaks. *Scientific Reports*, *3*(1), 1-6. doi: 10.1038/srep01905

Carlson, T. N. (2018). Modeling political information transmission as a game of telephone. *The Journal of Politics*, *80*(1), 348-352. doi: 10.1086/694767

Carlson, T. N. (2019). Through the grapevine: Informational consequences of interpersonal political communication. *American Political Science Review*, *113*(2), 325-339. doi: 10.1017/S000305541900008X

Cheatham, L., & Tormala, Z. L. (2015). Attitude certainty and attitudinal advocacy: The unique roles of clarity and correctness. *Personality and Social Psychology Bulletin*, *41*(11), 1537-1550. doi: 10.1177/0146167215601406

Cheatham, L. B., & Tormala, Z. L. (2017). The curvilinear relationship between attitude certainty and attitudinal advocacy. *Personality and Social Psychology Bulletin*, *43*(1), 3-16. doi: 10.1177/0146167216673349

Christakis, N. A., & Fowler, J. H. (2007). The spread of obesity in a large social network over 32 years. *New England Journal of Medicine*, *357*(4), 370-379. doi: 10.1056/NEJMsa066082

Churchill, W. (1931). Fifty years hence. *Originally published in Strand Magazine*.

Clark, J. K., Wegener, D. T., & Fabrigar, L. R. (2008). Attitudinal ambivalence and message-based persuasion: Motivated processing of proattitudinal information and avoidance of counterattitudinal information. *Personality and Social Psychology Bulletin*, *34*(4), 565-577. doi: 10.1177/0146167207312527

Connors, M., Bisogni, C. A., Sobal, J., & Devine, C. M. (2001). Managing values in personal food systems. *Appetite*, *36*(3), 189-200. doi: 10.1006/appe.2001.0400

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Harcourt Brace Jovanovich College Publishers.

Eagly, A. H., & Chaiken, S. (1998). Attitude structure. In D. T. Gilbert & S. T. Fiske (Eds.), *Handbook of social psychology*, (Vol. 1, pp. 269-322). Oxford University Press.

Eagly, A. H., & Chaiken, S. (2005). Attitude research in the 21st century: The current state of knowledge. In D. Albarracín, B. T. Johnson, & M. P. Zanna (Eds.), *The handbook of attitudes* (pp. 743–767). Lawrence Erlbaum Associates Publishers.

Eagly, A. H., & Chaiken, S. (2007). The advantages of an inclusive definition of attitude. *Social Cognition*, *25*(5), 582-602. doi: 10.1521/soco.2007.25.5.582

Egolf, A., Hartmann, C., & Siegrist, M. (2019). When evolution works against the future: Disgust's contributions to the acceptance of new food technologies. *Risk Analysis*, *39*(7), 1546-1559. doi: 10.1111/risa.13279

Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Psychology*, *54*(1), 297-327. doi: 10.1146/annurev.psych.54.101601.145225

Fazio, R. H., & Petty, R. E. (2008). *Attitudes: Their structure, function, and consequences*. Psychology Press.

Fazio, R. H., & Zanna, M. P. (1978a). On the predictive validity of attitudes: The roles of direct experience and confidence. *Journal of Personality*, *46*(2), 228-243. doi: 10.1111/j.1467-6494.1978.tb00177.x

Fazio, R. H., & Zanna, M. P. (1978b). Attitudinal qualities relating to the strength of the attitude-behavior relationship. *Journal of Experimental Social Psychology*, *14*(4), 398-408. doi: 10.1111/j.1467-6494.1978.tb00177.x

Forsyth, D. R. (2018). *Group dynamics*. Cengage Learning.

Graf, J., & Aday, S. (2008). Selective attention to online political information. *Journal of Broadcasting & Electronic Media*, *52*(1), 86-100. doi: 10.1080/08838150701820874

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford publications.

Hart, W., Albarracín, D., Eagly, A. H., Brechan, I., Lindberg, M. J., & Merrill, L. (2009). Feeling validated versus being correct: A meta-analysis of selective exposure to information. *Psychological Bulletin*, *135*(4), 555-588. doi: 10.1037/a0015701

Helbing, D., Brockmann, D., Chadefaux, T., Donnay, K., Blanke, U., Woolley-Meza, O., ... & Perc, M. (2015). Saving human lives: What complexity science and information systems can contribute. *Journal of Statistical Physics*, *158*(3), 735-781. doi: 10.1007/s10955-014-1024-9

Hocquette, A., Lambert, C., Sinquin, C., Peterolff, L., Wagner, Z., Bonny, S. P., ... & Hocquette, J. F. (2015). Educated consumers don't believe artificial meat is the solution to the problems with the meat industry. *Journal of Integrative Agriculture*, *14*(2), 273-284. doi: 10.1016/S2095-3119(14)60886-8

Johnson, D. M. (1940). Confidence and the expression of opinion. *The Journal of Social Psychology*, *12*(1), 213-220. doi: 10.1080/00224545.1940.9713815

Johnson, N., & Reimer, T. (2020). *Alexa for fun or for work? Purpose moderates the effects of cognitive and affective appraisals on the adoption of digital assistants* [Unpublished master's thesis]. Purdue University.

Jonas, K., Diehl, M., & Brömer, P. (1997). Effects of attitudinal ambivalence on information processing and attitude-intention consistency. *Journal of Experimental Social Psychology*, *33*(2), 190-210. doi: 10.1006/jesp.1996.1317

Jonas, E., Schulz-Hardt, S., Frey, D., & Thelen, N. (2001). Confirmation bias in sequential information search after preliminary decisions: An expansion of dissonance theoretical research on selective exposure to information. *Journal of Personality and Social Psychology*, *80*(4), 557-571. doi: 10.1037/0022-3514.80.4.557

Judd, C. M., & Johnson, J. T. (1981). Attitudes, polarization, and diagnosticity: Exploring the effect of affect. *Journal of Personality and Social Psychology*, *41*(1), 26-36. doi: 10.1037/0022-3514.41.1.26

Kasperson, R. E. (1992). The social amplification of risk: Progress in developing an integrative framework in social theories of risk. In S. Krimsky & D. Golding (Eds.), *Social theories of risk.* (pp. 153-178). Oxford University Press.

Kasperson, R. E., & Kasperson, J. X. (1996). The social amplification and attenuation of risk. *The Annals of the American Academy of Political and Social Science*, *545*(1), 95-105. doi: 10.1177/0002716296545001010

Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., ... & Ratick, S. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis*, *8*(2), 177-187. doi: 10.1111/j.1539-6924.1988.tb01168.x

Katz, D. (1960). The functional approach to the study of attitudes. *Public Opinion Quarterly*, *24*(2), 163-204. doi: 10.1086/266945

Khalifa, M., & Cheng, S. K. (2002, January 7-10). *Adoption of mobile commerce: Role of exposure* [Conference session]. Annual Hawaii International Conference on System Sciences, Big Island, HI, Unites States. https://www.computer.org/csdl/proceedings/hicss/2002/12OmNwpGgKr

Kim, Y. J. (2015). Does disagreement mitigate polarization? How selective exposure and disagreement affect political polarization. *Journalism & Mass Communication Quarterly*, *92*(4), 915-937. doi: 10.1177/1077699015596328

Kim, Y. J., Chun, J. U., & Song, J. (2009). Investigating the role of attitude in technology acceptance from an attitude strength perspective. *International Journal of Information Management*, *29*(1), 67-77. doi: 10.1016/j.ijinfomgt.2008.01.011

Knobloch-Westerwick, S., & Meng, J. (2011). Reinforcement of the political self through selective exposure to political messages. *Journal of Communication*, *61*(2), 349-368. doi: 10.1111/j.1460-2466.2011.01543.x

Knobloch-Westerwick, S., Johnson, B. K., & Westerwick, A. (2015). Confirmation bias in online searches: Impacts of selective exposure before an election on political attitude strength and shifts. *Journal of Computer-Mediated Communication*, *20*(2), 171-187. doi: 10.1111/jcc4.12105

Knobloch-Westerwick, S., Kennard, A. R., Westerwick, A., Willis, L. E., & Gong, Y. (2014). A crack in the crystal ball? Prolonged exposure to media portrayals of social roles affect possible future selves. *Communication Research*, *41*(6), 739-759. doi: 10.1177/0093650213491113

Krosnick, J. A., & Abelson, R. P. (1992). The case for measuring attitude strength in surveys. In J. M. Tanur (Ed.), *Questions about questions: Inquiries into the cognitive bases of surveys*, (pp. 177-203). Russell Sage Foundation.

Krosnick, J. A., & Petty, R. E. (1995). Attitude strength: An overview. In R. E. Petty & J. A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences.* (pp. 247-282). Lawrence Erlbaum Associates.

Krosnick, J. A., & Schuman, H. (1988). Attitude intensity, importance, and certainty and susceptibility to response effects. *Journal of Personality and Social Psychology*, *54*(6), 940-952. doi: 10.1037/0022-3514.54.6.940

Krosnick, J. A., Boninger, D. S., Chuang, Y. C., Berent, M. K., & Carnot, C. G. (1993). Attitude strength: One construct or many related constructs?. *Journal of Personality and Social Psychology*, *65*(6), 1132-1151. doi: 10.1037/0022-3514.65.6.1132

Laestadius, L. I., & Caldwell, M. A. (2015). Is the future of meat palatable? Perceptions of in vitro meat as evidenced by online news comments. *Public Health Nutrition*, *18*(13), 2457-2467. doi: 10.1017/S1368980015000622

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*(1), 159-174. doi: 10.2307/2529310

Mancini, M. C., & Antonioli, F. (2019). Exploring consumers' attitude towards cultured meat in Italy. *Meat Science*, *150*(1), 101-110. doi: 10.1016/j.meatsci.2018.12.014

McComas, K. A. (2006). Defining moments in risk communication research: 1996-2005. *Journal of Health Communication*, *11*(1), 75-91. doi: 10.1080/10810730500461091

McDill, E. L. (1959). A comparison of three measures of attitude intensity. *Social Forces*, *38*(2), 95-99. doi: 10.2307/2573925

Mehling, R. (1959). A simple test for measuring intensity of attitudes. *Public Opinion Quarterly*, *23*(4), 576-578. doi: 10.1086/266913

Mesoudi, A., Whiten, A., & Dunbar, R. (2006). A bias for social information in human cultural transmission. *British Journal of Psychology*, *97*(3), 405-423. doi: 10.1348/000712605X85871

Moussaïd, M., Brighton, H., & Gaissmaier, W. (2015, April 25-28). The amplification of risk in experimental diffusion chains [Conference Session]. National Academy of Sciences Conference, Washington, DC, United States. doi: 10.1073/pnas.1421883112

Newman, T. P. (Ed.). (2019). *Theory and best practices in science communication training*. Routledge. doi: 10.4324/9781351069366

O'Keefe, L., McLachlan, C., Gough, C., Mander, S., & Bows-Larkin, A. (2016). Consumer responses to a future UK food system. *British Food Journal*, *118*(2), 396-411. doi: 10.1108/BFJ-01-2015-0047

Prislin, R. (1996). Attitude stability and attitude strength: One is enough to make it stable. *European Journal of Social Psychology*, *26*(3), 447-477. doi: 10.1002/(SICI)1099-0992(199605)26:3<447::AID-EJSP768>3.0.CO;2-I

Reimer, T., Reimer, A., & Czienskowski, U. (2010). Decision-making groups attenuate the discussion bias in favor of shared information: A meta-analysis. *Communication Monographs*, *77*(1), 121-142. doi: 10.1080/03637750903514318

Salathé, M., & Bonhoeffer, S. (2008). The effect of opinion clustering on disease outbreaks. *Journal of The Royal Society Interface*, *5*(29), 1505-1508. doi: 10.1098/rsif.2008.0271

Sarker, S., Valacich, J. S., & Sarker, S. (2005). Technology adoption by groups: A valence perspective. *Journal of the Association for Information Systems*, *6*(2), 37-71. doi: 10.17705/1jais.00064

Sawicki, V., Wegener, D. T., Clark, J. K., Fabrigar, L. R., Smith, S. M., & Bengal, S. T. (2011). Seeking confirmation in times of doubt: Selective exposure and the motivational strength of weak attitudes. *Social Psychological and Personality Science*, *2*(5), 540-546. doi: 10.1177/1948550611400212

Sawicki, V., Wegener, D. T., Clark, J. K., Fabrigar, L. R., Smith, S. M., & Durso, G. R. (2013). Feeling conflicted and seeking information: When ambivalence enhances and diminishes selective exposure to attitude-consistent information. *Personality and Social Psychology Bulletin*, *39*(6), 735-747. doi: 10.1177/0146167213481388

Sears, D. O., & Freedman, J. L. (1967). Selective exposure to information: A critical review. *Public Opinion Quarterly*, *31*(2), 194-213. doi: 10.1086/267513

Siegrist, M., Sütterlin, B., & Hartmann, C. (2018). Perceived naturalness and evoked disgust influence acceptance of cultured meat. *Meat Science*, *139*(1), 213-219. doi: 10.1016/j.meatsci.2018.02.007

Smith, M. B., Bruner, J. S., & White, R. W. (1956). *Opinions and personality*. Cambridge University Press.

Sobal, J., & Bisogni, C. A. (2009). Constructing food choice decisions. *Annals of Behavioral Medicine*, *38*(1), 37-46. doi: 10.1007/s12160-009-9124-5

Stroud, N. J. (2010). Polarization and partisan selective exposure. *Journal of Communication*, *60*(3), 556-576. doi: 10.1111/j.1460-2466.2010.01497.x

Tannenbaum, P. H. (1956). Initial attitude toward source and concept as factors in attitude change through communication. *Public Opinion Quarterly*, *20*(2), 413-425. doi: 10.1086/266638

Tormala, Z. L., & Rucker, D. D. (2007). Attitude certainty: A review of past findings and emerging perspectives. *Social and Personality Psychology Compass*, *1*(1), 469-492. doi: 10.1111/j.1751-9004.2007.00025.x

Tucker, C. A. (2014). The significance of sensory appeal for reduced meat consumption. *Appetite*, *81*(1), 168-179. doi: 10.1016/j.appet.2014.06.022

Valente, T. W., Paredes, P., & Poppe, P. R. (1998). Matching the message to the process: The relative ordering of knowledge, attitudes, and practices in behavior change research. *Human Communication Research*, *24*(3), 366-385. doi: 10.1111/j.1468-2958.1998.tb00421.x

van Strien, J. L., Brand-Gruwel, S., & Boshuizen, H. P. (2014). Dealing with conflicting information from multiple nonlinear texts: Effects of prior attitudes. *Computers in Human Behavior*, *32*(1), 101-111. doi: 10.1016/j.chb.2013.11.021

van Strien, J. L., Kammerer, Y., Brand-Gruwel, S., & Boshuizen, H. P. (2016). How attitude strength biases information processing and evaluation on the web. *Computers in Human Behavior*, *60*(1), 245-252. doi: 10.1016/j.chb.2016.02.057

Verbeke, W., Marcu, A., Rutsaert, P., Gaspar, R., Seibt, B., Fletcher, D., & Barnett, J. (2015a). 'Would you eat cultured meat?': Consumers' reactions and attitude formation in Belgium, Portugal and the United Kingdom. *Meat Science*, *102*(1), 49-58. doi: 10.1016/j.meatsci.2014.11.013

Verbeke, W., Sans, P., & Van Loo, E. J. (2015b). Challenges and prospects for consumer acceptance of cultured meat. *Journal of Integrative Agriculture*, *14*(2), 285-294. doi: 10.1016/S2095-3119(14)60884-4

Weinrich, R., Strack, M., & Neugebauer, F. (2020). Consumer acceptance of cultured meat in Germany. *Meat Science*, *162*(1), 1-6. doi: 10.1016/j.meatsci.2019.107924

Wilks, M., & Phillips, C. J. (2017). Attitudes to in vitro meat: A survey of potential consumers in the United States. *PloS one*, *12*(2). doi: https://doi.org/10.1371/journal.pone.0171904

Yang, H. D., & Yoo, Y. (2004). It's all about attitude: Revisiting the technology acceptance model. *Decision Support Systems*, *38*(1), 19-31. doi: 10.1016/S0167-9236(03)00062-9

Yin, D., Mitra, S., & Zhang, H. (2016). Research note—When do consumers value positive vs. negative reviews? An empirical investigation of confirmation bias in online word of mouth. *Information Systems Research*, *27*(1), 131-144. doi: 10.1287/isre.2015.0617

Zillmann, D., & Bryant, J. (1985). Affect, mood, and emotion as determinants of selective exposure. In Zillmann, D., & Bryant, J. (Eds.), *Selective exposure to communication*, (pp. 157-190). Routledge.