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Research Article

## Capitalizing on Content: Information Adoption in Two Online communities

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### Abstract

*Online communities enable members to exchange messages, and rich content is generated in the wake of these contributions. Little research has systematically investigated how this content is utilized. In this paper we use the Heuristic-Systematic Model of information processing to explore the mechanisms by which the potential value of these information assets can be realized. We argue that the extent to which message content and heuristic cues influence the validity assessment process is moderated by two factors: how consistent the new information is with what is already known and the extent to which information-seeking members are actively searching for on-topic information to satisfy their specific information needs. Survey data collected from two online communities generally support the hypotheses derived from this model. This study demonstrates that community members process information from online communities in a highly contextual manner that may extend to the functionality of the technical tools provided by the online communities. It also suggests numerous opportunities for future research and potential ways that online communities might improve their information sharing.*

**Keywords:** Online communities, Information Adoption, Heuristic-Systematic Model of Information Processing, Argument Quality, Source Credibility, Focused Search, Disconfirming Information.

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## Capitalizing on Content: Information Adoption in Two Online Communities

### Introduction

Information sharing underlies successful knowledge work (Constant et al., 1994). As organizations grow larger and more geographically disbursed, their workers are increasingly using advanced communication technologies to share information and expertise. A prototypical tool for this purpose is email (e.g., Constant et al., 1996, Sussman and Siegal, 2003). More recently, online communities have gained popularity as tools for information sharing on both the public Internet and proprietary networks. Organizations are using online communities<sup>1</sup> in a wide variety of domains where information sharing is essential, such as new product development (Holmström, 2001), customer support (Gu and Jarvenpaa, 2003), professional support (Wasko and Faraj, 2005), and healthcare (Leimeister et al., 2005). Organizations from a broad array of industries are finding that their online communities are paying off in a multitude of ways (e.g., Algesheimer and Dholakia, 2006).

The popularity of online communities among practitioners has spurred a number of research streams, generating important insights into their characteristics (e.g., Sproull and Faraj, 1997, Wellman and Gulia, 1999), their designs (e.g., Bieber et al., 2002, Preece, 2000), and the motivations for community members to contribute to them (e.g., Rafaeli and LaRose, 1993, Wasko and Faraj, 2000). One important characteristic of these communities is that they generate repositories of content as a natural product of the information sharing they facilitate. These repositories represent a vast store of information that serves as organizational memory and a potentially valuable organizational resource (Stein and Zwass, 1995, Walsh and Ungson, 1991). Yet there is little research on how this contributed information is utilized by community members. If the potential for online communities to facilitate information sharing is to be fully realized, we need to fill this gap. This study seeks to explore this issue by identifying an appropriate theoretical framework, assessing it empirically, and suggesting opportunities for further work in this research stream.

In this study, we investigate how community members adopt information embedded in messages contributed by other members to help solve their problems — a common scenario in online communities. Such information adoption results from assessment of the validity of that information. For this reason, we take a cognitive perspective and utilize a dual-process theory of human information processing and validity assessment — the heuristic-systematic model (HSM) (Chaiken, 1980, Chaiken et al., 1989) — as the theoretical basis for this study. Using HSM, we develop a research model linking information adoption with information processing in online communities, and derive hypotheses from this model. Like much previous dual-process-based research, argument quality and source credibility are invoked here to manifest the dual processes. To examine the role that contextual differences play in dual processing, we propose and test two new moderators of these processes: the presence of disconfirming information and focused search, which reflects the extent to which members have specific information needs in mind during their active search for on-topic information. We argue that these new moderators are particularly important for information adoption in online communities, and hence deserve our research attention.

Online communities have been characterized as having “a minimum level of interactivity, a variety of communicators, a minimum level of sustained membership,” and a virtual “common-public-space” where interactive Computer-Mediated Communication (CMC) occurs (Jones, 1997). This characterization, however, makes only minimal specification of the technical capabilities of online communities and how members interact within them. There actually is much variation across online communities in terms of the specific technologies employed and how members use them to engage each other. Researchers of online communities have not addressed the technical differences of online communities and their implications in the past, perhaps because much previous research has precluded cross-site comparison by investigating only a single site, or perhaps because theory is underdeveloped in this domain. We believe there is considerable research work to be done to understand how these differences play out

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<sup>1</sup> The term “online communities” or “virtual communities” has been used to refer to many different kinds of online social gatherings. In this paper we use it to refer to communities that focus on facilitating information sharing between their members in the ways illustrated here.

across online communities. When assessing our theoretical model, we collected survey data from two online communities with different technical features. We then analyzed these data and compared the results across the two communities. Overall, the results support our research model – hence affirming the theoretical framework we identified, but we do notice some differences between the two communities. Based on the comparison and using the identified theoretical framework, we are able to draw some inferences about how community technical features may have influenced how people adopt content from online communities. As we will discuss, these inferences suggest important and interesting directions for future studies.

The rest of the paper is organized as follows: we begin by presenting the theoretical framework, the heuristic-systematic model, and use it to build our research model on the basis of how it applies to the phenomenon of information adoption in online communities. We then describe the empirical study that we conducted across two online communities to assess the theoretical model. Results of the data analyses are presented next, along with a discussion of these findings. We conclude by considering the contributions, limitations, and implications of the study for future research.

## Theoretical Development

This research explores the cognitive processes underlying individual members' information adoption in online communities. We define *information adoption* as the extent to which people accept content that they are presented with as meaningful, after assessing its validity. This definition is an individual-level information processing perspective that considers how meaning is attributed to received content when the context is not interactive or explicitly educational (e.g., Goodman and Darr, 1998). Just as organizational memory is a valuable organizational asset, an online community's repository is potentially invaluable to that community (Walsh and Ungson, 1991). However, it is only valuable to the extent that it is used. And because it is content-based, usage of the repository implies that the content in it is adopted by its members. For this reason, we sought a theory of content adoption to apply to the online community context by looking at studies of content adoption in other CMC contexts. We found that Sussman and Siegal (2003) had fruitfully applied a dual-process information processing model to adoption of email advice. These authors investigated the adoption of advice that was delivered via email, using the theoretical perspective of the Elaboration Likelihood Model (ELM, Petty and Cacioppo, 1986), one of several dual-process models of information processing. We chose the similar Heuristic-Systematic Model (HSM, Chaiken, 1980, Chaiken et al., 1989) rather than ELM for this study for several reasons. First, ELM has generally been used to model persuasive communication, specifically, whereas HSM was designed to be applicable to a wide range of validity-seeking contexts (Chaiken et al., 1989). We reasoned that the online community context was broader than one of persuasion, and HSM has been used to understand a wider range of information processing activities. Second, HSM has made some theoretical extensions that we believe allow room for interesting explorations within the dual-process framework. In particular, HSM accommodates the notion that the dual processes are not simply traded off cognitively, but can occur concurrently, influencing each other in various complex ways. We discuss this further below as we develop our research model and later when we interpret our findings. We refer interested readers to Eagly and Chaiken (1993, chapter 7) for an excellent discussion of HSM and ELM.

## Systematic and Heuristic Processing

Like other dual-process models, HSM examines the influence of both the information content of a received message and factors in the surrounding context. It investigates two information processing modes – systematic processing and heuristic processing – that occur during information acquisition, as people assess the validity of received content. During systematic processing, a message recipient carefully scrutinizes the presented information and works to incorporate it into what he or she already knows. During heuristic processing, a message recipient makes use of heuristics and simple decision rules embedded in the message context to do this. For example, the cue of “source credibility” may trigger the rule “credibility implies correctness,” leading a message recipient to favorably assess the validity of a message received from a more credible source (Chaiken et al., 1989).

According to HSM, both systematic and heuristic processing can result in positive validity assessments, but neither is automatic. Systematic processing requires motivation, ability, and sufficient cognitive resources, and it will be limited if one chooses not to make sense of the message or is not mentally

capable of making sense of the message. Insufficient cognitive resources such as time or energy may also prevent extensive systematic processing. Likewise, heuristic processing depends on the availability of cues and awareness of the heuristics associated with these cues. If a cue is not available to the message recipient, or if the message recipient is not aware of the implications of the cue, he or she cannot process the content heuristically.

When conditions for both systematic and heuristic processing are met, HSM holds that both processing modes can and do occur concurrently. Because extensive systematic processing “provides people with more judgment-relevant information” (Eagly and Chaiken, 1993, p328), high levels of systematic processing can attenuate the effects of heuristic processing. The extent of this attenuation effect has been under debate in the research community, however. Early studies found that elevated levels of systematic processing served to nullify the effects of heuristic processing (Chaiken, 1980). Researchers have since argued that these results were artifacts of experimental manipulations that artificially pitted contradictory heuristic cues against message content (e.g., using a message with weak content from a credible source) (Chaiken et al., 1989). When heuristic cues and message content are congruent with each other, dual-processing tends to generate consistent outcomes. Under such circumstances, heuristic processing may exert influence during message validity assessment over and above the influence of systematic processing, a phenomenon called *additive* effects in HSM (Maheswaran and Chaiken, 1991). We argue below that this is likely the case in our research context.

### The Dual Processing Modes in Online Communities

When members of online communities assess the validity of the information in a message related to a particular problem, they are sufficiently motivated to engage in systematic processing. And as members participate in the community over time, they become sufficiently knowledgeable about the community and its domain to be capable of engaging in systematic processing. In this way we believe that our research context meets the minimal criteria for systematic processing described above. In previous HSM research, systematic processing has been assessed on the basis of how deeply the message recipient reflects on the *argument quality* – “the strength or plausibility of persuasive argumentation” (Eagly and Chaiken, 1993, p325) – of the message (for a review, see Eagly and Chaiken, 1993, Chapter 7). In this view, when systematic processing occurs, high-quality arguments are associated with favorable message assessment.

Most research on the HSM (as well on the ELM) has been conducted in laboratory settings, where researchers have been able to manipulate levels of argument quality by composing messages with content that varies in its subjective probability (Eagly and Chaiken, 1993, Chapter 7) or substantiation of claims (Kim and Benbasat, 2006). In online communities, however, members compose messages to provide other members with helpful information. Thus, in this research we take a pragmatic perspective on argument quality, aligning it with the situational relevance of a message’s information content (Xu and Chen, 2006). We consider messages that are pertinent to solving the problem at hand to be of high perceived quality (Sussman and Siegal, 2003). When members of an online community carefully read a message and contemplate its validity, they are engaging in systematic information processing. The more truthful, relevant, and helpful the information embedded in the message is, the higher quality members will perceive the content-based arguments to be (Sussman and Siegal, 2003, Xu and Chen, 2006), and the more likely it will be that the member will adopt this information. Thus, in the context of online communities and through the mechanism of systematic processing;

*H1: Messages perceived to have higher argument quality produce a higher level of information adoption.*

Heuristic processing depends on the ready availability of heuristic cues. Text-based CMC technologies do reduce some social cues (Sproull and Kiesler, 1986) that may be used as heuristic cues. Members of online communities tend to use text-based CMC technologies, e.g., textual messages, to communicate with each other; hence, heuristic processing of messages in these communities may be limited. However, this need not be the case for several reasons. First, text is capable of conveying social cues that were once thought to be impossible in text-based environments. For instance, character combinations called emoticons are widely used in CMC contexts and can express even subtly different

emotions (Walther and D'Addario, 2001). Second, CMC can reveal certain heuristic cues that may go unnoticed in other media and even introduce new cues into the communication context. For example, the time that a communication takes place is implicit in face-to-face communications, but is generally explicit in CMC in the form of time-stamping. Golden (2000) described how a shrewd subordinate was able to use email timestamps to influence how his supervisors perceived him. Third, well-designed online community technologies can present a rich set of features that can serve as heuristic cues. For example, many online forums display messages in a threaded manner, which makes many potential cues available, such as the popularity of a thread (as reflected by thread size and number of hits), relationships between messages (as shown in the hierarchy of messages in a thread), interaction patterns between participants (e.g., who replies to whom), and the evolution of the thread over time.

One example of a heuristic cue that may be available in a CMC-based online community is source credibility. Source credibility has been studied extensively in offline contexts (Heesacker et al., 1983, Hovland, 1951, Hovland et al., 1953, Petty et al., 1981). Early laboratory experiments on the role of source credibility found significantly more opinion change in the advocated direction when the material was attributed to a high credibility source than when it was attributed to a low credibility source (Hovland, 1951, Hovland et al., 1953). Recent research in an email context also suggests that source credibility functions in the way a heuristic cue would function (Sussman and Siegal, 2003). In online communities, an author's name – or screen name – is usually displayed together with a message, making it possible to use source credibility as a heuristic cue, particularly when multiple messages by the same source have been read. In offline contexts such as face-to-face communities, recognition of a credible source often requires many direct interactions with the source, or repeated observations of interactions between the source and others. In an online community, reading the past contributions of a source can quickly provide similar information: Members that have a history of contributing insightful and truthful messages are likely to be considered credible even by members who were not present when the content was originally contributed. An important implication of this is that in online communities, when members contribute to the community, they are also building and maintaining their own credibility "profile" (Zhang and Watts, 2002). To maintain his or her credibility, a credible member is unlikely to contribute inferior messages. For this reason, argument quality and source credibility tend to be congruent with each other in online communities; heuristic processing based on source credibility assessment tends to be in the same direction as systematic processing, and heuristic processing tends to influence assessment of message validity in addition to systematic processing, which leads us to hypothesize:

*H2: Messages perceived to have higher source credibility produce a higher level of information adoption.*

### **Moderators of the Dual-processes in Online Communities**

The attenuation tenet of HSM holds that high levels of systematic processing can attenuate the influence of heuristic processing (Chaiken et al., 1989, Eagly and Chaiken, 1993, chapter 7, Maheswaran and Chaiken, 1991). Because systematic processing requires motivation and ability, the relative importance of the two processing modes is moderated by people's motivation and ability to process systematically: When motivation and ability to systematically process the received content are high, people are more likely to engage in higher levels of systematic processing. This can reduce or even negate the effects of heuristic processing and, consequently, decrease or even eliminate the influence of heuristic cues. For example, much previous research has shown that high levels of recipient involvement increase the influence of argument quality but decrease that of heuristic cues, because highly involved people are more motivated to undertake the additional cognitive effort of systematic processing (for an extensive review on this, see Eagly and Chaiken, 1993, chapter 7).

However, moderators commonly investigated in previous dual-process studies, such as recipient involvement, may not be appropriate for this context. As discussed above, most previous HSM research has been conducted in the laboratory, using single-message processing tasks. In field-based contexts such as ours, problem solving rarely involves assessment of a single readily available message. Rather, it typically entails identifying and examining many pieces of information. For example, Majchrzak et al. (2004) observed that NASA engineers searched for and evaluated knowledge to reuse for innovation in three stages: during the scanning stage, reusers conduct a broad search to identify relevant knowledge

with only limited processing. Next, during a brief evaluation, reusers apply meta-knowledge such as source credibility to help decide whether the identified knowledge seems promising. Finally, promising knowledge is subject to in-depth analysis to determine whether it will be reused or not. Apparently, for an individual solving a particular problem, dual-processing patterns can vary over time despite fairly consistent involvement levels. To explore moderations of the dual processes in our online problem-solving context, we sought new moderators with the potential to affect motivation and ability to process, along with available cognitive resources, at the moment that a particular message is processed. We discuss *disconfirming information* and *focused search* below.

### **Disconfirming Information**

In online communities, members can access messages that have accumulated over time. This high volume of prospective content increases the likelihood that members will encounter messages that disconfirm their previously held beliefs regarding the topic at hand. We use the term *disconfirming information* to refer to information content in messages that is inconsistent with one's previously held understandings and beliefs. When people receive such information, they attempt to defend their prior beliefs through various cognitive processes such as denial, bolstering, and differentiation (Abelson, 1983). Resolving inconsistencies between newly received information and previously held understandings and beliefs is a difficult cognitive task (Abelson, 1983) that entails systematic processing (Jain and Maheswaran, 2000, Sengupta and Johar, 2002). HSM researchers have incorporated this cognitive consistency perspective into dual-process research (Eagly and Chaiken, 1993, chapter 7), and we extend this work into the context of online communities.

From the perspective of HSM, disconfirming information motivates systematic processing because its presence is both intriguing and upsetting. It challenges the message recipient to more closely examine the message to identify and understand differences between the information embedded in the current message and what he or she already knows (Vandenbosch and Higgins, 1996). It compels the recipients to resolve these contradictions in order to assess the validity of the message (Maheswaran and Chaiken, 1991). The challenged recipients will be motivated to take on the additional cognitive effort that systematic processing demands. Under elevated levels of systematic processing, messages with higher argument quality are likely to engender more information adoption than messages with lower argument quality. Hence,

*H3a: For a particular message, the greater the level of disconfirming information perceived in the message, the more argument quality affects information adoption.*

Disconfirming information increases motivation to process content systematically, and elevated levels of systematic processing tend to attenuate the effects of heuristic processing. Therefore, we would expect the heuristic cue of source credibility to be less influential during validity assessment when the message content includes disconfirming information. Hence, when online community members are confronted with disconfirming information, they will be less influenced by the credibility of the message source:

*H3b: For a particular message, the greater the level of disconfirming information perceived in the message, the less source credibility affects information adoption.*

Next we hypothesize that *focused search* can also moderate processing modes in online communities by affecting available cognitive resources. Focused search is particularly relevant to online contexts but has not been conceptualized as such in prior research.

### **Focused Search**

In order for members to utilize the information content of their community's repositories, they must first locate the desired content. Searching and scanning are two basic ways that people look for new information in online contexts (Marchionini and Schneiderman, 1988): Scanning is an exploratory effort by which people briefly scan large quantities of information for possible relevancy to their information needs. When scanning, people rely on serendipity as they sift through large quantities of content for potential search solutions. By contrast, searching aims at a predefined goal, and is more efficient and cost-effective than scanning. At a particular moment, information seekers choose whether to search or scan based on their information needs (Vandenbosch and Huff, 1997). We are especially interested in how searching plays out in online communities because widespread adoption of Internet search engines

has made searching an easy and frequently used discovery method for online information seekers. We use the term *focused search* to refer to the extent that information-seeking members of online communities have specific information needs in mind and actively search for on-topic information. At different stages during their problem-solving quest, members have different information needs, which result in varying levels of focused search (Majchrzak et al., 2004). In comparison, their levels of involvement tend to be relatively constant throughout the problem-solving process.

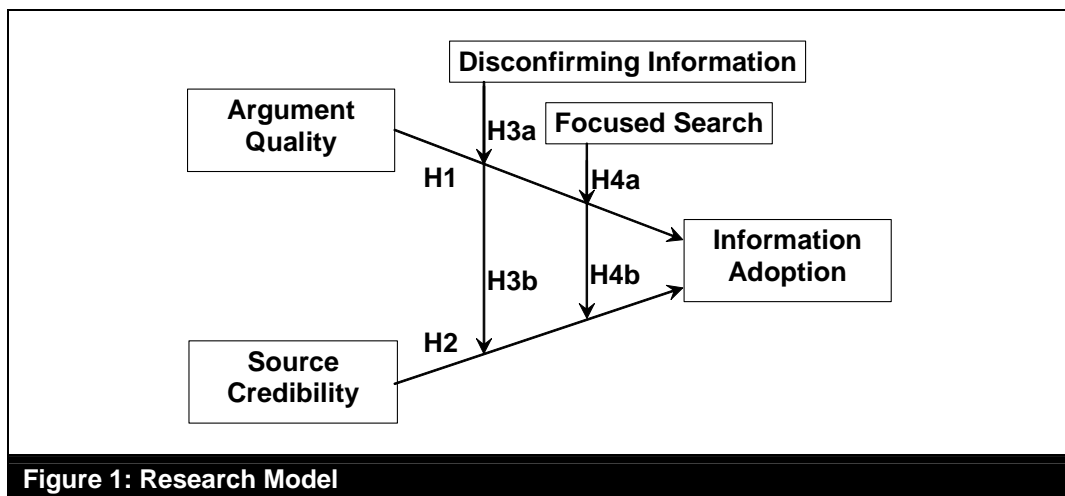
Thus members with higher levels of focused search have a better idea of what they are looking for, and are more likely to rely on searching rather than scanning to locate the information they need. If the search is successfully executed, it generates only a limited set of results on which the members can concentrate. Under such circumstances, even when cognitive resources are limited, members can expend them on only this limited set of messages. In this way, high levels of focused search affect dual-processing by allocating sufficient cognitive resources to enable systematic processing of individual messages. This will tend to increase the effects of message content and reduce those of heuristic cues.

Yet the use of the searching method does not necessarily lead to successful searches in online communities. Technically, searching in online communities is implemented by applying information retrieval techniques to message repositories (Kowalski, 1997). Different online communities use different information retrieval techniques, and they organize and maintain their repositories differently, resulting in wide variations in information retrieval functionality across online communities. The particular information retrieval functionality – the extent and manner that searching is supported and facilitated – an online community offers its members can impede or enable production of relevant and accurate search results, making it more or less difficult for members to successfully conduct searching and locate desired content. In online communities offering effective information retrieval functionality, searching is designed to produce results in such a way as to prioritize quality rather than quantity, and search results tend to present only a limited set of relevant messages. Each message can then be processed systematically without overloading the searchers' cognitive resources. Poor information retrieval functionality, on the contrary, tends to deliver too much content for searchers to process systematically. The moderation effect of focused search on systematic processing is, hence, more likely to be detected in online communities that have effective information retrieval functionality. As above, we use argument quality to manifest systematic processing and source credibility to manifest heuristic processing, and hypothesize:

*H4a: In online communities with effective information retrieval functionality, higher levels of focused search by a member increase the effect of a message's argument quality on information adoption.*

*H4b: In online communities with effective information retrieval functionality, higher levels of focused search by a member decrease the effect of a message's source credibility on information adoption.*

We depict the hypotheses described above graphically in Figure 1:





## Methods

We tested the above theoretically-derived hypotheses using an online survey of members of two online communities. Online communities are inherently field-based. In order to investigate them in their natural state, we needed to collect data from online communities that were established, active, and mature at the time (Rice and Love, 1987). We chose not to pursue a more controlled data collection method such as a laboratory experiment because doing so would have limited our ability to fully understand this complex phenomenon.

## Research Sites

We selected two text-based, asynchronous online communities engaging in information-sharing activities for this study. The first community is an online travel forum hosted by a major Internet portal company in China. This Travel Forum, founded in 1998, has evolved into one of the premier backpacking-related online communities in China (Zhang and Watts, 2002). The second research site that we investigated is CFD Online, a community of Computational Fluid Dynamics professionals that was first launched in 1998. Usage statistics indicated that CFD Online was a popular and established community. Member participation in both communities was active and stable at the time of the research. In both communities, we were able to identify information adoption tasks that we deemed likely to motivate members to engage in more demanding systematic processing, thus providing us the opportunity to examine dual information processing. During preliminary observation of Travel Forum, we noticed that it was a common practice for members to use information in the message repository to develop travel plans before they set off on a trip. In CFD Online, much information exchange was generated in response to member initiated questions. Hence, we chose "examining a message when making a travel plan" and "examining a reply to one's question" as the information adoption tasks in the two communities, respectively.

Another reason for our selection of these two online communities for data collection was the fact that they differed in information retrieval functionality. At the time of the study, Travel Forum's search engine allowed users to search either by the name of the author or by keywords in message subjects and/or bodies. Unlike Travel Forum, CFD Online's search tool did not support searching by author, and it did not differentiate between message subjects and bodies. Also, the success of a search depended not only on the effectiveness of the search engine, but also on the volume and organization of the message repository that was being searched. Both of the online communities that we studied maintained message archives, but they did so in very different ways. CFD Online retained all posted messages, simply categorizing them by the year that they were posted. Travel Forum was much more selective and organized. Rather than keeping a complete record of all postings, the moderators saved only high-quality messages in a repository called the "Best Article Collection." Messages whose quality did not merit being saved into this collection were automatically purged from the system after about a week. The best article collection was categorized into different topics and different geographic areas, making it easy for members to locate messages most relevant to their needs. Thus Travel Forum not only had a more powerful search engine, but also – perhaps more importantly – worked to reduce the quantity of poor quality entries and improve the organization of its message repository. For this reason we view Travel Forum as offering more effective information retrieval functionality that, at the time of the study, enabled better search results than those embedded at CFD Online. For this reason, we expect H4a and H4b to be supported in Travel Forum but not necessarily in CFD Online.

## Questionnaire Development and Pre-testing

We developed two version of the data collection instrument. Questionnaire content was largely the same for both communities, and consisted of questions asking members about a particular message that they utilized for problem solving. In Travel Forum, we asked members to focus on the last message they had read to make their travel plans. In CFD Online, we asked members how they responded to a reply to the most recent question they had asked. We screened the replies of each potential participant to ensure that they answered to the particular question posed. We then randomly chose one reply to serve as the focal message on which the participant could base his or her answers to the survey questions. In so

doing, we sought to minimize inaccurate memory recall, to approximate random sampling, and to avoid potential selection bias by our survey participants had they been allowed to choose their own messages.

We conducted a qualitative pre-test and a pilot survey in Travel Forum prior to administration of the actual survey. The qualitative pre-test probed the applicability of the research model to the phenomena and informed the questionnaire design. It consisted of 24 semi-structured phone interviews with Travel Forum members about their experiences using information from the forum to help make their travel plans. Qualitative data analyses of the interview transcripts supported the plausibility of our hypotheses and indicated the appropriateness of choosing the task of travel-plan making as the study context.

Next, we developed a pilot survey and distributed it to a number of members of Travel Forum in order to test the construct measures of the research model. We adopted and adapted previously validated scales for measuring argument quality (Bailey and Pearson, 1983) and source credibility (Sussman and Siegal, 2003). We developed a new measure of information adoption because we were not able to identify suitable existing scales. We also developed measures for focused search and disconfirming information, but informed by similar items used in a previous study (Vandenbosch and Higgins, 1996). For Travel Forum, we developed all items in English and had them translated into Chinese by a Chinese doctoral student enrolled in a U.S. business school who had no *a priori* knowledge of the purpose of the research. The translated items were then reviewed by one of the authors. Disagreements on the translation were resolved through discussions between the translator and reviewer. We then refined these items using the data and feedback collected from 63 usable responses to the pilot survey. Two senior members of Travel Forum reviewed the final version of the survey questionnaire to be used in that community. This revision resulted in minor changes before we made the final survey available online to Travel Forum members.

We based measures for the survey administered to the CFD Online community on those used in Travel Forum. We made minor changes to the wording of the items so that they made sense in the context of CFD Online. This final survey was reviewed by the moderator of CFD Online before it was administered.

## Survey Administration

We launched the Travel Forum survey in the fall of 2002, four days before a seven-day national holiday in China when many members were in the process of making travel plans for the holiday. The sample pool consisted of members who posted messages to Travel Forum to recruit travel partners during the eight weeks prior to survey administration and who also provided their email addresses in their recruiting messages. These members were contacted by personalized email on the day the survey was administered. In exchange for participation, a senior Travel Forum member offered each respondent two small plastic patches bearing the forum logo. The final sample pool included authors of 342 messages, each of whom received an email inviting his or her to participate in the study. In addition, with the help of the site administrators and permission from the moderators, we posted a link to the survey on the Travel Forum homepage. This generated additional survey respondents beyond the original sample.

For CFD Online, we solicited survey participation from members who had contributed questions to any of the three most popular discussion forums during the three months prior to survey administration and whose email addresses were available. We identified 267 such members in total, resulting in 267 invitation emails. The URL to the web survey was included in the invitation email. We offered no incentive to members of CFD Online to participate in this survey.

## Results

### Response Analysis

For the Travel Forum survey, 108 responses were received from members on the invitation list, 82 of which were complete and usable, resulting in a reasonable response rate of 24 percent. In addition to these invited participants, we also received 86 responses from self-selected participants via the link to the survey placed on the Travel Forum homepage. Of these 86 unsolicited responses, 60 were complete

and usable. We compared the factor structure and loadings for the two data sets and found no significant differences between them; hence, we combined the two data sets into one for data analyses.

Travel Forum respondents ranged in age from 18 to 62, with a mean of 28.2 and a standard deviation of 6.3 (N=139). Eighty two of the respondents were male and 60 of them female. Almost 95 percent of them had advanced beyond a high-school education (N=142), and all reported having at least seven months of experience with the Web. The respondents were familiar with Travel Forum – average experience with it was 18.0 months (with a standard deviation of 13.7 months). Respondents reported visiting the forum about seven times per week (mean=6.9; standard deviation=12.2; N=141) and spent more than six hours (mean=6.4; standard deviation=10.8; N=141) in the forum weekly. By the time of survey administration, most respondents (128 out of 142) had finished making their travel plans for the upcoming holiday. Typically, members read 20 to 30 messages before finalizing their travel plans. The large number of messages read suggested that our respondents were quite involved in making their travel plans.

In the CFD Online survey, 25 of the 267 invitation emails did not get delivered for various reasons. After one round of reminder emails, we received 112 usable responses, resulting in an effective response rate of 46 percent. Demographically, the typical CFD Online respondent was a highly educated young male: 71 percent of respondents had earned a master's degree, and another 24 percent held a bachelor's degree. More than 80 percent of the respondents were 35 years old or younger and only about 10 percent of them were female. Average experience in the CFD domain was around three years (mean=3.07; standard deviation=2.69; N=111). Most respondents were experienced members of the community: more than half of the respondents had been visiting the CFD forums for more than a year, and nearly 90% of the respondents had been doing so for at least three months, with an average of 22.95 months (standard deviation=20.90; N=111). Regarding visit frequency, respondents visited the CFD Online forums almost four times per week on average (mean=3.80; standard deviation=5.23; N=112) and spent about two hours per week (mean=2.15; standard deviation=4.94; N=111) in the forums. In both online communities, we analyzed a variant of the research model in which we included demographic variables, but this did not change the analytical results. Hence, for theoretical clarity, we report on analyses of models that do not include demographic variables.

### Measurement Properties

We primarily used Partial Least Squares (PLS) for data analyses. PLS is a Structural Equation Modeling (SEM) technique that evaluates the measurement model and structural model simultaneously. Compared with other popular SEM techniques such as LISREL, PLS makes minimal demands on sample size, sample data distribution, and residual distributions (Chin, 1998, 2000). Because of these advantages, PLS has gained popularity among business researchers (Gefen et al., 2000). The specific PLS software we used was PLS Graph Version 03.00 Build 1126 (Chin, 2001).

To determine the psychometric properties of our measures, we examined composite reliabilities of latent constructs, average variance extracted (AVE) by latent constructs from their indicators, correlations among latent constructs, and indicator-factor (cross-) loadings (Chin, 1998), all readily available from PLS Graph output, except for the factor loadings and cross-loadings. These were obtained using SPSS (Gefen and Straub, 2005), and we present them in Appendix I. To assess reliabilities of the measures, we first examined individual item reliabilities by checking their standardized loadings. Items with standardized loadings of less than 0.7 were pruned (Chin, 1998). We examined composite reliabilities next. The rule-of-thumb we followed is that composite reliabilities of 0.70 or higher are adequate (e.g., Yi and Davis, 2003). As shown in Table 1, the minimal composite reliability is 0.83 for focused search in CFD Online. All other composite reliabilities are greater than 0.85.

In order for indicators of a latent construct to demonstrate acceptable convergent and discriminant validity, the loadings onto their respective latent constructs must be significant and higher than the cross-loadings onto other latent constructs. Also, the square root of a latent construct's AVE must be at least 0.7 or higher than its correlations with other latent constructs (Chin, 1998, Gefen and Straub, 2005). In both of our measurement models – one for each of the online communities investigated — the loadings of all indicators onto their own latent constructs were significant at  $p < 0.001$ , and considerably higher

**Table 1: Descriptive Statistics, Composite Reliabilities, and Correlations among Latent Variables**

	Composite Reliability	Mean	SD	IA	AQ	SC	DI	FS
<b>Travel Forum</b>								
IA	0.93	4.86	1.36	<b>0.91</b>				
AQ	0.90	5.06	1.10	0.64	<b>0.87</b>			
SC	0.94	4.63	1.03	0.55	0.57	<b>0.84</b>		
DI	0.86	2.53	1.16	-0.18	-0.29	-0.13	<b>0.87</b>	
FS	0.88	5.25	1.30	0.63	0.55	0.40	-0.19	<b>0.88</b>
<b>CFD Online</b>								
IA	0.91	3.91	1.67	<b>0.88</b>				
AQ	0.89	5.19	1.33	0.58	<b>0.86</b>			
SC	0.92	5.10	1.09	0.55	0.66	<b>0.82</b>		
DI	0.88	3.10	1.51	0.50	0.34	0.35	<b>0.88</b>	
FS	0.83	5.57	1.16	0.21	0.09	0.14	0.16	<b>0.84</b>

**Note:** IA = Information Adoption; AQ = Argument Quality; SC = Source Credibility; DI = Disconfirming Information; FS = Focused Search; SD = Standard Deviation. Diagonal elements (bold) are the square roots of average variance extracted (AVE) by latent constructs from their indicators. N=142 in Travel Forum and N=112 in CFD Online.

than their cross-loadings with other constructs (see Appendix I). As shown in Table 1, the square roots of the AVE of all latent constructs are larger than 0.8 and higher than their correlations with other latent constructs.

Some of the correlations shown in Table 1 are somewhat high, raising concerns about common method bias and multicollinearity. We assessed common method bias in two steps. First, we conducted a Harmon's one-factor test (Podsakoff and Organ, 1986). For both data sets more than one factor emerged from the factor analyses, and no one general factor was able to account for the majority of the covariance between the variables. Thus, this test did not reveal substantial common method bias. Second, we created a common method factor and added it to the measurement models to assess the effects of an unmeasured latent method factor (Podsakoff et al., 2003). Although in both data sets the common method factor improved model fit, it accounted for a small portion of the total variance (4.26 percent in Travel Forum and 5.29 percent in CFD Online, respectively), which is far below the threshold amount suggested by Williams et al. (25 percent, 1989). Moreover, the addition of the common method factor hardly changed the correlations between the latent constructs. On the basis of these two tests, then, common method bias is not a threat in this study. To assess multicollinearity, we cross-validated the main effects using regression analysis, and examined their tolerances, variation inflation factors (VIFs), and condition indices. For both data sets, all tolerances were much higher than 0.1 (with the lowest one being 0.55), and all VIFs were much lower than 10 (with the highest one being 1.83). The highest condition index we found was 2.40, much lower than the typically recommended threshold value of 15 to 30 (Hair et al., 1995, p.153). These checks suggested that multicollinearity is not a problem either. In summary, we conclude that the refined measurement models of both data sets exhibit acceptable psychometric properties (See Appendix II for details of these measures).

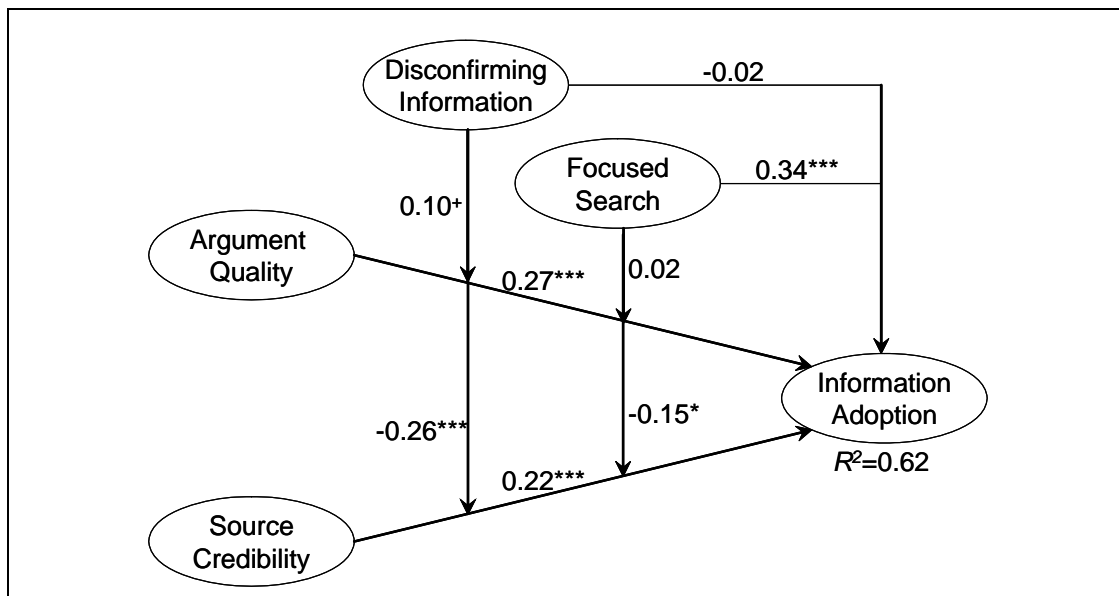
## Test of Hypotheses

We tested the hypotheses by examining the significance of the path coefficients of the estimated structural model. This is straightforward for H1 and H2, as these describe main effects only. H3 and H4 investigate the potential moderating effects of disconfirming information and focused search, respectively. To test them requires assessing the significance of interaction terms created from the cross-product of moderator and predictor variables (Baron and Kenny, 1986). Within PLS Graph, an interaction term consists of all possible products from the standardized indicators of a moderator variable and those of a predictor variable (Chin et al., 2003). Paths from the moderator to the dependent variable must also

be tested. We ran two models – one for each online community. We ran bootstrapping with 500 resamples to obtain the standard errors of the path coefficient estimates. Statistical significance was then computed using one-sided *t*-tests, because our hypotheses predict effect directions. Overall, our models accounted for considerable variance in the dependent variable of information adoption in both online communities ( $R^2 = 0.62$  in Travel forum and  $R^2 = 0.48$  in CFD Online).

### Results for Travel Forum

In Travel Forum (Figure 2), both argument quality and source credibility had a significant main effect on information adoption ( $\beta = 0.27$ ,  $p < 0.001$  for argument quality and  $\beta = 0.22$ ,  $p < 0.001$  for source credibility), supporting H1 and H2. Disconfirming information appeared to moderate the effects of argument quality on information adoption, as indicated by the moderately significant path coefficient between the interaction term of disconfirming information and argument quality, and information adoption ( $\beta = 0.10$ ,  $p < 0.1$ ). This positive path coefficient suggests that higher levels of disconfirming information increase the effect of argument quality on information adoption as hypothesized in H3a, manifesting elevated levels of systematic processing. Furthermore, disconfirming information strongly moderated the effect of source credibility on information adoption. The negative path coefficient is in the same direction as predicted by theory ( $\beta = -0.26$ ,  $p < 0.001$ ), supporting H3b. The presence of disconfirming information seems to have led members to rely less on heuristic processing, as suggested by the decreased influence of source credibility.



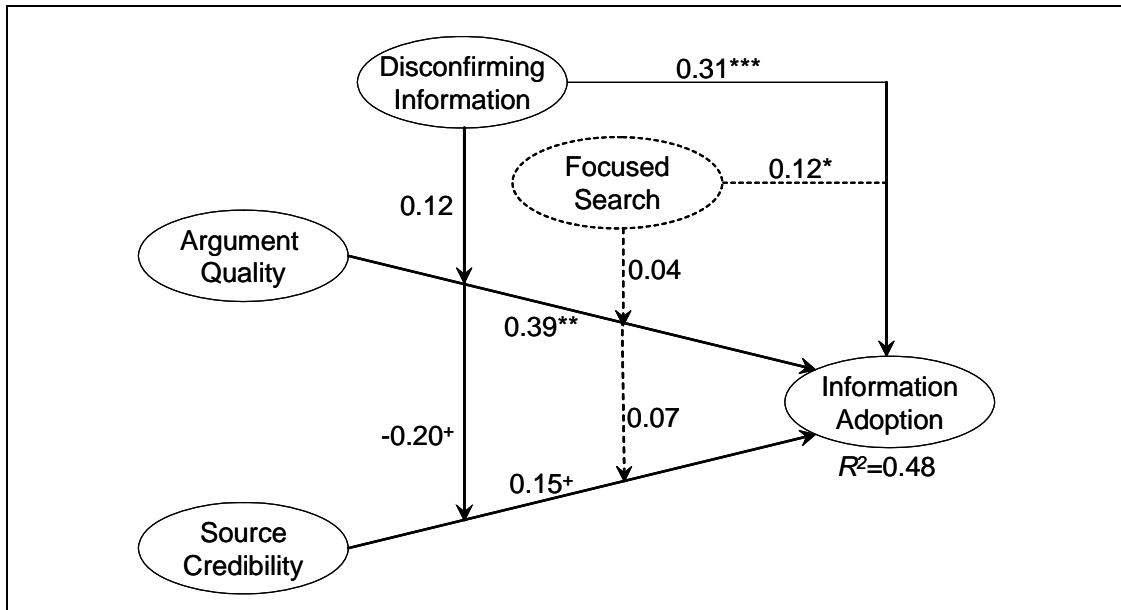
**Figure 2: PLS test of the proposed structural model for Travel Forum**

**Note:** <sup>+</sup> $p < 0.1$ ; \* $p < 0.05$ ; \*\* $p < 0.01$ , \*\*\* $p < 0.001$

H4a and H4b investigate the potential moderating effects of focused search in online communities. Because we view Travel Forum as having strong information retrieval functionality, we expect these hypotheses to be supported there. Indeed, the path coefficient of the interaction term of focused search and source credibility was significant and negatively associated with the dependent variable of information adoption ( $\beta = -0.15$ ,  $p < 0.05$ ). This is consistent with Hypothesis H4b, in which we posit that focused search decreases the effect of source credibility on information adoption in online communities having strong information retrieval functionality. However, the path coefficient of the interaction term of focused search and argument quality is barely positive, and H4a is not supported.

### Results for CFD Online

We repeated these same analyses for the CFD Online data. As shown in Figure 3, the path coefficient from argument quality to information adoption was strongly significant and positive ( $\beta = 0.39$ ,  $p <$



**Figure 3: PLS test of the proposed structural model for CFD Online**

**Note:** + $p < 0.1$ ; \* $p < 0.05$ ; \*\* $p < 0.01$ , \*\*\* $p < 0.001$

0.001), in support of H1. The path coefficient from source credibility to information adoption was moderately significant at the  $p < 0.1$  level ( $\beta = 0.15$ ), which was surprising given the high correlation between source credibility and information adoption ( $r = 0.55$ ,  $p < 0.01$ , see Table 1). We found no support for H3a. H3b was also moderately supported, since the path coefficient of the interaction term of disconfirming information and source credibility was significant in the predicted direction at the  $p < 0.1$  level ( $\beta = -0.20$ ). Thus, high levels of disconfirming information tend to decrease the effect of the source credibility in this community as predicted. This raised the possibility that the main effect of source credibility on the dependent variable was somewhat obscured by the interaction term. To investigate this issue, we examined the main effects in isolation using a simplified model that included only main effects. In the simplified model, source credibility significantly affected information adoption ( $\beta = 0.23$ ,  $p < 0.05$ ) beyond the effect of argument quality ( $\beta = 0.32$ ,  $p < 0.01$ ), in support of H2.

In an exploratory analysis, we tested the significance of the path coefficients of both the interaction terms involving focused search and found that both were insignificant (results shown with dashed lines in Figure 3). Note that this does not contradict H4a and H4b, because we hypothesized that the moderation effects of focused search would only appear in online communities with strong information retrieval functionality (e.g., Travel Forum in this study).

**Table 2: Summary of results of hypothesis testing**

	Main Effects	Travel Forum	CFD Online
H1	Argument Quality	Supported at $p < 0.001$ level	Supported at $p < 0.01$ level
H2	Source Credibility	Supported at $p < 0.001$ level	Supported at $p < 0.1$ level
	Moderation Effects	Travel Forum	CFD Online
H3a	Disconfirming Information x Argument Quality	Supported at $p < 0.1$ level	Not support
H3b	Disconfirming Information x Source Credibility	Supported at $p < 0.001$ level	Supported at $p < 0.1$ level
H4a	Focused Search x Argument Quality	Not supported	N/A
H4b	Focused Search x Source Credibility	Supported at $p < 0.05$ level	N/A

Table 2 summarizes the results of hypotheses testing of the survey data collected from both online communities. Overall, the data support our theoretical model across both communities.

## Discussion

Online communities are a popular and important means of information sharing, made easier by the fact that community content is generated as a natural product of member participation. This potentially valuable content can be used and reused by community members. However, use of this content is by no means axiomatic: many online repositories full of valuable content are underutilized, becoming “information junkyards” (McDermott, 1999). Yet there is a paucity of empirical research that systematically investigates this phenomenon. In this paper we report on a study that explores the mechanisms underlying how people adopt information from online communities, using the theoretical lens of the Heuristic-Systematic Model of dual-process information processing.

Consistent with HSM, we find that perceptions of both the argument quality of a posted message and of the credibility of its source influence adoption of the information in the message. In both communities we studied, the relationships between argument quality and information adoption were highly significant ( $p < 0.01$ ), underscoring the overall importance of argument quality for information adoption. This suggests that tactics taken to ensure the high quality of message arguments – such as monitoring posted content – can enhance the adoption of content and potentially increase the value of the message repository to members of online communities.

Source credibility is a widely utilized cue in many contexts, and this study confirms that it plays a role in online communities as well. In both communities, the more credible the source of a message’s content is perceived to be by a member, the more likely it is that this member will adopt that content. Further, the influence of source credibility on information adoption is over and above that of argument quality, precisely as the additive hypothesis of HSM predicts (Chaiken et al., 1989). Numerous previous HSM studies have found that for those that are motivated and able to process messages systematically, source credibility has a reduced influence on content adoption. Here we demonstrate this in the domain of online community information adoption: when members read messages containing disconfirming information, and/or they actively search for on-topic information, the influence of source credibility on information adoption is correspondingly reduced. All of these findings suggest that heuristic processing does occur in online communities, and that HSM provides a valid theoretical framework for studying information processing and consequent information adoption in this domain.

We undertook a closer examination of heuristic processing based on source credibility perceptions in these two communities, with some interesting results. Travel Forum supports various indicators of source credibility: the company that hosts Travel Forum enforces user registration, and members have to register with the hosting company to post messages. Once a member is registered, the company automatically creates a profile page for that user. Members can choose to disclose some personal information (e.g., demographic information and contact information) in their profile pages. Once a member posts a message, a link to this message is automatically generated and inserted into the profile page, making the profile page a historical record of that member’s activities. The profile page is easy to visit: next to each posted message the author’s user name is displayed, and clicking on this name brings up the author’s profile page in a new window. This feature allows for easy traversal between messages and the profile page of the author that contributed them, enabling anyone doing this to get a sense of the author’s credibility. Additionally, because the Best Article Collection archive in Travel Forum is highly selective, having a message included in this archive attests to the credibility of its author. In fact, some informants in our pre-test interviews said that when they read messages, they checked the author’s profile pages and looked to see whether or not the author had articles in the Best Article Collection. Together, Travel Forum’s design features seem to facilitate heuristic processing using the source credibility cue. This is a plausible explanation for why we found a highly significant association between source credibility and information adoption in this community.

The CFD Online community, on the contrary, provides only rudimentary support for source credibility assessment. This community has no user registration. When a member posts a message, he is required

to provide a name, which is displayed next to the messages he posts. However, there are no restrictions on what members can use for this name, nor is this process monitored. Members are not assigned profile pages, nor are there any other ready indications of the quality of a member's past contributions akin to the Best Article Collection in Travel Forum. Despite this relative lack of support for source credibility assessment, we were able to find some evidence of the influence of perceived source credibility on information adoption in CFD Online ( $\beta = 0.15$ ,  $p < 0.1$  in the full model and  $\beta = 0.23$ ,  $p < 0.05$  in the simplified model including only main effects). This influence was not as strong as that observed in Travel Forum ( $\beta = 0.22$ ,  $p < 0.001$ ). Taken together, these findings suggest that while source credibility is an important heuristic cue for information assessment in online communities, the technical design features of online communities appear to affect the extent of reliance on this cue.

Since source credibility has a higher correlation with argument quality (0.66) than with information adoption (0.55) in CFD Online, we investigated whether source credibility might actually affect information adoption indirectly by influencing perceptions of argument quality. That is, positive source credibility perceptions may lead a member to think more favorably about the message content, as measured by argument quality here, an HSM phenomenon known as the bias effect (Chaiken and Maheswaran, 1994). To explore this, we modified the basic model (the one including only argument quality, source credibility, and information adoption) by adding a path from source credibility to argument quality. This additional link was significantly positive, but did not render the link between source credibility and information adoption insignificant. Hence in CFD Online, source credibility appears to be associated with perceptions of argument quality, and also affects information adoption, independent of argument quality. This provides some support for the bias effect in this community. In our data, when a source is perceived to be credible, this seems to generate positive expectancies of the validity of the message content and, thus, makes the recipient more receptive to the information content of the message (Chaiken and Maheswaran, 1994). We found similar bias effect in Travel Forum. Bias effects are relatively under-studied even in HSM research, which is why we did not hypothesize them in this exploratory study. Future studies that incorporate bias effects will certainly improve our understanding of information adoption in online communities, in particular, and HSM, in general.

Despite the relative lack of technical features intentionally designed to enable users to assess source credibility in the CFD Online community, members still were able to assess the credibility of a message source, and this influenced the extent to which they adopted the information provided by the source. It is beyond the scope of this study to explore how these members formed their source credibility opinions, but this is a potentially fruitful avenue for future research. Source credibility is an important dimension of a member's identity in a community, and the identity shapes how that member behaves and is perceived by others in the community (Wenger, 1998). More research is needed to obtain a deeper understanding of the formation of source credibility perceptions, the role that source credibility plays in online communities, and how technical design features affect the influence of this role.

Moreover, results of our source credibility analyses in both communities suggest that text-based CMC can support heuristic processing using available cues. As discussed above, online communities offer a rich environment for understanding how heuristic cues are utilized in the new media. While we did not investigate this here, we believe that heuristic cues other than source credibility influence validity assessment in online communities. In order to understand how mediated knowledge adoption differs from face-to-face knowledge adoption, it is important for researchers to discover new cues and how they function in mediated contexts (Sussman and Siegal, 2003). Further, many online communities now support unique features that blur the boundary between cues and content. For example, content ratings on community web pages indicate others' opinions of a particular contribution (Poston and Speier, 2005). We need to understand more about how such features affect dual-processing of the content they describe, in order to understand their contextualized influence. For example, can such features increase the motivation of members to systematically process their associated content, or do they inhibit systematic processing of this content?

The proposed moderators, *disconfirming information* and *focused search*, are important contributions of this research. We have argued that they can affect motivation, ability, and availability of cognitive resources at the moment of processing a single message and that they are particularly relevant to our



research context. Consistent with HSM, we hypothesized that these two constructs affect online information adoption by altering the balance of systematic and heuristic processing. In Travel Forum, disconfirming information moderated the relationship between argument quality and information adoption, and also the relationship between source credibility and information adoption, as predicted by our model. In CFD Online, the presence of disconfirming information decreased the effect of source credibility on information adoption as predicted, but we were unable to replicate this moderation effect on argument quality. Interestingly, while disconfirming information did not have a direct effect on information adoption in Travel Forum (Figure 2), it had a highly significant, positive effect on information adoption in CFD Online (Figure 3;  $\beta = 0.31, p < 0.001$ ). It seems that in CFD Online, the more a message contained information that was inconsistent with what the member already knew, the more the member tended to adopt information from the message. One possible explanation for this might be unanticipated differences between these two online communities. In Travel Forum, interview respondents stated that they did not necessarily value inconsistent information highly, perhaps due to the difficulties of verifying the inconsistent information about a destination they had not yet been to. In contrast, CFD Online supported highly professional members in a very complex domain who were seeking solutions to their work problems. Disconfirming information might be of more value to these community members than to those in Travel Forum due to its potential to generate new and potentially innovative insights, akin to the benefits of weak ties (Constant et al., 1996, Granovetter, 1973). We suggest that in CFD Online, disconfirming information served not only to moderate the balance of systematic processing and heuristic processing, but also as an informational input to systematic processing: members may have viewed disconfirming information as an additional indicator of argument quality, such that it influenced their information adoption directly.

We hypothesized that focused search – the extent to which the members have specific information needs in mind and actively search for on-topic information – is another potential moderator of information processing in online communities. This is because members with a higher level of focused search tend to utilize searching to locate their desired information. Searching, when successfully executed, is likely to produce a limited amount of potentially relevant content for systematic processing, which in turn reduces the influence of heuristic cues – such as source credibility – on information adoption. Travel Forum had effective information retrieval functionality, and in this community we found that the influence of source credibility on information adoption decreased with higher levels of focused search, as theorized. Such a decrease was not observed in CFD Online, which had weaker information retrieval functionality than Travel Forum. These results suggest a potential for interaction effects between cognitive processing and focused search. Further, because searching can be facilitated or inhibited by design features of the supporting technology, these results imply that focused search can affect information adoption in online communities variously, depending on the nature of the information retrieval functionality provided: In Travel Forum, the strong, effective information retrieval functionality allowed members to undertake searches that enabled them to allocate their cognitive resources to the content of a limited number of messages. Whereas in CFD Online, the weak information retrieval functionality may have failed to distill potentially relevant messages from a larger mass of less specific messages, preventing members from concentrating their cognitive resources on just a few on-topic messages. Admittedly, our research design did not enable us to conclude that the weak information retrieval functionality of CFD Online alone prevented its members from executing successful searches, and we failed to detect any increase in the effects of argument quality in Travel Forum as we had hypothesized. Nevertheless, if these results are replicated in future research, they suggest that technical design features may influence information adoption by interacting with members' cognitive processes.

Our Travel Forum data did not support the moderation hypothesis that the influence of argument quality on information adoption increases with higher levels of focused search (H4a). Instead, we observed that focused search significantly affected information adoption in both communities directly ( $\beta = 0.34, p < 0.001$  in Travel Forum and  $\beta = 0.12, p < 0.05$  in CFD Online). In retrospect, this relationship between focused search and information adoption can be explained by the HSM framework as follows. HSM is distinct from other dual-process theories of information processing – including ELM – in suggesting the existence of a *sufficiency threshold*: “the degree of confidence a person aspires to attain in a given judgment setting” (Eagly and Chaiken, 1993, p330). HSM posits that to reach a satisfactory assessment of message validity, one either has to engage in sufficient systematic processing to reach the pre-established sufficiency threshold or to lower the sufficiency threshold to the level of assessed validity

(Maheswaran and Chaiken, 1991). Members with high levels of focused search were in strong need of specific information (The average scores for focused search were 5.25 in Travel Forum and 5.57 in CFD Online, Table 1). We suspect that this strong need to locate the desired information for solving the problem at hand might have led them to lower their sufficiency thresholds and adopt information that they might not otherwise have. Consequently, high levels of focused search led to high levels of information adoption, rather than merely moderating the effect of argument quality on information adoption. This is an intriguing topic for future research.

As an exploratory attempt to understand information adoption in online communities, this study has its limitations. We intentionally limited its scope, addressing only the process of adopting information for problem solving. Given the importance of problem solving in organizations (Nickerson and Zenger, 2004), it bears investigation. However, problem solving is but one of many contexts in which information is shared in online communities, and clearly adoption of online content can take place with or without a problem to solve. There is much research to be done investigating information sharing in online communities for other purposes. This study is also limited by some inevitable tradeoffs made during its execution. For example, we could not directly measure the levels of either systematic processing or heuristic processing. Instead, we used argument quality and source credibility to manifest them, as is standard practice in dual-process research (for reviews, see Eagly and Chaiken, 1993, Petty and Cacioppo, 1986).

This study compares results from two online communities. The two research sites differ from each other on several more dimensions than information retrieval functionality, such as culture (eastern vs. western), language (Chinese vs. English), and work-relatedness (recreational vs. professional). Nor were the tasks assigned to survey participants exactly the same across the two research sites. Where findings are inconsistent across the two communities, we cannot refute the alternative explanation that these are due to differences in community characteristics that we did not measure here. Further research is needed in order to understand findings that are inconsistent with our hypotheses. Despite this, we believe that it is important to investigate multiple online communities, particularly ones with different technical features, and that this is a strength of this exploratory study. Where findings are consistent across the two communities, their generalizability is enhanced, whereas the inconsistent findings suggest interesting and promising venues for future research.

We also share other researchers' concerns over the methodology issues presented by Internet-based research (e.g., Skitak and Sargis, 2005). The sampling methods we employed in both communities were not truly random across all members of both communities, especially if we consider lurkers to be legitimate members of online communities. Nor do we have enough information to estimate non-coverage or non-response error (Skitak and Sargis, 2005). However, response analyses of both communities indicated that we managed to exclude from our data sets occasional visitors to these online communities. Our respondents were representative of the population to which we would like to generalize our findings: members who are genuinely interested in sharing information with others in their online communities. Such members visit their online communities regularly, are familiar with them, and are able to learn and utilize heuristic cues such as source credibility.

Despite its limitations, this study makes several significant contributions to both theory and practice. It applies a well-known social psychology theory to an online phenomenon that is of increasing importance and popularity, thus providing a theoretical tool for understanding online communities and the behavior of their members. We confirm the important roles played by argument quality and source credibility in information adoption in this new research context. We demonstrate that disconfirming information affects information adoption by influencing the balance of systematic and heuristic processing. We introduce focused search as an important construct in this context, suggesting that it moderates information processing in online communities in a similar manner to disconfirming information, albeit by affecting available cognitive resources for processing individual messages systematically. We further suggest that technical features may affect information processing in terms of the relative influence of heuristic and systematic processing. In addition, exploratory findings regarding these new moderators suggest that the same construct can play different roles under different circumstances within the HSM framework. All of

these findings lead us to a better understanding of information processing and information adoption in online communities, and suggest interesting streams of future research.

By successfully applying HSM in a new research context, this study attests to the versatility of this popular theory. It also enriches HSM in several ways. First, most previous research in HSM has utilized laboratory experiments in which subjects are presented with standalone, single messages. This study did investigate how individuals process a single message, but it also sought to capture some aspects of real-life information processing for problem-solving by examining disconfirming information and focused search. This is important for testing the boundaries of HSM, a relatively mature theory. Second, in previous dual-process-based studies investigating source credibility, source perceptions have been engendered either through stereotypes (e.g., Hovland et al., 1953, chapter 2) or by real-life identities (e.g., Sussman and Siegal, 2003). This study demonstrated that source credibility can be identified and understood in virtual environments. It raises such questions as: How exactly are source credibility perceptions formed online? What are the implications of online source credibility perceptions for heuristic processing? These questions are not fully addressed in previous research and certainly bear further investigation. Third, to the extent that human information processing has been affected by new communication and information technologies, we need to understand more about the implications of these technologies for the HSM. In this study, we have begun exploring this by examining how the moderation effects of focused search are affected by information retrieval functionality (and, to a lesser extent and in a post hoc manner, how heuristic processing with source credibility is supported in online communities). We hope that our study stimulates further research in this direction.

Our findings should interest organizers and participants of online communities. They explain the micro-mechanisms underlying how online communities support information adoption, and suggest ways that organizations may be able to facilitate online communities more effectively. For example, our results indicate that source credibility functions as a valuable heuristic cue in online communities. While member identities – of which credibility is an important component – may be virtual in online communities, they are still recognized and utilized by members as they assess the validity of content. Therefore, whereas organizations may be interested in online communities as a means for promoting information sharing, they should not treat them as merely electronic information repositories. Rather, they are indeed communities where member identities are established and recognized (Wenger, 1998). Organizers of online communities should provide support for the development and recognition of such member identities, including source credibility, as was done in Travel Forum.

Moreover, online communities are increasingly making choices among a myriad of available technical features, the benefits of which are not always clear. Clearly, installing all available technical features on online communities' webpages will not necessarily improve member use of stored content. For example, Travel Forum did have a well designed search engine, but its potential for optimal information retrieval functionality may not have materialized had its moderators not painstakingly maintained the Best Article Collection. Organizers of online communities should work to understand how the technical features of their communities meet the information needs and usage patterns of their members in order to make optimal technical design choices.

Finally, our findings suggest some guidelines for how to contribute effectively to online communities. For example, if messages contain controversial information, or are subject to close scrutiny for other reasons, contributors should ensure the high quality of message content, for example by making supporting materials available together with their viewpoints (Kim and Benbasat, 2006).

This study should be of particular interest to software designers of online communities, since findings suggest design improvements that may improve member support. For example, in many online communities, cues such as member credibility are not always explicitly indicated. According to our findings, heuristic processing does affect and can even dominate information adoption. Thus it may be worthwhile to design means for explicating source credibility, along with other heuristic cues that may be identified in the future. Further, HSM specifies the cognitive mechanisms through which particular design features can function. For example, making it easier to assess argument quality can facilitate systematic processing; explicating source credibility or other heuristic cues can promote heuristic processing; and

disclosing disconfirming information or improving information retrieval functionality can sway the mode of information processing. In this way, HSM provides a valuable framework for software designers to understand the potential impacts of the design features of online community support software, and offers a paradigm for predicting, testing, and evaluating their effectiveness accordingly.

In summary, this study presents a theoretically-grounded model of the information adoption process in online communities. It demonstrates that information adoption in online communities is influenced by heuristic cues, and that this process is affected by the ability and motivation of the members involved, as well as by their available cognitive resources. Our findings suggest that the HSM is a useful lens for investigating this complex and highly contextual process. It also raises a number of interesting avenues for future research. We hope that this work opens a new channel for improving the design, facilitation, and effective use of online communities.

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