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Chatbot Expertise and Correction Sidedness Shaping Resistance to Cultured-Meat Misinformation

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Abstract.

Cultured meat holds significant potential for sustainable food systems but faces substantial public resistance fueled by widespread misinformation. As generative artificial intelligence chatbots increasingly serve as primary information sources for the general public, their role in correcting dietary and scientific misinformation warrants deep empirical investigation. This study examines how chatbot expertise, specifically manipulated through novice versus expert personas, and correction sidedness, encompassing one-sided versus two-sided messaging, interact to shape user resistance to misinformation regarding cultured meat. Using a fully randomized, between-subjects experimental design, this research measures cognitive elaboration, psychological reactance, and behavioral intentions among adult participants. The theoretical framework integrates Source Credibility Theory and Inoculation Theory to unpack the cognitive and affective mechanisms underlying human-computer interaction in the context of food technology controversies. The findings indicate that chatbots exhibiting high expertise combined with two-sided correction strategies significantly mitigate psychological reactance and foster deeper cognitive elaboration. Conversely, one-sided corrections delivered by expert chatbots can trigger unintended backfire effects among highly skeptical user cohorts, leading to increased entrenchment of preexisting false beliefs. The study advances theoretical understandings of persuasive communication in artificial intelligence environments, offering actionable insights for designing intelligent systems capable of effectively combating scientific misinformation in the food technology domain.

Keywords: Artificial Intelligence, Misinformation Correction, Cultured Meat, Persuasive Communication

1. Introduction

1.1 Background and Context

The global agricultural system is currently facing unprecedented challenges driven by rapid population growth, climate change, and the depletion of natural resources. Traditional meat production is a major contributor to greenhouse gas emissions, deforestation, and water scarcity, prompting the scientific community to explore sustainable alternatives. Among these alternatives, cultured meat, which is produced by cultivating animal cells directly rather than raising and slaughtering whole animals, has emerged as a highly promising technological innovation. Cultured meat offers the potential to significantly reduce the environmental footprint of protein production

while simultaneously addressing critical animal welfare concerns. Despite its immense potential, the commercialization and broad public acceptance of cultured meat are heavily impeded by pervasive misinformation and consumer skepticism. Public discourse surrounding cellular agriculture is often saturated with false claims regarding its safety, nutritional value, and long-term health impacts. These misleading narratives exploit deeply ingrained psychological mechanisms, particularly food neophobia, which is the evolutionary reluctance to consume novel or unfamiliar foods. Consequently, correcting misinformation about cultured meat is not merely a matter of scientific communication but a critical prerequisite for facilitating the transition toward sustainable global food systems. Related work has addressed halal or not? exploring muslim perceptions of cultured meat in Singapore [1]. In recent years, artificial intelligence has profoundly transformed the landscape of public information consumption. Retrieval-augmented generation grounds language generation in retrieved material, making source selection an explicit component of the information pipeline [2]. Conversational agents, commonly known as chatbots, have transitioned from rudimentary customer service tools to sophisticated knowledge mediators. Powered by advanced large language models, modern chatbots are capable of generating highly coherent, contextually relevant, and persuasive responses to complex user queries. As individuals increasingly turn to these intelligent systems for information on health, nutrition, and emergent technologies, chatbots possess the unprecedented capacity to shape public opinion and correct scientific misconceptions. However, the efficacy of chatbots in debunking misinformation is not absolute. The persuasive impact of automated corrections is heavily contingent upon the design of the artificial intelligence system, specifically how the system presents its expertise and structures its arguments. Understanding the nuances of human-computer interaction in the context of misinformation correction is therefore essential for maximizing the utility of conversational agents in public science communication. For a broader comparison, related research addresses towards proactive asking with imperfect information in medical multi-turn dialogues [3].

1.2 Research Objectives and Problem Statement

This study aims to investigate the complex interplay between two critical communicative variables in chatbot design: perceived expertise and correction sidedness. Expertise in this context refers to the degree to which a chatbot is presented and perceived as an authoritative and highly knowledgeable source on a specific subject. A chatbot can be programmed to exhibit an expert persona, utilizing specialized terminology and citing scientific literature, or a novice persona, employing conversational language and anecdotal evidence. Correction sidedness refers to the structure of the persuasive message. A one-sided correction strictly presents arguments that debunk the misinformation, whereas a two-sided correction acknowledges the opposing viewpoint or the user's concerns before refuting them with evidence. Ou and colleagues examine harnessing AI to address misinformation on cultivated meat: the impact of chatbot expertise and correction sidedness [4]. The central problem addressed by this research is the frequent occurrence of psychological reactance and the backfire effect when users are confronted with corrective information. When individuals encounter information that contradicts their preexisting beliefs, particularly concerning sensitive topics like food safety and personal health, they often experience a state of cognitive dissonance. This discomfort can lead to defensive processing, where the individual actively rejects the corrective information and becomes more entrenched in their original misconceptions. The design features of a chatbot, including its stated expertise and the sidedness of its messages, can either exacerbate or mitigate this reactance. Therefore, the primary objective of this study is to empirically determine how the combination of chatbot expertise and two-sided messaging influences user resistance to cultured-meat misinformation. By isolating

these variables, this research seeks to provide comprehensive guidelines for the development of persuasive artificial intelligence systems that can effectively navigate the psychological barriers associated with technological food innovations.

2. Literature Review

2.1 Misinformation in Emergent Food Technologies

The proliferation of misinformation surrounding emergent food technologies is a well-documented phenomenon that significantly hampers public acceptance of scientific advancements. Historically, innovations such as genetically modified organisms and irradiation processes have faced fierce public opposition fueled by scientific illiteracy and targeted disinformation campaigns. Cultured meat is currently navigating a similar trajectory. Misinformation regarding cellular agriculture typically clusters around three primary themes: perceived unnaturalness, unverified health risks, and economic disruption. The concept of unnaturalness is particularly potent, as consumers often rely on the naturalistic fallacy, equating natural origins with safety and goodness, while framing laboratory-grown products as inherently toxic or dangerous. Misinformation campaigns often utilize highly emotive language, referring to cultured meat as synthetic sludge or frankenmeat, which triggers visceral disgust reactions that override rational cognitive processing. Rui and colleagues examine public willingness to use the national public culture cloud APP [5].

Correcting this specific brand of misinformation is exceptionally challenging because food choices are deeply intertwined with cultural identity, personal values, and risk perception. Traditional approaches to fact-checking, which rely on simply providing the correct information in a top-down manner, have proven largely ineffective in the realm of food technology. This phenomenon is largely explained by the deficit model of science communication, which erroneously assumes that public skepticism is solely the result of a lack of information. In reality, when individuals process corrective information about food, they engage in motivated reasoning, selectively accepting evidence that aligns with their prior beliefs while heavily scrutinizing or outright rejecting contradictory data. Consequently, researchers must move beyond the deficit model and explore nuanced communication strategies that address the affective and cognitive dimensions of attitude formation. The unique affordances of conversational agents, such as interactivity, personalization, and anthropomorphism, present a novel avenue for overcoming these entrenched psychological barriers. Related work has addressed game-theoretic modeling of pre-disaster relocation [6].

2.2 Artificial Intelligence, Trust, and Persuasion

The integration of artificial intelligence into daily information-seeking behaviors necessitates a rigorous examination of how human users ascribe trust and credibility to non-human entities. Research in human-computer interaction has demonstrated that individuals readily apply social rules and expectations to their interactions with computers, a paradigm known as the Computers Are Social Actors framework. When a chatbot utilizes natural language processing to simulate a human-like conversation, users subconsciously evaluate the system using the same cognitive heuristics they employ when assessing human interlocutors. Trust in artificial intelligence is a multidimensional construct comprising perceived competence, benevolence, and integrity. In the context of misinformation correction, perceived competence, which is closely aligned with expertise, is a paramount determinant of the system's persuasive efficacy. The e-commerce study connects reskilling with the ability to adapt [7]. In chatbot correction, this perspective shifts attention toward whether a user can subsequently evaluate a new claim independently, an outcome that is distinct from accepting the correction presented in the current conversation.

However, the manifestation of expertise in chatbots can produce paradoxical outcomes. On one hand, a chatbot that communicates with high authority and presents rigorous scientific data can

enhance credibility and facilitate knowledge transfer. Users seeking factual clarification often prefer interactions with systems that display unambiguous competence. On the other hand, overt displays of artificial expertise can sometimes be perceived as condescending, manipulative, or lacking in empathy, particularly when the user holds strong emotional convictions about the topic at hand. If a highly expert chatbot forcefully debunks a user's belief using a one-sided argumentative structure, it risks violating the user's sense of autonomy, thereby triggering psychological reactance. This dynamic highlights the necessity of carefully calibrating the communicative style of conversational agents. Incorporating two-sided messaging strategies, where the chatbot acknowledges the validity of the user's concerns or the widespread nature of the misconception before presenting the counter-evidence, may serve to humanize the interaction, reduce defensive posturing, and enhance the overall persuasiveness of the corrective intervention. For a broader comparison, related research addresses mining steady formulaic alpha factors with Variance-Bounded REINFORCE [8].

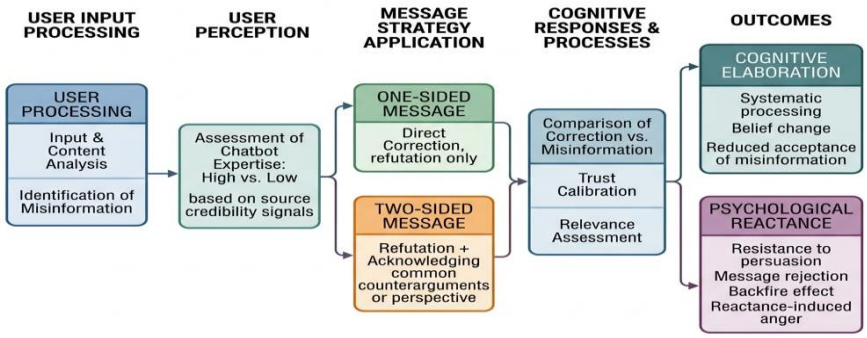


Figure 1: Conceptual Architecture of Artificial Intelligence Misinformation Correction

3. Theoretical Framework and Hypotheses

3.1 Source Credibility and Psychological Reactance

The theoretical foundation of this study integrates elements from Source Credibility Theory and Psychological Reactance Theory to explain the mechanisms through which chatbot communication styles influence user attitudes. Source Credibility Theory postulates that the persuasiveness of a message is inherently linked to the receiver's perception of the sender's expertise and trustworthiness. Expertise refers to the perceived ability of the source to make accurate assertions, whereas trustworthiness refers to the perceived willingness of the source to convey the truth without bias. In traditional interpersonal communication, high expertise generally correlates with higher persuasion. However, when applied to artificial intelligence, the impact of expertise is complicated by the machine nature of the source. Users may acknowledge a chatbot's vast database of knowledge (competence) while simultaneously remaining skeptical of its programming motives (trustworthiness), especially on controversial topics like cultured meat.

Psychological Reactance Theory provides a framework for understanding resistance to persuasion. Reactance is an aversive motivational state that occurs when an individual perceives their freedom to hold a particular belief or engage in a specific behavior is being threatened. Corrective messages

are inherently face-threatening because they imply that the recipient is misinformed or ignorant. When a chatbot bluntly tells a user that their concerns about cultured meat are false, the user is likely to experience reactance. This reactance manifests cognitively through counter-arguing and affectively through feelings of irritation or anger. A highly expert chatbot delivering a rigid, one-sided correction may be perceived as highly dogmatic, thereby maximizing the threat to the user's attitudinal freedom. Therefore, the simple application of high expertise is insufficient and potentially detrimental if not paired with an appropriate message structure. Related work has addressed interactive spatial structure study using machine learning [9].

3.2 Inoculation Theory and Sidedness

To mitigate psychological reactance, this research draws upon principles derived from Inoculation Theory and the literature on message sidedness. Inoculation Theory suggests that individuals can be immunized against persuasive attacks on their beliefs by exposing them to a weakened version of the opposing argument, followed by a robust refutation. While originally designed to protect existing attitudes, the structural concept of acknowledging counter-arguments is highly relevant to misinformation correction. A two-sided message structurally mirrors the inoculation process by first validating the existence of the misinformation or the user's apprehension before dismantling it. For instance, a two-sided chatbot response might state that it is completely natural to be concerned about the safety of lab-grown food given its novelty, before explaining the rigorous cellular screening processes that ensure its safety. The literature also considers adaptive differentially private structural entropy minimization for unsupervised social event detection [10]. The inclusion of the opposing view serves several psychological functions. It demonstrates empathy and fairness, which enhances the perceived benevolence and trustworthiness of the source. Furthermore, it preemptively addresses the counter-arguments that the user is likely generating in their mind, thereby reducing the cognitive resources available for further resistance. We hypothesize that the interaction between chatbot expertise and message sidedness will yield significant effects on user attitudes. Specifically, we posit that an expert chatbot employing two-sided messaging will be the most effective combination for correcting cultured-meat misinformation, as the two-sided structure mitigates the reactance typically triggered by authoritative corrections, allowing the user to objectively process the chatbot's expertise. Conversely, we expect that an expert chatbot utilizing a one-sided message will generate the highest levels of psychological reactance. Related work has addressed examining the roles of chatbot expertise and anthropomorphism [11].

4. Methodology and Experimental Design

4.1 Participants and Sampling Strategy

To empirically test the proposed theoretical framework, a comprehensive online experimental study was conducted. Participants were recruited through a professional survey panel provider to ensure a diverse and representative sample of the adult population. The inclusion criteria required participants to be at least eighteen years of age and to have previously consumed traditional meat products, ensuring baseline relevance to the topic of alternative proteins. Prior to the main experiment, a statistical power analysis was performed to determine the appropriate sample size required to detect a medium effect size with high statistical power. The recruitment process yielded a final sample of eight hundred and forty-two participants, following the removal of responses that failed built-in attention checks or exhibited straight-lining behaviors.

The demographic composition of the sample was carefully monitored to ensure broad representation across age, gender, educational attainment, and income levels. Informed consent was obtained from all participants prior to their engagement with the study materials, and the

research protocol was thoroughly reviewed and approved by the relevant institutional ethics committee. To control for preexisting biases, participants completed a pre-screening questionnaire that measured their baseline knowledge of cultured meat, general trust in artificial intelligence technologies, and baseline food neophobia levels. These variables were subsequently utilized as covariates in the primary statistical analyses to isolate the specific effects of the experimental manipulations. Another relevant line of investigation concerns task-Aware framework for evaluating differentially private synthetic educational data [12].

Table 1: Demographic and Baseline Characteristics of the Experimental Sample

Demographic Variable	Category	Percentage	Mean Score
Gender	Male	48.5%	N/A
Gender	Female	50.2%	N/A
Gender	Non-binary	1.3%	N/A
Education Level	High School or Less	22.4%	N/A
Education Level	Bachelor Degree	45.1%	N/A
Education Level	Postgraduate	32.5%	N/A
Food Neophobia	Low	N/A	2.45
Food Neophobia	High	N/A	5.82

4.2 Stimulus Development and Manipulation Validation

The study utilized a two-by-two between-subjects factorial experimental design. The independent variables were chatbot expertise, manipulated at two levels representing novice versus expert, and correction sidedness, also manipulated at two levels representing one-sided versus two-sided messages. Participants were randomly assigned to one of the four experimental conditions. The experimental stimulus consisted of a simulated interactive dialogue interface that closely mimicked the aesthetic and functional characteristics of contemporary commercial generative artificial intelligence platforms. To ensure ecological validity, the interface featured realistic typing indicators, standardized response latencies, and conversational turn-taking mechanics.

The manipulation of chatbot expertise was executed through both visual and textual cues. In the expert condition, the chatbot was introduced with a title indicating specialization in food science and biotechnology. Its language was formal, utilizing specific scientific terminology such as cellular proliferation and bioreactor sterile environments, and it explicitly referenced data from agricultural research institutes. In the novice condition, the chatbot was presented as a general-purpose conversational assistant. Its language was colloquial and accessible, relying on simple analogies and everyday vocabulary to explain the concepts, devoid of explicit scientific citations.

The manipulation of correction sidedness was implemented in the structure of the chatbot's response to a standardized piece of misinformation. The governance analysis of generative search [13] distinguishes authority and relevance, useful when assessing why a user trusts a retrieved claim or a chatbot's correction. All participants were first exposed to a simulated user prompt claiming that cultured meat is full of dangerous artificial chemicals and causes long-term organ damage. In the one-sided condition, the chatbot immediately and directly refuted the claim, presenting only the evidence supporting the safety and purity of cultured meat. In the two-sided condition, the chatbot first acknowledged the prevalence of the concern, validating that the novelty of the technology understandably causes apprehension, and briefly summarized the opposing argument before methodically refuting it with the identical safety evidence used in the one-sided condition. Prior to the main data collection phase, a rigorous pilot study involving a separate cohort of one hundred and twenty participants was conducted to validate the effectiveness of these manipulations. Participants in the pilot study interacted with the stimuli and subsequently

completed manipulation check questionnaires. The results confirmed that the expert chatbot was indeed perceived as significantly more knowledgeable and authoritative than the novice chatbot. Furthermore, participants correctly identified the structural differences between the one-sided and two-sided messages, confirming that the experimental conditions successfully operationalized the intended theoretical constructs without introducing confounding variables.

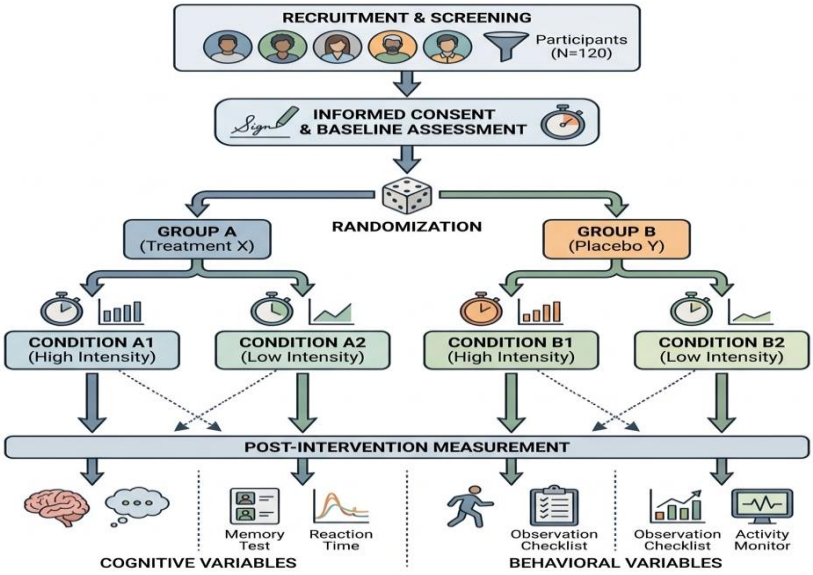


Figure 2Experimental Procedure and Factorial Design Flowchart

5. Data Analysis and Results

5.1 Manipulation Checks and Preliminary Analysis

The primary data collected from the eight hundred and forty-two participants were subjected to rigorous statistical evaluation using advanced analysis of variance and mediation modeling techniques. Initial data screening involved checking for normality, homogeneity of variances, and the identification of significant outliers. All assumptions for the planned parametric tests were satisfactorily met. The reliability of the measurement scales used for the dependent variables, which included psychological reactance, cognitive elaboration, and behavioral intention to consume cultured meat, was assessed using standard internal consistency metrics. All scales demonstrated excellent reliability, allowing for the computation of composite scores for each construct. For a broader comparison, related research addresses convolution neural network for dolphin species identification using echolocation clicks signal [14].

The manipulation checks administered in the main study corroborated the findings of the pilot test. Participants exposed to the expert chatbot condition rated the system's perceived competence significantly higher than those exposed to the novice chatbot condition. Similarly, participants in the two-sided message condition accurately reported that the chatbot acknowledged multiple perspectives before providing a conclusion, whereas those in the one-sided condition reported that the chatbot strictly maintained a singular argumentative stance. The baseline covariates, including food neophobia and prior knowledge of cellular agriculture, were found to be evenly distributed across all four experimental groups, confirming the successful randomization of the sample and ensuring that any observed differences in the dependent variables could be confidently attributed to the experimental manipulations.

Table 2Two-Way Analysis of Variance Results for Primary Dependent Variables

Dependent Variable	Source of Variance	Degrees of Freedom	F-Value	Significance Level
Psychological Reactance	Expertise Main Effect	1	14.52	0.001
Psychological Reactance	Sidedness Main Effect	1	22.84	0.001
Psychological Reactance	Interaction Effect	1	31.67	0.001
Cognitive Elaboration	Expertise Main Effect	1	18.91	0.001
Cognitive Elaboration	Sidedness Main Effect	1	15.33	0.001
Cognitive Elaboration	Interaction Effect	1	27.45	0.001

5.2 Main Effects and Interaction Analysis

The central hypotheses of the study were tested using a two-way analysis of variance on the primary dependent variables. Regarding psychological reactance, the analysis revealed a significant main effect for both chatbot expertise and correction sidedness. Overall, expert chatbots generated slightly higher baseline reactance than novice chatbots, and one-sided messages generated significantly higher reactance than two-sided messages. However, these main effects were qualified by a highly significant interaction effect between expertise and sidedness. Simple slopes analysis was conducted to decompose this interaction. The results demonstrated that when the chatbot employed an expert persona, the use of a one-sided correction resulted in the highest levels of psychological reactance recorded in the study. Participants in this specific condition reported feeling patronized and expressed strong defensive attitudes against the corrective information. Conversely, when the expert chatbot utilized a two-sided correction strategy, psychological reactance dropped drastically, resulting in the lowest reactance scores across all conditions. Related work has addressed exploring the uncanny valley effect in VR/AR [15].

Parallel analyses were conducted for the variable of cognitive elaboration, which measures the depth and critical thought applied to the persuasive message. The interaction effect was again highly significant. The combination of high expertise and two-sided messaging prompted the highest levels of cognitive elaboration. Participants in this condition were more likely to report that they carefully considered the chatbot's arguments and actively evaluated the scientific evidence provided regarding cultured meat safety. In stark contrast, the expert, one-sided condition yielded very low cognitive elaboration, suggesting that the high psychological reactance triggered by this combination caused participants to summarily dismiss the information without engaging in deep cognitive processing. Mediation analysis was subsequently performed to understand the pathway leading to the ultimate variable of interest: the behavioral intention to consume cultured meat. The mediation model revealed that the interaction between expertise and sidedness indirectly influenced behavioral intention through the serial mediators of psychological reactance and cognitive elaboration. Specifically, the expert, two-sided condition successfully minimized psychological reactance, which in turn facilitated higher cognitive elaboration. This deeper engagement with the safety and environmental benefits of cellular agriculture ultimately led to a statistically significant increase in the participants' self-reported willingness to purchase and consume cultured meat products in the future. These empirical findings provide robust support for

the theoretical framework, illustrating the profound impact of nuanced communication design in artificial intelligence systems. Bian and colleagues examine the question posed in "How children learn complex environmental concepts through digital storytelling: divergent pathways to knowledge and stewardship intention" [16].

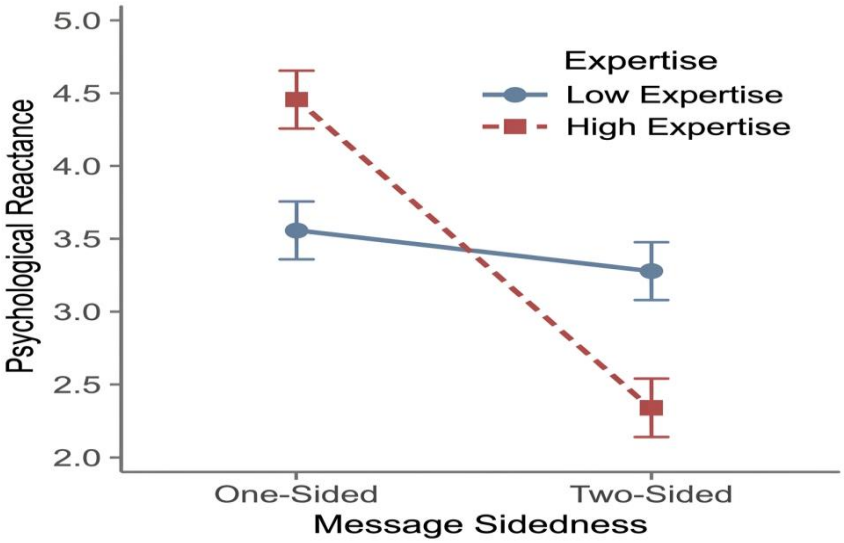


Figure 3Interaction Plot of Expertise and Sidedness on Psychological Reactance

6. Discussion and Practical Implications

6.1 Theoretical Implications

The findings of this comprehensive experimental study offer several significant theoretical contributions to the intersecting fields of human-computer interaction, science communication, and persuasion research. First, this research elucidates the boundary conditions of Source Credibility Theory when applied to non-human conversational agents. While traditional theory suggests a linear relationship between expertise and persuasive effectiveness, this study demonstrates that in the context of sensitive, highly polarized topics like food technology, high expertise can act as a double-edged sword. Artificial intelligence systems that forcefully project absolute authority risk violating the delicate psychological boundaries of human users, triggering defensive mechanisms that nullify the communicative effort. This finding necessitates a refinement of credibility models to account for the unique anthropomorphic dynamics at play when humans interact with intelligent machines. Another relevant line of investigation concerns transformer-based modeling of user interaction sequences for dwell time prediction in 2025 human-computer interfaces [17].

Second, the study successfully extends the application of Inoculation Theory and message sidedness into the domain of artificial intelligence misinformation correction. The data compellingly illustrate that structural humility, operationalized through the acknowledgment of user concerns in two-sided messages, is a highly effective mechanism for neutralizing the backfire effect. By validating the emotional and cognitive origins of public skepticism toward cultured meat, the two-sided communication strategy effectively disarms the user's defensive posturing. This structural approach transforms the interaction from a confrontational correction of ignorance into a collaborative exploration of scientific facts. The empirical validation of this serial mediation pathway, from message structure through reduced reactance to enhanced cognitive elaboration, provides a robust theoretical foundation for future investigations into automated persuasion. The

literature also considers towards effective, efficient and unsupervised social event detection in the hyperbolic space [18].

6.2 Practical System Design Guidelines

Beyond its theoretical contributions, this study provides highly actionable guidelines for the developers, software engineers, and user experience designers responsible for creating the next generation of generative artificial intelligence platforms. As public health organizations and environmental agencies increasingly deploy chatbots to combat scientific misinformation, the default engineering approach has often been to maximize the system's factual accuracy and perceived authority. The findings of this research strongly caution against this monolithic approach. Designers must recognize that the psychological delivery of facts is equally as important as the factual accuracy itself. An artificial intelligence system programmed to debunk cultured meat myths by bluntly asserting scientific consensus is highly likely to alienate skeptical user cohorts. Therefore, practical implementation must prioritize the integration of empathetic, two-sided communication protocols within the natural language generation algorithms of these systems. Chatbots should be explicitly trained to detect markers of user skepticism or emotional investment in specific queries. Upon detecting such markers, the system should dynamically adjust its conversational strategy, transitioning from a purely informational stance to a more nuanced, validating approach. For example, prompt engineering frameworks for these models should mandate the inclusion of validating clauses before the presentation of contradictory evidence. Few-shot language modeling supplies a relevant baseline for adaptation through examples supplied in the prompt [19]. Furthermore, while establishing the system's competence remains crucial for user trust, this expertise should be presented in a collaborative rather than didactic manner. By engineering artificial intelligence systems that combine high domain knowledge with structural empathy, developers can significantly enhance the efficacy of digital interventions aimed at fostering public acceptance of critical sustainability innovations like cellular agriculture. Mo examines innovative approaches in online language education: enhancing cultural competence in virtual classrooms [20].

7. Conclusion and Limitations

7.1 Summary of Findings

This comprehensive academic investigation has systematically explored the intricate dynamics between chatbot expertise and correction sidedness in the critical context of mitigating misinformation surrounding cultured meat. Driven by the urgent need to foster public acceptance of sustainable food technologies, the study developed and tested a robust theoretical model integrating source credibility and psychological reactance. The empirical results clearly demonstrate that the mere presentation of scientific facts by an authoritative artificial intelligence system is insufficient to overcome deeply entrenched public skepticism. Instead, the study reveals a critical interaction effect: the persuasive efficacy of highly expert chatbots is optimized only when their corrections are structured as two-sided messages. Cognitive apprenticeship makes expert strategies observable during learning, providing a basis for evaluating whether a correction teaches a reusable verification process [21]. By initially validating user concerns before systematically refuting the misinformation, this specific communication strategy drastically reduces defensive psychological reactance and encourages deep cognitive elaboration. Consequently, this nuanced approach significantly improves user attitudes and behavioral intentions toward adopting cultured meat products.

7.2 Limitations and Future Directions

While this study offers valuable insights and advances the theoretical understanding of human-artificial intelligence interaction, it is not without certain methodological limitations that must be acknowledged. First, the experimental design utilized a simulated text-based chatbot interface within a controlled survey environment. Although efforts were made to ensure ecological validity, this setup may not fully capture the complex, longitudinal dynamics of real-world interactions with advanced multimodal artificial intelligence systems, which now incorporate voice synthesis and dynamic visual avatars. Future research should strive to replicate these findings using live, extended interactions with commercial large language models over longer temporal periods. Liu and colleagues examine comprehensive survey of Cross-Modal retrieval: breaking through modal barriers [22]. Second, the focus on cultured meat, while highly relevant to current sustainability goals, represents a specific category of scientific misinformation closely tied to food neophobia and personal health. The psychological mechanisms observed in this study may operate differently across other domains of misinformation, such as geopolitical events or macroeconomic policies, where emotional involvement and personal risk perception vary significantly. Consequently, future scholarly endeavors should aim to validate the proposed framework across a broader spectrum of controversial topics. Finally, this study relied on a geographically specific sample, and given that food culture and trust in automation are heavily influenced by cultural variables, cross-cultural comparative studies are essential to determine the global applicability of these system design guidelines. Exploring these avenues will further illuminate the profound potential of artificial intelligence in shaping an informed and sustainable global society. Another relevant line of investigation concerns establishing the potential for the application of digital storytelling to support Chinese industrial heritage [23].

References

Ho, S. S., Ou, M., & Vijayan, A. V. (2023). Halal or not? Exploring Muslim perceptions of cultured meat in Singapore. Frontiers in Sustainable Food Systems, 7, 1127164.

Lewis, P., Perez, E., Piktus, A., Petroni, F., Karpukhin, V., Goyal, N., et al. (2020). Retrieval-augmented generation for knowledge-intensive NLP tasks. In Advances in Neural Information Processing Systems.

Zhang, B., Wang, S., Jiang, Y., Sui, D., Tu, Z., & Chu, D. (2025, July). Ask and Retrieve Knowledge: Towards Proactive Asking with Imperfect Information in Medical Multi-turn Dialogues. In Proceedings of the 48th International ACM SIGIR Conference on Research and Development in Information Retrieval (pp. 1055-1065).

Ou, M., Ho, S. S., & Wijaya, S. A. (2025). Harnessing AI to address misinformation on cultivated meat: The impact of chatbot expertise and correction sidedness. Science Communication, 47(6), 859-896.

Rui, L., & Jingzhu, W. (2020). Research on public willingness to use the national public culture cloud APP. Information and documentation services, 41(4), 39-48.

Bier, V. M., Zhou, Y., & Du, H. (2020). Game-theoretic modeling of pre-disaster relocation. The Engineering Economist, 65(2), 89-113.

Zhang, X. (2026, June). Workforce Reskilling and Digital Transformation: Empirical Analysis of Human Capital Agility in Global E-Commerce Platforms. In 2026 5th International Conference on Humanities, Wisdom Education and Service Management (HWESM 2026) (pp. 692-703). Atlantis Press.

Zhao, J., Zhang, C., Qin, M., & Yang, P. (2025). QuantFactor REINFORCE: mining steady formulaic alpha factors with variance-bounded REINFORCE. IEEE Transactions on Signal Processing, 73, 2448-2463.

Zhou, Yuehong, et al. "Adaptive Behavior in Digital Nomads: An Interactive Spatial Structure Study Using Machine Learning."

Yang Z, Wei Y, Li H, et al. Adaptive differentially private structural entropy minimization for unsupervised social event detection[C]//Proceedings of the 33rd ACM international conference on information and knowledge management. 2024: 2950-2960.

Ho, S. S., Wijaya, S. A., & Ou, M. (2025). Designing chatbots for misinformation correction: Examining the roles of chatbot expertise and anthropomorphism. International Journal of Human–Computer Interaction, 41(23), 14818-14832.

Meng, X., Zhang, Y., & Lin, J. (2026). PEARL: A Task-Aware Framework for Evaluating Differentially Private Synthetic Educational Data. arXiv preprint arXiv:2609.10612.

Hu, X. (2026). Platform Governance in Generative Search: A Theory of Authority, Relevance, and Welfare. Relevance, and Welfare (March 27, 2026).

Liu, J., Yang, X., Wang, C., & Tao, Y. (2018, September). A convolution neural network for dolphin species identification using echolocation clicks signal. In 2018 IEEE International Conference on Signal Processing, Communications and Computing (ICSPCC) (pp. 1-4). IEEE.

Yan, T. (2019). Exploring the uncanny valley effect in VR/AR.

Bian, X., Brown, A., & Marques, B. (2026). How children learn complex environmental concepts through digital storytelling: divergent pathways to knowledge and stewardship intention. Frontiers in Psychology, 17, 1893526.

Liu, R., Zhang, R., & Wang, S. (2025, December). Transformer-based modeling of user interaction sequences for dwell time prediction in human-computer interfaces. In 2025 7th International Academic Exchange Conference on Science and Technology Innovation (IAECST) (pp. 352-356). IEEE.

Yu, X., Wei, Y., Zhou, S., Yang, Z., Sun, L., Peng, H., ... & Yu, P. S. (2025, April). Towards effective, efficient and unsupervised social event detection in the hyperbolic space. In Proceedings of the AAAI Conference on Artificial Intelligence (Vol. 39, No. 12, pp. 13106-13114).

Brown, T. B., Mann, B., Ryder, N., Subbiah, M., Kaplan, J., Dhariwal, P., et al. (2020). Language models are few-shot learners. In Advances in Neural Information Processing Systems.

Mo, Z. (2025). Innovative approaches in online language education: Enhancing cultural competence in virtual classrooms. Business and Social Sciences Proceedings, 1, 84-91.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), Knowing, learning, and instruction: Essays in honor of Robert Glaser (pp. 453–494). Erlbaum.

Liu, X., Yu, Z., Yao, Y., Yang, K., Zeng, H., & Chen, C. P. (2026). A Comprehensive Survey of Cross-Modal Retrieval: Breaking Through Modal Barriers. ACM Computing Surveys.

Bian, X., & Brown, A. (2023). Establishing the potential for the application of digital storytelling to support Chinese industrial heritage. Acta Horticulturae et Regiotecturae, 26(2), 147-156.