MIS Quarterly

RESEARCH ARTICLE

NATURE AND NURTURE: THE IMPACT OF AUTOMATICITY AND THE STRUCTURATION OF COMMUNICATION ON VIRTUAL TEAM BEHAVIOR AND PERFORMANCE

Valerie L. Bartelt
Management, Marketing and Information Systems Department, Texas A&M University–Kingsville,
Kingsvile, TX 78363 U.S.A. {valerie.bartelt@tamuk.edu}

Alan R. Dennis
Operations and Decision Technologies Department, Indiana University–Bloomington,
Bloomington, IN 47405 U.S.A. {ardennis@indiana.edu}

Much prior research on virtual teams has examined the impact of the features and capabilities of different communication tools (the nature of communication) on team performance. In this paper, we examine how the social structures (i.e., genre rules) that emerge around different communication tools (the nurture of communication) can be as important in influencing performance. During habitual use situations, team members enact genre rules associated with communication tools without conscious thought via automaticity. These genre rules influence how teams interact and ultimately how well they perform. We conducted an experimental study to examine the impact of different genre rules that have developed for two communication tools: instant messenger and discussion forum. Our results show that in habitual use situations, these tools triggered different genre rules with different behaviors, which in turn resulted in significantly different decision quality. We used heightened time pressure as a discrepant event to interrupt the automatic enactment of habitual genre rules and found that users adopted similar behaviors for both tools, which resulted in no significant differences in decision quality. These findings suggest that the automatic enactment of genre rules for a communication tool may have as powerful an effect on behavior and performance as the actual features of the tool itself. We believe that our results, taken together with past research showing the effects of social structures on communication, call for the expansion of task–technology fit theories to include the role of social structures in explaining the use of and performance from communication tools.

Keywords: Collaboration, virtual teams, genre rules, structuration theory, IM, discussion board, time pressure

Introduction

Prior research has argued—and demonstrated empirically—that the *nature* of a communication technology (i.e., its innate features and capabilities) influences both how the tool is used, and the type of performance that ensues from its use (Dennis and Wixom 2001-02; Fjermested and Hiltz 1998-99). That is, the task–technology fit of a communication technology not only matters, but has a substantial influence on the processes and outcomes of communication (Zigurs and Buckland 1998). Past research has also shown that teams can use the innate features of technologies in different ways that are faithful or unfaithful to their intent (DeSanctis and Pool 1994) and that

[1]Suprateek Sarker was the accepting senior editor for this paper. Atreyi Kankanhalli served as the associate editor.

The appendix for this paper is located in the "Online Supplements" section of the *MIS Quarterly*'s website (http://www.misq.org).

the way a tool is used can significantly affect behavior and performance (Dennis et al. 2001).

In this paper, we argue that *nurture* has an equally important impact on the processes and outcomes of communication. By nurture, we mean the social structures for using a communication technology that are habitually enacted, usually without a conscious decision (i.e., the genre rules). Genre rules are the social structures that guide the form and substance of communication (Orlikowski and Yates 1994; Yates and Orlikowski 1992). Genre rules develop over time from repeated use of a communication tool and are typically based on the commonly occurring habitual patterns of use that emerge (Erickson 1999). Genre rules are influenced by the capabilities of the tool itself and usually emerge from repeated use (Karjalainen and Salminen 2000), although they can develop through formal guidance (Thomas and Bostrom 2010b; Yates et al. 1999). Genre rules are usually enacted without a conscious decision (they are akin to a habit), unlike the deliberate appropriation processes that occur during the adoption of new technologies (DeSanctis and Poole 1994).

Genre rules are like many other social structures in that they both enable and constrain future behavior, and evolve over time (Giddens 1984). The genre rules that have grown from communication tool use exhibit a powerful impact on the processes of communication, above and beyond the innate nature of the communication tool itself. Past research has shown that genre rules influence behavior (e.g., Köhler et al. 2012; Yates and Orlikowski 2002; Yates et al. 1999), but we are unaware of any research that has shown that genre rules influence the outcomes of team work. Thus, one key question that this paper addresses is: Does the use of different genre rules lead to different outcomes?

Technology use has traditionally been considered as being based on rational, intentional choices about behavior (Ortiz de Guinea and Markus 2009); however, in recent years, researchers have come to realize that much of human behavior, especially habitual behavior (such as use of a familiar technology), is performed without conscious thought (Jasperson et al. 2005; Kim et al. 2005; Limayem et al. 2007; Ortiz de Guinea and Markus 2009). Instead, when users encounter a familiar situation, they enact the social structures they have used in the past, automatically and without thought (Bargh and Morsella 2009; Kim et al. 2005; Ortiz de Guinea and Markus 2009).

In this paper, we examine two commonly used communication tools that we believed would have different genre rules among our study participants (instant messenger (IM) and discussion forum (DF)). For most of our participant population (undergraduate students), IM is often used for informal communication among friends so it is perceived as a more social tool. In contrast, for most of our participant population, DF is often used in more formal settings, such as in knowledge bases or class discussion forums.

We examined the use of these tools in a condition designed to encourage the automatic enactment of our participants' habitual genre rules and in a condition designed to inhibit their automatic enactment. We found important differences in the discussion, decision quality, and enjoyment between the two tools in the condition designed to encourage the use of habitual genre rules, but no differences in the condition designed to inhibit their use. Thus, it was the genre rules, not the nature of the tools themselves, that influenced the behavior and ultimate outcomes of team work.

This study shows that nurture matters; the genre rules associated with a tool that are habitually enacted (typically without a conscious decision) can influence how a tool is used and serve to improve or impair performance, over and above the actual features and capabilities of the tool itself. In other words, task–technology fit (Zigurs and Buckland 1998) is only half of the story; the social structures for communication technology use (i.e., genre rules), which evolve over time and are influenced by the technology, the users, and the use context, also need to be considered.

Theory and Prior Research

Genre Rules

Genres and genre repertoires have long been used to explain how communication tools influence behavior (Orlikowski and Yates 1994). Genre rules are the instantiation of the social structures for how a communication tool is used by a set of users (Fulk et al. 1990; Markus 1994; Watson-Manheim and Bélanger 2007). Such structures can influence how users understand a tool (e.g., whether a tool is seen as being rich or lean) and how these perceptions influence use (Fulk et al. 1990; Watson-Manheim and Bélanger 2007).

Genre rules build on the concepts of Giddens' (1984) structuration theory (Yates and Orlikowski 1992). The fundamental premise of structuration theory is that social structures "are created by human action and then serve to shape future human action" (Orlikowski and Robey 1991, pp. 146-147). That is, structure and action recursively influence each other. The use of a communication tool over time creates social structures and, in turn, those structures enable and constrain

how that tool is subsequently used. Human actors can choose to use existing structures, or to adapt and/or create new structures as they use a tool; thus, over time structures evolve and change. In this paper, we focus only on one part of this duality: how structures, in the form of genre rules, influence action. We do not examine how actions change genre rules. This selective use of structuration theory concepts is consistent with Giddens' recommendations for how to best use structuration theory. Structuration is a meta-theory that needs to be instantiated into the research domain in which it is used. It is seldom instantiated in its entirety, because most research does not attempt to examine all of its components (Jones and Karsten 2008). Giddens himself is critical of research that uses structuration theory in its entirety, preferring research that selectively uses pieces of the theory that are most relevant to the objective of the adopting research (Giddens 1991; Jones and Karsten 2008).

Routinization is key to the existence of social structures, for they exist only as they are routinely enacted by users (Giddens 1984). For most commonly used tools, the structures of tool use will eventually seem fairly stable and routine as they are repeatedly enacted (DeSanctis and Poole 1994) and become habitual—that is, genre rules (Yates and Orlikowski 1992). Enactment of genre rules may be either intentional or nonconscious (i.e., without deliberate thought) (Gersick and Hackman 1990; Jones and Karsten 2008). When structures become stable and are shared by users (i.e., genre rules), enactment is more likely to be automatic and without conscious thought (DeSanctis and Poole 1994; Ortis de Guinea and Markus 2009).

Genre rules are particularly interesting because they can influence goals and the means by which teams interact without conscious thought. The idea that nonconscious processes can interfere with and alter the ways that people behave was suggested by Duncker in 1945 (see Bargh and Chartrand 2000). Other cognitive psychology research has examined nonconscious processes at the individual level in terms of automaticity (Bargh 1989, 1994; Logan and Cowan 1984).

At the same time, there is a growing body of research that shows that individual goals and behavior are triggered by external stimuli that individuals encounter (Bargh and Chartrand 1999; Bargh et al. 1996; Camerer et al. 2005), including the use of technology (Ortiz de Guinea and Markus 2009). These external stimuli may nonconsciously trigger behavior directly (Bargh and Chartrand 1999; Bargh and Ferguson 2000; Bargh and Morsella 2009), or may nonconsciously influence an individual's goals which then affect behavior (Bargh and Ferguson 2000; Ortiz de Guinea and Markus 2009).

We believe that similar triggers occur at the team level. One of the most powerful stimuli for genre rules is the tool itself. Individuals develop different genre rules for different communication tools. These genre rules are automatically invoked when the tool is used and influence subsequent behavior. Teams can choose not to follow genre rules if something in the situation suggests they are not appropriate, but this choice involves conscious cognition, in contrast to the enactment of genre rules, which is commonly nonconscious.

Teams perform many functions as they communicate, such as completing the task, socializing and relationship development, and individual growth and development (McGrath 1991). Past research has characterized these functions as falling into two primary categories of task-focused interaction and non-task-focused social interaction (Dennis et al. 2008; Marks et al. 2001; Yoo and Alavi 2001). Although genre rules can influence various types of behaviors, our focus is on only one aspect of team behavior: the balance between task-focused interaction and non-task-focused social interaction. This is important to our study because the degree to which teams are task focused can significantly affect their performance.

In the sections that follow, we first define and explain genre rules, and then examine the nature of IM and DF to consider how the differences between these tools may influence genre rule development. Then we argue that in habitual use situations, these different genre rules will be enacted automatically and affect the balance of task-performance and social-relationship activities, so that IM discussions will be more likely to include more non-task discussions than DF discussions. Next, we argue that although a certain degree of non-task social-relationship activity is important in well-functioning teams (McGrath 1991), once the balance between task performance and non-task activities approaches a particular level, a tipping point is reached beyond which task performance drops. Finally, we argue that some interventions, such as time pressure, can act as a discrepant event that breaks the automatic enactment of genre rules, which can lead to different behavior and performance even though the same communication tool is used.

Genre Rule Development

Genre rules are overarching social structures that develop and are adapted over time for each communication tool (Yates and Orlikowski 1992). They often are based on individual, social relationship well-being, and technical aspects of recurring communication patterns (Erickson 1999; Watson-Manheim and Bélanger 2007). These patterns, which are shaped by each tool's *form* and *substance,* as well as its context of use, are considered to be the instrumental components in shaping

the communication tool's use (Karjalainen and Salminen 2000; Orlikowski and Yates 1994; Yates and Orlikowski 1992). Genre rules typically are learned intuitively as users use tools to communicate with each other; they are usually not formed through formally established rules of operation (Karjalainen and Salminen 2000) but develop over time, sometimes helped by deliberate interventions such as a leader proposing a new way of working (Thomas and Bostrom 2010a). This intuitive learning process may facilitate genre rules becoming part of the subconscious, resulting in them causing automatic responses.

It is important to note that the same communication tool used in different environments may result in different genre rules due to different patterns of use that create the genre rules; thus, use of the same tool may differ among environments (Cho et al. 2005; Watson-Manheim and Bélanger 2007). Likewise, different communication tools used in the same environment may have different genre rules (Watson-Manheim and Bélanger 2007), because genre rules are also influenced by the form and substance of the communication tool itself (Yates and Orlikowski 1992). Form is the "physical and linguistic features" of the communication tool (Yates and Orlikowski 1992, p. 301). Form involves three aspects: built-in features, interpersonal distance, and language type. Built-in features are the structural traits present in the communication tool's design (Karjalainen and Salminen 2000; Yates and Orlikowski 1992), which includes the tool's capabilities as well as more subtle interpretations of them made by the user. For instance, the default window size available to type and receive messages may indicate the amount of information anticipated when communicating. Likewise, the number and type of text formatting styles establishes varying degrees of formal expectations.

Interpersonal distance is defined as the physical distance between those who are communicating (Yates and Orlikowski 1992). A person who writes a letter on stationary paper is typically a certain physical distance away from the person who receives the letter. Conversely, people attending a face-to-face meeting have a shorter physical distance among one another.

Language type refers to the type of dialogue that takes place during a conversation (Crowston and Williams 2000; Freedman and Medway 1994; Yates and Orlikowski 1992). This could range from technical jargon to slang. For instance, business letters are generally more sophisticated than post-it notes, which are often jotted down as quick messages or reminders of things to do.

Substance is the second component of genre rules, referring to the "social motives, themes, and topics" of the communication; that is, the content of the tool's discussion (Yates and Orlikowski 1992, p. 301). Since substance involves the intent of the message, it is considered to be subjective. In comparison, form (the other genre rule component) is based on objective measures, such as features of the tool's design. Subjective areas included in substance involve the message's intent and motives, which are based on human perceptions (Miller 1984; Yates and Orlikowski 1992). For example, the substance of a job application letter would include motives related to positive attributes of the candidate who is applying for the position as well as a proposal for what the applicant intends to accomplish when successfully hired. The motives and intent of the letter would then be subjectively evaluated by its recipient. In comparison, form involves the professional writing style in which the applicant's letter is written. The structural features of application letters have become more objective and uniform due to the availability of word processing software (Erickson 1999; Yates and Orlikowski 1992).

Comparison of IM and DF

We use the analysis framework of Yates and Orlikowski (1992) to examine the similarities and differences in form and substance between IM and DF. One aspect of form, interpersonal distance, is similar for typical uses of both DF and IM, so this will not be discussed in detail (with both tools, users are not typically in the same location). Instead, we will focus on other aspects of their form, including built-in features and language type.

IM has many built-in features that are conducive for quick, real-time interactions. Its near-synchronous operation makes it possible to easily communicate with one another, both in one-to-one and team discussions (Lin et al. 2004). Similar to IM, DF is a text-based communication tool. DF has commonly been used for posting and sharing information in discussion forums (Harman and Koohang 2005) and for question and answer discussions among users (Wagner and Bolloju 2005).

Common features of both IM and DF involve slightly varied designs based on each tool's intended use. For instance, the window areas (where users can type and read messages) are usually smaller in IM than in DF. This smaller window size may increase IM users' tendency to write and respond in a short and more abbreviated style. IM is often used for quick correspondence, leading to short replies and abbreviated language (Tagliamonte and Denis 2008). In contrast, the larger window sizes in DF may subconsciously cause people to send longer postings and facilitate more organized thoughts

(Marra et al. 2004; McCreary 1990). Because DF is commonly used to gain knowledge (Wagner and Bolloju 2005), it is sometimes considered a more "robust and thoughtful" communication tool (Eastman 2002, p. 34) in comparison to IM.

Another contrasting feature is the timing of viewing others' messages. The DF user chooses when to view messages but the IM user does not have this control. Thus, the DF user is not typically distracted by other messages on the screen when he or she is typing a message.

The organizational features of IM and DF may also affect the language type used. Similar to e-mail, in DF conversations people tend to take more time to compose their thoughts when typing (Marra et al. 2004; McCreary 1990), leading to more formally constructed messages. DF discussions have been described as being precise (Marra et al. 2004; McCreary 1990), possibly because of its organized, threaded communication format. Replies of a similar content can be grouped together under the same topic heading. Because of this organization, longer and more thorough messages can be exchanged in a more precise and organized fashion.

In comparison, the amount of text exchanged in IM conversations tends to be shorter and written in a more casual style (Tagliamonte and Denis 2008). Frequent use of improper language (e.g., "LOL - ru there?") has led critics to attribute the demise of the English language to IM (Axtman 2002; O'Connor 2005). The lack of an organized structure for the content may lead to more confusing conversations if a greater amount of text is exchanged at one time. Shorter text messages allow each person to quickly exchange messages, thus creating a perceived need to respond to messages more quickly. Because less time is taken to review messages, more slang and incomplete sentences are used in IM in comparison to DF.

Genre rules often emerge and evolve over time because initial understandings of a tool may be different than understandings that develop from long-term use (Crowston and Williams 2000; Majchrzak et al. 2000; Thomas and Bostrom 2010b). Wikis are an example of this situation, due to users' prior experience clashing with the web's interactive capabilities. People discovered that in a wiki environment, they could be contributors of content, changing expectations of their role in relation to web pages (i.e., from a consumer to a contributor). Thus, genre rules are adapted and new genre rules emerge as a result of the conflict between expectations and tool use (Crowston and Williams 2000; Thomas and Bostrom 2010b). Although research has examined genre rules' emergence and adaptation over time (Crowston and Williams 2000; Erickson 1999; Yates et al. 1997), our focus is on the enactment and use of genre rules, not their formation and adaption (see Majchrzak et al. 2000; Watson-Manheim and Bélanger 2007).

Genre Rules, Team Behavior, and Outcomes

Past research has shown that genre rules influence team *behavior*, but there is a lack of research linking genre rules to the *outcomes* of team work. Genre rules influence many aspects of team behavior. For example, Yates et al. (1999) studied the use of a computer conferencing system at a large Japanese corporation, and found that different genre rules emerged in different parts of the corporation, leading to different types of interaction. Likewise, Yates and Orlikowski (2002) found three distinct types of genre rules when using the same collaboration tool at a technology company (team meeting, collaborative authoring, and collaborative repository), each of which evoked different content and different patterns of interaction among team members. As a final example, Köhler et al. (2012) used an experiment to study teams whose members were drawn from both the United States and Germany and found that team members from different countries brought different genre rules to the collaboration, including the amount of socializing versus task performance activities.

In this paper, we examine how the use of different genre rules leads to differences in outcomes. Teams often perform activities that strive to address three distinctly different types of outcomes simultaneously: task performance, social relationship/well-being, and individual development (McGrath 1991). Task performance refers to activities that move the team to the successful completion of the task assigned to them, often measured by the quality of a team decision. Social relationship/well-being is the development and maintenance of good social relationships among team members. Individual development refers to the desire of each participant to develop and hone his/her individual skills. All three types of activities typically occur throughout the duration of a task, albeit in different proportions (McGrath 1991). Particular teams may emphasize one type of activity over another at any given point, but all three are typically performed during successful team interactions. Much prior research has combined social-relationship activities and individual-development activities, arguing that the most useful distinction in team interactions is between activities designed to accomplish the task and the non-task activities that support the more social aspects of relationship development and individual development (Dennis et al. 2008).

We focus on one aspect of genre rules: how genre rules affect the balance between task performance activities and non-task

social-relationship activities. These social expectations are part of an habitual set of genre rules for the way users expect to interact using a specific communication tool. For instance, most people perceive email as being less capable at sharing emotional cues than the telephone, so they typically do not expect to use e-mail when the substance of the message involves sensitive and/or emotional information that could be misinterpreted. Because of this, for most people, social expectations for e-mail in business settings primarily centers on task performance activities, not relationship development activities.

Genre rules, like most social structures, are context-specific (Yates and Orlikowski 1992). For example, when using e-mail with family members, genre rules for social expectations may be quite different than those enacted when using e-mail in a work setting. For this reason, genre rules are not universally generalizable.

We use three outcome variables, two that focus on task performance (decision quality, perceived effectiveness) and one that focuses on the social aspects of team interaction (enjoyment). Decision quality is the primary measure of task performance. We included perceived effectiveness to assess whether team members could accurately evaluate their team performance. We are also interested in social aspects, such as relationship development, something that doesn't necessarily make sense in a laboratory experiment when team members have few expectations of future interaction. Therefore, we chose instead to examine the enjoyment that team members experience.

Hypotheses

How Genre Rules in Instant Messaging and Discussion Forum Affect Use

We argued earlier that genre rules are shaped both by the form and substance of the communication tool itself as well as by the environment in which it is used. In this section, we focus on the communication tool, which is separate and distinct from the context in which it is used. We will return to the effects of the context in the discussion.

Our focus is on how genre rules affect the balance of task performance activities versus non-task social-relationship activities when using discussion forum (DF) and instant messaging (IM). We believe that the subtle differences in form and substance between the two tools may have powerful effects on their use. For many users, these subtle differences result in the development of different genre rules for each tool.

Prior research has found many IM users to experience a variety of social-related effects, including perceived enjoyment of tool use when interacting with others (Li et al. 2005), attachment and motivation to stay in touch with other users (Li et al. 2005), and an increased relationship commitment to others (De Vos et al. 2004; Isaacs et al. 2002a; Swartz 2003).

In comparison, DF's more formal structure suggests more thoughtful discussions (Marra et al. 2004; McCreary 1990). People often use DF in knowledge management systems to seek information (Marra et al. 2004; McCreary 1990) and are less likely to use DF for social-relationship activities. Thus, for many users, genre rules for DF tend to be more conducive for task-performance activities than for social-relationship activities.

Differences between IM and DF can also be examined in relation to their substance of use. Because they perceive IM to be useful for non-task social communication (Garrett and Danziger 2007; Herbsleb et al. 2002; Li et al. 2005), many users anticipate conversing with people they know, resulting in more socially oriented genre rules. IM is often the tool of choice when fostering relationships in the work environment (Isaacs et al. 2002b; Li et al. 2005) or for social communication with friends and family while at work (Garrett and Danziger 2007). Due to heightened social expectations surrounding IM, we believe that for many users, the genre rules associated with IM will result in an increased proportion of non-task-related discussion.

In summary, we argue that when users encounter a communication situation that does not contain any discrepant events and is similar to habitual use situations, they will automatically enact the habitual genre rules associated with typical use situations. These genre rules, in turn, will shape their behavior. Past research suggests that for many users (and most importantly, for the users in our specific research context[2]), the habitual genre rules associated with IM use include more non-task-related comments than the habitual genre rules associated with DF use. Thus, we believe that IM discussions are less likely to be highly task-focused than are DF discussions. Therefore, we hypothesize

H1: When users are in an habitual use situation, more discussions using DF will be task-focused than those using IM.

[2]As discussed in the "Methods" section, our participants were undergraduate students. Past research has found that undergraduate students' use of IM has a high social component (Junco and Cole-Avent 2008; Salaway et al. 2008). As we report in the "Methods" section, we verified that these differences were also present in our participant population.

A good balance between task-performance activities and non-task social-relationship activities is important for effective team functioning: too few social activities impair relationships, while too many social activities impair task performance (McGrath 1991). The relationship between this balance of social and task activities and team performance is not continuous; below a particular threshold, this balance can vary and have little effect on relationships and task performance. However, when the balance shifts above a threshold, relationships or task performance can be sharply affected, just as shifting weight on a teeter-totter beyond the balancing point causes an abrupt shift in the position of its riders. To explain this phenomenon, we turn to theory on tipping points.

Tipping Point

A tipping point is a specific point where sufficient critical mass has been reached to induce a state change in a phenomenon (Gladwell 2002), such as a step function in a line graph. As values increase in one direction on the graph, a discontinuity occurs when a particular point is reached and the shape of the function becomes markedly different after that point. For example, the state change of water from liquid to solid is a tipping point (Buchanan 2002). As the temperature decreases, water remains unchanged as liquid (a stable state) until the temperature reaches 32 degrees Fahrenheit, the point at which a discontinuity occurs and water changes state. Once a new state is reached, it becomes stable (i.e., ice). Further temperature decreases do not affect its state.

Tipping points can also be observed in social phenomena. For example, a tipping point (called a separation threshold) has been identified in IS professionals' job retention (Josefek and Kauffman 2003). Below the separation threshold, an employee intends to remain with his/her current employer. However, once a variety of job factors, such as dissatisfaction and unmet work-related expectations, surpasses this threshold, the employee decides to leave his/her job (Josefek and Kauffman 2003).

The tipping point phenomenon has also been observed in virtual teams. Thomas and Bostrom (2010b) developed a model examining what caused tipping points in virtual team behavior. They examined virtual teams that used a set of communication tools in certain ways until the team leader intervened to change how the team interacted. The trigger for action could have been an external discrepant event (e.g., a new deadline, or new requirements imposed on the team) or recognition that an issue internal to the team or its use of communication tools had reached a threshold that required a change. After the team leader intervened to change the way in which the team worked, behaviors again stabilized.

The key idea in social tipping points is that individual or team behavior follows a certain path or trajectory. When a tipping point occurs, individual or team behavior changes or adapts so that behavior is distinctly different after the particular tipping point is passed (Buchanan 2002). In this study, we use the tipping point phenomenon to examine how the amount of non-task-related discussion (i.e., social communication) affects team performance.

Non-task-related social-relationship discussion is important to team functioning (McGrath 1991). However, a threshold exists beyond which the amount of non-task-related social discussion will interfere with task performance. Once this threshold is reached, the discussion is no longer adequately task-focused and task performance will be negatively affected because more time spent on social-relational discussion will leave less time to complete the task. Although people may be enjoying the discussion, if it does not contribute to the task, then performance will be negatively affected. Therefore,

H2a: When the discussion is no longer task focused, decision quality will be reduced.

Research has found that team members' perceptions often match their experiences (Short et al. 1976). Thus, the perception of a team's success typically mirrors the actual decision quality. Since H2a argued that decision quality will drop after the tipping point is passed, we propose that individual team members will perceive this. Thus,

H2b: When the discussion is no longer task focused, perceptions of effectiveness will be reduced.

Once the proportion of non-task social activities passes the tipping point threshold, the focus of the discussion will be on non-task topics that do not contribute to performing the task. This situation should be enjoyable to team members, at least in comparison to the experimental task. Thus, team members should find the discussion more enjoyable. Therefore,

H2c: When the discussion is no longer task focused, user enjoyment will be increased.

Interrupting the Automatic Enactment of Genre Rules

Prior research suggests that the automatic enactment of habitual routines occurs when users encounter a situation that matches prior situations in which these routines have been habitually enacted (Gersick and Hackman 1990; Limayem and Hirt 2003; Limayem et al. 2007; Morsella 2005). A discrepant event which creates a situation that does not match

prior habitual use situations will likely interrupt the automatic enactment of habitual routines and trigger conscious deliberation about work processes. This occurs when the existing stable structures (the genre rules) no longer seem to fit the situation (DeSanctis and Poole 1994; Majchrzak et al. 2000; Thomas and Bostrom 2008, 2010a), triggering the search for and adoption/adaptation of different genre rules.

One potential discrepant event is time pressure. Research has found that people act in different ways when they experience lower and higher time pressure, especially during decision making (Ariely and Zakay 2001; Rothstein 1986; Zakay and Wooler 1984). For instance, higher time pressure has been found to induce information-processing overload and to reduce cognitive functioning (Ariely and Zakay 2001; Goldberger and Breznitz 1999; Holsti and George 1975).

We used heightened time pressure as a discrepant event to interrupt our participants' automatic enactment of genre rules. There are, of course, many different interventions that we could have used to create a situation that was unlikely to match past situations. Because heightened time pressure can cause people to think more deliberately about the task at hand (Mohammed and Nadkarni 2011), we believed it was an appropriate strategy to interrupt the automatic enactment of genre rules.

We hypothesize that when participants encounter a situation with higher time pressure, they will be less likely to automatically enact the genre rules they have habitually associated with the use of IM. Instead, an increased task-focused behavior and a decreased social-relational behavior will be adopted during IM use as a result of higher time pressure breaking the automatic enactment of its genre rules. In other words, the use of IM will begin to look more like the use of DF. Thus, under increased time pressure, the extent of non-task-related discussion will be the same in both the IM and DF environments, resulting in discussions that are more task focused.

H3: When users encounter a situation with a discrepant event (i.e., time pressure) that does not match an habitual use situation, more discussions using IM will be task-focused than those in situations without discrepant events.

Method

Participants

A total of 156 undergraduate sophomore students from a core business course at a large state university participated in the study (69% were male). Participants were assigned to 39 four-member teams and the teams were randomly assigned to treatments.

Task

We wanted a simple task that would engage our participants so that they would not just go through the motions of participating, but rather behave as they might for a real task outside the experimental setting. We wanted the participants to become engaged so that they would be more likely to behave in ways similar to real tasks in their lives and thus be more likely to enact their habitual genre rules. We created a task that was similar to the successful StrikeCOM game developed at the University of Arizona which has been used in prior team research (Twitchell et al. 2005). Our task was a search and rescue assignment that involved navigating around cells on a 10 ×10 gridded map to find six missing groups of campers lost in the forest. The locations of the six groups of missing campers were randomly assigned before the game play by the researcher running the experimental session to ensure that the location of the missing campers would not be revealed to participants by previous experiment sessions.

Each participant was assigned a unique role in the team: a police officer, a forest ranger, a volunteer, or a helicopter rescuer. Each role had different maneuvering and search capabilities. For example, the helicopter rescuer could move the greatest number of map cells, but due to its distance from the ground, its search ability (the ability to determine whether a camper group was in a cell), was less accurate than the other roles. The land roles were allowed to move fewer cells during each round, but their visibility was more accurate than the helicopter rescuer.

The task had four search rounds and one rescue round. During every search round, each participant would choose which cell(s) to search, and would be provided with one of three results for the cell(s) they chose to search: definite evidence, possible evidence, or no evidence. Definite evidence meant that there was a missing camper group in the cell. Possible evidence indicated that there was a camper group either in the cell or in the cell adjacent to it. No evidence meant that the camper group was not in the searched cell.

During the rounds, the participants worked as a team to determine a strategy for searching the cells. Each team used a communication tool to discuss where the players would search on the next round. After every round, each participant would report the results of his or her search to the rest of the team and then they would work as a team to decide each parti-

cipant's next move. During the rescue round, the team worked together to determine six cells to send the rescue helicopters in an attempt to rescue the six missing camper groups.

Past research has found StrikeCom to be easy for participants to learn and highly engaging (Twitchell et al. 2005). StrikeCOM is an online computer game, whereas our task was a paper and pencil task. Nonetheless, our pilot tests showed that our task also was easy to perform and highly engaging.

Treatments

This 2 × 2 experiment varied time pressure (higher or lower) and the communication tool used (instant messenger or discussion forum). Ten teams participated in all treatments except the IM with the lesser time pressure treatment, which had nine teams. We pilot tested the treatments to ensure that a difference in perceived time was experienced between the two time pressure treatments. The pilot test was also used to determine the number of rounds that were sufficient for the task. In prior research, time pressure is typically generated by shortening the length of time available for decision making (Ariely and Zakay 2001; MacGregor 1993). Ten minutes were allowed for each round in the lower time pressure treatment and four minutes for each round in the higher time pressure treatment. To intensify the perception of time, a visual stopwatch showing the time remaining for each round was displayed on a projector.

Instant messenger (IM) and discussion forum (DF) were the two communication tools used. MSN Messenger, the tool used for the IM conversations, worked like a typical IM chat tool where comments were typed in the bottom of the screen and then appeared on the top of the screen for all participants to read.

The DF tool was part of the university's Sakai collaboration and learning environment. Its design was similar to popular online discussion forums, organized where comments could be posted under relevant topic headings. The threaded structure of DF was organized by the following topics: the four roles and the rescue round. Although specific organization couldn't be embedded in the IM tool, teams were asked to discuss the topics in the same way as the design available in the DF teams.

In this way, the structural format of both IM and DF were similarly designed and participants using both tools were provided with similar instructions for how to proceed in their discussions. The identity of each team member was not revealed to other participants during the study. Comments were identified only by the character role: police officer, forest ranger, volunteer, or helicopter. Only communication through the designated tool was allowed; no verbal communication occurred. In the statistical analysis, the tool variable was coded as a one for IM and as a zero for DF.

Measures

Decision quality was measured by the number of camper groups successfully located at the end of the rescue round. Decision quality, therefore, ranged from 0 to 6.

We created a categorical variable called non-task-focused discussion based on the proportion of non-task-related comments each discussion contained. The proportion of non-task-related comments was determined by coding the IM and DF transcripts. A task-related comment was defined as a response that was related to the decision-making task of finding the missing campers. A non-task-related comment was defined as a comment that did not have any task relevance; that is, it did not contribute to deciding where to search, nor did it contribute to reporting the results of a search. The greetings at the beginning and end of the conversations were considered a task-related component of the practice round, as this was a standard protocol that most teams used to ensure that all participants had successfully entered the chat.

In the rare event that a single comment contained both task-related and non-task-related text, the comment was coded as task-related unless it caused any other non-task-related comments. (For example, if the comment "I found one – I am a [expletive deleted] genius!" was followed by a non-task-related response, the comment would also be considered non-task-related. In the event that no other non-task-related comments ensued, the comment would be counted as task related.) The idea here is that a comment is interpreted by the participants as task-relevant or not task-relevant and the way participants responded to the comment indicated their interpretation. The Appendix provides the coding rules.

The proportion of non-task comments was calculated for each team based on the number of non-task-related comments divided by the total number of comments. One rater coded all transcripts. Ten randomly selected transcripts (26%) were coded by a second rater. The inter-rater reliability between the two coders was adequate at 98 percent, calculated as 1 – (number of differences/total codings).

The tipping point is considered the point at which situations change from one state to another; in this case, the point beyond which the proportion of non-task comments results in a discussion that is no longer task-focused. We chose a

tipping point based on a calculus analysis of the rate of change in the proportion of non-task comments. The Appendix provides our method for selecting the tipping point. We coded each team's discussion as task-focused (0) or not task-focused (1), based on whether the proportion of non-task comments was below or above this threshold.

Three constructs, perceived time pressure, perceived effectiveness, and enjoyment, were measured using questionnaire items with seven-point Likert scales, with higher scores representing higher values of each construct. Perceived time pressure (four items, alpha = 0.91) was used as a manipulation check to confirm that the participants perceived a time pressure difference between treatments. Perceived effectiveness (two items, alpha = 0.73) was adapted from Dennis and Garfield (2003) and enjoyment (three items, alpha = 0.92) was adapted from Dennis (1996). The items are presented in the Appendix.

Perceived effectiveness and enjoyment were collected at the individual level, but analyzed at the team level by averaging the questionnaire responses of the four team members. Interclass correlation coefficients (ICC) were calculated for both variables to justify this aggregation. The ICC(1) value for perceived effectiveness was 0.19 and enjoyment was 0.15, which is considered to be "realistic" (Bliese 2000; Bliese and Halverson 1998). ICC(2), which indicates the estimated correlation among the team members, should be greater or equal to the ICC(1) amounts (Bartko 1976). Our ICC(2) calculations were sufficiently higher than the ICC(1) calculations: perceived effectiveness was 0.48 and enjoyment was 0.41.

Procedures

The research lab contained four rows of cubicles with computers. Upon entering the lab, participants were assigned to a cubicle in a different row from the other team members to ensure that participants communicated solely through the communication tool. Additionally, they were instructed not to talk during the lab. If they had questions, they were instructed to raise their hand and wait patiently for the researcher to help them.

Although most participants were familiar with the communication tool they would be using during the experiment, all participants were provided with instructions explaining how to use each tool at the beginning of the experiment. Instructions were also provided regarding the task and the participants' roles. Each participant was allowed to ask questions to clarify the task and tool use. A ten-minute training round before the four regular search rounds gave participants the opportunity to ask questions. The training round was considered an additional turn to enable participants to move and search one more location on the gridded map. Individual search results were reported at the end of every round to each participant. Participants were instructed to share their individual results with the team to facilitate the discussion. At the end of the rescue round, each participant was provided with the results of the rescue. An individual questionnaire was given after the team's results were revealed. At the end of the session, the participants were debriefed and released.

Analysis and Results

Construct Validities and Reliabilities

PLS-Graph 3.0 was used to test this research model.[3] PLS was chosen for its ability to handle smaller data sets and mediated models (Chin 2001). A bootstrapping procedure was used to test the statistics of the parameter estimates. The two latent constructs, enjoyment and perceived effectiveness, were checked for construct validity and reliability. Three reflective variables represented the enjoyment latent constructs. Two reflective variables represented the perceived effectiveness latent construct. All ICRs of the latent constructs for enjoyment and perceived effectiveness were sufficiently reliable at above 0.7 (Fornell and Larcker 1981; Nunnally 1978). The correlation matrix confirms that both convergent and discriminant validity has been achieved (see Table 1). The square root of the average variance extracted (AVE) are the diagonal values of the correlation matrix which determine the average variance shared within the measures of each construct. All of the AVE values in this model are sufficiently above 0.5. As shown in the table, each AVE value is greater than the numbers located in the corresponding columns and rows, indicating that discriminant validity has been achieved (Fornell and Larcker 1981). The means and standard deviations of the non-latent variables can be found in Table 2.

Manipulation Checks

To verify that our subjects perceived a time pressure difference between the lower and higher time pressure teams, a univariate ANOVA analysis was performed. There were signifi-

[3]Because of the small sample size, we verified the PLS results with four separate GLM analyses, one examining the effects of the treatments on the adequately task-focused discussion variable. The three other GLM analyses examined its effects on the dependent variables decision quality, enjoyment, and perceived effectiveness. The GLM analyses produced the same statistical conclusions as the PLS analysis.

Table 1. Correlations of Latent Variables

	Mean (Std)	ICR	Tool	Time Pressure	Tool × Time Pressure	Non-Task-Focused Discussions	Decision Quality	Enjoyment	Perceived Effectiveness
Tool		N/A	1.00						
Time Pressure	0.51 (0.51)	N/A	0.026	1.00					
Tool × Time Pressure	0.26 (0.44)	N/A	0.602	0.572	1.00				
Non-task-focused Discussions	0.23 (0.43)	N/A	0.197*	-0.197*	-0.182	1.00			
Decision Quality	2.74 (1.07)	N/A	-0.055	0.201	0.143	-0.328*	1.00		
Enjoyment	4.49 (0.79)	0.964	0.386	0.008	0.153	0.465**	-0.42	0.900	
Perceived Effectiveness	4.44 (0.76)	0.918	0.540	-0.006	0.234	0.049	0.105	0.417	0.849

* p<.05, ** p<.01, *** p<.001
Square root of average variance extracted (AVE) is reported on the diagonals.

Table 2. Effects of Treatments on Discussion

	Instant Messenger with Lower Time Pressure		Instant Messenger with Higher Time Pressure		Discussion Forum with Lower Time Pressure		Discussion Forum with Higher Time Pressure	
	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
Proportion of Discussions Coded as Non-Task-Focused	.56	.53	.10	.32	.10	.32	.20	.42

cant differences between perceived time pressure in the lower and higher time pressure treatments ($F(1,37) = 14.397$, $p = .001$). We conclude that participants in the higher time pressure treatment perceived greater time pressure.

We argued that our participant population had different genre rules for social communication when using IM versus DF. To ensure this was the case, we conducted a survey of 70 undergraduate students drawn from this same participant population; this was a different sample of participants from those who participated in the experiment so as not to influence the behavior of our experimental participants. We asked 12 questions about social behaviors when using IM (alpha = 0.92) and DF (alpha = 0.92). The items are in the Appendix. A repeated measures GLM found the likelihood of social communication to be significantly different between the two tools ($F(1,68) = 58.87$, $p = .000$). Social communication was more likely when using IM ($M = 4.43$) than when using DF ($M = 2.89$). Thus, we conclude that the genre rules among members of our participant population differed between the two tools in a similar way to what past research has found from other samples of undergraduates.

Structural Model Assessment

Figure 1 shows the structural model results. There is a significant main effect for the communication tool and a significant interaction between the tool and time pressure for task-focused discussions.

Table 2 shows the effects of the treatments on the discussions. IM with lower time pressure had a higher proportion of teams coded as having a non-task-focused discussion (.56) than the other treatments (which ranged from .10 to .20); that is, the proportion of non-task-focused comments exceeded the tipping point in more discussions in the treatment with IM and lower time pressure than the other treatments (the proportion

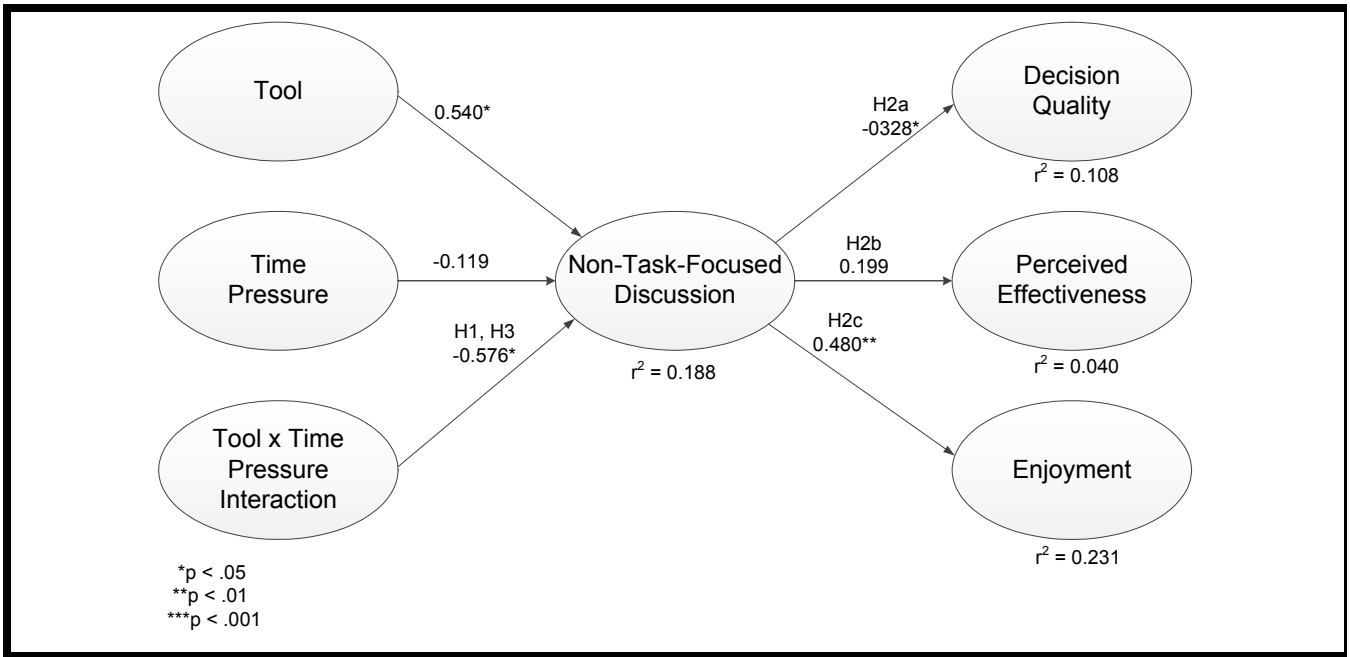

Figure 1. Structural Model

Table 3. Effects of Discussion on Dependent Variables

	Discussions Coded as Task-Focused		Discussions Coded as Non-Task-Focused	
	Mean	**Std.**	**Mean**	**Std.**
Decision Quality	2.93	1.01	2.11	1.05
Perceived Effectiveness	4.42	0.73	4.61	0.89
Enjoyment	4.29	0.68	5.15	0.80

of non-task-focused comments in this treatment was .14, compared with a range of .06 and .08 in the other three treatments). Table 3 shows the effects of the discussion on the three outcome variables.

We conclude that H1 and H3 are supported: under conditions that matched habitual use situations, IM discussions were less likely to be task-focused than DF discussions, but this difference disappeared when a discrepant event was encountered (i.e., higher time pressure).

Hypothesis 2 argued that when a discussion was no longer task-focused, decision quality would be lower (H2a), perceived effectiveness would be lower (H2b), and enjoyment would be higher (H2c). There were significant effects on decision quality and enjoyment but none for perceived effectiveness (see Figure 1). We conclude that H2a and H2c were supported but H2b was not.

Discussion

Previous research has focused on the importance of understanding the features offered by communication tools and how to best fit these features to the needs of the task to improve performance; that is, task–technology fit (Zigurs and Buckland 1998). Our research shows that genre rules also play an important role in team communication, yet they have not been the subject of as much research as the more traditional focus on the features of the technology. Because genre rules evolve over time and are typically evoked automatically without conscious thought, users are often unaware of how their behavior is influenced by them.

Our results show that genre rules can have powerful effects that significantly impact team behavior and, more importantly, performance. Under habitual use conditions, the teams in our study enacted different genre rules for the two different

tools, which led to significant differences in non-task discussion, decision quality, and enjoyment. When the enactment of the habitual genre rules was interrupted by heightened time pressure, these differences disappeared; the teams enacted similar genre rules for both tools and, as a result, their behavior, decision quality and enjoyment were not significantly different. Thus the differences in outcomes between the normal use of the two tools was not due to the tools themselves, but rather the genre rules that users enacted.

Finally, our findings showed that participants' perceptions about effectiveness may not be accurate. Participants in our study were unable to successfully determine whether they were performing effectively, in terms of team performance. This is a reminder that when using socially oriented tools, like Web 2.0 or virtual worlds, it is important for managers to rely on objective measures when evaluating team success.

Limitations

This research suffers from the usual limitations of experimental research concerning generalizability. It is possible—and even likely—that the genre rules of the participants in our study (undergraduate students) and the experimental task differs from those in organizations. The smaller sample size also is a limitation to this study. Although the size is sufficient for PLS (Chin 2001), a larger sample size would help improve its robustness. Our study explored social expectations surrounding tool use, so we chose IM and DF because of different genre rules enacted by our participant population rather than for their demonstrated strength in team decision-making.

Implications for Research

We believe this research makes four important contributions. First, it shows that genre rules can have significant impacts on performance. Team behavior and performance were significantly different while using the same tool when different genre rules were invoked. Team performance was primarily influenced by the genre rules participants enacted, *not which tool they used*. Thus, when selecting a communication tool, we need to consider both its innate capabilities (i.e., its nature) and the genre rules that have emerged for the tool (i.e., nurture). Previous research has argued that a task–technology fit between the task and tool capabilities is important (Dennis et al. 2001; Zigurs and Buckland 1998). This is important and appropriate, but is analogous to arguing that nature influences behavior and outcomes; however, this is only part of the story. Prior research has identified the importance of the spirit and the structural features of the tool in influencing how tools are used (DeSanctis and Poole 1994; Markus and Silver 2008). Over time, routines develop and evolve into genre rules (Dennis et al. 2001; DeSanctis and Poole 1994; Orlikowski and Yates 1994). We know that genre rules can lead to differences in behavior (Orlikowski and Yates 1994), but to date it is unclear whether genre rules influence team performance.

Our research shows that different genre rules can have significant impacts on team performance, over and above any impacts due to the features of the tool. Thus, one key implication is that we need more research on the impact of genre rules, especially in cases where different teams achieve different outcomes when using the same tool (see Watson-Manheim and Bélanger 2007). We need to develop new communication theories that move beyond our current focus on the characteristics of the tasks and technologies (e.g., Dennis et al. 2008; Zigurs and Buckland 1998) to include theorizing about the role of genre rules and how genre rules influence behaviors and performance.

Of course, genre rules can be broken—and some tools may be more effective when this occurs. Our research found that heightened time pressure actually improved performance in the IM environment by inducing the teams to use IM in a more task-focused manner. Increased time pressure caused participants to be more task-focused when their genre rules for IM were abandoned. More research is needed to understand how we can manage genre rules used in different contexts to improve performance.

A second contribution of this study is showing that discrepant events have the ability to change what genre rules are enacted, sometimes for the better. Genre rules develop over time through a structuration cycle of experimentation and adaptation, and often evolve into somewhat stable structures (DeSanctis and Poole 1994). Genre rules may or may not promote high task performance, especially when tools originally designed for consumer use (e.g., IM) are imported into organizations and deployed for work tasks (Herbsleb et al. 2002). In the context of this research, productivity improved when habitual genre rules were disrupted by discrepant events and different genre rules were enacted.

An implication from this is that researchers (and managers) may choose to use discrepant events to intentionally interrupt the nonconscious invocation of less effective genre rules. We are not arguing that higher time pressure per se has positive effects on performance; heightened time pressure may hurt performance (Ozel 2001). In this study, we used time pressure as a discrepant event to inhibit the automatic enactment

of genre rules so we could investigate the impact of genre rules separately from the impact of the tool itself. Discrepant events can be used to inhibit automatic enactment of less effective genre rules and trigger a cycle of adaptation that may lead to better performance and ultimately new, more effective genre rules. Additionally, a field study can be conducted to better determine genre rules that are generally formed by employees as well as ideal discrepant events that can be implemented in businesses.

A third contribution is the process we used to identify the tipping point for social communication, or the threshold of a qualitative change in behavior. The relationship between the amount of non-task comments and decision quality is discontinuous, meaning that traditional correlation or regression approaches to finding a relationship are not appropriate. Instead, we developed a calculus-based approach to identify the tipping point. We separated our data into two sets based on this analysis and found that the mean performance between the two was significantly different. We believe that this basic approach to finding a tipping point may be appropriate in other domains as well, although the specific steps should be customized as needed.

Fourth, this paper shows that two text communication tools can trigger the enactment of very different genre rules. Future field studies can further determine situations under which particular genre rules form and change. For example, some prior research has found that IM use in organizational work environments is task-focused, while other research has found it to be more social than other communication tools (see Cho et al. 2005; Isaacs et al. 2002b; Muller et al. 2003). Even within the same organization, genre rules for the same tool may differ. For example, in Cho et al.'s (2005) research, Paul, from a Computing System team, socialized only 8 percent of the time when using IM while John, from a Marketing team, socialized 33 percent of the time.[4]

One key implication for research is that the medium is indeed the message, but perhaps in more ways than McLuhan (1964) intended. McLuhan argues that the medium shapes the way a message is perceived; our results show that the tool shapes the content of the message itself, perhaps in ways unrecognized and unintended by the designer. We found that the choice to use a specific tool—or receiving a message using a specific tool—is likely to trigger the automatic enactment of the genre rules associated with that tool. Each set of users who participate in research studies may import their own genre rules. The observed behavior and outcomes from using the same tool may be strikingly different depending on the specific participants and genre rules enacted. For example, when student participants are used, it is possible that they will enact different genre rules than users in organizations. This is also likely to be *even more true* of field research; each team may enact different genre rules (Watson-Manheim and Bélanger 2007). Because field research typically studies participants in natural environments, the impact of genre rules is likely to be stronger than in the artificial confines of the laboratory. Thus, researchers need to be sensitive to the extent to which findings may be influenced by the genre rules and other social structures by which the participants in their studies use technology.

This also implies that it is not appropriate to conclude that the use of IM will always be more social or will always lead to less effective decisions than DF; it depends on the genre rules enacted by the users. Future research may be able to identify circumstances in which teams have developed different genre rules and achieved different performance.

Implications for Practice

Genre rules are behaviors so ingrained that over time they become automatically enacted. Because genre rules are enacted nonconsciously, people are often unable to recognize their effect on behavior and outcomes. We found that the genre rules the teams invoked had a greater effect on performance than the communication tool they used. The implication from this for managers is the need to consciously assess the genre rules associated with different tools and to choose tools appropriately. It may be that one tool is better suited to some tasks than others, not because of its capabilities, but because of the genre rules it evokes in the teams that use it. For example, e-mail may be more appropriate than IM for decision making if employees' genre rules associated with e-mail are more business-focused than the genre rules associated with IM. In many cases, the genre rules associated with IM are such that an immediate response is expected, which could induce a quick, knee-jerk reaction. In contrast, in many cases, the genre rules associated with e-mail are such that a more thoughtful response might be induced.

A second implication is that in some situations there may be a need to deliberately break genre rules. We used time pressure to break the automatic enactment of genre rules, but this is probably not an ideal practice in organizational settings. More appropriate interventions could be used to interrupt the automatic enactment of genre rules in organizations (see Thomas and Bostrom 2010a), such as explicit statements in messages directing recipients on how to respond (e.g., instruc-

[4]We would like to thank an anonymous reviewer for this example.

tions in IM asking recipients to think carefully before they respond). Prior research exploring habitual routines (Gersick and Hackman 1990) and automatic responses (Bargh and Morsella 2009) suggest that even subtle differences in a situation may be sufficient to interrupt the automatic enactment of genre rules. An intervention that causes the team to perceive the situation as novel may be sufficient to prevent automatic enactment. It is also important to consider ways in which genre rules can be slightly altered instead of completely broken and replaced with other genre rules.

Conclusion

We found that behavior and outcomes when using the same communication tool changed depending on the genre rules enacted by the users. Thus, we argue that behavior and outcomes are influenced both by nature (the inherent capabilities of a technology) and nurture (the genre rules that users enact for its use). Past research on communication technology has focused primarily on the nature of tools and how the features they provide influence behaviors and outcomes. Our study adds to the growing collection of research which shows that the social structures that teams adopt (sometimes without conscious thought) can have as powerful effects on behaviors and outcomes as the nature of the tools themselves. We conclude that future research needs to consider the genre rules for tool use as much as it considers the innate features of the tools themselves.

Acknowledgments

We would like to thank the senior editor, the associate editor, and the reviewers for helpful comments on prior versions of this paper.

References

Ariely D., and Zakay, D. 2001. "A Timely Account of the Role of Duration in Decision Making," *Acta Psychological* (108), pp. 187-207.

Axtman, K. 2002. "'r u online?': The Evolving Lexicon of Wired Teens," *Christian Science Monitor* (12:1) (available at http://www.csmonitor.com/2002/1212/p01s01-ussc.html).

Bargh, J. A. 1989. "Conditional Automaticity: Varieties of Automatic Influence in Social Perception and Cognition," in *Unintended Thought*, J. S. Uleman and J. A. Bargh (eds.), New York: Guilford Press, pp. 3-51.

Bargh, J. A. 1994. "The Four Horsemen of Automaticity: Awareness, Intention, Efficiency, and Control in Social Cognition," in *Handbook of Social Cognition* (2nd ed.), R. S. Wyer and T. K. Srull (eds.), Hillsdale, NJ: Erlbaum, pp. 1-40.

Bargh, J. A., and Chartrand, T. L. 1999. "The Unbearable Automaticity of Being," *American Psychologist* (54:7), pp. 462-479.

Bargh, J. A., and Chartrand, T. L. 2000. "A Practical Guide to Priming and Automaticity Research," in *Handbook of Research Methods in Social Psychology*, H. Reis and C. Judd (eds.), New York: Cambridge University Press, pp. 253-285.

Bargh, J. A., Chen, M., and Burrows, L. 1996. "Automaticity of Social Behavior: Direct Effects of Trait Construct and Stereotype Activation on Action," *Journal of Personality and Social Psychology* (71), pp. 230-244.

Bargh, J. A., and Ferguson, M. J. 2000. "Beyond Behaviorism: On the Automaticity of Higher Mental Processes," *Psychological Bulletin* (126:6), pp. 925-945.

Bargh, J. A., and Morsella, E. 2009. "Unconscious Behavioral Guidance Systems," in *Then a Miracle Occurs: Focusing on Behavior in Social Psychological Theory and Research,* C. R. Agnew, D. E. Carlston, W. G. Graziano, and J. R. Kelly (eds.), New York: Oxford University Press, pp. 89-122.

Bartko, J. J. 1976. "On Various Intraclass Correlation Reliability Coefficients," *Psychological Bulletin* (83:5), pp. 762-765.

Bliese, P. D. 2000. "Within-Group Agreement, Non-Independence, and Reliability: Implications for Data Aggregation and Analysis," in *Multilevel Theory, Research, and Methods in Organizations: Foundations, Extensions, and New Directions*, K. J. Klein and W. J. Kozlowski (eds.), San Francisco: Jossey-Bass, pp. 349-381.

Bliese, P. D., and Halverson, R. R. 1998. "Group Size and Measures of Group-Level Properties: An Examination of Eta-Squared and ICC Values," *Journal of Management* (24:2), pp. 157-172.

Buchanan, M. 2002. *Nexus: Small Worlds and the Groundbreaking Science of Networks*, Norton, NY: W. W. Norton and Company, pp. 156-169.

Camerer, C., Loewenstein, G., and Prelec, D. 2005. "Neuroeconomics: How Neuroscience Can Inform Economics," *Journal of Economic Literature* (43), pp. 9-64.

Chin, W. W. 2001. "PLS – Graph User's Guide: Version 3.0," Soft Modeling Inc.

Cho, H. K., Trier, M., and Kim, E. 2005. "The Use of Instant Messaging in Working Relationship Development: A Case Study," *Journal of Computer-Mediated Communication* (10:4) (available at http://jcmc.indiana.edu/vol10/issue4/cho.html).

Crowston, K., and Williams, M. 2000. "Reproduced and Emergent Genres of Communication on the World-Wide Web," *The Information Society*, (16), pp. 201-215.

De Vos, H., Hofte, H., and De Poot, H. 2004. "IM [@Work] Adoption of Instant Messaging in a Knowledge Worker Organization," in *Proceedings of the 37th Annual Hawaii International Conference on System Sciences*, Los Alamitos, CA: IEEE Computer Society Press.

Dennis, A. R. 1996. "Information Exchange and Use in Group Decision Making: You Can Lead a Group to Information, but You Can't Make it Think," *MIS Quarterly* (20:4), pp. 433-457.

Dennis, A. R., and Garfield, M. J. 2003. "The Adoption and Use of GSS in Project Teams: Toward More Participative Processes and Outcomes," *MIS Quarterly* (27:2), pp. 289-323.

Dennis, A. R, Fuller, R. M., and Valacich, J. S. 2008. "Media, Tasks and Communication Processes: A Theory of Media Synchronicity," *MIS Quarterly* (32:3), pp. 575-600.

Dennis, A. R., and Wixom, B. H. 2001-2. "Investigating the Moderators of the Group Support Systems Use with Meta-Analysis," *Journal of Management Information Systems* (18:3), pp. 235-258.

Dennis, A. R., Wixom B. H., and Vandenberg, R. J. 2001. "Understanding Fit and Appropriation Effects in Group Support Systems via Meta-Analysis," *MIS Quarterly* (25:2), pp. 167-197.

DeSanctis, G., and Poole, M. S. 1994. "Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory," *Organization Science* (5:2), pp. 121-147.

Duncker, K. 1945. "On Problem Solving" (L. S. Lees, Trans.), *Psychological Monographs* (58:5), pp. I-113.

Eastman, J. K. 2002. "Enhancing Collaborative Learning: Discussion Boards and Chat Rooms as Project Communication Tools," *Business Communication Quarterly* (65:3), pp. 29-41.

Erickson, T. 1999. "Rhyme and Punishment: The Creation and Enforcement of Conventions in an On-Line Participatory Limerick Genre," in *Proceedings of the 32nd Annual Hawaii International Conference on System Sciences*, Los Alamitos, CA: IEEE Computer Society Press.

Fjermestad, J., and Hiltz, S. R. 1998-99. "An Assessment of Group Support Systems Experimental Research: Methodology and Results," *Journal of Management Information Systems* (15:3), pp. 7-149.

Fornell C., and Larcker, D. F. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research* (18:1), pp. 39-50.

Freedman, A., and Medway, P. 1994. "Locating Genre Studies: Antecedents and Prospects," in *Genre and the New Rhetoric*, A. Freedman and P. Medway (eds.), London: Taylor and Francis, pp. 1-20.

Fulk, J., Schmitz, J., and Steinfield, C. W. 1990. "A Social Influence Model of Technology Use," in *Organizations and Communication Technology*, J. Fulk and C. W. Steinfield (eds.), Newbury Park, CA: Sage Publications, pp. 117-141.

Garrett, R. K., and Danziger, J. N. 2007. "IM=Interruption Management? Instant Messaging and Disruption in the Workplace," *Journal of Computer Mediated Communication* (13:1), pp. 23-42.

Gersick, C. J. G., and Hackman, J. R. 1990. "Habitual Routines in Task-Performing Groups,"*Organizational Behavior and Human Decision Processes* (47:1), pp. 65-97.

Giddens, A. 1984. *The Constitution of Society: Outline of a Theory of Structuration,* Cambridge, England: Polity Press.

Giddens, A. 1991. "Structuration Theory: Past, Present and Future," in *Giddens' Theory of Structuration: A Critical Appreciation*, C. G. A. Bryant and D. Jary (eds.), London: Routledge, pp. 201-221.

Gladwell, M. 2002. *The Tipping Point: How Little Things Can Make a Big Difference,* New York: Back Bay Books, Little, Brown and Company.

Goldberger, L., and Breznitz, S. 1999. *Handbook of Stress: Theoretical and Clinical Aspects*, New York: Free Press.

Harman, K., and Koohang, A. 2005. "Discussion Board: A Learning Object," *Interdisciplinary Journal of Knowledge and Learning Objects* (1:1), pp. 67-77.

Herbsleb, J., Atkins, D., Boyer, D., and Handel, M. 2002. "Introducing Instant Messaging and Chat in the Workplace," in *Proceedings of the SIGCHI conference on Human Factors in Computing Systems*, New York: Association for Computing Machinery.

Holsti, O. R., and George, A. L. 1975. "The Effects of Stress on the Performance of Foreign Policy Makers," *Political Science Annual* (6), pp. 255-319.

Isaacs, E., Walendowski, A., and Ranganathan, D. 2002a. "Mobile Instant Messaging through Hubbub," *Communications of the ACM* (45:9), pp. 68-72.

Isaacs, E., Walendowski, A., Whittaker, S., Schiano, D. J., and Kamm, C. 2002b. "The Character, Functions, and Styles of Instant Messaging in the Workplace," in *Proceedings of the 2002 ACM Conference on Computer Supported Cooperative Work*, New York: Association for Computing Machinery, pp. 11-20.

Jasperson, J. S., Carter, P. E., and Zmud, R. W. 2005. "A Comprehensive Conceptualization of Post-Adoptive Behaviors Associated with Information Technology Enabled Work Systems," *MIS Quarterly* (29:3), pp. 525-557.

Jones, M. R., and Karsten, H. 2008. "Giddens's Structuration Theory and Information Systems Research," *MIS Quarterly* (32:1), pp. 127-157.

Josefek Jr., R. A., and Kauffman, R. J. 2003. "Nearing the Threshold: An Economics Approach to Pressure on Information Systems Professionals to Separate from Their Employer," *Journal of Management Information Systems* (20:1), pp. 87-122.

Junco, R., and Cole-Avent, G. A. 2008. "An Introduction to Technologies Commonly Used by College Students," *New Directions for Student Services* (124), pp. 3-17.

Karjalainen, A., and Salminen, A. 2000. "Bridging the Gap between Hard and Soft Information Genres," *Challenges of Information Technology Management in the 21st Century: Proceedings of 2000 Information Resources Management Association Conference*, Anchorage, AK, May 21-24.

Kim, S. S., Malhotra, N. K., and Narasimham, S. 2005. "Research Note—Two Competing Perspectives on Automatic Use: A Theoretical and Empirical Comparison," *Information Systems Research* (16:4), pp. 418-432.

Köhler, T., Cramton, C. D., and Hinds, P. J. 2012. "The Meeting Genre Across Cultures: Insights from Three German-American Collaborations," *Small Group Research* (43:2), pp. 159-185

Li, D., Chau, P. Y. K., and Lou, H. 2005. "Understanding Individual Adoption of Instant Messaging: An Empirical Investigation," *Journal of the Association for Information Systems* (6:4), pp. 102-129.

Limayem, M., and Hirt, S. G. 2003. "Force of Habit and Information Systems Usage: Theory and Initial Validation," *Journal of the Association for Information Systems* (4), pp. 65-97.

Limayem, M., Hirt, S. G., and Cheung, C. M. K. 2007. "How Habit Limits the Predictive Power of Intention: The Case of Information Systems Continuance," *MIS Quarterly* (31:4), pp. 705-737.

Lin, J., Chan, H. C., and Jin, Y. 2004. "Instant Messaging Acceptance and Use among College Students," in *Proceedings of the 8th Pacific Asia Conference on Information Systems*, Shanghai, China, July 8-11, pp. 181-194.

Logan, G. D., and Cowan, W. B. 1984. "On the Ability to Inhibit Thought and Action: A Theory of an Act of Control," *Psychological Review* (91:3), pp. 295-327.

MacGregor, D. 1993. "Time Pressure and Task Adaptation: Alternative Perspectives on Laboratory Studies," in *Time Pressure and Stress in Human Judgment and Decision Making*, O. Svenson and A. J. Maule (eds.), New York: Plenum Press, pp. 73-82.

Majchrzak, A., Rice, R. E., Malhotra, A., King, N., and Ba, S. 2000. "Technology Adaptation: The Case of a Computer-Supported Inter-Organizational Virtual Team," *MIS Quarterly* (24:4), pp. 569-600.

Marks, M. A., Mathieu, J. E., and Zaccaro, S. J. 2001. "A Temporally Based Framework and Taxonomy of Team Processes," *Academy of Management Review* (26:3), pp. 356-376.

Markus, L. M. 1994. "Electronic Mail as the Medium of Managerial Choice," *Organization Science* (5:4), pp. 502-527.

Markus, M. L., and Silver, M. S. 2008. "A Foundation for the Study of IT Effects: A New Look at DeSanctis and Poole's Concepts of Structural Features and Spirit," *Journal of the Association for Information Systems* (9:10/11), pp. 609-632.

Marra, R. M., Moore, J. L., and Klimczak, A. K. 2004. "Content Analysis of Online Discussion Forums: A Comparative Analysis of Protocols," *Educational Technology Research and Development* (53:2), pp. 23-40.

McCreary, E. 1990. "Three Behavioral Models for Computer-Mediated Communication," in *Online Education: Perspectives on a New Environment*, L. Harasim (ed.) New York: Praeger, pp. 117-130.

McGrath, J. E. 1991. "Time, Interaction, and Performance (TIP): A Theory of Groups," *Small Group Research* (22:2), pp. 147-174.

McLuhan, M. 1964. *Understanding Media: The Extensions of Man*, New York: Mentor.

Miller, C. R. 1984. "Genre as Social Action," *Quarterly Journal of Speech* (70:2), pp. 151-167.

Mohammed, S., and Nadkarni, S. 2011. "Temporal Diversity and Team Performance: The Moderating Role of Team Temporal Leadership," *Academy of Management Journal* (54:3), pp. 489-508.

Morsella, E. 2005. "The Function of Phenomenal States: Supramodular Interaction Theory," *Psychological Review* (112:4), pp. 1000-1021.

Muller, M. J., Raven, M. E., Kogan, S., Millen, D. R., and Carey, K. 2003. "Introducing Chat into Business Organizations: Toward an Instant Messaging Maturity Model," in *Proceedings of the 2003 International ACM SIGGROUP Conference on Supporting Group Work*, New York: Association for Computing Machinery, pp. 50-57.

Nunnally, J. C. 1978. *Psychometric Methods*. New York: McGraw-Hill.

O'Connor, A. 2005. "Instant Messaging: Friend or Foe of Student Writing," *New Horizons for Learning Online Journal* (11:2).

Orlikowski, W., and Robey, D. 1991. "Information Technology and the Structuring of Organizations," *Information Systems Research* (2:2), pp. 143-169.

Orlikowski, W. J., and Yates, J. 1994. "Genre Repertoire: The Structuring of Communicative Practices in Organizations," *Administrative Science Quarterly* (39:4), pp. 541-574.

Ortiz de Guinea, A., and Markus, M. L. 2009. "Why Break the Habit of a Lifetime? Rethinking the Roles of Intention, Habit, and Emotion in Continuing Information Technology Use," *MIS Quarterly* (33:3), pp. 433-444.

Ozel, F. 2001. "Time Pressure and Stress as a Factor during Emergency Egress," *Safety Science* (38:2), pp. 95-107.

Rothstein, H. G. 1986. "The Effects of Time Pressure on Judgment in Multiple Cue Probability Learning," *Organizational Behavior and Human Decision Processes* (37:1), pp. 83-92.

Salaway, G., Caruso, J. B., and Nelson, M. R. 2008. "The ECAR Study of Undergraduate Students and Information Technology, 2008,"Research Study, EDUCAUSE Center for Applied Research (available online: http://net.educause.edu/ir/library/pdf/ers0808/rs/ers0808w.pdf).

Short, J. A., Williams, F., and Christie, B. 1976. *The Social Psychology of Telecommunications*, New York: Wiley.

Swartz, N. 2003. "Instant Messaging goes Corporate," *Information Management Journal* (37:4), p. 8.

Tagliamonte, S. A., and Denis, D. 2008. "Linguistic Ruin? LOL! Instant Messaging and Teen Language," *American Speech* (83:1), pp. 3-34.

Thomas, D. M., and Bostrom, R. 2008. "Building Trust and Cooperation through Technology Adaptation in Virtual Teams: Empirical Field Evidence," *Information Systems Management* (25:1), pp. 45-56.

Thomas, D. M., and Bostrom, R. P. 2010a. "Team Leader Strategies for Enabling Collaboration Technology Adaptation: Team Technology Knowledge to Improve Globally Distributed Systems Development Work," *European Journal of Information Systems* (19:2), pp. 223-237.

Thomas, D. M., and Bostrom, R. P. 2010b. "Vital Signs for Virtual Teams: An Empirically Developed Trigger Model for Technology Adaptation Interventions," *MIS Quarterly* (34:1), pp. 115-142.

Twitchell, D. P., Wiers, K., Adkins, M., Burgoon, J. K., and Nunamaker, J. F. 2005. "StrikeCOM: A Multi-Player Online Strategy Game for Researching and Teaching Group Dynamics," in *Proceedings of the 38th Hawaii International Conference on System Sciences*, Los Alamitos, CA: IEEE Computer Society Press.

Wagner, C., and Bolloju, N. 2005. "Supporting Knowledge Management in Organizations with Conversational Technologies: Discussion Forums, Weblogs, and Wikis," *Journal of Database Management* (16:2), pp. 1-8.

Watson-Manheim, M. B., and Bélanger, F. 2007. "Communication Media Repertoires: Dealing with the Multiplicity of Media Choices," *MIS Quarterly* (31:2), pp. 267-293.

Yates, J., and Orlikowski, W. J. 1992. "Genres of Organizational Communication: A Structurational Approach to Studying Communication and Media," *Academy of Management Review* (17:2), pp. 299-326.

Yates, J., and Orlikowski, W. J. 2002. "Genre Systems: Structuring Interaction through Communication Norms," *The Journal of Business Communication* (39:1), pp. 13-35.

Yates, J., and Orlikowski, W. J., and Okamura, K. 1999. "Explicit and Implicit Structuring of Genres in Electronic Communication: Reinforcement and Change of Social Interaction," *Organization Science* (10:1), pp. 83-103.

Yates, J., Orlikowski, W. J., and Rennecker, J. 1997. "Collaborative Genres for Collaboration: Genre Systems in Digital Media," in *Proceedings of the 30th Annual Hawaii International Conference on System Sciences* (Volume 6), Los Alamitos, CA: IEEE Computer Society Press, pp. 50-59.

Yoo, Y., and Alavi, M. 2001. "Media and Group Cohesion: Relative Influences on Social Presence, Task Participation, and Group Consensus," *MIS Quarterly* (25:3), pp. 371-390.

Zakay, D., and Wooler, S. 1984. "Time Pressure, Training and Decision Effectiveness," *Ergonomics* (27:3), pp. 273-284.

Zigurs, I., and Buckland, B. K. 1998. "A Theory of Task/Technology Fit and Group Support Systems Effectiveness," *MIS Quarterly* (22:3), pp. 313-334.

About the Authors

Valerie L. Bartelt is an assistant professor of Information Systems at Texas A&M—Kingsville. She received a Ph.D. in information systems, an M.S. in business, and an M.S. in immersive mediated environments from Indiana University. She has published in *Journal of Management Information Systems* and *Group Decisions and Negotiation*. Valerie is currently serving as co-PI for a $775,775 Health Resources and Services Administration grant and is director of operations at the Health Information Network of South Texas, implementing a health information exchange system in healthcare facilities located in South Texas. Her research interests primarily involve information communication technologies in virtual teams, issues surrounding technology use and adoption, and neuro-IS.

Alan R. Dennis is a professor of Information Systems and holds the John T. Chambers Chair of Internet Systems in the Kelley School of Business at Indiana University. Alan has written more than 100 research papers, and has won numerous awards for his theoretical and applied research. His research focuses on four main themes: the use of computer technologies to support team creativity and decision making; neuro-IS; IS for the subconscious; and the use of the Internet to improve business and education. He was named a Fellow of the AIS in 2012. He is editor-in-chief of *Foundations and Trends in Information Systems*, and publisher of *MIS Quarterly Executive*. Alan also has written four books, two on data communications and networking, and two on systems analysis and design.

MIS Quarterly

RESEARCH ARTICLE

NATURE AND NURTURE: THE IMPACT OF AUTOMATICITY AND THE STRUCTURATION OF COMMUNICATION ON VIRTUAL TEAM BEHAVIOR AND PERFORMANCE

Valerie L. Bartelt
Management, Marketing and Information Systems Department, Texas A&M University–Kingsville, Kingsvile, TX 78363 U.S.A. {valerie.bartelt@tamuk.edu}

Alan R. Dennis
Operations and Decision Technologies Department, Indiana University–Bloomington, Bloomington, IN 47405 U.S.A. {ardennis@indiana.edu}

Appendix

Perceived Time Pressure Measure

(Cronbach's Alpha = 0.91)

Concerning discussions for each round, did you:

Have as Much Time as You Needed			Neutral/ Undecided			Want More Time
1	2	3	4	5	6	7

Did you have enough time to review other comments and suggestions?

Have as Much Time as You Needed			Neutral/ Undecided			Want More Time
1	2	3	4	5	6	7

Did you feel rushed when making comments?

Have as Much Time as You Needed			Neutral/ Undecided			Want More Time
1	2	3	4	5	6	7

Considering all the comments you made, did you:

Have as Much Time as You Needed			Neutral/ Undecided			Want More Time
1	2	3	4	5	6	7

Perceived Effectiveness Measure

(Items were reverse coded for analysis, so that higher values meant higher perceived effectiveness; Cronbach's Alpha = 0.91)

How effective was your group at making decisions?

Very Effective			Neutral/ Undecided			Not at All Effective
1	2	3	4	5	6	7

How effective was your group at evaluating decisions?

Very Effective			Neutral/ Undecided			Not at All Effective
1	2	3	4	5	6	7

Enjoyment Measure

(Items were reverse coded for analysis, so that higher values meant higher enjoyment; Cronbach's Alpha = 0.92)

How much fun was this discussion?

Very Enjoyable			Neutral/ Undecided			Not at All Enjoyable
1	2	3	4	5	6	7

Overall, how enjoyable did you find your experience in this group?

Very Enjoyable			Neutral/ Undecided			Not at All Enjoyable
1	2	3	4	5	6	7

To what extent did you enjoy participating in this discussion?

Very Enjoyable			Neutral/ Undecided			Not at All Enjoyable
1	2	3	4	5	6	7

Social Communication Behaviors during Tool Use Measure

(Cronbach's Alpha = 0.92)

Please consider a situation where you are using [IM, DF] to discuss a homework assignment with three or four of your friends who are taking the same course. How likely would you do the following (1 = Not at all likely; 4 = Neutral; 7 = Very likely):

- Make a humorous comment
- Tell a joke
- Mention a current event (e.g., news, politics, sports)
- Mention an event on campus (e.g., basketball, movies)
- Mention your social plans for the weekend
- Invite someone to party
- Mention how you feel (e.g., tired, hungry)
- Ask someone else how they feel
- Mention work in another class
- Have a side conversation
- Discuss something not directly related to the homework assignment
- If two members of the group started talking about something not related to the homework assignment, reply to their comments

Non-Task Comments Coding Rules

Comments about the game play are to be coded as on-task, including

- Comments about where to move during each other's turn including speculation on where the campers might be
- Comments on individual findings after each round, including definite, possible evidence, or no evidence, that each participant received from the facilitator and were asked to share with one another
- Encouraging comments to one another specifically related to the game play (e.g., "Good job, team! We found 2 missing campers so far.")
- Comments about participants' role that were related to the game play (e.g., "Ranger – why don't u and ur search dogs go a bit closer to the water?")

Comments that are not relevant to the game play are considered to be off-task, including

- Comments about participants' role or the game play that had nothing to do with the task and appeared to be intended as humor (i.e., "Sasquatch may be better at finding these kids than us. What color do you think Sasquatch is?")
- Comments about where participants were going after the experiment
- Comments about current events outside of the experiment (e.g., sports teams, politics)
- Comments about the experiment itself (e.g., "Do we have to do a survey after the missing camper task is done?")

If one comment contains multiple thoughts, some of which are on-task and some off-task, it should be coded as on-task, unless it triggered subsequent related comments that were off-task.

Finding a Tipping Point

There is no continuous relationship between the proportion of non-task-focused comments and decision quality. Instead, it is a discontinuous relationship that has two separate and distinct means. Below a certain tipping point, the team discussion is task focused and results in task performance that is distributed around some mean decision quality. Above the tipping point, a contagion effect occurs and the non-task-focused discussion drives out the ability to reach good quality decisions; the discussion is not adequately task-focused and performance is distributed around a different, much lower mean decision quality. In both cases, the distribution around the mean decision quality is not related to the proportion of non-task-related comments by any specific function.

Thus, to find this tipping point beyond which contagion ensues, we should not examine the relationship between non-task-focused comments and decision quality, because there is no functional relationship. Instead, we examined the proportion of non-task-focused comments to see if we could identify a point at which it grew faster than would otherwise be expected. We began by converting the proportion of non-task-focused comments into a 0 to 1 scaled variable; we divided the number of non-task-focused comments by its maximum (41%) to produce a non-task-focused comments variable ranging from 0 to 1. We then sorted the teams based on the proportion of non-task-focused comments from lowest to highest and assigned all 39 data points an ordinal number from one to 39 representing their order from lowest to highest. We then mean-centered this ordinal data (i.e., subtracted 20) and then divided by the maximum (20) to give a uniform ordinal distribution from -1 to +1, centered on zero.

We used the SPSS regression curve estimation procedure to find the best fitting curve between the ordinal placement of the team and its proportion of non-task-focused comments. The best fit curve was a cubic function, with an R^2 of .98 and all four terms significant (see Figure A1). The function is: $f(x) = .089 + .231\ x + .420\ x^2 + .322\ x^3$, where x is the mean-centered ordinal value on the -1 to +1 scale and f(x) is the non-task-focused comments variable on the 0 to 1 scale.

This function shows how the amount of non-task-focused comments increases over the sample. We see that below the median (x=0), there is a slow, gradual increase in the amount of non-task-focused comments from one ordinal position to the next. After the median, non-task-focused comments begin to increase at an increasing rate.

What slope should we consider a potential tipping point? We believe that a key tipping point could be when the slope first exceeds 1 (i.e., a 45 degree tangent line). At this point, the amount of non-task-focused comments is increasing at a noticeably faster rate. The first derivative provides the slope at any given point. The first derivative is $f'(x) = .231 + .840\ x + .966\ x^2$. Solving for x when $f'(x) = 1$, gives x=.559, or the 31st ordinal data point (at which point the percent of non-task comments equals 16%). This partitions the data into two sets: (1) 30 teams below this point; and (2) 9 teams above this point. This has some face-value appeal as it divides the data into close to a 75-25 split.

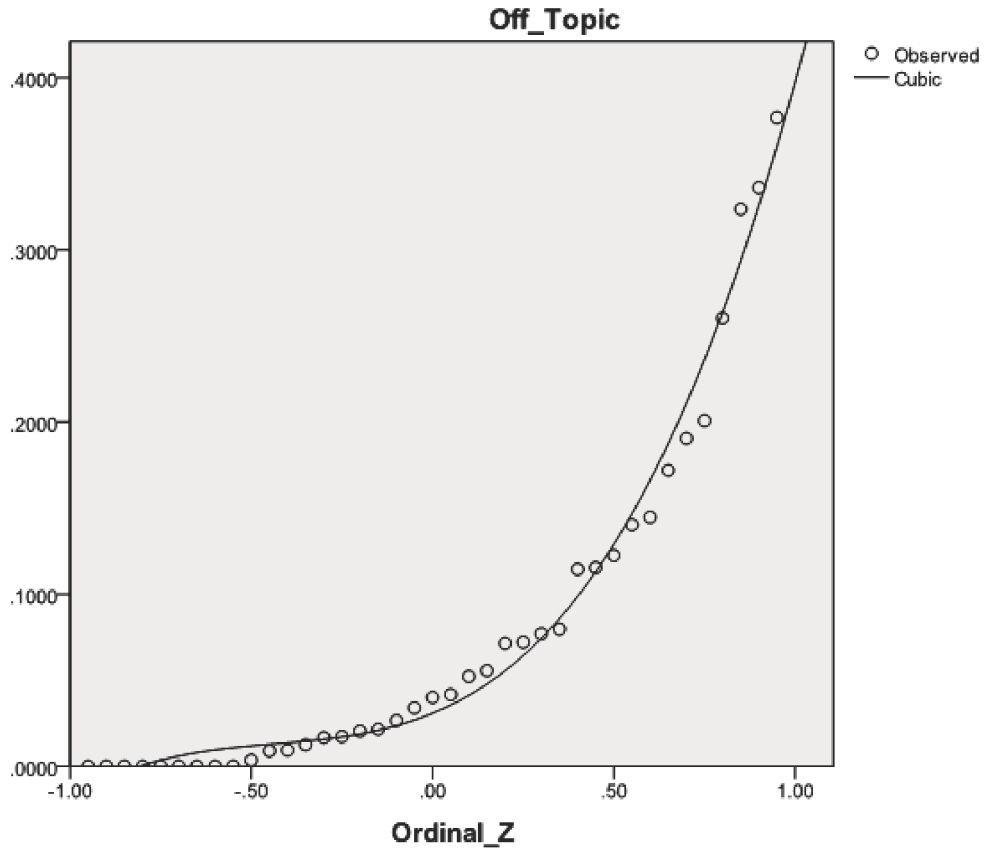

Figure A1. The Relationship between Ordinal Position and Relative Non-Task Comments