

Bias Effects, Synergistic Effects, and Information Contingency Effects: Developing and Testing an Extended Information Adoption Model in Social Q&A

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To advance the theoretical understanding on information adoption, this study tries to extend the information adoption model (IAM) in three ways. First, this study considers the relationship between source credibility and argument quality and the relationship between herding factors and information usefulness (i.e., bias effects). Second, this study proposes the interaction effects of source credibility and argument quality and the interaction effects of herding factors and information usefulness (i.e., synergistic effects). Third, this study explores the moderating role of an information characteristic – search versus experience information (i.e., information contingency effects). The proposed extended information adoption model (EIAM) is empirically tested through a 2 by 2 by 2 experiment in the social Q&A context, and the results confirm most of the hypotheses. Finally, theoretical contributions and practical implications are discussed.

Introduction

The Information Adoption Model (IAM) proposed by Sussman and Siegal (2003) has been widely used in information science and systems research to explain individuals' information adoption behaviors. This theory integrates the Technology Acceptance Model (TAM; Davis, 1989) and

Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986), arguing that individuals evaluate information usefulness through two different routes or processes: a central route emphasizing effortful, careful, and thoughtful elaboration on the content (e.g., argument quality); and a peripheral route emphasizing effortless processing of cues, which are associated with the content (e.g., source credibility). Whether an individual relies on the central route or peripheral route during decision making depends on his or her motivation and ability to process the content of information. Shen, Zhang, and Zhao (2016) further advanced IAM by considering the role of herding factors in shaping information adoption. Although the original IAM or its updated version has shed light on the mechanism underlying individuals' information evaluation and adoption behaviors, there remain several research gaps to be filled.

First, most previous studies have postulated that argument quality and source credibility exert their impacts independently, without considering the potential interrelationship. Some recent studies have begun to pay attention to the interrelationship by addressing the bias effect (e.g., K.Z.K. Zhang, Barnes, Zhao, & Zhang, 2018; K.Z.K. Zhang, Zhao, Cheung, & Lee, 2014), whereas the interrelationship between information usefulness and herding factors, as well as the boundary conditions under which the bias effects occur, is still not clearly understood.

Second, previous studies have paid attention to the main effects of argument quality and source credibility but have ignored the interaction or synergistic effects (Luo, Luo, Schatzberg, & Sia, 2013). Beyond the synergistic effect

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between argument quality and source credibility, whether there is a synergistic effect between information usefulness and herding factors is also unknown. If there are synergistic effects, will they be positive or negative, and when will the synergistic effects occur?

Third, although previous studies have revealed how central and peripheral routes are selected according to various user characteristics (e.g., expertise and involvement; Cheung, Sia, & Kuan, 2012; Sussman & Siegal, 2003), whether route selection depends on information characteristics remains unexplored. User characteristics capture the individual differences in personality, cognitive styles, behavioral motivations and abilities. For example, someone may have more knowledge on digital products than others. In contrast, information characteristics reflects the information differences in format and content. Specifically, in this study, we pay attention to the information dichotomy—search versus experience information. Search information refers to the information whose credibility can be evaluated through searching other relevant information (e.g., what is the world population till 2018?), whereas experience information refers to the information whose credibility cannot be evaluated simply through information searching (e.g., how about your opinion about the movie Transformers?). Compared with user characteristics, information characteristics can be more easily manipulated by information service providers, so understanding how information adoption decisions are contingent on information characteristics might be of more important theoretical and practical value.

Therefore, this study attempts to address these issues by developing an extended information adoption model (EIAM) to explore the potential bias effects, synergistic effects, and information contingency effects. Specifically, one information characteristic—search versus experience information—is investigated as the contingent factor that determines the route selection and boundary conditions of bias effects and synergistic effects.

Furthermore, this study also attempts to empirically test the validity of EIAM in the research context of social Q&A. Social Q&A (e.g., Yahoo! Answers and Quora in the United States and Zhihu in China) generally refers to online web sites that enable peer-to-peer interactions relevant to asking and answering questions in crowdsourcing mode (Fu, Wu, & Oh, 2015; Kim & Oh, 2009; Salmerón, Macedo-Rouet, & Rouet, 2016; Shah, Oh, & Oh, 2009; Zhao, Detlor, & Connelly, 2016). Social Q&A has increased dramatically over the last decade. For example, according to a report by Zhihu (a popular social Q&A in China), by September 2017, there were more than 100 million registered users and more than 26 million daily active users. Although previous studies of social Q&A have focused on information sharing or contribution processes from the answerer side (e.g., Jin, Li, Zhong, & Zhai, 2015; Liu & Jansen, 2017b; Lou, Fang, Lim, & Peng, 2013; Oh, 2012; Raban, 2009; Vasilescu, Serebrenik, Devanbu, & Filkov, 2014; Zhao et al., 2016), less attention has been paid to information seeking or information adoption processes from the

asker side (Choi & Shah, 2016; Liu & Jansen, 2017a). Thus, beyond contributing to information science research by extending the IAM in general, this study could also contribute to the social Q&A literature by investigating information adoption behavior in social Q&A specifically.

Theoretical Background

Information Adoption Model (IAM)

Most previous studies on information adoption (e.g., online product review and recommendations) have been built on the foundation of the IAM (Cheung et al., 2012; Cheung, Lee, & Rabjohn, 2008; Cheung, Luo, Sia, & Chen, 2009; Cheung & Thadani, 2012; Luo et al., 2013; Shen et al., 2016; K.Z.K. Zhang et al., 2014). Specifically, IAM argues that information adoption behavior is determined by perceived usefulness, which is further determined by argument quality and source credibility (Sussman & Siegal, 2003). Argument quality captures the extent to which individuals perceive information as complete, consistent, and accurate, whereas source credibility refers to the extent to which individuals consider information sources to be credible, knowledgeable, and trustworthy (Sussman & Siegal, 2003). The key principle of IAM suggests that whether argument quality or source credibility can affect information usefulness depends on the elaboration likelihood which is further determined by individuals' expertise and involvement (see Figure 1). Specifically, when individual expertise and involvement are high, the elaboration likelihood is high, triggering the central route and increasing the importance of argument quality. In contrast, when both individual expertise and involvement are low, the elaboration likelihood is low, activating the peripheral route and strengthening the power of source credibility (Petty & Cacioppo, 1986).

IAM has been extended in several ways. First, it has been extended by specifying the dimensions of argument quality and source credibility. For example, Cheung et al. (2008) identified relevance, timeliness, accuracy, and comprehensiveness as dimensions of argument quality and source expertise and source trustworthiness as the dimensions of source credibility.

The second way to extend IAM is to add more independent variables. For example, Shen et al. (2016) included herding factors in the original IAM and proposed that both information usefulness and herding factors affect information adoption. Considering the adoption of multiple messages rather than a single message, Cheung et al. (2009) argued that information adoption is determined by both informational determinants (e.g., argument quality, source credibility, recommendation framing, recommendation sidedness, confirmation with previous belief) and normative determinants (e.g., recommendation consistency, recommendation rating). Because we study the adoption of a single message rather than multiple messages, Shen et al. (2016) extended model is used as the baseline model. Specifically, unlike the evaluation of information usefulness, which relies on

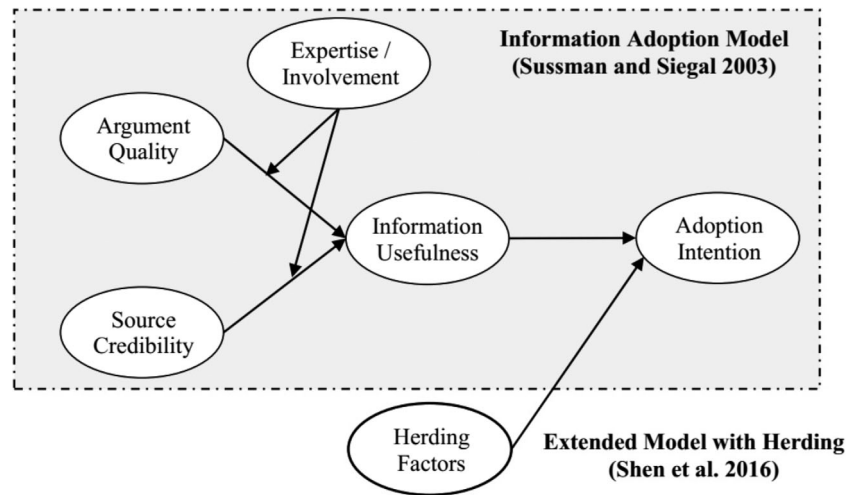


FIG. 1. Information adoption model (IAM).

individuals' conscious cognitive processing of content or peripheral cues, herding factors could reflect the unconscious decision-making processes through which individuals surrender their own judgments and simply follow others' opinions or behaviors (Shen et al., 2016). Compared with the peripheral route of decision making, the herding process involves even less cognitive effort. Thus, including herding factors can better depict how individuals adopt information through conscious (central and peripheral) and unconscious processes.

Third, IAM can be extended by considering other moderating factors beyond involvement and expertise. For example, previous studies have empirically investigated the moderating role of a sense of membership (Luo, Luo, Xu, Warkentin, & Sia, 2015), individualism versus collectivism in cultural orientation (Luo, Wu, Shi, & Xu, 2014), time pressure (Chou, Wang, & Tang, 2015), disconfirming of information and focused searching (W. Zhang & Watts, 2008), and job relevance (Bhattacharjee & Sanford, 2006) in central-peripheral route selection. Although these studies shifted the focus from user characteristics to contextual characteristics, whether route selection varies across different types of information has still not been explored. Thus, this study attempts to extend IAM by including information characteristics as contingent factors.

Furthermore, although most previous studies of information adoption have considered that argument quality and source credibility exert their impacts independently, some recent studies have begun to discuss on the interrelationships. For example, according to Heuristic Systematic Model (HSM; Chaiken & Maheswaran, 1994), another dual process theory similar to ELM, some scholars have paid attention to the relationship between source credibility and argument quality by addressing bias effects (e.g., K.Z.K. Zhang et al., 2014, 2018). Bias effects suggest that, for a message with same content, individuals might perceive higher argument quality if source credibility is higher (Chaiken & Maheswaran, 1994). Similarly, bias effects can also occur regarding the relationship between information usefulness

and herding factors. Furthermore, the boundary conditions under which bias effects emerge are unknown. Thus, this study empirically examines these bias effects and the boundary conditions by considering the moderating role of information characteristics.

The synergistic effects of argument quality and source credibility have drawn researchers' attention too (e.g., Luo et al., 2013). However, there are two contradictory mechanisms to explain the synergistic effects. The positive synergistic mechanism argues that argument quality and source credibility complement each other, and argument quality can exert its impact on information usefulness only when source credibility is high (Heesacker, Petty, & Cacioppo, 1983). In contrast, the negative synergistic mechanism states that "heuristic and systematic processing are mutually exclusive," and "systematic processing *suppresses* the occurrence of heuristic processing" (Chaiken & Maheswaran, 1994, p. 460). It is worth noting that the positive and negative synergistic mechanisms can work only under certain conditions, such as argument ambiguity in Chaiken and Maheswaran (1994) and field dependence in Heesacker et al. (1983). In this study, besides the synergistic effects of argument quality and source credibility, we investigate the synergistic effects of information usefulness and herding factors, as well as the moderating role of information characteristics.

In summary, based on the literature review of information adoption, this study attempts to extend IAM by understanding the bias effects and synergistic effects of the conscious process (i.e., central and peripheral) and unconscious process (i.e., herding factors) and the boundary conditions of the main effects, bias effects and synergistic effects by considering the moderating role of information characteristics. One specific information characteristic—search versus experience information—is investigated in this study.

Search and Experience Information

Previous studies of social Q&A have recognized that there are different types of information. Specifically, scholars

have argued that not only information but also experience is shared in social Q&A (Kim & Oh, 2009), and Q&A is more appropriate than search engines for subjective questions with no definite answers (Morris, Teevan, & Panovich, 2010). Harper, Moy, and Konstan (2009) distinguished conversational questions from information questions, and Liu and Jansen (2017a) proposed an ASK framework and classified questions into three types: accuracy questions (i.e., A), social questions (i.e., S), and knowledge questions (i.e., K). In this study, beyond these typologies, we propose classifying information into search and experience information in terms of the concepts of search and experience products in the marketing literature.

Nelson (1970) introduced the search-experience dichotomy of products based on the possibility of consumers discovering product quality before purchasing. Search products refer to those products with full information about dominant attributes that can be known before purchasing (e.g., digital camera and computer hardware), whereas experience products are those with full information about dominant attributes that cannot be known without direct experience (e.g., apparel and shoes; Klein, 1998). Unlike search products, which can be evaluated using external information, experience goods should be evaluated in person (Kiang, Ye, Hao, Chen, & Li, 2011). Because experience products are closely related to individuals' subjective experience or sense, which can be verified only through use of products (Wright & Lynch, 1995), decision making about experience products is regarded as involving higher risks or uncertainty than search products (Girard & Dion, 2010; Luo, Ba, & Zhang, 2012).

Similarly, we propose that information can also be classified into search and experience. Some information objectively describes widely agreed on rules or knowledge (e.g., what the Elaboration Likelihood Model is) whereas some information is closely related to individuals' personal subjective experiences and is heterogeneous in nature (e.g., how to travel in Beijing). Because the former type of information can satisfy users' information needs simply through information searching, whereas the latter type of information only can be well understood when adequate experience is available, we call the former "search information" and the latter "experience information."

There are two key differences between search and experience information: *information subjectivity* and *decision uncertainty*. First, compared with search information, experience information is subjective and relies more heavily on individual judgments (Wright & Lynch, 1995). The subjective nature of experience information leads to answer heterogeneity such that different answerers might have different opinions about the same question. Heterogeneity can further lead to the sidedness of a single answer (Cheung et al., 2009) and raise users' concerns about decision uncertainty. Second, decision uncertainty is related to the cognitive processes through which individuals use information to make decisions. Compared with search information, which might be well articulated through descriptions, experience information calls for linking the information descriptions with personal experience.

Therefore, individuals might perceive greater uncertainty, ambiguity, and risks (Girard & Dion, 2010; Luo et al., 2012) when processing experience information.

Because of these differences, we propose that individuals rely on different routes when processing search and experience information.

Research Model and Hypotheses

The proposed research model (see Figure 2) aims to understand bias effects, synergistic effects, and information contingency effects. Specifically, bias effects are reflected by the interrelationships between source credibility and argument quality and between herding factors and information usefulness. Synergistic effects capture the interaction effects of source credibility or argument quality and information usefulness and herding factors. Information contingency effects describe the moderating effects of information type (e.g., search and experience information).

Bias Effects

According to Heuristic Systematic Model (HSM; Chaiken & Maheswaran, 1994), source credibility can positively affect argument quality because heuristic processing (e.g., source credibility) can affect individuals' expectations or inferences about the validity of arguments (K.Z.K. Zhang et al., 2014, 2018), causing them to perceive greater argument quality for a message with greater source credibility than for a message with the same content but less source credibility. In the social Q&A context, because both the content of answers and the source information about the answers are available, askers can consider source credibility as a reference for argument quality evaluation. Therefore, we propose that:

H1. *Source credibility is positively associated with argument quality.*

Similarly, there is a bias effect of herding factors. Herd behavior captures the phenomenon that "people will be doing what others are doing rather than using their information" (Banerjee, 1992, p. 797). It can be depicted through two characteristics: *discounting own information*, which reflects the extent to which individuals disregard their own information for decision making; and *imitating others*, which describes the degree to which individuals follow others' decisions (Shen et al., 2016; Sun, 2013). When an individual has a strong tendency to herd, she or he will be more likely to surrender his or her own cognitive evaluation and simply adopt others' opinions as his or her own opinions. In this way, she or he will be more susceptible to social influence (Bearden, Netemeyer, & Teel, 1989; Burnkrant & Cousineau, 1975) and believe the information provided by others. Within the research context of social Q&A, for the same message, individuals with greater herding tendency will regard the message to be more useful than others with lower herding tendency, suggesting a positive relationship

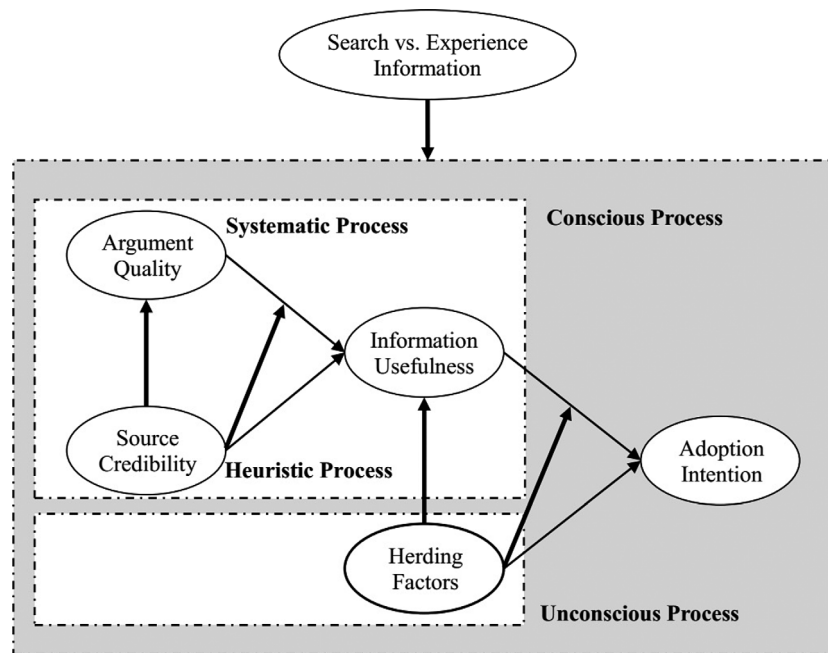


FIG. 2. Research model.

between herding factors and information usefulness. Therefore, we propose that:

H2. *Herding factors are positively associated with information usefulness.*

Information Contingency Effects

According to dual process theory (e.g., ELM), whether individuals employ a central route (e.g., argument quality) or a peripheral route (e.g., source credibility) depends on individuals' motivations and ability to elaborate the content of information such that the central route will be used when motivation and ability are high, whereas the peripheral route will be used when motivation and ability are low (Chaiken & Maheswaran, 1994; Petty & Cacioppo, 1986).

Information type (e.g., search versus experience information) can determine route selection because it is closely associated with individuals' ability to scrutinize content. Specifically, experience information is regarded as more subjective and heterogeneous across individuals (Huang, Lurie, & Mitra, 2009; Wright & Lynch, 1995) than search information. Consequently, during information evaluation, experience information compared with search information will involve greater uncertainty, ambiguity, and risks (Girard & Dion, 2010; Luo et al., 2012), rendering it more difficult and costly to achieve a conclusion (Klein, 1998). In this case, when making decisions about information adoption, individuals will be more likely to rely on the peripheral route for experience information but the central route for search information. Therefore, we propose that:

H3. *The relationship between argument quality and information usefulness is stronger for search information than for experience information.*

H4. *The relationship between source credibility and information usefulness is stronger for experience information than for search information.*

Similarly, we argue that whether individuals rely on conscious processes (e.g., information usefulness) or unconscious processes (e.g., herding factors) is also determined by information type. Information usefulness reflects individuals' own evaluations of information, whereas herding factors capture the extent to which individuals simply follow others by discounting their own information. Thus, which factor has a stronger impact depends on whether individuals have confidence about their own information. According to the herd behavior literature, herd behaviors occur when individuals want to reduce uncertainty and avoid information asymmetry (Devenow & Welch, 1996). Because experience information involves greater uncertainty and ambiguity than search information, individuals will be more likely to rely on unconscious processes (e.g., herding factors) for experience information but on conscious processes (e.g., information usefulness) for search information. Therefore, we propose that:

H5. *The relationship between information usefulness and information adoption is stronger for search information than for experience information.*

H6. *The relationship between herding factors and information adoption is stronger for experience information than for search information.*

The bias effects of heuristic and unconscious processes are also contingent on information type. Specifically, when arguing the bias effects of heuristic processing, Chaiken and Maheswaran (1994) emphasized that the bias effect would be salient when information is ambiguous and interpreted differently. Information ambiguity increases the difficulty in evaluating information through content per se; then, source credibility can be considered an indicator of argument quality. Although previous studies have proposed that bias effects might be more salient when information is ambiguous (K.Z.K. Zhang et al., 2014, 2018), this theory has not been empirically tested. In this study, we argue that experience information involves high subjectivity, uncertainty, and ambiguity (Girard & Dion, 2010; Luo et al., 2012), so the bias effect will be stronger. Thus, we propose that:

H7. *The relationship between source credibility and argument quality is stronger for experience information than for search information.*

The bias effect of unconscious processes is supposed to be stronger for experience information as well. Individuals with a high herding tendency are more likely to believe others' opinions and give high ratings to information usefulness. This bias effect becomes more salient when decision uncertainty or difficulty is high, and imitating others can be an easy way for individuals to form their perceptions about information usefulness (Girard & Dion, 2010; Luo et al., 2012). Regarding the high uncertainty and ambiguity of experience information compared with search information (Girard & Dion, 2010; Luo et al., 2012), it is reasonable to anticipate a stronger bias effect for experience information than for search information. Therefore, we propose that:

H8. *The relationship between herding factors and information usefulness is stronger for experience information than for search information.*

Synergistic Effects

There are two contradictory mechanisms to explain the synergistic effects of source credibility and argument quality. The negative synergistic mechanism suggests that heuristic processing and systematic processing are mutually exclusive (e.g., substitutive effect), and systematic processing can attenuate the effects of heuristic processing (Chaiken & Maheswaran, 1994). In contrast, the positive synergistic mechanism argues that there is a complementary effect such that argument quality can have a stronger impact when source credibility is high (Heesacker et al., 1983). The key difference between these two mechanisms is relevant to the fundamental assumption for theorization: whether the two processes can coexist or whether individuals will consider the two processes simultaneously. The negative synergistic mechanism considers the two processes to be exclusive (e.g., either-or mode), whereas the positive synergistic mechanism believes that the two processes should work together

(e.g., copresence mode). To reconcile the debate, we propose a *sequential decision-making model of information adoption*.

ELM is developed based on the assumption that the priorities of the central route and peripheral route are different: the central route has a higher priority than the peripheral route such that the peripheral route works when the central route is inefficient (Petty & Cacioppo, 1986). In other words, when individuals have adequate motivation and ability, they make decisions through the central route. If not, the peripheral route is used. Thus, individuals could follow a central-peripheral sequence when making decisions.

The sequential decision-making model has two implications. First, individuals evaluate whether they have enough motivation and ability, and if they do, they rely on the central route, whereas the peripheral route will not be triggered, suggesting a negative synergistic effect. Second, if individuals find that they do not have adequate motivation and ability, they will use both the central and peripheral routes together, unless their motivation and ability are extremely low when the only peripheral route is used (Petty, Kasmer, Haugtvedt, & Cacioppo, 1987). In summary, the negative synergistic effect emerges when motivation and ability are high, whereas the positive synergistic effect occurs when motivation and ability are low.

As stated before, compared with search information, experience information involves more uncertainty and ambiguity and increases the difficulty in making decisions according to the content of information (e.g., low ability), so there will be a negative synergistic effect of source credibility and argument quality on information usefulness for search information but a positive synergistic effect of source credibility and argument quality on information usefulness for experience information. Thus, we propose that:

H9. *The synergistic effect of argument quality and source credibility on information usefulness will be positive for experience information but negative for search information.*

Like arguments about the synergistic effect of source credibility and argument quality, we state that there is also a conscious-unconscious sequence during decision making. When the subjectivity and uncertainty of information are low (e.g., search information), individuals might rely solely on conscious processing (e.g., negative synergy). In contrast, when the subjectivity and uncertainty of information are high (e.g., experience information), individuals will consider both conscious and unconscious processing together (e.g., positive synergy). Thus, we propose that:

H10. *The synergistic effect of information usefulness and herding factors on information adoption will be positive for experience information but negative for search information.*

Research Methods

Experiment Design

A 2 (high vs. low argument quality) by 2 (high vs. low source credibility) by 2 (search vs. experience information)



FIG. 3. Experimental design. [Color figure can be viewed at wileyonlinelibrary.com]

factorial experiment was designed to test the proposed research model and hypotheses. Specifically, the experiment interface followed the format of a popular social Q&A site in China, Zhihu, which like Quora has more than 100 million registered users and more than 26 million daily active users. Taking the scenario with high argument quality, high source credibility, and search information as an example, the experiment interface is shown in Figure 3. An ordinary message on Zhihu includes information about the question, the answer, a helpfulness rating of the answer, and a reputation rating of the answerer. We designed the experiment by setting the question and answer (e.g., search vs. experience information), the helpfulness rating of the answer (e.g., argument quality), and the reputation rating of the answerer (e.g., source credibility). The contents of questions and answers used in the experiment are shown in Appendix B.

For argument quality (AQ), to avoid bringing in more confounding factors relevant to the descriptions of answers (e.g., message framing and style), we did not change the content of the answer but changed the helpfulness rating of the answer, which could be considered a cue of argument quality. Specifically, for the high argument quality group, there were 1000 Likes (Likes are used to convey agreement or perceived helpfulness by other users in Zhihu). In contrast, for low argument quality, there were only 20 Likes. To ensure the validity of this manipulation, we used argument quality as the manipulation check. The results showed that the argument quality for the group with more Likes (mean = 3.731) was significantly higher ($F = 58.336$, $p = .000$) than the group with less Likes (mean = 3.143), indicating that the manipulation is appropriate.

Source credibility (SC) was manipulated by setting different source characteristics. Three characteristics were used to reflect the reputations of answerers in Zhihu: answers

provided, articles published, and followers. For the high source credibility group, the values of these three characteristics were set at 300, 20, and 20 k (20 thousand), respectively. For the low source credibility group, these three values were set at 10, 0, and 200. These values were set according to the statistics of answerers for these questions, with the high source credibility group having values in the top 25%, whereas the low source credibility group had values in the bottom 25%. To further ensure the validity of the manipulation, source credibility was used as the manipulation check. The results showed that perceived source credibility was higher for the high SC group (mean = 3.571) was significantly higher ($F = 24.541$, $p = .000$) than for the low SC group (mean = 3.159), indicating that the manipulation is appropriate.

Information type was manipulated by setting the questions and answers. For search information, the question was about “how to conduct product analysis as an Internet product manager.” For experience information, the question was about “how are your feelings about living in Xiamen.” Information subjectivity was used as a manipulation check. The results showed that information subjectivity was significantly higher ($F = 62.980$, $p = .000$) for the experience information group (mean = 3.794) than for the search information group (mean = 3.119), indicating that the manipulation is appropriate.

Data Collection Procedure and Measures

Subjects were recruited at a university in Central China. College students were selected because they were regarded as the most active users of social Q&A sites such as Zhihu. The experiment was first briefed in several classes, and students were invited to participate in the experiment voluntarily. Students were also encouraged to invite their peers

to participate in the experiment. Because the experiment interface was similar to Zhihu, only participants with certain experience in Zhihu were eligible. The experiment was conducted online rather than in a lab, so every participant was provided with a URL leading to the online experiment. Participants were randomly assigned to eight scenarios according to the levels of argument quality, source credibility, and information type (i.e., between-subject design).

During the experiment, the respondents were first asked to read the information content in the scenarios. Then, they were asked to complete a questionnaire with questions relevant to manipulation checks (e.g., argument quality, source credibility, and information subjectivity) and other constructs in the research model (e.g., information usefulness, herding factors, and adoption intention). Measures for all the constructs and manipulation checks were adapted from the previous literature or developed based on previous arguments (see Appendix A). Specifically, argument quality was measured with four items adapted from Cheung et al. (2009). Source credibility and information usefulness were measured with items adapted from Sussman and Siegal (2003). Three items from Cheung et al. (2012) were used to measure adoption intention. The measures for herding factors (e.g., discounting own information and imitating others) were adapted from Shen et al. (2016). Three items to capture information subjectivity (manipulation check for information type) were developed based on previous statements on search versus experience products, emphasizing the concepts of “experience,” “subjective,” and “inadequacy of simply searching for existing information” (Girard & Dion, 2010; Huang et al., 2009).

Finally, 289 valid subjects participated in the experiment. Among them, there were 49.5% female participants. More than 80% of the subjects were between 18 and 35 years old. Approximately 84% of the subjects had a bachelor’s degree or more. Of the subjects, 90% had more than 2 years of experience using the Internet. The sample distribution across eight scenarios is shown in Table 1.

Data Analysis

The Partial Least Squares (PLS) technique was used to test the proposed hypotheses. As Structural Equation Modeling (SEM), PLS has the advantages of addressing factors measured with multiple items (compared to the *t*-test) and can simultaneously analyze measurement models and structural models and provide systematic and holistic insights into the complex relationships between different independent variables and dependent variables (compared to regression; Chin,

TABLE 1. Sample distribution.

	High AQ		Low AQ	
	High SC	Low SC	High SC	Low SC
Search information	40	37	37	26
Experience information	43	40	34	32

Note. AQ = argument quality, SC = source credibility.

TABLE 2. Reliability.

	AVE	CR	Alpha
Adoption intention (AI)	0.732	0.891	0.817
Argument quality (AQ)	0.654	0.883	0.825
Discounting own information (DOI)	0.661	0.854	0.744
Imitating others (IO)	0.685	0.866	0.763
Information usefulness (IU)	0.694	0.872	0.779
Source credibility (SC)	0.602	0.858	0.780

1998). Compared to covariance-based SEM, PLS is more appropriate for accommodating a relatively small sample size and formative constructs, and it has no restrictions on normal distribution of the sample (Hair, Ringle, & Sarstedt, 2011). Specifically, SmartPLS software, version 2.0, was used as the analytic tool (Ringle, Wende, & Will, 2005). The two-step procedure, which analyzes measurement model and structural model, respectively (Hair, Anderson, Tatham, & Black, 1998), was used in the following analysis.

Measurement Model

The measure model intensively involves evaluations of the reliability and validity of constructs. Reliability can be evaluated by checking three indicators: Cronbach’s alpha, composite reliability (CR), and average variance extracted (AVE). The threshold values for alpha, CR, and AVE are 0.7, 0.7, and 0.5, respectively (Fornell & Larcker, 1981). As shown in Table 2, the actual values for these three indicators were greater than the recommended values for all of the constructs, suggesting that all of the constructs had good reliability.

There are two types of validity: convergent validity and discriminant validity. Convergent validity captures whether the items of one construct are consistent, and it can be evaluated by checking whether item loadings on the respective construct are high (Fornell & Larcker, 1981). Discriminant validity reflects whether the items for different constructs can be differentiated from each other, and it can be evaluated by determining whether the loading of one item on its corresponding construct is greater than its loading on other constructs (Fornell & Larcker, 1981). As shown in Table 3, the item loadings on their respective constructs were all greater than 0.7 (except for SC2 and IO3), and the item loadings on the respective constructs were greater than on other constructs, suggesting good convergent validity and discriminant validity.

Furthermore, because this study focused on the whole impacts of unconscious processes but paid less attention to the different impacts of the two dimensions of herding factors, herding factors were considered a formative second-order construct. The weights for discounting own information ($w = 0.582$, $t = 22.326$) and imitating others ($w = 0.556$, $t = 25.573$) were significant, so both dimensions were included in the consequent analysis.

Structural Model

The results of structural model analysis for the overall sample are reported in Figure 4. Consistent with the

TABLE 3. Loadings and cross-loadings.

	AI	AQ	DOI	IO	IU	SC
AI1	0.840	0.524	0.460	0.330	0.539	0.433
AI2	0.885	0.544	0.521	0.397	0.499	0.557
AI3	0.840	0.497	0.461	0.343	0.493	0.491
AQ1	0.471	0.796	0.363	0.298	0.464	0.546
AQ2	0.440	0.809	0.419	0.320	0.410	0.513
AQ3	0.523	0.813	0.395	0.292	0.536	0.549
AQ4	0.529	0.816	0.443	0.384	0.520	0.659
DOI1	0.467	0.433	0.801	0.373	0.351	0.397
DOI2	0.417	0.380	0.833	0.432	0.388	0.378
DOI3	0.486	0.414	0.805	0.509	0.430	0.481
IO1	0.378	0.404	0.490	0.872	0.374	0.381
IO2	0.340	0.342	0.447	0.904	0.362	0.342
IO3	0.318	0.239	0.405	0.691	0.261	0.327
IU1	0.527	0.454	0.378	0.309	0.810	0.419
IU2	0.503	0.526	0.460	0.418	0.862	0.479
IU3	0.460	0.520	0.362	0.284	0.826	0.526
SC1	0.468	0.593	0.467	0.390	0.459	0.745
SC2	0.400	0.498	0.412	0.313	0.446	0.699
SC3	0.451	0.570	0.391	0.294	0.454	0.854
SC4	0.466	0.517	0.335	0.313	0.417	0.798

Note. AI = adoption intention, AQ = argument quality, DOI = discounting own information, IO = imitating others, IU = information usefulness, SC = source credibility.

previous literature, argument quality ($\beta = 0.332$, $t = 4.787$) and source credibility ($\beta = 0.214$, $t = 3.194$) were found to positively affect information usefulness, and information usefulness ($\beta = 0.404$, $t = 7.587$) and herding factors ($\beta = 0.352$, $t = 6.252$) were found to positively affect information adoption. Furthermore, source credibility significantly affected argument quality ($\beta = 0.705$, $t = 21.799$), and herding factors significantly affected information usefulness ($\beta = 0.210$, $t = 3.420$), lending support to the bias effect hypotheses (H1 and H2). However, the interaction effect of source credibility and argument quality on information usefulness ($\beta = -0.054$, $t = 0.969$) and the interaction effect of information usefulness and herding factors on adoption intention ($\beta = -0.102$, $t = 0.967$) were not significant. These interaction effects were further tested by considering the differences between search and experience information.

The information contingency hypotheses were tested through the cross-group coefficient comparison approach (Keil et al., 2000; see Appendix C). Specifically, the overall

sample was separated into two subgroups—a search information group and an experience information group—and the structural model was reanalyzed based on subgroup data. As shown in Figures 5 and 6, the relationship between argument quality and information usefulness was stronger for search information ($\beta = 0.418$, $t = 6.278$) than for experience information ($\beta = 0.145$, $t = 2.284$), and the difference in path coefficients was significant ($\Delta\beta = 0.273$, $t = 35.700$). In contrast, the relationship between source credibility and information usefulness was stronger for experience information ($\beta = 0.247$, $t = 3.400$) than for search information ($\beta = 0.206$, $t = 4.171$), and the difference was significant ($\Delta\beta = 0.041$, $t = 5.570$). Information usefulness had a stronger impact on the adoption of search information than of experience information ($\Delta\beta = 0.285$, $t = 43.207$), whereas herding factors had a stronger impact on the adoption of experience information than of search information ($\Delta\beta = 0.209$, $t = 32.717$). These results supported H3-H6.

Regarding bias effects, there was a significant difference in the bias effect of herding factors for experience and search

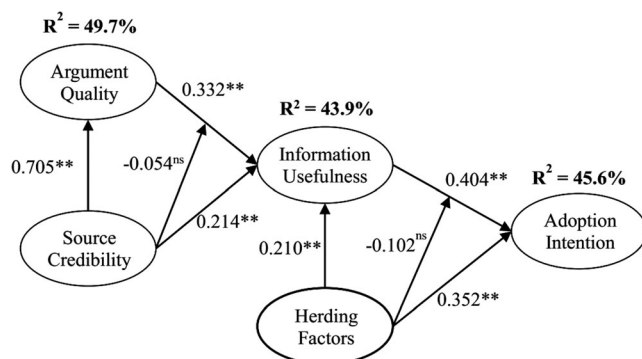


FIG. 4. PLS results for the overall model.

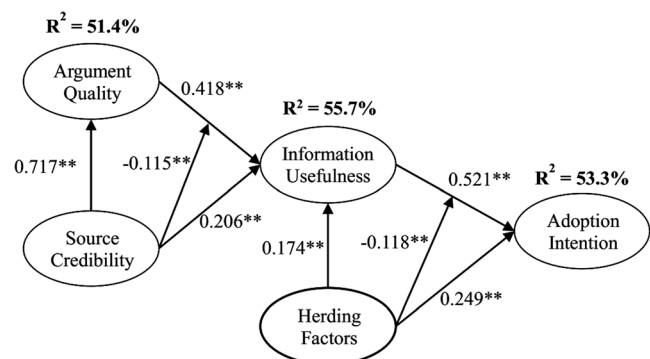


FIG. 5. PLS results for search information.

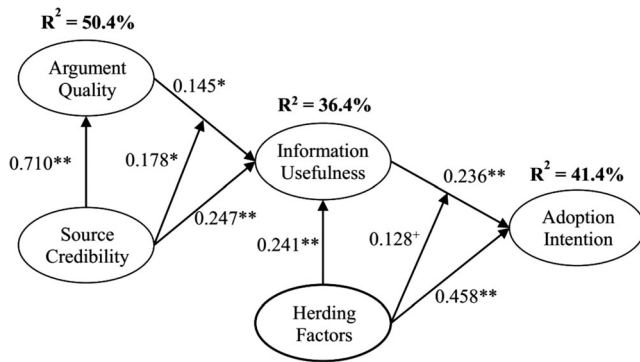


FIG. 6. PLS results for experience information.

information ($\Delta\beta = 0.067$, $t = 9.215$), but no significant difference in the bias effect of source credibility ($\Delta\beta = 0.007$, $t = 0.120$). Thus, H8 was supported, whereas H7 was not supported.

The interaction effect of argument quality and source credibility was found to be positive for experience information ($\beta = 0.178$, $t = 2.195$) but negative for search information ($\beta = -0.115$, $t = 3.561$), supporting H9. Similarly, the interaction effect of information usefulness and herding factors was found to be positive for experience information ($\beta = 0.128$, $t = 1.765$, marginally significant) but negative for search information ($\beta = -0.118$, $t = 2.717$), supporting H10.

Discussion

Theoretical Contributions

This study contributes to the information adoption literature in three ways. First, this study extends the previous information adoption models by considering the contingency effects of information type. Although previous studies of information adoption have identified series of moderators beyond expertise and involvement (Sussman & Siegal, 2003), such as sense of membership (Luo et al., 2015), cultural orientation (Luo et al., 2014), and time pressure (Chou et al., 2015), these moderators are still closely relevant to individual characteristics or social contexts. The moderating effects of information characteristics have not been well understood despite their important role in information adoption. This study is one of the first to investigate the information contingency effects in information adoption. Furthermore, based on the concepts of search and experience products in the marketing literature, this study proposes a search-experience dichotomy to classify information, enriching the dimensions that can be used for information classification. Beyond the search-experience typology of information characteristics, future research can consider other information characteristics as potential moderators.

Second, this study theorizes and empirically tests the bias effects of heuristic processing and unconscious processing and identifies the boundary conditions under which bias effects occur. Previous information adoption models focused on the independent effects of different cognitive processes: heuristic

processing versus systematic processing; and conscious processing and unconscious processing. The interrelationships between different cognitive processes were neglected. Although several recent studies have begun to pay attention to the bias effect of source credibility (K.Z.K. Zhang et al., 2014, 2018), the bias effect of unconscious processes, as well as the boundary conditions, have not been well articulated. This study advances information adoption models by considering the bias effects to address the potential interrelationships between different cognitive processes and identifying the boundary conditions of these bias effects. It provides a solid theoretical underpinning for future researchers to understand bias effects in information adoption.

Third, this study reconciles the contradictory mechanisms of synergistic effects and identifies the boundary conditions under which different synergistic effects emerge. Specifically, previous studies have pointed out that the synergistic effects of source credibility and argument quality might be negative (Chaiken & Maheswaran, 1994) or positive (Heesacker et al., 1983). To resolve the debate and form a unified theory, we propose a sequential decision-making model arguing that systematic processing and heuristic processing have different priorities. Following a systematic-heuristic sequence, there will be a negative synergistic effect when only systematic processing is triggered but a positive synergistic effect when both systematic and heuristic processing are triggered. We further propose that the sequential model can also be applied to the analysis of conscious and unconscious processing such that conscious processing has the priority. To understand when these two synergistic effects occur, this study proposes that there will be a positive synergistic effect for experience information but a negative synergistic effect for search information.

In summary, EIAM extends the original information adoption model by considering bias effects, synergistic effects, and information contingency effects (see Appendix D for the comparisons between different theories). As highlighted in the bold lines in Figure 2, bias effects refer to the relationship between source credibility and argument quality, as well as the relationship between herding factors and perceived usefulness. Synergistic effects refer to the interaction effect of argument quality and source credibility and the interaction effect of perceived usefulness and herding factors. Information contingency effects indicate that all the proposed effects (main effects, bias effects, and synergistic effects) are moderated by information features (e.g., search vs. experience information).

Practical Implications

Practical implications can be derived from the findings. First, social Q&A service providers should recognize the informational differences in information adoption and offer personalized services according to information type. Specifically, for experience information, more detailed information for answerers should be provided, whereas for search information, more functions aiding users' information searches should be provided. Second, bias effects can

influence users' personal judgments of the answers. Therefore, to avoid negative bias effects, there should be certain labels to remind users to make their own judgements for certain information (e.g., advertisement). Third, because there can be positive or negative synergistic effects, social Q&A designers should consider ways to leverage the positive synergistic effect but avoid the negative synergistic effect. For example, for search information, the content of answers should be designed as more salient, attracting users' attention to cause them to focus on content. In contrast, for experience information, both content and source should be emphasized to help users make better decisions.

Limitations and Future Research

There are several limitations to be acknowledged. First, following previous studies on social Q&A (e.g., Salmerón et al., 2016; Savolainen, 2012; Shah, Kitzie, & Choi, 2014), this study collected data from university students. This sampling strategy was used because college students were identified as the most active user population. However, regarding whether professionals might have cognitive styles different from students, the proposed research model must be further validated in other populations. Second, this study was conducted in China, which is regarded as a country with a collectivist culture. Thus, whether the conclusions can be applied to other countries with different cultural orientations requires further investigation (Luo et al., 2014). Third, this study proposed and empirically tested the moderating effects of one information characteristic (e.g., search vs. experience information). There might be other information characteristics that influence individuals' cognitive processing mode selection, calling for future research to explore the roles of other information characteristics.

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Appendix A Constructs and Items

Constructs	Definitions	Items
Argument quality (Cheung et al., 2009)	The extent to which individuals perceive information as complete, consistent, and accurate.	AQ1. The arguments of this answer are convincing. AQ2. The arguments of this answer are strong. AQ3. The arguments of this answer are persuasive. AQ4. T The arguments of this answer are good.
Source credibility (Sussman & Siegal, 2003)	The extent to which individuals consider information sources to be credible, knowledgeable, and trustworthy.	SC1. This answerer is knowledgeable. SC2. This answerer is an expert on this topic. SC3. This answerer is trustworthy. SC4. This answerer is reliable.
Information subjectivity (Girard & Dion, 2010; Huang et al., 2009)	The extent to which the information evaluation varies across individuals because of the differences in experience and subjective feelings.	IS1. Understanding the information requires much relevant experience. IS2. Evaluating the information depends on subjective opinions. IS3. Simply searching for existing information is not adequate for understanding the information.
Herding factors – discounting own information (Shen et al., 2016)	The extent to which individuals disregard their own information for decision making.	DOI1. I did not rely on my own information in evaluating this information. DOI2. I choose to agree with this information, although I might have other opinions. DOI3. If I did not see this information, I might have other evaluations.
Herding factors – imitating others (Shen et al., 2016)	The degree to which individuals follow others' decisions.	IO1. I agree with this information because it appears to be widely accepted. IO2. I choose to agree with this information because it has been agreed with by many other persons. IO3. I follow others in making evaluations of this type of information.
Information usefulness (Sussman & Siegal, 2003)	The extent to which the information is perceived as useful and helpful.	IU1. The information in this answer is valuable. IU2. The information in this answer is informative. IU3. The information in this answer is helpful.
Information adoption (Cheung et al., 2012)	The extent to which an individual is willing to adopt the information for decision making.	IA1. I agree with this answer. IA2. I will follow this answer IA3. I will adopt this answer in my evaluation on this topic.

Appendix B Contents of Q&A in Experiments

Search Information

Q: *Introduce a method for the Internet product manager to analyze a product.*

A: A set of analytical methods that I commonly use: nABC method.

n represents the needs. To be specific, N1: What is the most basic need for the user? N2: What is the size of market? N3: How is the industry chain constituted? N4: How about the development trends in this industry? N5: What are the expanded needs?

A represents the approach. Specifically, A1: How is an approach formed? A2: How are the priorities of the needs defined? A3: How about technical feasibility? A4: Are there any political and regulation risks? A5: How is the version planned and the releasing roadmap defined? A6: How about the marketing ideas of each version, and what are the focuses of these versions?

B represents the benefits. To be specific, B1: How about the benefit mode? B2: Benefit expectation (time and amount); B3: Benefit estimation of each version; B4: Input–output evaluation.

C represents the competition. Specifically, C1: Competition of industry chain; how about the replacement possibility? C2: Who are the major competitors? C3: Who are the target competitors of each stage and version? C4: SWOT analysis and USED strategy of the major competitors at each stage.

transportation in Beijing, Shanghai, and Guangzhou is horrible.

When you go to the beach or the garden, you will see the old people doing morning exercises, kids playing and lovers embracing, and you will know that it is the fresh air and harmonious environment that makes the city better, rather than the concrete jungle.

When you are feeling down, take a beer out of the refrigerator to drink by the sea, listen to the waves lapping, feel the sea wind and tell the sea all of your sufferings. Perhaps you will believe the saying “Facing the sea, spring blossoms.”

When you know how Xiamen citizens protested again the PX project by marching in front of the municipal government gate, you will understand that the true charm of a city lies in a group of lovely citizens with civic awareness, not just the beauty and boom.

Certainly, it is a tourist city and must develop, so you cannot expect it to be the land of idyllic beauty.

Fortunately, Xiamen is far enough from Beijing.

Appendix C

Path Coefficient Comparison (Keil et al., 2000)

$$t = (PC_1 - PC_2) / \left[S_{pooled} \times \sqrt{(1/N_1 + 1/N_2)} \right]$$

$$S_{pooled} = \sqrt{\left\{ [(N_1 - 1)/(N_1 + N_2 - 2)] \times SE_1^2 + [(N_2 - 1)/(N_1 + N_2 - 2)] \times SE_2^2 \right\}}$$

Experience Information

Q: *Why is Xiamen fine and a suitable place to live?*

A: As a person who has studied there for 4 years, I have something to say.

When you take a bus in Xiamen, you will observe that some people offer seats to others. In contrast, the public

where S_{pooled} = a pooled estimator for the variance;

t = a t-statistic with $N_1 + N_2 - 2$ degrees of freedom;

N_i = the sample size of the dataset for group i ;

SE_i = the standard error of the path in the structural model of group i ; and.

PC_i = the path coefficient in structural model of group i .

Appendix D Key Terms

Abbreviation	Full name	Source	Key statements
ELM	Elaboration likelihood model	(Petty & Cacioppo, 1986)	<ul style="list-style-type: none"> • There are two routes to persuasion: central route and peripheral route: a central route emphasizing effortful, careful, and thoughtful elaboration on the content, and a peripheral route emphasizing effortless processing of cues, which are associated with the content. • Which route works depends on the elaboration likelihood which is further determined by individuals' motivations and abilities.
TAM	Technology acceptance model	(Davis, 1989)	<ul style="list-style-type: none"> • Technology adoption is determined by two key constructs – perceived usefulness and perceived ease of use.
HSM	Heuristic systematic model	(Chaiken & Maheswaran, 1994)	<ul style="list-style-type: none"> • Individuals process information in two ways: heuristically or systematically. • Similar to ELM, heuristic processing captures the effortless way, whereas systematic processing reflects the effortful way. • HSM also postulates the bias effect, i.e., the relationship between heuristic process and systematic process.
IAM	Information adoption model	(Sussman & Siegal, 2003)	<ul style="list-style-type: none"> • IAM integrates ELM and TAM. • Information usefulness affects information adoption. • Argument quality and source credibility affect information usefulness. • Expertise and involvement moderate the impacts of argument quality and source credibility on information usefulness.
EIAM	Extended information adoption model	This study	<ul style="list-style-type: none"> • EIAM extends IAM by considering bias effects, synergistic effects, and information contingency effects. • Bias effects: source credibility affects argument quality, and herding factors affect information usefulness. • Synergistic effects: the interaction effect of source credibility and argument quality on information usefulness, and the interaction effect of information usefulness and herding factors on information adoption. • Information contingency effects: the proposed main effects, bias effects, and synergistic effects depend on the information characteristics (e.g., search vs. experience information)