Supporting Critical Thinking with Group Discussion on Threaded Bulletin Boards: An Analysis of Group Interaction

by

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Abstract

This study examines the nature of group interactions and critical thinking in threaded bulletin board discussions by analyzing events and event sequences. Particular attention was given to interactions involving opposing and conflicting viewpoints to determine how, when, and which interactions support critical thinking. This study proposes a model of critical thinking, consisting of twelve critical thinking functions and event categories, for coding threaded discussions. Based on the model, various methods and computer algorithms were developed to compute and analyze event frequencies and event sequences in threaded messages based on the sequential analysis methods of Bakeman & Gottman (1997). These methods were used to examine *group processes* in online discussions in terms of event sequences and event probabilities. The study found the methods to be effective and useful for identifying patterns in the group interaction and measuring the outcomes that follow the interactions - surmounting many of the challenges in analyzing event sequences faced in previous studies. The events and event sequences observed in this study provided evidence to both support and challenge existing models of critical thinking. All together, the results of the study illustrated the potential application of the methods for diagnosing problematic interactions, exploring effective forms of interaction, and testing the effects of different interventions and communication technologies on group processes and outcomes.

Chapter 1 - Problem Statement

Introduction

Technologies for electronic group communication are proliferating at a rapid pace. Next to electronic mail, threaded bulletin boards have become one of the more prolific and accessible technologies on the Internet. Its availability on the World Wide Web has created a technology that is easier to use, lower in cost, and more accessible than many other communication technologies (Newman, 1996, p.72). Dozens of Web sites offer users the ability to create personal bulletin boards for group discussions for both personal and professional communication. Bulletin boards can be found on commercial Web sites helping customers share information, providing customer support, and strengthening user communities. Similar trends can now be seen in higher education, as colleges introduce Web applications like bulletin boards for supporting group discussion and collaborative learning.

A bulletin board is a tool that presents and organizes a group discussion into the form of a structured outline or hierarchical index. See example in Figure 1. Main topics or "discussion threads" are posted as main headings, and subsequent replies are threaded or hyper-linked in chronological order and displayed hierarchically in multilevel subheadings. These "threaded" bulletin boards allow users to expand and collapse topical threads and sub-threads to allow participants to read and build a discussion in an organized and structured format. Messages can be posted via the Internet without the constraints of time and space. As a result, participants have time to reflect and compose messages to challenge and elaborate on ideas presented in previous messages. Some bulletin boards allow participants to contribute messages anonymously or use pseudo-names.

Research on the effects of "threaded" bulletin boards and other forms of group ware have focused largely on improving access, student participation and learning outcomes (Hiltz, 1990; Harasim, 1991 & 1993; Winkelmans, 1988; Bellman, 1992; Dubrovsky, Kiesler & Sethna, 1991; Kiesler & Sproull, 1992; McGrath & Hollingshead, 1994; Berdahl & Craig, 1996). In addition, the research has focused largely on issues concerning the use of this technology and learning outcomes using empirical and quantitative methodologies (Mason, 1991). In general, the research on the instructional uses computer-mediated communication (CMC) shows that participation increases in group discussions because the conditions that often inhibit participation are absent in a CMC environment. The research also has shown improvements in the quality of individual contributions.

In addition, Cooper & Selfe (1990, p.849) found that bulletin boards "encourage students to resist, dissent, and explore the role that controversy and intellectual divergence play in learning and thinking, more so than when groups had face-to-face (F2F) discussions. Belleman (1992) found that students are better able to engage in critical rather than hostile and competitive discussions, shifting the focus of discussions to the ideas rather than personalities. The physical separation of participants (Coleman et al., 1999; Rice, 1984) and the salience of the electronic text (Cooper & Selfe, 1990) has been found to diffuse conflict and enable participants to focus more on issues and arguments and less on personal antagonisms and attacks on personalities. These studies illustrate how bulletin boards can increase a group's ability to explore and "express differences, alternatives, and perspectives," as well as "challenge and evaluate ideas."

Together, these findings suggest that bulletin boards are ideal tools for facilitating critical thinking (CT), which in turn, can facilitate critical discourse in group communication. Mezirow (1991) lists seven conditions necessary for critical discourse. The seven conditions for critical discourse require that participants be able to:

1) engage in open and equal participation without coercion
2) express or allow others to express differences, alternatives and perspectives
3) challenge, evaluate and compare ideas and their assumptions
4) have access to accurate and relevant information to support ideas
5) participate in different roles in the discussion
6) accept the negotiation of shared meanings and results of group consensus
7) exhibit an understanding that beliefs are subjective and dependent on contexts

The previously mentioned studies generally address how CMC supports the first two of these seven conditions for critical discourse. More recent studies have begun to address the remaining conditions by examining critical thinking in computer-mediated group discussions. Several studies document *critical thinking* in computer-mediated group discussions (Gunawardena et al., 1997; Newman et al., 1995 & 1996; Webb et al., 1994; Henri, 1992) and present a number of models of critical thinking. In all the models, critical thinking includes such functions as the sharing of viewpoints, comparing information, evaluating arguments, negotiating shared meanings and constructing knowledge, and other types of student interactions. All of these student interactions are part of the process of critical thinking.

Gunawardena, Lowe and Anderson (1997) proposed an interaction analysis model to study critical discussions in electronic mail. Their model (see Table 1) divides critical thinking into five phases:

1) the sharing and comparing of information

2) discovery and exploration of dissonance or inconsistency among ideas, concepts, or statements
3) negotiation of meaning and co-construction of knowledge
4) testing and modification of proposed synthesis or co-construction
5) agreement statements and applications of newly constructed meaning

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Insert Table 1 about here

With this model, Gunawardena examined email discussions and found that critical thinking resulted from direct exchanges among the discussion participants, and that discussions progressed from lower to higher phases of critical thinking. The findings demonstrate how knowledge is constructed by means of exchanges between participants, and how participants are able to change their understanding and personal constructions of knowledge as a result of group interaction.

Group interactions have also been examined in research on group decision support systems (GDSS), providing rich analysis of group interactions while using communication tools to facilitate negotiation and decision-making (Poole et al., 1991 & 1993; Ocker et al. 1995; Turoff et al. 1998). Table 2 and Table 3 show some of the interactions examined in GDSS research. These tools include shared text editors, simple group messaging (without message threading), and automated voting and polling. Poole et al. (1991 & 1993) compared group interactions between computer-mediated versus F2F communication among interactions associated with conflict management and group decision-making.

Insert Table 2 & 3 about here

Findings in the research show that GDSS both supports and inhibits critical discussion, depending on how groups choose to use or not to use specific communication tools. But most of all, the findings are difficult to apply to our understanding of bulletin boards because of the differences between the two communication tools. For example, groups in the GDSS studies were examined while working in synchronous real-time discussions. Bulletin boards, on the other hand, are often used for "asynchronous" discussions, in which participants can post messages at different times. Secondly, students in the GDSS studies used multiple communication tools which included text editors, message threading, and vote ballots.

Research on computer-supported collaborative writing (CSCW) also examines interactions as groups write collaboratively with CMC (Posner et al., 1996; Lebie et al 1996; Sharples, 1993; Easterbrook et al., 1993; Mitchell, 1996; Mittleman & Adkins, 1996). Surprisingly, the CSCW research has not examined the use and effects of threaded bulletin boards when used to support collaborative writing. Instead, the research has focused on computer tools that help groups *coordinate* the editing of electronic documents while communicating F2F (Cummings, Schlosser & Arrow, 1996; Posner et al., 1996) or in synchronous relay chats (Lebie et al 1996). Furthermore, the CSCW research has focused primarily on the processes for managing conflict and document editing and revisions (see Tables 4, 5, 6 & 7), and not on processes involving critical thinking and the discussion of substantive issues (Easterbrook et al., 1993).

Insert Table 4, 5, 6 & 7 about here

In fact, Dillon (1993) stresses that CSCW should focus more on providing communications support for the sharing of documents and discussions with group members. Beck and Bellotti (1993) suggest that computer systems need to support the way groups shift to different writing strategies as well as different activities (e.g. critical discussion of substantive issues) over the course of a project. Collaboration requires effective communication between group members to establish shared understandings and shared contexts (Beaudouin-Lafon, 1990; Miles et al., 1993 p. 145-147). These observations emphasize the need for more research on tools that support substantive discussion and development of group ideas, like threaded bulletin boards.

In this study, a theoretical framework is proposed to examine student interactions and critical thinking in bulletin board discussions. The framework is based on Bakhtin's theory of dialogism (1981), a theory that views language as part of a larger whole or social context in which all possible meanings of a word interact, possibly conflict, and affect future meanings. Meaning is produced by the relationship between one utterance and another, and is affected, re-negotiated and reconstructed as a result of *conflict* arising from social interaction. Through conflict, needs and values are identified, providing the possibility for change and construction of new meanings (Cooper & Selfe, 1990 p. 851).

Based on this framework, *interaction* is defined by the relationship between threaded messages exchanged between discussants in a bulletin board discussion. The messages and the relationships between threaded messages can be coded and classified into *events* and *event sequences*. Analysis of the event sequences provides insight into the types of student interactions that lead to critical as well as *un*-critical thinking, and the data to test and refine models of critical thinking in group discussions.

Purpose of Study

This study examined the processes and *event sequences* that lead to critical thinking in group discussions on threaded bulletin boards. Event sequences were examined using an interaction analysis model developed within a theoretical framework based on Bakhtin's theory of dialogism. The theory of dialogism emphasizes the examination of the relationships between thoughts and messages shared among group discussants. As a result, this study investigated how specific *event sequences* produce specific forms of critical thinking, particularly event sequences associated with conflict, disagreements and differences in opinion and viewpoints. This study focused on the following research questions:

1) What types of *events* (e.g. contributions from participants) can be observed in threaded bulletin board discussions?

2) What *event sequences* can be observed in these discussions? And what event sequences appear to illustrate or define important critical thinking operations?

3) How often are specific events or event sequences followed by critical thinking, particularly events sequences occurring over interchanges between participants? What are the event probabilities in the observed event sequences?

Scope of Study

In the following discussion, the studies by Newman (1996) and Gunawardena (1997) are reviewed to examine existing themes, research methodologies, as well as similarities and differences in instructional contexts, challenges and issues relating to the study of critical

thinking in group discussions. With respect to these and other studies on CMC, here is a summary of the issues that distinguish this study from previous studies.

1) This study examined group interactions in *threaded* bulletin boards, in which the relationships between messages are explicit unlike message in electronic mail, non-threaded bulletin boards, and Internet Relay Chats (IRC).

2) This study examined the *interactive* dimensions of CMC (Henri, 1992) by using an interaction analysis model to identify and classify *event sequences* in threaded bulletin boards. The analysis of event sequences determined what events and event sequences lead to critical thinking.

3) This study focused on the qualitative analysis of event sequences and *processes* of critical thinking, and *not* on the quantitative analysis of critical thinking.

4) This study examined group interactions in small group discussions within a class of undergraduate students, as opposed to a large group discussion among professional participants (Gunawardena, 1997).

5) This study analyzed events or event sequences rooted in *conflict* (e.g. disagreements, differences in viewpoints) and examined how these events or event sequences contribute to critical thinking.

Chapter 2 - Literature Review

This section outlines the theoretical framework used in this study. Two studies on critical thinking in group discussions (Newman 1995 & 1996; Gunawardena, 1997) are reviewed, with discussion of the findings and methodologies used to examine how student interaction in group discussions lead to critical thinking. The limitations of these studies and directions for continued research are identified in light of the proposed theoretical framework. The section ends with a description of this study and its potential implications in terms of future research and instructional applications.

Theoretical Framework

Mikhail Bakhtin's theory on dialogism (1981) provides a useful framework and rationale for examining social interaction in bulletin board discussions. Bakhtin's theory emphasizes "depth and mutual understanding" of alternative conceptions through "dialogic reasoning" (Sappo & Mononen-Aaltonen, 1988 p.37). The main concept in Bakhtin's dialogic theory is that language is part of a larger whole or social context in which all possible meanings of a word interact, possibly conflict, and affect future meanings. The underlying assumptions of the theory are:

1. Meaning is produced by the relationship between one utterance and another, and by the social context in which they exist.
2. Meanings are affected, re-negotiated and reconstructed particularly through *conflicts* in ideas, viewpoints and underlying assumptions. Conflict is the energy that drives inquiry, reflection and articulation of individual viewpoints and their underlying assumptions.

3. Social interaction is essential to producing *conflict* and the social construction of new knowledge and meaning.

Bakhtin's theory of dialogism is a perspective, a point of view, a standpoint with reference to communication (Sappo & Mononen-Aaltonen, 1998). His ideas had a clear influence on Lev Vygotsky and his theories on zone of proximal development, social learning and the role of dialogue. For both Vygotsky and Bakhtin, learning is a social process. It is a dialogue with other human beings that develops one's conceptions of the world. Learning is both reproductive and productive. One can remember and repeat, but he is also able to shape and reshape his own conceptions. Consistent with the constructivist view of learning is that people construct their knowledge based on their prior knowledge and experience.

According to Bakhtin, "dialogue is a unique form of conversation with potential to improve collective inquiry processes, to produce coordinated action among collectives, and to bring about genuine social change. Dialogue creates a special environment in which the tacit, fragmented forces that guide how people think and act can begin to be perceived and inquired into, and the underlying patterns of influence can be shifted" (Isaacs, 1997).

Dialogic theory supports group discussions as an instructional practice because it emphasizes the importance of critical thought, argumentative dialogue and social interaction. Bakhtin's dialogic theory emphasizes struggle and voice, and views language as fully interactional, arising from the juxtaposition of multiple and cultural contexts. It provides a rationale for interaction among discussants and offers a social explanation of the value of conflict toward social construction of knowledge and meaning. In essence, conflict is a vital component of successful group discussions as well as group collaboration.

Research on Critical Thinking in CMC

Henri (1992) described five dimensions, as well as models and techniques, for evaluating the effects of CMC. These five dimensions are:

1. *Participative* - the quantitative examination of student usage and contributions to the group discussions.
2. *Social* - the motivations and social dynamics that affect the course of a group discussion.
3. *Interactive* - the examination of how particular events or statements lead to particular responses, providing insights into ways to improve processes and facilitate critical discussions, and the effects of CMC on processes.
4. *Cognitive* - the specific skills used in discussion that lead to critical thought and reasoning, providing a measure of quality in group discussions.
5. *Metacognitive* - statements referring to reflections and awareness of group processes and changes in personal understanding.

Some of the research on CMC and its effects on critical thinking (Newman, 1995 & 1996; Gunawardena, 1996) has investigated the *interactive* and *cognitive* dimensions of CMC. The methods used to examine these dimensions have included content analysis and interaction analysis. The following is a review of one study (Newman, 1995 & 1996) that used content analysis to examine the effects of threaded computer conferences on critical thinking. Although the study did not examine *event sequences* in group interactions and critical thinking, the study suggests directions for an interaction analysis model.

Content Analysis Model

Newman et al (1995) developed a content analysis technique to evaluate the quality of group discussions in a course taught with asynchronous computer conferencing, a tool similar to threaded bulletin boards. The purpose of the study was to develop a technique for evaluating the *cognitive dimension* and quality of group discussions, different from previous studies that examined the *participative* dimension of CMC. Content analysis was used to examine the cognitive dimension of CMC and to produce a model that could be easily used by instructors for evaluating student performance.

Newman identified the cognitive dimensions according to Garrison's (1992) five-stage model of critical thinking. The model was framed by the problem-solving process, used originally to evaluate individual distance learners, and is extended by Henri (1992) with more specific indicators of critical thinking. The models include the following five stages:

Garrison's CT stages	Henri's critical reasoning skills
1. Problem identification a triggering event arouses interest in a problem	Elementary clarification observing or studying a problem, identifying its elements, observing their linkages
2. Problem definition define problem boundaries, ends and means	In-depth clarification analyzing a problem to understand its underlying values, beliefs and assumptions
3. Problem exploration ability to see to heart of problem based on deep understanding of situation	Inference admitting or proposing an idea based on links to admittedly true propositions
4. Problem applicability evaluation of alternative solutions and new ideas	Judgment making decisions, evaluations and criticisms
5. Problem integration acting upon understanding to validate knowledge	Strategies for application of solution following a choice or decision

From these five stages, Newman developed a set of paired indicators to measure the frequencies of specific critical and non-critical skills demonstrated in discussions (Newman, 1995, p.67). Table 8 lists the paired indicators. Statements from the transcripts and audio tapes of the discussions were analyzed and scored across the list of indicators. A phrase, sentence, paragraph or message was used as a single unit of meaning when it illustrated any one of the indicators. To simplify and improve the accuracy of the coding process, ambiguous statements that could not be assigned an indicator were ignored. To compare the relative frequency of critical thinking skills between groups, Newman tallied the totals for each + and – indicator and computed a ratio, x ratio = (x+ - x-)/(x+ + x-), converting the counts to a -1 (all uncritical, all surface) to +1 (all critical, all deep) scale.

Insert Table 8 about here

Classroom Experiment and Findings

In a controlled classroom experiment using repeated measures, three groups of 10-20 students in an information society course participated in half of the course seminars in F2F meetings, and half over a computer conferencing system. In each week, some of the students had F2F seminars, while others went each day to a computer lab to participate in discussion that would continued for two weeks at a time on a computer conferencing system. The purpose of the discussions were to encourage students to think critically about contentious issues in instructional technology.

The results (see Table 9) showed that computer conference led to a deeper overall critical thinking ratio than the F2F seminars. The computer conference discussions generated more ideas

that were relevant, justified, and linked together. More linkages between contributions were likely the result of increased opportunities and time to review and address previous messages posted to the conferences. In turn, this helped students justify statements with outside knowledge and supporting arguments, and generate more evaluation and integration of group ideas. In contrast, students in the F2F discussions had to recall from memory points made earlier in the discussions, making it difficult for the F2F students to create the linkages between contributions. Transcripts of the audio tapes showed that frequent interruptions in F2F discussions made it difficult to complete and advance discussion threads.

Insert Table 9 about here

The smallest difference between the F2F and computer conference discussions was found in the number of new and creative ideas generated in discussion. In some groups, the F2F discussions generated more new ideas than the computer conferences. This may have been the result of self-censorship of new ideas before committing finger to key-board (Newman, 1996), or less spontaneity at the slower pace of asynchronous computer conferencing. This finding suggests that computer conferencing is most beneficial for more structured and less creative tasks found in other phases of critical thinking. In addition, the depth of critical thinking in problem integration, stage 5, was found to be influenced more by the subject of discussion than the computer conferencing tool.

In summary, Newman's study provides some useful indicators and a coding scheme for examining critical *and uncritical thinking* in group discussions. Using the coding scheme for content analysis, Newman was able to obtain findings to support the following assertions about CMC and its effects on critical thinking:

1. CMC increases the level of relevant contributions to a discussion
2. CMC increases the justification of ideas with supporting information and experiences
3. CMC increases linking (evaluation and integration) of ideas
4. CMC decreases the generation of new and creative ideas due to lesser spontaneity and tendency for self-censorship in written communication
5. CMC increases the need for more structured interactions

Limitations of Content Analysis

The content analysis used in Newman's study provides a quantitative measure and understanding of the types of critical thinking that occur within a group discussion. Newman did not examine the *processes* of critical thinking in the group discussions because he found that recording and measuring event sequences over time was difficult and that individuals often performed different stages of critical thinking simultaneously in concurrent threads of conversation. As a result, Newman focused on measuring the frequencies of specific cognitive operations within each of the five stages critical thinking.

Newman's quantitative measures cannot provide a description or understanding of the *processes* (or event sequences) that produce the observed results. Quantitative measures cannot tell what event sequences, interactions or processes lead to or elicit the types of cognitive operations needed for critical thinking. Furthermore, quantitative measures cannot provide any *operational definitions* of each cognitive operation in critical thinking - explicit descriptions of the process or series of acts that effect a certain outcome or define a specific cognitive operation

For example, Newman found that there was more justification of ideas with supporting information and experiences in computer conference discussions when compared with F2F

discussions. However, the study does not provide a description of the *process* in which justifications were elicited, constructed and evaluated. Without a description of the process, it is not possible to determine what types of actions, events or strategies can be used to encourage more or better use of justifications. It is also not possible to determine what types of events or actions tend to discourage or produce conditions that inhibit use of justifications. Finally, quantitative analysis of the discussions also does not provide any *operational definitions* of each cognitive operation that would allow insight into *how* each operation is performed or how it can be identified and measured.

By examining the *processes* in group discussions, we can begin to answer questions like these: Are there specific events or event sequences in the group discussions that produce more justification of arguments? Can "idea squashing" early in the process discourage contribution of additional justifications and supporting arguments? Do participants pre-maturely evaluate supporting arguments before they have sufficiently explored and identified additional arguments? Do these kinds of non-constructive events even have an impact on idea contribution and development in a threaded bulletin board discussion? What types of events or event sequences tend to encourage contributions that demonstrate critical thinking?

These types of questions can be best addressed by examining group discussion through *interaction analysis* rather than content analysis. The following is a review of one study by Gunawardena (1997) that used an interaction analysis model to not only track forms of critical thinking, but also the progression or movement between different levels of critical thinking. Some of the limitations in Newman's study are specifically addressed by Gunawardena (1997). The following is a description and discussion of Gunawardena's study and her interaction analysis model.

Interaction Analysis Model

Gunawardena (1997) reviewed the strengths and shortcomings of existing analysis techniques to find an appropriate *interaction analysis model* to examine the negotiation of meaning and co-construction of knowledge in group discussions. Like Newman, Gunawardena focused on the problem of assessing the quality of interactions in a computer-mediated conferencing environment, but approached the problem from both the "interactive" and "cognitive" dimensions of CMC. The purpose of the study was to evaluate two research questions: 1) Was knowledge constructed within the group by means of the exchanges among participants and process of social negotiation? and 2) Did individual participants change their understanding or create new personal constructions of knowledge as a result of interactions within the group?

Gunawardena began with a content analysis of transcripts from a one-week global debate on instructional technology hosted on an open Listserv emailing list for instructional technology professionals around the world. The participants in the online debate were invited from a list of 554 subscribers dedicated to discussing CMC issues in distance education. In this case, the issue of debate was posed in the extreme position and statement: "No Interaction, No Education". Debate leaders were assigned to moderate the affirmative and negative sides of the statement, to maintain a structured agenda and schedule that involved opening statements, first arguments, rebuttals, and restatements over the course of one week. A second team member reviewed and summarized each day's discussion.

Using the transcripts from the debate, Gunawardena reviewed and tested existing interaction analysis models and their underlying definition of "interaction", and tested the applicability of the models to the analysis of the debate and her research questions. The shortcomings observed in each model were used to develop a new definition of interaction and to develop a new

interaction analysis model. Observed themes and issues arising from the examination of the transcripts were used to shape a new interaction analysis model. In the end, the interaction analysis model was applied to examining the debate itself. The following is Gunawardena's observations gained from testing the various analysis models on the email discussions.

Analysis Models Reviewed

Gunawardena reviewed and tested analysis models associated with each dimension of CMC proposed by Henri (1992), and identified various shortcomings and problems in each approach. What was most problematic was establishing a *unit of analysis*, the first step in conducting any content or interaction analysis. To examine the cognitive dimension of CMC, Henri (1992) suggested dividing messages into units of meaning because a written message often contains more than one idea. Gunawardena found this approach to be difficult and complex because it generated overly complicated message maps (graphical representations of linked messages) intended to show the inter-relationships between units of meaning. Gunawardena also found that the essence of meaning was lost once messages were divided into separate units of meaning. She believed that separating messages into different units of meaning resulted in an analysis that only generated "superficial" results that reveal only the presence and frequency of CT skills (Gunawardena, 1997 p.406).

To examine the interactive dimension of CMC, Henri (1992) and Levin et al. (1990) suggested a technique for *mapping threads and linkages* between messages to examine patterns of connections among messages. The technique has been used to identify monologic from interactive exchanges, and also to identify influential from non-influential messages. However, Gunawardena made the following observations while testing this technique on the transcripts of the online debate.

> "This kind of analysis merely describes the pattern of connection among messages, and not the entire gestalt to which messages contribute. While truly monologic messages occasionally do appear, … this is the exception rather than the rule: generally speaking all the messages in a conference are linked … even if they are not readily apparent; We are all capable of holding multiple considerations, or threads of argument, in mind as we examine a subject … All respond to each other and to the emerging totality of constructed knowledge, regardless of whether a message can be identified as responding to another specific message or group of messages ... Thus, Henri's interpretation of interaction is mechanistic and descriptive, and not central to the construction of knowledge … The crucial importance of interaction for the social construction of knowledge…cannot be overemphasized. Interaction is the process through which negotiation of meaning and co-creation of knowledge occurs" (p. 407).

Re-defining Interaction

Because message mapping was so problematic, Gunawardena proposed a different model or definition of interaction using a metaphor to describe the process of shared construction of knowledge. A patchwork quilt block is used to represent the process, in which small pieces of cloth are assembled or contributed by each participant piece by piece into a patchwork of colorful patterns. Working from the inside-out, the sharing of ideas within a topic forms the center of the patchwork. Movement from stage 1 through stage 5 of Garrison's phases of CT is represented by the concentric rings that form around the center of the patchwork, eventually leading to a complete formation. "The process by which the contributions are fitted together is interaction, and the pattern which emerges at the end, when the entire gestalt of accumulated

interaction is viewed, is the newly-created knowledge or meaning... Interaction is the essential process of putting together the pieces in the co-creation of knowledge" (Gunawardena, 1997 p. 411).

Based on this patchwork metaphor and review of the discussion transcripts, a new interaction analysis model was outlined, consisting of five phases of knowledge co-construction that mirror Garrison's stages of CT. These five phases are: Sharing/Comparing, Dissonance, Negotiation/Co-construction, Testing Tentative Constructions, and Statement/Application of Newly-Constructed Knowledge. More specific classifications of cognitive skills and operations were added within each phase, based on the interactions observed in the transcripts. Table 1 presents Gunawardena's interaction analysis model. This model was designed to assess the exchanges made between group members, and how these exchanges moved from the lower to the higher phases of CT. If movement from one phase to the next could be documented, then Gunawardena would succeed in showing that knowledge was constructed by the process of social negotiation.

Results of Study

The study found clear indications that discussions advanced from Phase I, through Phase II, and to Phase III. The discussions were fairly high in quality, demonstrating all five Phases of CT, with the majority of postings and references to resources occurred at Phases II and III, exploration of dissonance or inconsistency, and the negotiation of meaning and co-construction of knowledge. What was notable was that contributions to Phase III and higher Phases of IV and V were inhibited by the moderator's insistence to maintain the debate format in trying to keep the two sides apart, and discouraging compromise, idea synthesis and integration. Nevertheless, movements through the phases were observed not only in the transcripts, but also in the daily

group summaries. Movement through the phases generally progressed in sequence from the lower to the higher mental functions. In addition, movement to one and sometimes three phases were also found within individual messages. Overall, the interaction analysis model was able to determine that knowledge construction occurred within groups by means of the exchanges among participants.

To determine whether the discussions helped to change personal constructions of knowledge, the interaction analysis model also included meta-cognitive statements illustrating a participant's understanding of knowledge or ways of thinking (cognitive schema), and how they have changed as a result of the conference interaction. Review of the transcripts revealed indications of such changes, particularly excerpts that demonstrated the integration of previous contributions from other participants in constructing new and personal positions or meanings on the debated issue.

In summary, Gunawardena developed an interaction analysis model based on Garrison's five-stage process of critical thinking. With the model, discussions from an email list were coded and then counted and analyzed to evaluate movement from low to higher phases of critical thinking. Findings from the study support the following conclusions:

1. An interaction analysis model can be developed and used to demonstrate and assess the quality of critical thinking in online group discussions, as well as examine progressions from low to high phases of critical thinking.
2. Critical thinking in online group discussions can be the direct result of exchanges between participants.
3. Interactions in group discussion via CMC can and do result in changes in personal constructions of knowledge.

Main Discussion

The following discussion outlines the purpose of this study and the arguments for developing a new interaction analysis model for examining the *processes* of critical thinking in threaded group discussions. The discussion outlines the purpose and the arguments by addressing the following:

1. The limitations and failures of previous studies to examine the processes of critical thinking in group discussions.

2. How this study addressed the challenges faced in previous studies with the development of a new interaction analysis model.

3. The potential research questions that can be addressed with the interaction analysis model developed in this study.

Analyzing Message Links and Event Sequences

Henri (1992) proposed that CMC can be examined in terms of *interactions* among participants in discussions. This involves the analysis of *event sequences* to identify how events elicit different types of responses. Generally speaking, it involves the examination of the processes or series of acts that produce the desired cognitive operations necessary for critical thinking. This includes the analysis of event sequences spanning over linked messages between two or more participants as well as event sequences that occur within an individual participant's message. Both Newman and Gunawardena describe in their studies their attempts to examine this

dimension of CMC, but both encountered major challenges that limited their ability to study the processes of critical thinking in group discussions.

Previous Attempts to Analyze Event Sequences

Newman reported the difficulties in recording links and sequences between participants' messages in his analysis of discussions in a computer conference. He observed that participants often addressed multiple and concurrent discussion threads within a single message. As a result, Newman chose to only analyze and document the frequency of cognitive operations in a computer conference discussion using content analysis (versus interaction analysis). Newman's main purpose was to develop a coding scheme that was easy to use by teachers to evaluate the quality of student discussions.

Gunawardena also found it difficult to map the links and sequences between messages. She argued that the analysis of the links between messages was too complex and too mechanistic. She believed that the analysis of event sequences (or message maps) would not provide useful insights into the process of negotiation and knowledge construction. As a result, Gunawardena performed a simplified analysis to document the process or progression from lower to higher phases of critical thinking operations by limiting the analysis to *within individual* messages (*not* between participants' messages). No analysis was done on transitions between phases of critical thinking occurring between linked messages.

The analysis of event sequences between messages can examine the processes and interactions that occur between participants, and how these interactions lead to critical thinking. For example, Gunawardena found that critical thinking was more frequent when students disagreed on an issue, and that cognitive conflict tended to elicit a progression from low to higher phases of critical thinking. Because event sequences were not examined in

Gunawardena's study, her findings did not describe the *processes* in which conflict and disagreements occur and how they elicit critical thinking in subsequent events. By including the analysis of message links and event sequences, it is possible to examine the most "influential messages" (Henri, 1992) or event sequences that promote critical thinking.

Analyzing Event Sequence in Threaded Discussions

Although Newman and Gunawardena believed that analyzing the relationships between messages was too complex, examining event sequences between linked messages in a *threaded bulletin board* is more practical and is therefore possible. Threaded bulletin boards are designed to make the links between messages and replies explicit so that each topic of discussion is clearly delineated from other topics of discussion. Other CMC tools like electronic email, as studied by Gunawardena, do not provide the necessary structures to make these links explicit. As a result, analyzing events sequences in *non-threaded* discussions is more difficult if not impossible. The analysis of threaded discussions will enable close examination of the processes in student interactions and critical thinking.

The Challenges of Using Units of Meaning

To develop an interaction analysis model, Gunawardena used the *unit of meaning* (as suggested by Henri, 1992) as the unit of analysis in her initial attempts to code email discussions. A unit of meaning was equivalent to a single sentence or even part of a sentence that expressed a single meaning. Each unit of meaning was then classified and coded by category. However, the attempt to code by units of meaning led to the following observation and decision:

> "If a message was broken down into units of meaning and each unit analyzed separately, we would not be able to describe the process by which arguments were advanced, building upon each other to support or refute propositions and negotiate meaning. We therefore decided to use a message [one or more sentences] as a unit of analysis, which taken as a whole embodies a participant's cognitive activity and contribution to the construction of knowledge, and code each message according to the phases and operations [in the model]." (Gunawardena 1997, p.416)

In choosing to use the *message* as the unit of analysis, however, Gunawardena's study did not take into account the multiple events and critical thinking operations that often occur within the messages. The impact of this decision must have had some impact on the accuracy of her findings. When using units of meaning as the unit of analysis, on the other hand, it is possible to identify the specific events and/or *sets of events* within individual messages and between threaded messages. As a result, coding discussions by *units of meaning* would provide a more accurate description of the events in the critical thinking process in group discussions.

Addressing the Challenges of Using Units of Meaning

In this study, the *unit of meaning* was used as the unit of analysis and various methods were developed to address the challenges reported by Gunawardena. Methods were developed specifically to examine event sequences between threaded messages that could account for *both* the cognitive activity of the message *as a whole* and the individual and separate cognitive activities *within* the messages. Specifically, the cognitive activity of the message as a whole was examined by analyzing the events observed in the titles of messages. These message-title events were then examined together with events from within the texts of the messages.

Using this approach, this study developed a coding scheme to code all events observed in threaded discussions by units of meaning. The methods developed in this study, along with the techniques of sequential analysis prescribed by Bakemann & Gottman (1997), were then used to analyze the coded discussions for patterns in events and event sequences. The sequential analysis of events provided statistical probabilities on the types of events that tend to follow one another in sequence. This sequential data presented a concrete measure and description of the interactions that occurred in threaded group discussions with explanation on how these interactions contribute to critical thinking.

Summary & Implications for Future Research

The purpose of this study was to expand on the previous research on computer-mediated group discussions and critical thinking by specifically examining *event sequences* in group interactions. To examine event sequences, new methods and an interaction analysis model were developed to address the challenges faced in previous studies and previous attempts to analyze event sequences in online discussions - particularly threaded discussions. The interaction analysis model and methods developed and tested in this study present opportunities to explore questions concerning the processes of group discussions and critical thinking in terms of event sequences and their statistical probabilities, and to explore these processes at a level of detail that no other study has yet accomplished. For example, what is the probability that a stated argument is followed by a disagreement and how does that compare with the probability of a stated argument followed by an agreement? Most of all, what are the possible outcomes following each of these two interactions? How do the outcomes following each interaction differ, and what are the probabilities of each outcome?

Achieving this level of analysis by examining event sequences will lay the foundation for further research and development in communication technologies to support group discussion as well as collaborative work. For example, the methods developed in this study provides a framework for evaluating the effects of different instructional designs and interventions intended to facilitate discussions. This might include interventions such as grouping students by positions on an issue, grouping by gender, and allowing anonymous versus non-anonymous participation. It will provide a framework for evaluating how different communication technologies (e.g. email, threaded bulletin boards, IRC, F2F) affect communication processes and outcomes. Last of all, the methods used in this study can be developed into tools to assist students and instructors in monitoring, diagnosing and directing discussions, and to present alternative strategies for performance assessments of group discussions that can evaluate both process and outcomes.

Chapter 3 - Methods

This chapter describes the methods and procedures of a pilot study in which the primary purpose was to develop a coding scheme and to test materials and procedures. Following the review of the pilot study are the methods and procedures of the main study.

Pilot Study

The objective of the pilot study was to create a coding scheme for classifying events with *units of meaning* as the unit of analysis. In the pilot study, graduate students participated in group discussions on a threaded bulletin board. Transcripts from the discussions were reviewed by content analysis to establish event categories at the specified unit of analysis. The end result was a coding scheme that could be used to examine discussions and critical thinking using sequential analysis.

Subjects

Thirty-eight MBA students from a graduate course, "Ethics and Social Responsibility in Business" - General Business 710, participated in the pilot study under the direction of Professor Laura Hartman, the course instructor. This 8-week course examined the moral, ethical and legal bases of corporate decision-making and other business activities, using critical ethical analysis. The purpose of the course is to educate the student regarding the legal, moral and ethical issues in business, to create a sensitivity to the consequences of one's decisions, as well as to train the student in critical thinking and moral/ethical analysis.

Instructional Assignment

Students participated in online group discussions on four ethical dilemmas. Each ethical dilemma was researched and presented by the students in a *team debate*. In the team debates, students were divided into eight teams, with each team assigned to a position that advocated or opposed one of the four ethical issues. Each team had the responsibility to develop and advocate a position supporting or opposing one of the following debate propositions:

1. Employers should have the right to electronically monitor employees as much as they choose (including telephone, email, Web use, videotaping performance and so on).
2. Corporate drug testing of both current and prospective employees is ethical.
3. It is unethical for mutual fund managers to trade for their personal accounts in individual stocks held by the funds they manage.
4. The U.S. government should develop international labor standards that would subject multinational organizations to trade sanctions if the standards are not met by the firm or any of its suppliers.

During each of the four class sessions in weeks 6 and 7 (in an 8-week course), two teams presented and defended their positions in an F2F oral debate. The team advocating the premise presented a 10-minute statement of the team's proposition in class, followed by a 10-minute presentation by the opposing team. This was then followed by a brief rebuttal by the advocating team. At the time of the debates, each team also submitted a 5-7 page (double-spaced) paper and class handout detailing the team's position on the proposition with proper documentation and/or supporting arguments.

Grading Participation

Participation in the group discussions was 25% of the *course participation* grade (or 5% of the total course grade). Grades were assigned by the course instructor, and were based on individual participation and group performance scored on a 4-point scale for each of the four discussions. Again, see Appendix A for more details.

Grading of Reports and Oral Debates

The written reports and oral debate was 20% of the course grade and was assessed on the basis of research beyond the readings, clarity, accuracy, comprehensiveness and persuasiveness. Individual grades for the project were based on the quality of the oral group presentation as a whole (35%), quality of the written report (35%), and peer evaluations on adherence to group agreements, rules, expectations and active contributions to written project and oral presentations (30%).

Assigning Students to Debate Teams

Students were *randomly* assigned to debate teams, with 5 to 6 students assigned to each team, forming a total of eight teams in all. An alternative method to assigning students to the teams was considered in which students would have been grouped according to individual stance on a position in order to maximize participation in the debates and online group discussions. However, the course instructor felt strongly that her students needed to explore and engage in alternative viewpoints in order to avoid entrenching students in prior beliefs. In addition, the instructor was concerned that students might complain about their assigned topics if matches could not be fully achieved.

Bulletin Board Discussions

Students participated in a threaded bulletin board discussion on the first three topics of debate. See example of threaded discussion in Appendix F. The fourth topic was not discussed due to time constraints. Each team debate was followed immediately with an online group discussion outside of class. Each of the debated topics were open for discussion for one week. The purpose of the group discussions was to reflect on insights gained from the debate, to share students' personal views and knowledge, to explore multiple viewpoints and contexts, and to apply arguments and viewpoints toward a joint recommendation on how to address the ethical issue at hand. In Appendix A is a copy of the student handout with details and instructions on the group discussions.

Assigning Students to Discussion Groups

Students from each debate team were evenly distributed across all four discussion groups so that each discussion group consisted of at least one member that researched, defended, and presented a particular side of an ethical debate. This was done so that each discussion group could draw on the research and arguments established in the team debates. Students remained in the same groups for all three topics of discussion. In the end, each group consisted of eight to nine students. Groups were also balanced by gender and computer experience, which was ascertained through a student questionnaire at the beginning of the course (see Appendix CC).

Instructional Materials

Students were provided a handout containing instructions and guidelines pertaining to the group discussions. See appendices A through D. In Appendix A is a description of the purpose of

the group discussions, with references to an example bulletin board discussion on the Web, grading criteria, and beginning and due dates.

Appendix B provided students an example bulletin board containing an example that highlighted some guidelines and rules to help maintain organized discussions.

Appendix C listed the roles students can perform to contribute to a group discussion and to think critically about the issues under discussion. The roles outlined in the handout were based on Gunawardena's interaction analysis model (1997), with the addition of strategies for managing the group and a list of non-constructive behaviors.

Appendix D presented a short list of guidelines and rules on how to post contributions to the bulletin board, and again was geared specifically to helping students maintain an organized discussion. Included on the page is a link to the bulletin board where students are to post their messages, including information on how to request help and how to use the bulletin board on the Web.

Informed Consent

Students completed a human subject consent form (Appendix E) detailing the expectations and guidelines for participating in the study. The consent form was presented in class on the day of the first oral debate to inform students that participation in the group discussions was completely voluntary, and that students could withdraw from the study at any time. The decision not to participate would in no way affect their grade in the course. If a student decided not to participate, that student was required to write a graded paper on the topics discussed in the group

discussions as a substitute assignment. For more details on the terms of the consent form, see Appendix E.

The Discussion Transcripts

To develop a coding scheme with *units of meaning* as the unit of analysis, the first discussion assignment (on the ethics of electronic monitoring) was selected for content analysis. Only the first of three discussions was selected for analysis in order to constrain the amount of data that could be feasibly analyzed. The first of three discussion was also selected because it displayed the most depth and because the discussions were more extensive than the subsequent two discussions. The differences in depth of discussion could be partly due to the degree of contention in the topics discussed, or it could also be due to the timing of the discussions as students approached the last week of the semester.

Group #1 produced a discussion (see Appendix F) that consisted of eight different discussion threads. The example shows how each thread in the discussion generated from as many as 0 to 9 responses. Most threads in the discussion elicited responses from other students. The example also illustrates instances where the authors of a thread in turn responded back to the replies of other participants. As a result, most of the messages posted in Group 1 were responses to previously posted messages (29 of 37 messages).

The other three groups generated discussions that were similar in structure and organization, but were not quite as active as Group 1. Group 1 was particularly active because one student was anticipating her absence in the last two of the four assigned discussions. As a result, this student participated heavily in the first two discussions to make up for the absence. The increased participation helped to produce longer and more in-depth discussion threads. Group 1 provided a rich discussion for analyzing student interactions and event sequences. Overall, the four groups

generated 8 to 10 threads per discussion. The number of messages posted in a group discussion ranged from as few as 13 messages to as many as 37 messages.

Coding the Transcripts

Transcripts from each of the four discussion groups were reviewed using content analysis to determine the event categories for the coding scheme. The primary goal was to establish categories that can describe and classify each *unit of meaning* observed in the discussions. The unit of meaning could be no longer than a single sentence, and could be as short as a single phrase within a sentence, or even a single word.

As each discussion was reviewed, event categories (see Appendix H) were created to classify each observed unit of meaning. During each reading of the transcripts, categories were either revised, collapsed or eliminated or new categories were created. At the same time, each unit of meaning in the discussion transcripts were assigned a code. Appendix H illustrates an example of a coded discussion from Group 1, thread #6. After many iterations of this process, a total of 752 units of meaning were coded and classified from the 93 messages posted in the four groups.

To examine and test the consistency of the categories and assigned codings, the coded transcripts were entered into a spreadsheet, and then sorted by code. Appendix I shows an example of a transcript sorted and viewed by event category. Each unit of meaning was reviewed within each category to determine overall match and consistency with similarly coded units. Areas where ambiguous codings were found were opportunities to refine the definitions of each code, and to assign new or different codes to anomalies.

The Coding Scheme

A total of 20 event categories were identified and included in the coding scheme. Appendix G displays all 20 categories and their definitions. Appendices I through BB show multiple examples of student contributions for each of the 20 different codes. All 752 units of meaning found in the group discussions were classified into one and only one of the 20 codes in the coding scheme.

Because this coding scheme was developed using the *unit of meaning* as the unit of analysis, the coding scheme identified events that were more discrete than the codes used in Gunawardena's interaction model. This is because in Gunawardena's model was based on the message as the unit of analysis. For example, one category in Gunawardena's model is the "Answering of questions to clarify details of statements". This operation must involve at least two or more events occurring in an event sequence because it is the result of an interaction between two participants. The coding scheme used in this study provides codes for events that were discrete enough to reveal event sequences for this particular operation. The operation might include the series of events such as Observation → Ask → Experience, in which one participant states an observation, another participant responds to it by asking a question, and the former participant replies back by offering a personal experience to support initial statements.

Using this approach, more discrete codes in the coding scheme allows for the sequential analysis and the examination of specific event sequences that produce some of the critical thinking operations outlined in Gunawardena's interaction model. Furthermore, the codes enable a sequence analysis that can determine what events or event sequences tend to elicit more critical thinking.

The Main Study

The following is a description of the methods and procedures used in the main study. The coding scheme developed in the pilot was modified to address coding errors in an inter-rater reliability test. As a result, a modified version of the coding scheme was used in the main study to analyze events and event sequences in threaded bulletin board discussions.

Procedures

Subjects

The student participants in the study were 34 graduates students from a MBA course on Ethics in Business – General Business 710. Like the pilot study (but taught under a different instructor), this 8-week course examined the moral, ethical and legal bases of corporate decision-making and other business activities, using critical ethical analysis. The purpose of the course was to educate the student regarding the legal, moral and ethical issues in business, to create a sensitivity to the consequences of one's decisions, as well as to train the student in critical thinking and moral/ethical analysis.

Pre-survey for Assigning Students to Discussion Groups

At the beginning of the course, students completed a questionnaire (see Appendix EE) to provide information for assigning them to one of four discussion groups (eight or nine students per group). Completed with the questionnaire was a human subjects consent form (see Appendix E). In the questionnaire, students were asked to identify their position on a list of ethical issues. Their reported positions were used as the primary criteria for grouping students to ensure the

number of students on opposing sides were balanced within groups. The groups also were balanced in terms of gender and experience with bulletin boards and the Internet.

Group Discussions

In this course, students were required to participate in only one group discussion on an assigned discussion topic. Specific readings were assigned to each issue under discussion. Three ethical issues were selected by the instructor for discussion based on the results of the student pre-survey. The issues that drew the largest split between those opposed and those in favor were used for the group discussions and response papers. The purpose for selecting the issues in this way was to ensure that there were equal numbers of students on opposing sides in each discussion group.

Students were required to post at least one to two contributions per week to their discussion group. At least one contributions had to be a direct reply to another students' messages to encourage deeper discussion. Students had a period of four weeks to contribute to their discussion. The purpose of the group discussions was to provide students the opportunity to share, identify, explore, compare, and evaluate diverse viewpoints, experiences, and supporting arguments on the ethical issues. Students were encouraged to share and explore in depth the range of viewpoints, positions and differences, along with supporting arguments from experiences or existing literature/research, and most of all, to critically evaluate, compare and contrast viewpoints and arguments. Details on specific requirements are explained in the student handout in Appendix DD.

Data & Measures

Group Discussions

The data collected and analyzed in this study were transcripts from all four group discussions hosted on a threaded bulletin board. Figure 1 is an illustration of the web-based bulletin board used in both the main study and the pilot study. The bulletin board selected for this study is hosted at http://network544.com on the World Wide Web (WWW). The discussions were downloaded and archived into transcripts for review and coding. Names were removed from the transcripts and replaced with student initials to protect student identities.

Student Post-survey

Appendix FF lists the questions presented in the student post-survey to determine if students felt that the bulletin boards helped or didn't help them to think critically about the issues. The survey also asked if students felt comfortable expressing and discussing differences in views and opinions on the online discussions. A question was included to identify what barriers inhibited their ability to use the bulletin board effectively in the group discussions.

Coding Data

The coding scheme displayed in Appendix G was used to code each group discussion. The procedures for coding the discussions were similar to the procedures outlined in the pilot study. When coding each transcript from the group discussions, messages were parsed into separate units of meaning. This unit of meaning was a single act defined as a single, uninterrupted verbalization, typed into a computer message that meaningfully fits into one of the coding categories in the coding scheme. Each unit of meaning could consist of a full sentence, a part of a sentence of phrase, or even a single word. Appendix H illustrates how messages were parsed and

assigned individual codes. Included with each coded was the participant identification, group assignment, and unit number.

For both the researcher and the second observer, every parsed unit was assigned to one and only one code. In cases where a parsed unit could not be clearly assigned a specific code, the unit was marked for later review. These marked units were reviewed and discussed between the researcher and second observer to determine if there was a more suitable code in the coding scheme to assign each anomalous unit. If no match was determined, the coders together constructed new codes for the coding scheme to accommodate the anomalous units.

Data Analysis

Sequential analysis provided a powerful means to examine group interactions and the processes of critical thinking in terms of events and event sequences. This study used the techniques established by Bakeman & Gottman (1997) to examine event frequencies, rates, probabilities and percentages, event sequences, conditional and transitional probabilities. This study began with a qualitative analysis of observed events (as described in focus questions 1 & 2) to search, identify and document events and event sequences observed in group discussions and associated with critical thinking. Examining the frequency and probabilities of events *and* event sequences provided supplemental but useful information to these qualitative findings.

The analysis of conditional probabilities, however, was useful for addressing the third focus question addressed in this study - how often are specific events or event sequences followed by instances of critical thinking, particularly events sequences occurring over interchanges between participants? The transitional probabilities between events provided a quantitative measure on how often specific events or events sequences were followed by other events, particularly critical thinking events. In this study, transitional probabilities were examined to determine what events

or event sequences (especially exchanges between students) were effective in promoting more critical thinking. Details on the analysis are described below.

Identifying & Coding Event Sequences. The index of messages displayed in the threaded bulletin boards (see example in Appendix F) were used to identify the direct linkages between messages. From the linked messages, event sequences between participants' exchanges were mapped and recorded. All the observed event sequences were recorded, and then reviewed to identify patterns in the observed event sequences.

For example, a student states an opinion and in response another student states an opposing opinion. This sequence of events would be recorded as OPINION → OPINION. Event sequences such as these were analyzed to identify re-occurring patterns in the student interactions. The most common patterns of event sequences were further analyzed to determine what other events followed. For each pattern of event sequences, the message contents in the event sequence were analyzed to determine if any critical thinking operations were associated with specific events or event sequences.

Frequencies & Rates. The events observed in the coding of the discussion transcripts were counted to obtain event frequencies and event rates. The frequencies were counted for each of the 20 event categories listed in the coding scheme in Appendix G. Each observed event sequence was also counted to obtain frequencies for event pairs and three-event sequences. The frequencies of events were then used to compute event rates or percentages to determine event distributions. Because all coded events were mutually exclusive and exhaustive, the frequencies for each event was divided by the total number of observed events to determine how much or how often each type of event was observed among all observed events.

Transitional Probabilities. A transitional probability is the probability with which a particular event occurred, relative to another given event (Bakeman & Gottman, 1997, pp. 95-99). For every event, a transitional probability was computed to determine how often another event follows. For example, a transitional probability was computed to determine the probability in which a stated opinion was followed immediately by a reply expressing disagreement, OPINION → DISAGREE.

The sequential analysis in this study also included examination of event *chains* (sequences of three events). Adding to the previous example of the event pair OPINION → OPINION, the third response might follow this interaction with evidence to support one or both of the stated opinions, OPINION → OPINION → ARGUMENTS. For specific event pairs, transitional probabilities were computed to determine how this event pair OPINION → OPINION was followed by Arguments as well as other event categories. Because the number of possible event *chains* was large, this analysis was confined to event pairs that were most relevant to the objectives of the study - examining the effects of conflict and disagreements on the critical thinking process.

Additional Revisions to Coding Scheme

Coding the Discussions

While training the second observer, unclear and ambiguous portions of the coding scheme were identified. Modifications were made before a sample discussion was coded by both the researcher and second observer. After the modifications were discussed by the researcher and second observer, a transcript of a discussion from one group discussion was coded to establish inter-rater reliability. The results of the first coding indicated that the coding scheme and the coding procedures required additional modifications. In this first attempt at coding, the second

observer parsed and coded a total of 550 units of meaning, where as the experimenter parsed and coded only 440 units - 110 fewer units. Given that there were 324 lines to code in the printed transcripts, 96 (or 29.6%) of the lines were parsed differently. For the units that were marked by both researcher and second observer, there was only a 52.7% agreement.

Modifying the Coding Scheme

The observers reviewed and discussed the differences in assigned codes and parsing of units. The sources of disagreement were identified by using an agreement or "confusion" matrix (Bakemann & Gottman, 1997 p.62) in which tallies on the diagonal indicate agreement between both observers, whereas tallies off the diagonal identify areas of disagreement. After discussing the sources of disagreements, the researcher made additional modifications to the coding scheme and parsing rules. In making the modifications, several principles were kept in mind:

1. All modifications made to the coding scheme had to address specific disagreements between observers in the first trial coding. The first task was to provide example codings for each code category. The second, refine definitions and provide keywords to look for in each statement.
2. Any changes had to make an attempt to simplify the coding scheme, rather than increase its complexity. It was more important to clarify code definitions to make them more distinctive and easier to discriminate than to add additional codes.
3. Any changes had to serve the primary objectives of the study (examining critical thinking) and not objective beyond the study.

Coding Scheme and Modifications

The complete coding manual is in Appendix GG. Below is a summary of the modifications made to the coding scheme and procedures based on the disagreements observed in the first trial coding:

1. *Parsing rules* - Because 29.6% of the lines in the transcript were parsed differently by the coders, the parsing rules were expanded, clarified and defined in greater detail. Also specific examples of parsed data were included with the instructions. Rules were included on how to parse compound sentences, clauses (e.g. containing if-then clauses), embedded clauses (including statements in parenthesis), use of headings for bulleted lists, and bulleted items in a list.
2. *Coded examples* - For each code category, specific examples of coded statements were included. These examples were taken from the transcript coded in the first trial.
3. *Code units independently* - Emphasis was placed on coding units *independently* of previous units. This was emphasized in order to prevent the coding of statements that re-visit statements from earlier messages. For example, “You said that this employee has a good work record” must not be coded as SUMMARY but as a FACT.
4. *Coding levels and event categories* - The event categories were re-organized into hierarchical groups like the event categories in Gunawardena’s interaction model (see Table 1). For example, the codes EXPERIENCE, LITERATURE, DATA were listed in adjacent order as a form of supporting arguments.
5. *Arguments* - A new event category ARGUMENT was added to identify and categorize statements that were posed more as arguments in support or against the position. This category was added to help distinguish events as opinions.

6. *Questions versus Ask* - There was confusion and disagreement about the use of ASK and QUESTION. In addition, the researcher realized that both codes did not describe the function of a statement. For example, “Does anyone agree with me?” was coded *both* as ASK and QUESTION. To correct this, both codes ASK and QUESTION were eliminated and replaced with a code tag "?" for coding statements posed as questions. For example, AGREE? = “Does anyone agree with me?”, OPINION? = “Do we not all deserve a second chance?”
7. *Condition* - The code CONDITION was eliminated to simplify the rules for parsing if-then statements. For example, “If someone is an alcoholic, he should receive help for it” was simply coded as REACTION.

   REACTION? = “If you found out he was doing drugs, what would you do?”
8. *Personal* - This code was eliminated because it was not observed in the discussions. It was intended to mark statements like “That example really makes me mad” - statements concerning personal feelings and emotional reaction. This event category was collapsed with BELIEFS, assuming that emotional reactions could be interpreted as statements in favor or against an issue.
9. *Procedural and Reflect* - These to event categories were collapsed and re-labeled as COMMENTS to count meta-cognitive statements that mad explicit reference to specific events in the coding scheme. It was also used to count meta-cognitive statements that expressed an individual’s train of thought. For example, “I’ll have to think about that” or “Let me see…”

Coding Scheme and Category Definitions

The final coding scheme (see Table 10) consisted of 12 event categories - position, agree, disagree, argument, personal experiences, literature, formal data, hypothetical actions and choices,

evaluate, summary, negotiate, and process comments. The event categories were defined, accompanied with examples, and are listed in order from lower to higher levels of critical thinking based on existing models of critical thinking (Garrison, 1992; Gunawardena, 1996; Henri, 1992). Note + and - tags were included with the Position event category to identify supporting from opposing position statements. In addition, the "?" tag was included to identify statements posed as questions or as requests. Although the tags were included in the coding scheme and the inter-rater reliability tests, the tags were *not* used in the final data analysis in order to minimize the number of event categories and maximize the power of the analysis.

Insert Table 10 about here

Inter-coder Reliability

To establish the inter-rater reliability for the coding scheme, the second observer was re-trained by the experimenter using data from the pilot test. Both the experimenter and the second observer referred to the coding manual to code a sample of the group discussions - Group 3's discussions on corporate drug testing. The level of agreement was 84.6%, and the estimated Cohen's Kappa Coefficient of reliability was .766 - an excellent level of inter-rater reliability According to Bakemann & Gottman (1997 p.66), a coefficient of .40 to .60 is considered fair, .60 to .75 as good, and over .75 as excellent reliability. This coefficient takes into consideration the expected probabilities of agreement and disagreement given the number of codes within the coding scheme. The squared variance was 0.012 and z-score = 65.17 indicated that the reliability score was statistically significant.

Recording Data & Coding Procedures

Data Entry Procedures

Line numbers. Table 11 contains an excerpt of the Microsoft Excel spreadsheet used to parse, code and record the discussion transcripts and related data. Column 1 contains the *line numbers* from beginning to end of each discussion transcript. The alphanumeric characters "A" through "D" were included as prefixes to the line numbers to identify group membership. Each discussion transcript for each of the four discussion groups was coded on a separate spreadsheet.

Insert Table 11 about here

Message and texts. Column 2 of Table 11 contains the contents of the messages posted to the group discussions. The group and topic of discussion were entered in the first line of column 2 for each coding sheet. Lines A2 to A9 contain the contents of the first message in the discussion. This message, like all messages, consists of the message *title* (line A2), the message *author* (line A3), the message *text* (lines A4-A8), and the date and time of posting (line A9). The message texts in column 2 were parsed into units of meaning based on parsing rules described in the coding manual. The symbol "//" was inserted points in the text (see line A15 for example) to separate individual units of meaning. Each unit of meaning was reserved a separate line in the code sheet so codes could be recorded across from each recorded unit. All texts were parsed *before* units were coded.

Codes. Column 3 of Table 11 contains the *codes* assigned to each unit listed in column 2 - to the immediate right of the corresponding unit. For example, the message title in line A2 was coded as a position statement (P+) in favor of mandatory drug testing. The code P+ was entered into line A2 in column 3. Note that the codes entered into column 3 were abbreviated codes in

order to facilitate coding and data entry. The abbreviated codes and their represented event categories were described earlier in the section on coding scheme and category definitions.

Thread levels. Column 4 in Table 11 holds numerical values for *thread level*, which identifies the location of a given message in relationship to the first message initiating a topic of discussion. For example, a thread level of 0 was recorded in column 4 of line A2 to denote that the message (starting at line A2 and ending at line A8) was the first and initial message in the discussion. The end of every message was marked by the time and date of posting as in line A9. The message starting at A12 (and ending at A19) was recorded at thread level 1 (incremented by 1 from the thread level of the previous responded message) to denote that the message was posted as an *immediate* reply to the previous message posted at thread level 0. Similarly, thread level 2 was assigned to the message starting at A23 to denote that the message was posted as an immediate reply to the previous message (at A12) posted at thread level 1. The three messages together form a *discussion thread*. Every new *discussion thread* (or topic of discussion) was marked by a message at thread level 0.

Threaded responses. A unique characteristic of threaded bulletin boards is that a message can receive not just one direct reply, but one, two or more direct replies. Each direct reply or *threaded response* to a message spawns a new sub-topic for discussion and is displayed at the same thread level. Table 12 illustrates a message (at line A36) that elicited three direct responses shown in lines A54, A167 and A176. All three responses are listed at thread level 1 in response to message A36 listed at thread level 0. As a rule, the thread levels of one message and responding messages immediately following it differs by exactly 1 thread level.

Insert Table 12 about here

Compiling the Data for Sequential Analysis

In this study, Visual Basic programs were written and executed in Microsoft Excel to perform various sequence analyses. To execute the programs more quickly and efficiently, algorithms were used to compile and reduce the base data (see Table 11) to a simpler data format. Table 12 illustrates a sample of the data compiled from Group 1's coding sheet and first discussion thread. In the compiled data, *only the titles of messages*, their assigned codes, and thread levels are entered into column 2. Units in the message texts and their codes were reduced to a string of codes entered into column 5 of the *compiled* coding sheet. Each string contained the codes assigned to all units from *both* the title and units of a message, and were listed in their natural order of occurrence. This data compilation approach not only made computations and analysis more efficient, but also provided a summary view of the discussion threads and message structures for visual exploration and manual analysis.

Procedures for Data Analysis

Focus Questions Reviewed

This study focused on the following research questions:

1) What types of *events* (e.g. contributions from participants) can be observed in threaded bulletin board discussions?

2) What *event sequences* can be observed in these discussions? And what event sequences illustrate good and poor critical thinking?

3) How often are specific events or event sequences followed by instances of critical thinking, particularly events sequences occurring over interchanges between participants?

Challenges in Analyzing Event Sequences in Threaded Discussions

One of the challenges in analyzing event sequences in threaded discussions is that more often than not, messages contain lengthy prose consisting of continuous series of events and units of meaning. In contrast, F2F discussions often contain short conversational turns with fewer and more discrete units of meaning. The challenge lies in how to analyze specific event-to-event sequences among *discussion participants* (in order to examine group interaction) when individual messages consist of long sequences of events (prone to vary across individual differences in styles of writing and argumentation) and not single discrete events. As a result, various methods were formulated for conducting a sequential analysis of events in the threaded discussions. Before reviewing the methods used in this study, the structures of threaded discussions and their terminology must be described.

Definition of Structures in Threaded Discussions

The technical elements and structures of a threaded discussion, as illustrated in Table 11 and Table 12, are defined below. These elements and their terminology are referenced later to describe the methods used in this study to analyze events and event sequences.

Message. The main element in a bulletin board discussion is the 'message'. Each message consists of a message title, author identification, the text, and the date and time of posting. Each line in Table 12 represents a single message. For example, lines A2, A12 and A23 represent three different messages. Message A2 was posted with the title "In favor of drug testing". As described earlier, the actual contents of this message - the message title, author, text and time of posting - are shown in Table 11 in lines A2 to A9.

Title Events and Unit Events. Events are comprised of units of meaning observed in the message titles and within the message texts. Events in the message titles are referred to as *title-*

events. An example of a message title is illustrated in column 2 in line A12 of Table 11. The events observed *within* the message texts are referred to as *unit-events*. An example of a *unit-event* is illustrated in column 2 of line A14 of Table 11.

Discussion Thread. - A discussion thread is made up of one or more messages addressing a particular topic of discussion. When more than one message is present in a discussion thread, the messages are structurally organized into sequences of message and message replies. For example, the first three message in Table 12 (A2, A12, A23) form a simple linear sequence of message and message replies to form discussion thread #1. The 12 messages from A36 to A208 form discussion thread #2 - a more complex sequence of messages partitioned into *sub-threads*.

Sub-Threads. - Sub-threads are created when a given message receives two or more direct replies. In discussion thread #2 (lines A36 to A208 in Table 12), for example, note that the first message (A36) received three direct replies in A54, A167 and A176. These three direct replies form the beginnings of three separate *sub-threads* at thread level 1, with some sub-threads containing their own sequence of subsequent messages. For example, message A54 generated two direct replies (or two sub-threads), message A167 generated no replies (or no sub-threads), and message A176 generated two direct replies (or two sub-threads).

Discussion. A *discussion* is made up of a series of discussion threads. Table 12 illustrates a discussion consisting of two discussion threads - discussion thread #1 and #2. A discussion often consists of a series of discussion threads.

Notations for Defining Event Sequences

The following is a description of the symbolic notation used in this study for constructing and defining various methods of analyzing event sequences in threaded bulletin board discussions. Note that the notations are used to construct various definitions and measures of

event sequences in reference to *title* and *unit events*. The notations are *not* used to identify the location of observed events within a discussion or discussion transcript.

Title Events. Title-events are denoted with the symbol T_i using the parameter i to identify the *lag* between one title-event and another title-event. *Lag* is a term used to specify event sequences in which a given event is labeled as an event at lag 0, and event that immediately follows a given event (called target event) is labeled as an event at lag 1, and so on. For example, a given message and its title-event is denoted as T_0 and a direct reply to the message at lag 1 is denoted as T_1. The two-event sequence between these two messages is represented as $T_0 \rightarrow T_1$. A three-event sequence is denoted as $T_0 \rightarrow T_1 \rightarrow T_2$. To denote *all* events following a given event (events across all lags), the symbol + is added to the i parameter. For example, $T_0 \rightarrow T_1+$ represents all events following title-event between T_0 at lag 1, lag 2, and up to the end of the discussion thread. A simple count of all events following a given event is represented with the symbol $\rightarrow$# so that ($T_0 \rightarrow \#T_{1+}$) represents a count of all title-events following T_0.

Unit Events. A unit-event is represented with the symbol $U_{i,j}$ and is used to identify any unit-event within a message. The parameter i identifies the parent message to which the unit belongs. The parameter j identifies the position of the unit-event relative to all unit-events within a message. For example, message A23 in Table 11 consists of five unit-events. The sequence between the third and fourth unit-event at A27 to A28 is represented as $U_{i,3} \rightarrow U_{i,4}$. Sequences between title *and* unit events can also be examined. For example, the sequence from title-event A12 (T_0) to the title-event and unit-events in message A23 (T_1) is represented with the notation $T_0 \rightarrow T_1 + U_{1,1+}$.

Table Summary of Possible Methods

Table 13 lists 19 different methods for analyzing event sequences. The methods are classified into analysis of two-event, three-event and four-event sequences. These three methods are divided in turn into three additional classifications: the analysis of events *within* messages, *between* messages, and a combination of events *within and between* messages. Within each cell in Table 13 are two possible methods for examining sequences and outcomes: 1) computing the frequencies and transitional probabilities of *title* and/or *unit* event sequences; and 2) counting the number of *title* and/or *unit* events following an event or event sequence. Included in the "Two-event x Within message" is the computation of *conditional probabilities* between unit-events within a message.

Insert Table 13 about here

Table 13 by no means lists all possible methods for analyzing event sequences in threaded discussions. New methods or variations of methods can be constructed by manipulating the parameters in the notations. With each possible method are possible strengths and weaknesses as well as overall usefulness. The methods highlighted in Table 13 are the methods selected for and used in this study. A description of the methods and how they were selected is provided in the following section.

Selection and Descriptions of Methods for Analysis of Event Sequences

In this study, a number of methods were selected to explore event sequences in student interactions *and* to explore the overall utility of the methods. Methods were selected specifically to examine the nature of student-to-student interactions and their effects on critical thinking in

the *threaded* messages of group discussions. Methods used in this study were *not* designed to examine implied links between messages posted in *separate* discussion threads, nor were these methods used to examine the sequences between discussion threads (versus messages). Given these objectives, five methods were developed and explored in this study. Each of these methods is described below.

Two-Event Sequences with Title-Events. The main analysis in this study examined two-event sequences between title-events ($T_0 \rightarrow T_1$). Frequencies were computed for the number of times one title-event of one specific event category was immediately followed by a title-event of another event category. The observed frequencies were used to compute transitional probabilities to determine how likely one type of event was to be followed by another type of event. For example, this method counted the number of times Disagreement (in title-events) was followed immediately by another Disagreement in a responding message (also in title-events), the number of times Disagreement was followed by Agreement, followed by Arguments, and by all other possible events. Based on the observed frequencies, transitional probabilities were computed to determine how likely Disagreements were followed by Disagreements relative to all other observed responses to a Disagreement. In this method of analysis is the underlying assumption that the *title-events* (as the unit of analysis) represent the main intentions and functions of the author and the message. Using title-events as the unit of analysis was an approach to examine interactions between participants without having to examine the complex sequences of *unit-events* within messages, as described earlier.

Two-Event Sequences Between Title Plus Unit-Events. To incorporate unit-events into the analysis, the method $T_0 \rightarrow (T_{1,j}+U_{1,\,1+})$ was used to examine sequences between title-events of a given message T_0 and the title- *plus* all unit-events in the responding message. This analysis provided an additional measure of outcomes and events following given events. It was also used

in part to cross examine and evaluate results from the two-event sequential analysis ($T_0 \rightarrow T_1$) and to evaluate how well message titles accurately reflect the main content and intentions of the message as a whole. Similar to the previous method, the analysis of event sequences between titles *plus* unit events computed the frequencies and transitional probabilities of every possible pairing of the given title-event T_0 and *all the events* in the responding message (both title and unit events). As a result, all units in the responding message were represented in the frequency counts, including repeated unit events. For example, a responding message containing three units of meaning with three Argument events was tallied as three separate events.

Three-Event Sequences with Title-Events. This method of analysis was used to examine what events followed observed two-event sequences or pairs. For each two-event pair identified in the ($T_0 \rightarrow T_1$) analysis, the three-event analysis of title-events ($T_0 \rightarrow T_1 \rightarrow T_2$) determined the number of times a particular event followed a particular event pair. Based on the observed frequencies, transitional probabilities were also computed to determine how likely a given two-event pair was to be followed by a specific event. For example, this analysis was used to examine what types of events (if any) could be expected to follow a Disagree→Disagree event sequence (e.g. Disagree → Disagree→ event?), which could then be compared with events that follow Agree→Agree event pair. In Table 12 are illustrations of two three-event sequences: (Disagree → Disagree → Agree) in the message sequence A36 → A54 → A62, and (Disagree → Disagree → Argument) in the message sequence A36 → A54 → A76.

Number of Responses Following Event Pairs. A variation of the three-event sequence analysis was used to compute the total number of responses following a given event pair through to the end of the discussion thread, using the method $(T_0 \rightarrow T_1) \rightarrow \#T_{2+}$. This method was used to measure *and* identify *all* events following each event pair. For example, Table 12 shows an example of a Disagree → Disagree interaction in messages A36 and A54. The total number of

messages that followed this specific event pair was 6 (message A62 to message A154). The two-event pair in messages A36 and A167 (Disagree → Agree) was followed by 0 responses. The two-event pair (Disagree → Agree in message sequence A36 → A16 was followed by a total of 2 responses.

Conditional Probabilities Between Events Within a Message. This method ($U_{0,a} \leftrightarrow U_{0,b}$) computed *conditional* probabilities to determine how likely one event occurred relative to another given event *within* a message (events included *both* unit and title events for any given message). For example, this method determined how likely a given Argument was to be presented with Position statements, or how likely a given Evaluation was to be presented with an Argument within the same message. Unlike all the previous methods described above, this analysis provided information on events that occurred together within messages - not information on event *sequences* within messages. The assumption was that information on sequential events *within* messages would not be on the whole very useful because the analysis of events *within* messages did not directly address the objectives of this study - the examination of interactions *between* discussion participants.

However, the probabilities on which events tended to occur together *within* messages was useful for extrapolating additional outcomes in observed event sequences between messages. For example, suppose the analysis finds that when an Argument is presented in a response, there is a 50% conditional probability that events *within* the same message will include Evaluation. Then suppose a two-event analysis finds that Position statements are followed by Arguments (Position→Argument) 50% of the time. As a result, it is possible to predict that Position statements that are followed with Arguments are also followed by Evaluations 25% of the time.

Frequency, Transitional and Conditional Probability Matrices

In this study, the frequencies, conditional probabilities, and transitional probabilities were reported in matrix tables. In each matrix, *given* events for each event category were listed by row. Each column in the matrix listed the *target* events - events that follow a given event at a specified lag. As a result, the 12 event categories in the coding scheme produced a 12 x 12 matrix. In a *frequency matrix*, each cell contained the number of times each given-target event pair was observed. The sum of all the frequencies within each row produced marginal *totals* representing the total number of event pairs observed for each given event. In a *transitional probability* matrix, the frequencies and marginal totals from the frequency matrix were used to compute the overall probability of observing each given-target event sequence relative to the total number of observed event pairs *and* the observed frequencies of target events. The transitional probability was computed by dividing the cell frequency by the marginal total for the given event and row in the frequency matrix. This methods for computing transitional probabilities were developed and described by Bakeman & Gottman (1997, pp. 95-99).

Statistical Significance in Probability Matrices

Computing z-scores. In this study, the transitional probabilities between events were evaluated to determine if their observed frequencies were *higher* or *lower* than expected. The expected frequencies were computed with the formula $m_{GT} = (X_{+T} * X_{G+}) / X_{++}$ where m_{GT} is an estimate of the expected frequency (m because often expected values are means), X_{G+} is the sum of the observed frequencies in the given row, X_{+T} is the sum of the observed frequencies in the target column, and X_{++} is the total number of tallies in the table (Bakeman & Gottman, 1997 p.108). Expected frequencies m_{GT} converted into expected probability by dividing the expected frequency m_{GT} by the sum of the observed frequencies in the given row X_{G+}.

Based on the observed and expected frequencies, *z* scores were computed for each given-target event pairing. The z scores were computed with the formula $z_{GT} = (X_{GT} - m_{GT})/ SQRT(m_{GT}(1- p_{G+})(1- p_{+T}))$ where p_{G+} is X_{G+} / X_{++} and p_{+T} is X_{+T} / X_{++}. See Bakeman & Gottman (1997, p.109). This formula takes into account the differences in relative and *observed* frequencies of *both* given and target events. A *z*-score larger than 1.96 absolute is often regarded as statistically significant at the .05 level. Given the exploratory nature of this study, a z-score of ±1.65 at a .10 alpha level was used to test for statistical significance.

The z-scores for each event pair were displayed in z-score matrices, and were used to report which transitional probabilities were statistically higher and lower than the expected probabilities (z-score > ±1.65, alpha = .10). The underlined probabilities values distinguish values that were significantly *lower* than the expected probabilities (Z-score < -1.65, alpha = .10). With alpha level at .10, a z-score greater than 1.65 or less than -1.65 indicated a probability that was likely to occur only 10% of the time by random chance alone.

Avoiding Type I error. Due to the large number of event sequences in the transitional probability matrices (12 x 12 = 144 event pairs), testing the significance for all event pairs ensured a type I error - when probabilities are claimed to be significant when in fact they are not. At alpha level of .10, an estimated 14 of the 144 transitions would be found to be statistically significant by chance alone. As a result, this study used the results of the transitional probability matrices and the z-scores simply to determine the extent in which observed frequencies were found to be below or above expected frequencies *without* claiming statistical significance. The data was used to explore and examine patterns in group interactions and event sequences, and not to test for statistical significance.

Computing the Matrices with Visual Basic in Microsoft Excel

Because of the complexities and challenges in analyzing event sequences and the immense effort required to compile and compute sequential data, computer algorithms were written and executed in Visual Basic and Microsoft Excel to perform the data analysis. The algorithms computed the frequencies, transitional probabilities, and *z*-scores from the coded data (see Table 12), as well as generated the data output for each of the five methods used in this study. Additional algorithms were written to generate additional summary data, and to manipulate and format data to facilitate data analysis and review of the transcripts. For example, scripts were written to: record the *locations* of every event pair observed and tallied in the matrices so that each event pair could be reviewed in the discussion transcripts; and to highlight values in the frequency and probability matrices to identify values that were higher or lower than expected based on results in the corresponding *z*-score matrices. Appendix HH contains an example of the algorithm used to compute the frequencies for the two-event sequence analysis with title and unit-events.

Chapter 4 - Results of Data Analysis

Background Data

Number of Messages and Threads

Table 14 displays the number of messages and discussion threads observed in all four discussion groups. The groups generated a total of 208 messages on the threaded bulletin board. Group 1 posted 61 messages in 8 different discussion threads. Group 2 posted 58 messages in 12 discussion threads. Group 3 posted 46 messages in 7 discussion threads. Group 4 posted 43 messages in 6 discussion threads.

The mean number of messages per group was 52 (STD = 8.8). The mean number of discussion threads per group was 8.25 (STD = 2.63). The mean number of messages per thread was 6.30 (STD = 1.22). Although Groups 3 and 4 generated fewer messages than Groups 1 & 2, the mean number of messages per thread were equal or greater than Groups 1 and 2. Recall that Groups 1 and 2 discussed identical issues on the topic of corporate drug testing, whereas Group 3 discussed targeted advertising and Group 4 discussed the hiring/firing of employees based on outside conduct.

Insert Table 14 about here

Frequencies of Title Events and Unit Events Combined

The frequencies and relative frequencies of events (both title and unit events combined) are displayed in Table 15. A total of 1,823 events were observed in the group discussions. Based on this total, the relative frequencies for each event are displayed under the “total percentage” column. Arguments were found to contribute the largest proportion (50.7%) of events observed

in the discussions. This was followed next by Comments (14.4%), Negotiations (10.9%), Evaluation (6.5%), Agreement (4.9%), and Personal Experiences (4.7%).

Table 15 also displays the event frequencies for each group. The table shows that, on the whole, the relative frequencies within event categories were similar between groups. In only three event categories were the relative frequencies between groups found to be significantly different. Adjusting cell frequencies for group differences in total number of units posted (adjusted frequency = frequency / total units within group), a Chi-Square test was used to test for significant differences in the distribution of frequencies between groups. The results indicate that Group 3 posted significantly more Arguments than any other group, X^2 (3, n = 207.5) = 11.92, $\underline{p} < .05$. Group 1 posted significantly more Hypothetical Actions than any other group, X^2 (3, n = 11.8) = 11.81, $\underline{p} < .05$). Group 2 posted significantly more Comments than any other group, X^2 (3, n = 56.6) = 8.57, $\underline{p} < .05$).

Insert Table 15 about here

Frequencies of Title Events

Table 16 lists the frequencies and relative frequencies (or percentages) of observed title-events (unit-events not included), based on a total of 195 coded message titles. Thirteen messages were not titled by their authors and therefore, were not coded nor included in the analysis of title-events and event sequences. The relative frequencies of title events (in Table 16 under Percentage column) were similar to those for all title and unit events combined (see Table 15), with a Pearson correlation of .945. The high correlation between the relative frequencies supports the that message titles effectively represent the main intentions of the message as a

whole, and that title-events alone (separate from unit-events) can be used effectively in the analysis of event sequences.

Insert Table 16 about here

Distribution of Messages & Events Across Thread Levels

Messages Across Thread Levels. Table 17 shows the distribution of messages across thread levels, providing information on *where and when messages* occur within discussion threads. For example, the table shows that 15.9% of messages were posted at thread level 0 to initiate new topics of discussion. The largest percentage of messages (29.3%) were posted at thread level 1 *in response to messages initiating new topics of discussion*. The second largest proportion of messages (20.7%) were posted at thread level 2 as a second response to initial responses posted at thread level 1. All the messages posted from thread levels 0 to 2 contributed 65.9% or almost two thirds of all messages in the discussions. The remaining 34.1% or about one third of messages were posted at thread level 3 (as a third reply) and higher. In addition, the table shows that the longest discussion thread was 8 messages in sequence, with a total of two messages posted at level 8.

Insert Table 17 about here

Event Categories Across Thread Levels. Table 18 shows the distribution of events across thread levels, providing information on *where and when particular events occur* within a discussion thread. For example, the table shows that the first message in a discussion thread (at

thread level 0) is most often an Argument (42%), followed next by Comments (21%) and Negotiations (12%). When looking at the figures by column, the table shows that Position statements were most often posted in the opening messages of a discussion thread at thread levels 0 and 1. The Argument column, in contrast, shows that Arguments occur regularly throughout a discussion thread. Evaluations are never presented in the opening message (0%), but are instead presented later in a discussion thread. Agreements tend to occur throughout a discussion thread from level 0 to level 6, whereas Disagreements tend only to occur in levels 0 to 3. The relatively high frequency of Negotiation at thread level 0 and 1 indicates that new threads are often initiated to begin negotiations and group consensus.

Insert Table 18 about here

Two Event Combinations Within Messages

Table 19 displays conditional probabilities that measure how often two events occur together in a message (including both title events and unit events) or the types of critical thinking that *tend to occur together* within a message. For example, the table shows that of all messages that contained an Agreement, 88% also contained Arguments. Of all messages that contained Arguments, 33% also contained an Agreement. Of all messages that contained an Agreement, 69% also contained Negotiation. In comparison, of all messages that contained a Disagreement, only 38% contained Negotiations.

Insert Table 19 about here

Two-Event Sequences Between Title-Events

Transitional Probabilities for Two-Event Sequences

Table 20 lists the transitional probabilities between given events at lag 0 and target events at lag 1 (between *title* events only). For example, Table 20 shows that Disagreements were followed 38% of the time by Agreements, 13% of the time by Disagreements, 38% of the time by Arguments, and so on. These probabilities are based on a total of 8 replies to Disagreements observed in the discussions. Of all the possible responses to a Disagreement, two types of responses were found to occur at *higher* than the expected frequencies (as described earlier in section "Statistical Significance in Probability Matrices"). These were responses in Agreement (z score = 2.22, $p < .10$), and responses in Disagreement (z score = 1.88, $p < .10$). See Table 21 for z-scores measuring deviation from expected frequencies.

Insert Table 20 & Table 21 about here

The results also show transitional probabilities that were *below* expected probabilities. For example, Arguments were followed by Evaluation only 4% of the time, which was *lower* than the expected probability (z score = -1.68, $p < .10$). In another example, responses to Negotiation with Arguments was found to be lower than expected at 20% (z score = -1.79, $p < .10$).

State Transitional Diagram

In Figure 2 is a state transitional diagram summarizing the transitional probabilities between the main events observed in this study. The diagram is particularly useful for determining if transitions between two particular events are uni-directional or multidirectional. For example, the diagram shows that Position statements were followed by Agreements 17% of the time, whereas

Agreements were followed by Position statements 0% of the time. As a result, the transitions between Position statement to Agreements was uni-directional. In the transitional diagram are eight event sequences that suggest uni-directional sequences: Position → Agree, Agree → Argument, Position→Argument, Disagree → Argument, Disagree → Agree, Evaluation → Argument, Negotiation → Argument, and Agree → Negotiation. No direction is suggested between Negotiation and Evaluation events. The diagram also shows that a Position statement was followed by another Position statement 33% of the time, and that many events tend to be followed by events of the same category. These findings are useful for examining and confirming event sequences and processes prescribed in existing models of critical thinking.

Insert Figure 2 about here

Response Rates and Threaded Responses

Table 22 displays *responses rates* and *number of threaded responses* to given events which reveal *how* and *how often* responses follow given events. These two measures of group interaction are based on the observed frequency of events, the number of times a reply (versus no reply) was received by a given event, and the actual *number* of threaded replies posted in immediate response to a given event. Both are simple measures of how each type of event elicits responses from other participants in a group discussion, and their results are reported with data on event sequences and transitional probabilities.

Insert Table 22 about here

Response rate. *Response rate* measured how often a given event received at least one response. The measure was computed by taking the number of times an event received a reply divided by the event frequency. For example, Table 22 shows that Disagreements had an 80% response rate, whereas Agreements had only a 32% response rate - almost 2.5 times less than the response rate of Disagreements. The table also shows that Untitled messages received the low response rate of 23%, suggesting that message titles play an important role in eliciting responses. More discussion of these and other results is presented in the discussion section. The average response rate for all messages across all event categories was 49%.

Number of threaded responses. For every message that received a reply, the average number of *threaded responses* (the number of immediate responses to any one given message at lag 1) were computed and are displayed in Table 22. The average number of *threaded responses* was computed by dividing the total *number of replies* for a given event (title events) by the number of given events that received at least one response (under column "with reply"). For example, Table 22 shows that any Disagreement that received at least one response received on average 2.00 threaded responses, where as Agreements received an average of 1.29 threaded responses. In addition, Untitled messages received an average of only one threaded response - which was the lowest number of threaded responses for all given events. The overall average number of threaded responses was 1.51.

Limitations of Analysis

The marginal totals were very low for some of the given title-events. This presents one of the limitations of analyzing sequences by title events only. Some of the marginal totals were low because the number of event categories (12 in all) in the coding scheme was relatively large. The total 195 message titles had to be assigned to and distributed among12 event categories. Thirteen

messages (of the 212 messages) were not included in the analysis because participants did not include a title with their messages. Taking these factors into consideration, the expected average marginal total was 16.25 (195 divided by 12) per row or event.

Marginal totals could be increased by collapsing categories in the coding scheme to reduce the number of event categories. Another solution would be to increase the data set to increase the number of messages and message titles for the sequential analysis. The findings that are based on low marginal totals are best interpreted as qualitative data - used primarily to identify unique patterns of interaction in critical thinking. All the findings - regardless of whether they are based on low or high marginal totals - are useful for evaluating the methodologies and procedures developed in this study and to determine if the methods produce data that accurately describe group interactions in online discussions.

Interpreting the Results

To interpret the findings from the ($T_0 \rightarrow T_1$) analysis, the size of the marginal totals (or number of targets for each given event) must be taken into consideration. Event categories with large marginal totals can provide reliable information on patterns in student interactions, and are more reliable than event categories with small marginal totals. Small marginal totals are susceptible to random error, making it difficult to draw general conclusions about observed event sequences and outcomes.

For example, Table 20 shows that Personal Experience is followed 50% of the time (z-score = 4.36, $p < .10$) by Personal Experience, and 50% of the time by Evaluation (z-score = 2.09, $p < .10$). However, these probabilities are based on a total of only two instances of a paired event with Experience as the given event. Even with the significant z-scores, it is difficult to conclude with confidence that we would see this very same pattern in future student discussions. As a

result, the events with high marginal totals should be the primary focus of the analysis and interpretation of the findings. On the other hand, this study is primarily exploratory - focusing on developing methods that can produce data to describe event sequences. Therefore, no attempts are made to assess the confidence of the observations gained from the data analysis.

One limitation of the ($T_0 \rightarrow T_1$) analysis is that *unit events* contained within the given and target messages are excluded from the analysis. As demonstrated in Table 19, messages often contained multiple events in addition to the events in the message titles. As a result, the ($T_0 \rightarrow T_1$) analysis provides only a partial glimpse into the possible interactions that occur between messages. The results of this analysis, however, were very similar to the results (see next section) from the analysis that included both title and unit events $T_0 \rightarrow (T_{1,j}+U_{1,\ 1+})$.

In conclusion, a two-event sequence analysis using the method ($T_0 \rightarrow T_1$) was useful for identifying patterns in group interactions. The patterns identified in this analysis must be validated and grounded on more detailed analysis and review of excerpts from the discussions, and also cross referenced with the results from other methods of analysis. These issues are addressed in the main discussion.

Two-event Sequences Between Title and Unit Events

Transitional Probabilities

Table 23 contains the transitional probabilities between a given event (by title-event) and all events in the target message (title and unit events). The transitional probabilities of 28 event pairs were found to deviate from the expected probabilities. Seventeen of the probabilities were *higher* than the expected probabilities, and eleven of the probabilities were *lower* than the expected probabilities. Table 24 shows the z-scores or deviations from expected frequencies for each event

pair. For example, Table 23 shows that messages that responded to a given Argument contained additional Arguments 56% of the time, which was more than the expected probability (z-score = 2.94, $p < .10$). In contrast, no responses to Arguments contained Position statements, which was *lower* than the expected probability (z-score = -3.78, $p < .10$).

Insert Table 23 and Table 24 about here

Three-event Sequences Between Title Events

Table 25 displays the frequencies of all three-event chains observed in the threaded discussions. Each row in the table represents one of the 51 observed two-event sequences (at lag 0 and lag 1). Each column designates a possible target event (at lag 2) following any of the 51 listed event pairs. A total of 67 unique three-event sequences were observed, based on 32 event pairs that received responses. The remaining 19 event pairs did not receive any responses to create three-event sequences. For example, given the paired event in which a disagreement was followed by another disagreement (Disagree → Disagree), there were two replies at lag 1 to this event pair. One reply was an Agreement, resulting in the three event chain (Disagree → Disagree) → Agree. The other reply was an Argument, resulting in the three-event chain (Disagree → Disagree) → Argument. The table also shows that (Disagree → Disagree) was observed only once in all the discussions, and that this one occurrence produced two replies. The ratio of the frequency of occurrence for (Disagree → Disagree) and the number of responses generated by (Disagree → Disagree) was a 2 to 1 ratio (or 200%).

Insert Table 25 about here

Number of Messages Following Two-event Sequences

Table 26 displays 51 event pairs and the *total* number of messages *following* each event pair within a discussion thread. The event pairs are listed in each row of Table 26, and the possible target events following each event pair from lag 2,3,4 *and onward* are displayed in each event column. For example, the (Disagree → Disagree) event pair was followed by 1 Agreement, 2 Arguments, 2 Hypothetical Actions, and 1 Comment. The total number of target events following this event pair was 6, listed under the column 'Total'. The number of times this event pair was observed was 1, listed under the column 'Frequency'. The *average* number of messages following each instance of this event pair was 6.0, listed in column 'Average'. The average was computed by dividing the total number of messages by the frequency. The paired events in Table 26 are listed in order from the highest to lowest average number of replies per event pair.

Insert Table 26 about here

Note that most of the event pairs listed in both Table 25 and Table 26 were observed at very low frequencies, which presents a major limitation of three-event sequence analysis. Attempts to investigate event sequences at lag 2 or higher will often result in very low expected frequencies for each event sequence (Bakeman & Gottman, 1997 p. 111). The number of possible sequences grows exponentially for every event category in the coding scheme, and the large number of possible sequences makes them difficult to interpret. As a result, the findings must be interpreted with caution. Nevertheless, the findings are useful for exploratory research and identifying unique patterns of interaction. When the total frequencies are low, the results should not be used to establish normative measures. For these reasons, no transitional probabilities and z-scores were computed in this analysis.

Summary of the Results

Below is a summary of the results from the two-event sequential analysis, sequential analysis of given title events and unit events, analysis of thread lengths following event pairs, and the analysis of three-event sequences. Presented with these results are response rates, average number of threaded responses, and descriptive statistics on title/unit events, messages and discussion threads. Due to the amount of data generated in the data analysis, this summary of the findings is focused on only four events: Position statements, Agreements, Disagreements, and Arguments. These events form the core set of events that compose the interactions addressing conflict and differences in viewpoints. They are also the events that set the stage for subsequent events in the critical thinking process.

Position Statements

Given event. A total of 10 messages (5.1% of all messages) were posted with the primary function of stating a position (see Table 16). Overall, Position statements were stated in the titles and message text in 11.5% of messages (see Table 19). Position Statements in messages were often presented with Arguments (71%), Comments (54%), Negotiation (33%) and Evaluations (25%).

Target events. The *responses* to Position Statements (see Table 20) were most likely to be Position statements (33%), or Arguments (33%), then Agreements (17%), or Comments (17%). The result was four unique event pairs with the given Position statement. Responses with Position statements were higher than the expected probability, z-score = 3.56, $p < .10$ (see Table 21). The overall response rate for Position statements was 50% (see Table 22). Among those that

received responses, the number of responses threaded to the Position statement averaged 1.2, *below* the overall average of 1.51.

Contents of target events. When looking at *the content within the responses* (title and unit-events combined) to Position statements (see Table 23), the responses presented Arguments (42%), Comments (19%), Position statements (14%), Evaluations (14%), Agreements (8%), and Negotiations (3%). The frequency of Evaluations with Position statements was higher than expected, z-score = 1.76, $p < .10$ (see Table 24).

Events following given-target sequence. Four Position→Event pairs with responding messages at lag 2 were observed (see Table 25), generating a total of 7 responses or target messages at lag 2. These responses included Agreements (2), Arguments (2), Comments (2) and Experiences (1). Of the four event-pairs observed, Position→Agreement received no responses. In *all events* following the observed Position→Event interactions, a total of 15 messages (or 7.7% of all 195 titled messages) were posted, resulting in an average of 2.5 messages following every Position → Event interaction (see Table 26) - well above the overall average of 1.2 messages.

Agreements

Given event. A total of 22 Agreements were observed in 11.3% of all messages (see Table 16). Agreements tended to occur throughout a discussion thread, with slightly higher frequency at the beginning of threads (see Table 18). In the *messages*, Agreements often occurred with Arguments (88%), Negotiations (69%), Comments (66%), and Evaluations (44%). See Table 19.

Target events. The *responses* to Agreements at lag 1 (see Table 20) were Arguments (33%), Agreements (22%), and Negotiations (22%), Evaluation (11%), and Comments (11%), producing a total of five event pairs with Agreement as the given event. None of the response frequencies

were found to be higher or lower than the expected frequencies (see Table 21). The overall response rate for Agreements was 32% (see Table 22). Among those events that received responses, the number of immediate responses threaded to Agreements averaged 1.29, *below* the overall average of 1.51.

Contents of target events. When looking at *the unit events within the* responding messages (see Table 23), the responses to Agreements contained Arguments (53%), Negotiations (15%), Comments (14%), Evaluations (8%), and Agreements (6%). None of the frequencies of the target events in responses appeared to deviate widely from the expected frequencies (see Table 24).

Events following given-target sequence. Five Agreement→Event pairs with responding messages at lag 2 were observed (see Table 25). Responses to these event pairs included Arguments (2), Agreements (2), Evaluation (1), and Comments (1). In *all events following* Agreement → Event pairs, a total of 7 messages (or 3.6% of all 195 titled messages) were posted in response, averaging 0.78 messages for each Agreement→ Event pair, which is *below* the overall average of 1.2 messages. See Table 26.

Disagreements

Given event. A total of 5 Disagreements were stated in message titles, contributing to 2.6% of all messages (see Table 16). Overall, 14 Disagreements were observed in the messages, contributing to 0.8% of all observed events (see Table 15). Disagreements tended to occur only *at the beginning* of discussion threads, between levels 0 to 2 (see Table 18). The *messages* of Disagreements most often occurred with Arguments (92%), Agreements (62%), Comments (62%), Negotiation (38%), and Evaluation (31%). See Table 19.

Target events. The *responses* to Disagreements at lag 1 (see Table 20 and Table 21) were Agreements (38% and higher than expected, z-score = 2.22, $p < .10$), Arguments (38%),

Disagreements (13% and higher than expected, z-score = 1.88, p < .10), and Comments (13%). The result was four unique event pairs with the given event Disagreement. The overall response rate for Disagreements was 80% (see Table 22). Among those that received responses, the number of immediate responses threaded to the Disagreements averaged 2.00, *above* the overall average of 1.51.

Contents of target events. When looking at *the unit events within the responding* messages (see Table 23), the responses to Disagreements mainly contained Arguments (52%), Negotiations (13%), Agreements (12%), Evaluations (10%), and Comments (7%). The frequency of responses with Agreements to Disagreements was higher than the expected frequency (z-score = 2.56, p < .10), as was the case with responses with Disagreements (z-score = 1.74, p < .10). See Table 24. In contrast, the frequency of responses with Comments appears to be below expected frequency (z-score = -1.76, p < .10).

Events following given-target sequence. Four Disagree → Event pairs with responding messages at lag 2 were observed (see Table 25) - Disagree→Comment, Disagree->Disagree, Disagree->Argument, and Disagree→Agree. These event pairs elicited a total of eight responding messages. These responses were Arguments (5), Agreements (1), Evaluations (1), and Comments (1). In *all events following* the Disagree→Event pair, a total of 16 messages (or 8.2% of all 195 titled messages) were posted in response, resulting in an average of 2.0 messages following every Disagreement→ Event interaction (see Table 26) – *higher* than the overall average of 1.2 messages.

Arguments

Given event. A total of 72 Arguments were observed in message titles, contributing to 36.9% of all messages (see Table 16). Overall, Arguments composed of 50.7% of all observed

events (see Table 15). Arguments tended to occur regularly throughout a discussion thread (see Table 18), except at thread level 1, at which the frequency of Arguments appears to be *lower* than the expected frequency (z-score = -3.07, p < .10, n = 11). This drop in frequency was accompanied by a rise in the frequency of Agreements and Evaluations in the transition from thread level 0 to thread level 1. In the *messages*, Arguments were most likely to have occurred with Comments (53%), Negotiations (49%), Evaluations (39%) and Agreements (33%). See Table 19.

Target events. The *responses* to Arguments were events from 9 of the 12 event categories (see Table 20 and Table 21). These included Arguments (49% and higher than expected, z-score = 3.08, p < .10, n = 34), Agreements (16%), Comments (13% and lower than expected, z-score = -2.14, p < .10, n = 9), Negotiation (6%), Evaluation (4% and lower than expected, z-score = -1.68, p < .10, n = 3), Hypothetical choices (4%), Experiences (3%), Disagreements (3%), and Position statements (1%). The overall response rate for Arguments was 60% (see Table 22). The number of responses threaded to the Arguments averaged 1.60, about *equal* to the overall average of 1.51.

Contents of target events. When looking at *unit events within the* responding messages (see Table 23), the responses contained Arguments (56% and *higher* than expected, z-score = 2.94, p < .10, n = 315), Comments (10% and *lower* than expected, z-score = -3.66, p < .10, n = 54), Negotiation (9% and *lower* than expected, z-score = -1.73, p < .10, n = 53), Agreements (6%), Evaluation (6%), Experiences (5% and *higher* than expected, z-score = 2.50, p < .10, n = 30), Hypothetical choices (5% and *higher* than expected, z-score = 2.21, p < .10, n = 28). Responses rarely contained Disagreements (1%), and Literature (1%), and none were found to contain Data, Summary of arguments, or Position statements (0% and *lower* than expected, z-score = -3.78, p < .10, n = 0). See Table 23 for all z-scores.

Events following given-target sequence. Nine Argument→Event pairs with responding messages at lag 2 were observed (see Table 25). These event pairs elicited a total of 49 responding messages. These responses included Arguments (25), Agreements (4), Hypothetical Actions (4), Comments (9), Negotiations (3), Evaluations (2), Disagreements (1), Experiences (1), and no Position statements. In the *events following* these Argument → Event interactions, a total of 128 messages (or 65.6% of all 195 titled messages) were posted, resulting in an average of 1.5 messages following each observed Argument→ Event interaction (see Table 26) – *slightly above* the overall average of 1.2 messages.

Other Two-event Interactions with Deviations in Observed Frequencies

Here are some additional results on two-event sequences that were found with higher and lower than the expected probabilities based on results from Table 20 and Table 21:

EXPERIENCE→EXPERIENCE - Personal Experience was followed 50% of the time more Personal Experiences, which was higher than expected (z-score = 4.36, $\underline{p} < .10$, $\underline{n} = 1$).

EXPERIENCE→EVALUATE - Personal Experience was followed 50% of the time with Evaluations, which is higher than the expected (z-score = 2.09, $\underline{p} < .10$, $\underline{n} = 1$).

LITERATURE→EVALUATE - Literature was followed 100% of the time with Evaluation, which was higher than expected (z-score = 3.26, $\underline{p} < .10$, $\underline{n} = 1$).

HYPOTHETICAL→HYPOTHETICAL - A Hypothetical Action was followed 75% of the time with more Hypothetical Actions, which was higher than expected (z-score = 7.65, p < .10, n = 3).

EVALUATION→EVALUATION – Evaluation was followed 40% of the time with responses containing Evaluations, which is higher than expected (z-score = 2.53, p < .10, n = 2).

NEGOTIATE→ARGUMENT - A Negotiation was followed 20% of the time with Arguments, which is *lower* than expected (z-score = -1.79, p < .10, n = 5).

NEGOTIATE→EVALUATION - Negotiation was followed 20% of the time with Evaluation, which is higher than expected (z-score = 2.20, p < .10, n = 5).

COMMENTS→AGREE – Process Comments were followed only 3% of the time by Agreements, which is *lower* than expected (z-score = -1.82, p < .10, n = 1).

COMMENTS→LITERATURE - Process Comments were followed 3% of the time by Literature, which was *higher* than expected (z-score = 1.98, p < .10, n = 1).

COMMENTS→COMMENTS – Process Comments were followed 42% of the time by more Process Comments, which was higher than expected (z-score = 3.39, p < .10, n = 14).

Chapter 5 - Discussion

Focus of Discussions

One of the main purposes of this study was to develop a methodology for examining and measuring critical thinking in student interactions in threaded discussions. Various strategies were used to identify and quantitatively measure the occurrence of events and event sequences in order to examine group *processes* or *interactions* and their effects on critical thinking outcomes. Based on Bakhtin's theory of dialogism, particular attention was focused on interactions that addressed conflict and the negotiation of differences in opinion and viewpoints. The methods developed in this study were used to determine:

1) The types of events that occur in threaded discussions in terms of critical thinking processes.
2) The types of event sequences that occur in threaded discussions, and the transitional probabilities between events for each event sequence.
3) The event sequences that elicit and encourage the most critical thinking.

Each of these issues are discussed below with references to the results of the data analysis, findings from previous research, and observations about the methods of analysis used in this study.

Events and Event Frequencies

The first objective of this study was to examine different types of critical thinking and their frequency of occurrence in the threaded discussions. Events frequencies were examined and

reported primarily in terms of *relative* frequencies (or percent likelihood) in relationship to the frequency of all *observed* events posted in response to each given event. In this study, a total of 12 event categories were used to examine 144 possible event sequences. To compare the relative frequencies found in this study, the differences in number of event categories in the coding schemes of this and other studies must be taken into consideration and interpreted accordingly.

For example, the coding scheme in this study was based on 12 categories of critical thinking, developed from the analysis of transcripts in pilot tests. Newman's coding scheme (see Table 9) consisted of seven categories of critical thinking *operations*, mixed in with additional indicators of quality and good versus poor critical thinking. Gunawardena applied a coding scheme that consisted of five general categories or phases of critical thinking (see Table 1), consisting of a total of 21 event categories distributed among the five phases.

To compare the frequencies between the studies, multiple event categories and frequencies must be collapsed so that the final number of event categories in all the coding schemes under comparison are equal in number. To the extent in which this can be done, the frequencies between studies can then be compared and interpreted. The following discussion compares the events and event frequencies observed in this study with the findings from the studies by Newman and Gunawardena.

Stating Positions, Agreements and Disagreements

Position statements. In this study, *position statements* were found to occur relatively infrequently. When positions were stated *in the titles of messages*, they tended to occur at the beginning of discussion threads. In addition, Position statements tended to occur in the titles of messages more often than any other event category (except Disagreement) - 10 of the 30 observed position statements were posted in the title of messages. These findings indicate that

Position statements, when used in the titles of messages, were useful for marking and initiating a discussion thread and discussion topic, particularly during the opening stages of a group discussion. In Group 1's discussions, position statements were also observed in a later thread used to poll the positions of participants. The 20 position statements observed *within the messages* (as unit events) were used to preface presented arguments or were presented as conclusions drawn from presented arguments.

Disagreements. Statements of *disagreement* were found to occur more infrequently, with half the frequency of Position statements. Like Position statements, Disagreements *in the titles of messages* tended to occur at the beginning of a discussion thread. Five of the observed 14 Disagreements were expressed in the title of messages. The nine other Disagreements observed in the message text (as unit events) were either stated at the beginning of the message in response to a previous message, or stated later in the text in response to arguments re-iterated within the message. In almost all cases, a Disagreement was accompanied with counter-arguments and challenges to previously stated arguments.

Agreements. *Statements* of *agreement* were found to be six times more likely to occur than Disagreements. Agreements stated in the titles of messages tended to occur throughout a discussion thread - not just at the beginning of threads. Agreements stated in the titles of messages produced 11.3% of all the message titles, the third largest percentage of all 12 event categories behind Arguments and process Comments. Review of the transcripts showed that agreements (in the message title or at the beginning of the message text) were often used to preface Arguments and Negotiations. In almost all cases, Agreements were stated as a preface to the presentation of additional information in support of a given argument. In a few cases, agreements were used to preface a counter-argument using phrases like "I agree…but…".

Comparing frequencies. The coding schemes in Newman and Gunawardena's studies either did not code Position statements, Agreements or Disagreements, or they did not report any observed frequencies for these events. As a result, the observed frequencies between the studies cannot be compared. However, the frequencies found in this study can be used to establish potential benchmarks from which to conduct comparative studies in the future. In this study, no interventions were presented to shape the discussions and group interactions. As a result, the frequencies reported in this study can be used as bench-marks to evaluate how particular types of interventions affect group process and critical thinking.

Sharing Ideas, Information and Justifications

The findings in this study and Newman and Gunawardena's studies suggest that two-thirds or more than two-thirds of events in group discussions can be expected to be arguments or the sharing of ideas, information and justifications. This study found 50% of observed events as Arguments (see Table 15), which consisted of information to develop a position such as explanations of consequences, implications, solutions to problems, beliefs, and facts and events. Arguments were most often supported with personal experiences and hypothetical actions/choices. Summing the relative frequencies between the categories Arguments, Position statements, Agreement, Disagreement, Personal experiences, Literature, Formal data, Hypothetical actions, and Summary (with three remaining event categories) results in a 68.3% proportion of statements used to "share ideas, information and justifications".

In comparison, Newman (1995) found that 63% of events were sharing ideas, information and justifications when combining the frequencies from three of the five categories of critical thinking *operations* in his coding scheme (see Table 9) - information, ideas and solutions (N+-), bringing outside knowledge (O+-), and justification (J+-). Gunawardena's study (1997, p.427) of

an online debate with electronic mail found that 92.7% of messages to be in Phase I - the sharing and comparing of information (see Table 1). Compared to the frequencies observed in the current study and Newman's study, the frequencies observed in Gunawardena's study appear to be highly skewed towards the sharing of information, with very few events observed in the remaining four phases.

The results of both the current study and Newman's study were based on discussions in formal credit courses on threaded bulletin boards, whereas Gunawardena's results were based on a professional discussion among 554 list subscribers using electronic mail. In other words, the differences in population and context might explain the differences in observed frequency in Gunawardena's study.

In addition, this study and Newman's study used the *unit of meaning* as the unit of analysis, where as Gunawardena's used the message as the unit of analysis. The unusually high frequency of arguments observed by Gunawardena *suggests* that use of *messages* as a unit of analysis produces a tendency to *underestimate* the relative frequencies of higher order critical thinking events - particularly events that tend to occur together with ideas, information and justifications *within* messages. In this study, Arguments were almost always presented with other events in the texts of the messages. This shortcoming in the use of *messages* as the unit of analysis is discussed in more detail in the next section.

Evaluation and Critical Assessment

This study found 6.5% of events to be evaluation statements - statements that judge the accuracy, likelihood, validity, logic, relative importance or value of an argument or claim. Some examples are: "This is especially crucial in professions where your actions have implications on other people's safety, etc." and "For example, privacy here in the States seems to be more

important than in South America." If statements posed as questions are included as evaluative and critical statements (*additional* events with ? tags), the resulting percentage of Evaluation statements increases to 19.7%. By comparison, Newman found that 23% of statements were critical assessments of shared ideas, information and justifications. In contrast, the findings in Gunawardena's study suggest that less than 3.4% of *messages* (7 out of 206 messages) contributed to the evaluation of given information based on the five messages observed in Phase II (the discovery and exploration of dissonance among ideas) and two messages observed in Phase IV (the testing and modification of proposed synthesis or co-construction).

By adding posed questions to the Evaluation event category, the relative frequencies observed in this study are similar to Newman's findings. A reason for this similarity is that both studies used of *units of meaning* as the unit of analysis. As mentioned earlier, it is possible that use of *messages* as units of meaning can severely underestimate the frequencies of less common events (e.g. Evaluation), which may account for the apparently low percentage of Evaluation statements found in Gunawardena's study. As explained earlier, the use of messages as the unit of analysis can potentially create a *tendency* to code messages to most frequent events that occur with less frequent events *within* the texts of messages - particularly because only one code can be assigned per message when using the message as a unit of analysis.

In this study, Arguments were presented in the messages with Evaluations about 17% of the time, and Evaluations were presented with Arguments 28% of the time (see Table 19). Review of the transcripts indicated that participants tended to state their arguments or the arguments of others before stating their evaluation of the arguments. Table 18 shows how both Arguments and Evaluations tended to occur through out a discussion thread from thread levels 1 through 7 (not just near the beginning or the end of a thread like Position and Disagreement), providing additional data to support this pattern of events in messages.

When two events like Arguments and Evaluations occur together within a message, the use of *messages* as units of analysis forces the researcher to arbitrarily choose which code to assign to the message. As a result, *the unit of analysis in any interaction analysis can significantly affect event frequencies*. The differences in frequencies observed in this study and Gunawardena's study may very well be the result of using *messages* as the unit of analysis versus using *units of meaning*.

Summary Statements

Summary statements were observed at a very low frequency, and were only stated in the message text (as unit events) and not in the message titles. Close examination of the transcripts revealed that summary statements were often used to review previously presented arguments mid way into a discussion, and not necessarily near the end of a discussion as suggested in Gunawardena's model. An example of this is, "I think there are two distinct issues with drug testing that have been touched upon in these discussions, but not explicitly separated". Summary statements were also used to summarize *arguments* near the end of a discussion or during *negotiations* for group consensus, such as "From most of the people in favor of drug testing I get the sense that they are most concerned with the interests of the corporation as it pertains to productivity and safety. On the other side, we tend to have put forth a position based on the importance of individual rights, which you have continued".

Negotiation

Negotiation statements were found to be the third most frequent event in the group discussions. In this study, the Negotiation category included events for making group consensus, such as "Now that we seem to be getting out most of our points of view, how about we start

attempting to reach a compromise?" This particular form of negotiation was found to occur near the end of discussions. In Gunawardena's model, this form of negotiation occurs half way into the critical thinking process in Phase III. This finding indicates that the discussions in this study were designed primarily to engage students in discussions involving only Phases I, II and III. Students were not instructed in this study to propose solutions to any specific problems. As a result, no events were observed in Phase IV of Gunawardena's model.

The Negotiation category also included events in which participants stated individual conclusions and conditional terms based on given arguments, such as "If performance is being affected, then something *should* be done". Individual conclusions and conditional terms like these were found frequently and regularly throughout the discussions. What is particularly interesting is that conclusions were often drawn from arguments stated by the same individual, rather than *after* the careful review and evaluation of all stated arguments. These findings are not consistent with Gunawardena's model which suggests that events like these should occur during Phase III of discussion - *after* the presentation of arguments.

Altogether, the evidence suggests that the students in this study were premature in making judgments, and that some intervention may be necessary to encourage students to state and evaluate all arguments *before* stating conclusions. The state transitional diagram in Figure 2 does not reveal this particular pattern and event sequence because the diagram does not show events as they occur over time. This pattern would be visible in the diagram if it was viewed at different periods of time during the discussions.

Comments on Process

Comments on process occurred at a relatively high frequency. Examples of these statements are: "This is my point", "I would like to add more issues", "I hope you understand my point",

"After some more thought…", "Some of us have touched on this already" or comments to address statements to specific individuals. These statements occurred regularly throughout the discussion threads, and served to maintain the flow of discussion. They were most frequent during the presentation of arguments, evaluations and negotiations (see Table 19).

Given that 21% of messages were titled with process Comments, the participants were essentially attaching codes to their own messages. If done on a regular basis, this action could be applied in a way that would help students model the argumentation process. As described in Jonassen's (1996, p. 173-174) research on hypertext knowledge-construction environments, structures can be built into the communication environments to assist participants in assigning codes to messages. With this comes the unprecedented opportunity to analyze larger data sets to assess group interactions and critical thinking through analysis of event sequences.

Event Sequences, Interactions and Outcomes

Position Statements and Interactions

Responses to Position statements. In Gunawardena's (1997) model of critical thinking (see Table 1), discussions begin with the statement of positions and are followed by statements of agreement and supporting arguments. In this study, the results showed that Position statements were often followed by Position statements (33% of the time), Arguments (33%), Agreements (17%) and process Comments (17%). The findings also showed that positions were stated at the beginning of discussions and discussion threads, except for times where threads were used to conduct group polls. Most of all, the transitions from Position statements to Agreements and Arguments were primarily uni-directional rather than bi-directional. Figure 2 shows a *state transitional diagram* that illustrates this directional pattern between statements of position,

agreement and arguments. These findings are consistent with Gunawardena's model which prescribes the same sequence of events in the critical thinking process.

Responding to Positions with Evaluation Statements. Evaluative statements were found in responses to Position statements *more often than expected* (see Table 23). The transcripts show that *responses* were often presented with supporting arguments along with an evaluative statement that expressed the weight and importance of the arguments. Take this excerpt as an example: "I believe that drug testing should be mandatory especially in certain professions. This is *especially crucial* in professions where your actions have implications on other people's safety, etc." One explanation for this finding is that participants may sense a need to validate positions or arguments when responding to another individual's position statement. If this is the case, this interaction pattern suggests that arguments should be regularly stated in explicit reference to stated positions in order to encourage evaluation and assessment of supporting arguments.

Arguments and Interactions

Responses to Arguments. Arguments were the most frequently observed event of the 12 event categories, comprising 50.7% of all coded events (for both title and unit events). Messages with Arguments stated in the message titles received responses with additional Arguments 49% of the time (see Table 20). Review of the transcripts indicated that these responses to Arguments most often presented additional Arguments, counter-arguments or additional information to elaborate on statements from the previous message. A total of 34 of these Argument→Argument event sequences were observed, which was *higher* than expected (z-score = 3.08, $\underline{p} < .10$, $\underline{n} = 34$) relative to the 12 possible event categories. Responses with evidence to support the given arguments (see Table 23) were most likely to be presented in the form of personal experiences (5%) and hypothetical actions (5%).

Constructive responses with Arguments. A close reading of the 34 observed Argument→Argument sequences revealed that the majority of responses related or *elaborated* new information back to the Arguments presented in the previous message. This included elaboration with additional supporting arguments (e.g. case examples), with counter-arguments and experiences. For example, Table 27 illustrates an Argument → Argument sequence in which an argument was given in support of hiring and firing employees based on personal conduct outside of work. The argument was that corporations have the right to protect their image from being slandered by the questionable beliefs or behaviors of its employees. In the responding message was an Agreement with the Argument presented with supporting case examples.

Insert Table 27 about here

Table 28 illustrates an Argument → Argument sequence in which the response presents *counter-arguments* and challenges to points made in the previous message. The given message presents an Argument against corporate drug testing by arguing that if problems like drug testing are left to the discretion of companies, they may also use their discretion to perform other questionable practices in the hiring and firing of its employees, like screening employees for alcoholism. The responding message responds to and challenges the presented Argument from a legal and economic standpoint, and not from an ethical standpoint. It presents the counter-argument that businesses have the right to protect their interests so long as they abide by the law. Note that in this interaction, the Argument was posed as a question or critical assessment of drug testing, which in turn, elicited a response to counter the argument. This event sequence might be characterized as a Question/Answer interaction. Another example of this type of interaction is illustrated in Table 29.

Insert Table 28 & Table 29 about here

Non-constructive responses with arguments. Responses in an Argument→Argument sequence were also found to be *non-constructive*, if not less constructive. Such an example was found in responses that avoided or diverted discussion away from the previously stated Argument by stating a counter-argument in support of the opposing position. No statements in the response are given to elaborate or draw relationships to arguments presented in the previous message. This pattern of interaction might best be characterized as "*cross-arguing"* - when participants volley arguments and counter-arguments in support of opposing positions without considering or critically examining the grounds of the stated arguments. This is similar to what Gottman (1994 pp. 86-87) termed as "cross-complaining" and "yes-butting" in his sequential analysis of problematic (if not destructive) interactions between married couples. Table 30 illustrates an example of a "yes-butting" response in which a message starts with a form of acceptance or agreement, but then ends with a counter point, often using morally justifiable reasons that outweigh the negatives or transgressions. Another example of cross-arguing was found in a Disagree→Disagree interaction illustrated in Table 31, which is described later in more detail.

Insert Table 30 & Table 31 about here

Discriminating constructive from non-constructive interactions. The analysis of message titles ($T_0 \rightarrow T_{1,j}$) was able to identify Argument → Argument interactions that were on the whole constructive interactions - responses that elaborated on specific arguments stated in previous messages. Other types of interactions (e.g. cross-arguing and yes-butting), identified in this study

after close examination of the transcripts, are believed to be less constructive forms of interaction (Gottman, 1994). The frequency and the effects of these interactions can be assessed, measured and compared through sequential analysis *if* arguments are tagged with valences to produce event categories for supporting (+) and opposing arguments (-). With the tags, cross-arguing can be identified by event sequences where valences alternate between threaded messages. Yes-butting responses can be identified by observing event sequences like Argument(+) → (Agree + Argument(-)) using the analysis of title events and unit-events ($T_0 \rightarrow T_1 + U_{1,\,1+}$).

In this study, attempts were made to tag arguments with valences in the initial coding scheme. This approach was abandoned because the combined task of assigning codes *and* assigning valences was difficult to achieve with high inter-coder reliability. At times, arguments were ambiguous, difficult to interpret and therefore difficult to assign a valence. However, a simple solution to this problem would be to instruct discussion participants to assign valences to their arguments (and assign codes as well) at the time they post messages to the threaded discussions. As discussed earlier, this would be a plausible solution given that 21% of the messages observed in this study were already *coded* with process comments in message titles. By having the discussion participants assign valences and codes, the arduous task of coding discussion transcripts would essentially be eliminated, thus enabling greater opportunities to examine different types of interactions (e.g. cross-arguing) and their outcomes in more detail using sequential analysis.

The outcomes of argument-argument interactions. The results in Table 25 and Table 26 show that Argument → Argument interactions formed the brunt of the discussions relative to all the other observed event sequences. In Table 25, the results of the three-event sequential analysis (by title events only) showed that the Argument → Argument event pair was followed 55% of the time by additional Arguments. The Argument → Argument event pair was the most effective

interaction for eliciting and generating more Arguments for discussion. Equally important is that almost all of the observed Argument → Argument event pairs drew responses, giving this interaction an overall response rate of 97%. The overall average response rate was 59% across all event pairs, and 49% for any single given event (see Table 22).

The data from Table 26 reveals that 62% (46 of 74) of all responses in a discussion thread following an Argument → Argument interaction provided additional Arguments. Relative to all the other event pairs, Argument → Argument also generated the most Evaluations in responses within the discussion thread - eight in all. Even more significant is that there were a total of 74 messages within discussion threads following this event pair, producing 38% of all messages observed in the group discussions. The average number of responses within an Argument → Argument thread was 2.3 - almost twice the overall average of 1.2 responses for any event pair. These findings clearly show that the Argument → Argument interactions generated the majority of the discussions. More study is needed to determine how and if outcomes differ between different types of Argument → Argument interactions (e.g. cross-arguing) when valence tags are added to the coding scheme.

Assessing the Use of Arguments. How well students use arguments in the critical thinking process can be assessed according to the prescribed processes in models of critical thinking (e.g. Gunawardena's model). The process can also be assessed in relation to normative data obtained through empirical evaluation of events, event sequences and outcomes. Gunawardena's model of critical thinking suggests that the elaboration of arguments and question and answer of Phase I are the necessary events that precede Phase II of critical thinking. The model does not suggest specific sequences for events involving disagreements in Phase I of discussion and counter-arguments (e.g. cross-arguing) in Phase II of critical thinking process. The model suggests that arguments be shared, identified and defined in Phase I *before* differences between arguments and

positions are addressed. Normative data must be obtained through empirical analysis to determine how counter-arguments and disagreements are constructive or non-constructive in the critical thinking process.

Once normative data is established, it will be possible to quantitatively measure and assess how well or how poorly arguments are being used in a discussion using the methods of sequential analysis prescribed in this study. The use of valences in coded arguments will enable the identification, discrimination and enumeration of different types of Argument → Argument interactions (both good and bad). The measures can be used to compute a percentage score based on a ratio between *constructive* versus *non-constructive* interactions observed in the discussions. This performance ratio can be used by instructors and discussion participants can be used to monitor and assess the process and quality of discussions.

Disagreements and Interactions

Responses to disagreements. Disagreements were found to draw the highest response rates and were most likely followed by Arguments (38%) and Agreements (38%), with some responses with Disagreement (13%) and process Comments (13%). The transcripts revealed that in the Disagree → Argument interaction, counter-arguments were presented to critically *challenge* an opposing argument or position. This event sequence is consistent with the prescribed sequence in Phase II of Gunawardena's model of critical thinking (see Table 1). In contrast to the Disagree → Argument interaction, Disagree → Agree was also observed in this study involving interactions in which information was provided to *develop* a given argument. This interaction was found to occur at a higher frequency than was expected. These two interactions (Disagree → Agree, Disagree → Argument) can be useful for identifying

interactions in which arguments are *developed* with supporting information versus *challenged* through critical assessment.

An example of cross-arguing. The review of the transcripts revealed that the Disagree → Disagree interaction was an instance of a *cross-arguing* interaction - a form of interaction often viewed as non-constructive. As described earlier, cross-arguing occurs when a participant presents an argument and the responding message presents counter-arguments *without* addressing the previously stated argument. In the example (see Table 31), JK disagreed with statements made in a previous discussion thread that supported drug testing, and then posed arguments against drug testing by presenting personal experiences to illustrate the negative impact. A response was posted by AM, who in turn *disagreed* with JK's position and presented a counter-argument in support of drug testing. The comments by AM, however, did not address nor elaborate on the arguments presented by JK. This particular example of a Disagreement → Disagreement interaction suggests that Disagreements, when stated explicitly in message titles, might lead to cross-arguing in which there is little evidence of critical thinking and constructive argument.

Effects of cross-arguments. Although the Disagree →Disagree interaction may not appear to be a constructive interaction, analysis of the discussions *ensuing* the Disagree → Disagree interaction showed that this interaction elicited the greatest number of responses (see Table 26) compared to other event pairs observed. Consistent with this finding was that Disagreements elicited a response rate of 80% - the highest response rate for all event categories (see Table 22) - and elicited a *high* number of discussion threads, averaging two threads for every Disagreeing message (compared to the overall average of 1.5 threads). Thirty-eight percent of responses to Disagreements were arguments. Only Arguments elicited a higher rate (49%) of Arguments than Disagreements. Close review of the messages following the Disagree → Disagree interaction

showed that subsequent responses were constructive messages that elaborated on previous arguments. These observations suggest that cross-arguing can also be constructive - not in the interaction itself, but in the events that follow the interaction. These findings illustrate the potential value of analyzing events *subsequent to event pairs*.

Agreements and Interactions

Responses to Agreements. Table 20 showed that the various types of responses to Agreements included Arguments (33%), Agreements (22%), Negotiations (22%), Evaluations (11%) and process Comments (11%). The overall response rate to a stated Agreement (32%) was less than half of the response rate to Disagreement (80%). Furthermore, Disagreements were found to generate discussion threads that were more than twice the number of messages following a stated Agreement - based on a count of 7 subsequent responses following 9 given Agreements (computed from data in Table 25) and a count of 16 subsequent responses following 8 given Disagreements.

Agreements showed no tendency to elicit Disagreements. Because Disagreements were found to generate more responses and longer discussion threads than Agreements (as explained earlier), this finding challenges the utility of stating agreements in Phase 1B of Gunawardena's model - the statement of agreement from one or more other participants. The findings in this study suggest that Disagreements and challenges to given arguments help to encourage participants to develop a threaded discussion in more detail, such as presenting supporting arguments and defining problems (Phase 1E).

Table 20 suggests that Agreements were more likely to elicit Evaluations and Negotiation statements than Disagreements. At the same time, Table 23 shows that their likelihood of eliciting Evaluations and Negotiation statements are approximately equal when taking into

account *all unit-events* presented in responding messages. The differences in finding between the two methods of analysis illustrates a potential limitation of the two-event analysis of message titles. It also suggests that more structures are needed to improve the correspondence between message titles and the function of a message in order to facilitate data analysis and group communications. Regardless, the findings from these analysis clearly show that Disagreements elicits more interaction than Agreements. This suggests that participants should be encouraged to voice their differences in order to generate deeper discussion.

Eliciting more agreements. The transcripts showed that in the observed Agree → Agree interactions, one response to the event pair presented counter-arguments to *challenge* an argument and the other response presented information to *develop* a given argument. In contrast, all three Disagree → Agree interactions elicited responses to *develop* a previous arguments. These findings suggests that Disagreements can be more effective in eliciting the *development* of given arguments than stated Agreements. Although these patterns of interaction must be tested and validated with larger sample sizes, the findings illustrate some of the processes and considerations required to identify and understand different patterns of interaction and their effects on critical thinking.

Evaluations and Interactions

A review and cross-comparison of the transitional probabilities in Table 19, Table 20 and Table 23 revealed no consistent patterns of interaction with Evaluation statements except for one. Evaluation of stated arguments was found to occur very infrequently and occurred at lower than expected frequency. When Arguments were presented, however, Evaluation statements were also presented 17% of the time. This finding suggests that fewer than one out of five arguments presented in the discussions were evaluated and critically examined.

A close review of the transcripts also showed that most Evaluation statements were brief one-sentence remarks (e.g. “probably not” and “I’m not so sure”) or critical questions (e.g. “Is it possible?” and “Sound good?) presented with Arguments raised (or re-stated from a previous message) *within* the message - which is a reminder of how the presentation of Arguments tended to be the dominating function of discussions. There were no observed instances in which messages were posed with the single purpose of evaluating a given argument at length.

In light of these findings, however, the observed frequency of Evaluation statements may have been underestimated. In this study, Evaluation was narrowly defined in the coding scheme. Newman’s (1995) coding scheme included a category “critical assessment and evaluation” that included events in which questions are posed to challenge or induce critical examination of arguments. It included statements intended to cast doubt on the accuracy or validity of arguments. The data analysis in this study did *not* include the posing of critical questions in the Evaluation category. Review of the transcripts revealed instances where critical questions were listed and posed in immediate succession (see Table 32). This form of evaluation appeared to be a common practice in the group discussions. As a result, these observations suggest that critical questions like, “How will the rights of individuals be protected?” should be coded as an Evaluation event and not as an Argument.

Insert Table 32 about here

Supporting Arguments and Interactions

Personal Experiences. Arguments were often supported with personal experiences. When a personal experience was shared, more personal experiences were presented in responding messages (see Table 23) and at a higher than expected frequency (40% probability). They also

tended to elicit Evaluation statements, also at a higher than expected frequency (20% probability).

Hypothetical Actions. Some arguments were supported by predictions or inferences on how individual's might choose to respond to hypothetical situations, using statements like "I would" or "I could". This study found that a stated Hypothetical Actions usually elicited responses stating additional Hypothetical Actions from other participants in the discussion at a higher than expected probability (75%). See Table 20. The results also show that responses to Hypothetical statements tended to contain Arguments *less often* than the expected frequency (see Table 23), suggesting that the transitions between Arguments and Hypothetical actions occurred primarily in the direction from Arguments to Hypothetical actions. These findings all together suggest that Hypothetical statements were used to support arguments by establishing expected consequences based on hypothetical choices or actions of individuals under given situations. See example excerpt in Table 33.

Insert Table 33 about here

Table 25 and Table 26 also show Hypothetical → Response interactions received no responses. This finding suggests that once Hypothetical statements were presented in support of given arguments, no more responses were posted to advance the discussion. This finding is consistent with Phase IIC of Gunawardena's model in which the events - the advancing of arguments through participant's experiences, etc. - are listed as the closing events to Phase II of the critical thinking process. Consistent with this pattern is that Phase III (Negotiation), the next phase of critical thinking involving negotiation, was often initiated in new discussion threads.

Process Comments and Interactions

Process Comments were used to preface statements in messages (e.g. “Here’s my position”), that managed the flow of discussion (e.g. “Let’s vote”), and that addressed responses to individual participants. Most of these comments were meta-cognitive in effect - making direct reference to specific event categories and critical thinking functions. The data analysis and review of the transcripts did not reveal any uniquely identifiable patterns in interactions with process comments. As a result, the coding scheme should be revised so that statements coded as process Comments in this study will be coded as event categories that are referenced in the statements. This event category can then reserved for meta-cognitive statements regarding participant’s understanding of the discussion or changes in position or opinions resulting from the discussions, as proposed in Phase V of Gunawardena’s model of critical thinking.

Implications on Models of Critical Thinking

Preface

The findings in this study present both support and challenges to existing models of critical thinking. The following is a discussion and summary of the findings and their implications on the models and theories of critical thinking, with particular focus on event categories and event sequences. Drawing from the discussion are suggested changes to the models of critical thinking, as well as recommended changes to the methods and procedures for future research on group interaction and critical thinking.

Event Categories

Unit of Analysis. In this study, the event categories and their observed frequencies were similar to Newman’s findings, and different from Gunawardena’s findings. The models of

critical thinking differed in number of event categories partly because the models were based on different units of analysis. Because this study and Newman's study used *units of meaning* as the unit of analysis, the observed event frequencies were very similar. In contrast, the distribution of event frequencies in Gunawardena's study was significantly different, most likely due to Gunawardena's use of *messages* as the unit of analysis.

Number of Event Categories. One of the main challenges faced in this study was determining a suitable number of event categories. As the number of event categories increases, the number of observed events in each category and their frequencies tends to decrease proportionately. Also, the number of possible event sequences grows exponentially, further diminishing the power of the sequential analysis and its findings. Bakemann & Gottman (1997) recommend an upper limit of 10 event categories per coding scheme. In the model used in this study, there were 12 event categories and the consequences were clearly visible in the low marginal totals in the majority of event sequences, particularly in the three-event sequences.

On the other hand, constructing a coding scheme with fewer event categories can produce a coding scheme with little descriptive power. Newman's model consists of only seven "functional" categories where as Gunawardena's model consists of 21 event categories. Gunawardena's model provides a thorough and complete coding scheme with high descriptive power. The model presents the event categories in a hierarchy of five phases. These phases can be used as a framework for collapsing event categories prior to performing sequential analysis, resulting in more power in the analysis (higher marginal totals). The model used in this study could be improved by including higher order categories or hierarchies like those in Gunawardena's model, and using these higher-order categories in the analysis of event sequences.

Event Sequences

Confirmed transitions among events. The model of critical thinking developed by Gunawardena (see Table 1) proposes a critical thinking process composed of specific event sequences. The results of this study summarized in the state transitional diagram (Figure 2) confirm some of the event sequences proposed in the model. Paralleling *Phase I* of Gunawardena's model, the findings in this study support the transitions from the statement of opinion to agreement (Position → Agreement), Agreements to corroborating examples (Agree → Argument), and statement of Opinion to corroborating examples (Position → Argument). No transitions from Position → Disagreement were observed in this study, which is consistent with the omission of Disagreements in Phase IB of Gunawardena's model. Paralleling *Phase II* of the model, this study's findings support the transition from disagreement to advancing arguments (Disagree → Argument). Paralleling *Phase III*, there was evidence to confirm the transition from the identification of areas of Agreement to offering of proposals (Agree → Negotiation).

Disagreement and counter-arguments. Although the state transition diagram in Figure 2 showed few interactions involving Disagreements, close review of the discussion transcripts indicated that most Disagreements occurred in the form of counter-arguments as illustrated in Table 28. The Argument → Argument event sequences clearly illustrated a dialectic process in which arguments were presented and challenged with counter-arguments. Phase I of Gunawardena's model does not prescribe this form of dialectical interaction in the critical thinking process. Instead, the model suggests that all positions and supporting arguments are best presented *before* discussion of differences and Disagreements in Phase II of the model. The methods of sequential analysis used in this study can be refined to examine this pattern of argumentation to determine its efficacy and its implications on models of critical thinking.

Negotiation as an iterative process. Although there was clear evidence to support the transition from Phase IIIB to Phase IIID - the "weighting of arguments" to "offering proposals" (or Evaluation→Negotiation), this study also found that the transitional probability from Evaluation → Negotiation was *equal* to the transitional probability from Negotiation → Evaluation. This finding suggests that this phase of discussion was an *iterative* process rather than a linear sequential process. The state transition diagram in Figure 2 suggests that the processes of negotiation in Phase III of Gunawardena's model involved iterative rounds of negotiation, evaluation and validation - as illustrated in the event sequence Negotiation → Evaluation → Agreement. This iterative process is not explicitly represented any of the models of critical thinking reviewed in this study.

Evaluating Arguments. The use of evaluation and the transitional probabilities between Arguments and Evaluation was not consistent with some of the processes described in existing models of critical thinking. The transitional diagram (Figure 2) shows that presented arguments were rarely followed by evaluation of the arguments. Instead, the majority of responses to arguments were additional arguments or elaboration of arguments. Responses to arguments also contained agreements often accompanied by additional information, or disagreements usually accompanied by counter-arguments. The transitional diagram indicates that participants were more likely to jump to negotiations (or offering of proposals or conclusions) in response to a given argument than they were to evaluate a given argument *before* negotiating proposals.

These contradictory findings might not be attributed to flaws in the models, but rather they can be attributed more to the performance and abilities of the participants in the discussions. A review of the transcripts revealed that many of the Evaluation statements were brief assessments of given arguments, consisting of one or two phrases. Evaluations were not presented in great detail or with much elaboration. Detailed discussions of evaluation criteria and assignment of

weight to arguments were not observed. This finding may not be so surprising given that critical assessment of arguments is a skill that requires extensive instruction and practice. This task requires appropriate knowledge of various decision-making techniques. In addition, this task requires access to appropriate tools (e.g. vote balloting) to support and coordinate the process, as described in the research on group decision support systems (Poole et al., 1991 & 1993).

The contradicting findings might also be attributed to limitations in the methods of the sequential analysis used in this study. Close readings of the transcripts indicated that participants often performed critical assessment of arguments with the presentation of counter-arguments. Critical evaluation may have been *implied* through the presentation of counter-arguments intended to challenge and test the validity or accuracy of given arguments. Furthermore, critical assessment was also found to occur in the posing of questions, modeling a process much like the Socratic method of critical thinking. As discussed earlier, adding valences to arguments to identify argument versus counter-arguments and adding the posing of questions to the model may help achieve a more accurate measure of critical assessment in group discussions.

Modeling sequential versus parallel events. Gunawardena's model prescribes the critical thinking process as a progression through a set of event sequences. This study was able to experiment with methods to analyze the consequences and outcomes of different event sequences as well as event combinations. For example, the results of this study suggest that more evaluation of arguments can be elicited when arguments position statements are presented at the same time. This finding suggests that some outcomes may be better achieved by allowing multiple events to take place in parallel rather than in linear sequence. These types of findings and interaction suggest more possibilities for modifying existing models of critical thinking.

Implications on Student Interactions in Threaded Discussions

This study was able to demonstrate the importance of conflict and differences in viewpoint as the impetus to critical discussion using formal measures of event sequences and transitional probabilities. As suggested in Bakhtin's theory of dialogism, meaning is produced by the relationship between one utterance and another, and is affected, re-negotiated and reconstructed as a result of *conflict* arising from social interaction. The findings that particularly supported this theory of interaction came from the analysis of outcomes and events following disagreements. However, these findings were limited because participants tended not to express disagreements explicitly but rather more implicitly through the presentation of counter-arguments and critical questions. Improvements in the coding scheme will enable better measurement of these implicit forms of disagreement to continue the evaluation of conflict and its role in critical thinking in group discussions.

The primary contribution of this study was the development of an interaction analysis model and methods for examining group interactions and critical thinking in threaded bulletin board discussions. In summary, the chief advantages of the methodology established in this study are:

1) The ability to examine and identify group interactions in terms of events and *event sequences*.

2) The ability to quantitatively measure and predict critical thinking outcomes from observed interactions, and to identify those interactions that are most constructive.

3) The potential to use these methods to create tools for assessing performance in constructivist and collaborative learning activities.

4) The potential ability to adapt the tools to different coding schemes for different evaluation purposes.

The methods developed and tested in this study will open new opportunities to examine, measure, assess and better understand how *group interactions* lead to specific outcomes. At the time of this study, no methods or tools were known to be available to evaluate event sequences that occur in group discussions and to use the results of the evaluations to support the co-construction of knowledge through critical thinking. The algorithms and methods developed in this study (as well as other proposed methods) will lay the ground work to developing advanced techniques and designs to augment the power of communication technologies as instructional tools.

Modifications to Model and Methods

Close examination of the results revealed both strengths and weaknesses in the methods used in this study. Overall, the methods were successful in identifying patterns in student interactions and their relationship to critical thinking. The methods used in this study were particularly effective when data from multiple methods of analysis were cross-referenced and interpreted together, providing a more complete and detailed look into group interactions and critical thinking. In addition, many of the observed patterns and frequencies were found to be consistent with findings from previous studies, the existing models of critical thinking, and

theoretical assumptions on interaction and conflict. At the same time, possible improvements to the model, methods and procedures were identified during the review and discussion of the findings. Some of the recommended changes and modifications to the methods and procedures are:

1) Tag valences to arguments to help identify different uses of arguments in responses, such as repeating arguments, cross-arguing, and yes-butting.
2) Obtain valences and/or event codes by instructing students to tag their messages as they submit them to the discussion through manual entry or through built-in tag menus.
3) Increase sample size, decrease the number of event categories, or include higher-order event categories to increase the observed frequencies and to increase the power of two-event and three-event sequence analysis.
4) Revise coding scheme so process comments are coded to the functions referenced in the process comment.
5) Revise coding scheme so remarks posed as questions are coded as a form of evaluation and critical assessment of arguments.

Implications on Assessment

In this study, the observed frequencies across event categories were interpreted in context to findings from previous studies. These interpretations are the beginnings to the establishment of normative measures for evaluating the quality of group discussions. Normative measures can be useful for roughly determining how much arguments and evaluations, for example, can be expected to create a quality discussion. To establish more valid norms and measures, future studies are needed to examine the critical thinking processes of content experts. Also needed are

formal and overall assessments of the discussions by content experts, accompanied with each analysis of events and event sequences.

This study was able to examine the transitional probabilities between events in threaded discussions. Because this had not been done in previous studies, there was no means to interpret the findings in this study with findings from previous research to establish any normative data. Future research is needed to measure and establish normative data on transitional probabilities between events for different group activities, disciplines, and instructional mediums. In the process, it will be necessary to develop measures of quality (e.g. good versus poor argument) which has been addressed in Newman's (1995) study.

Implications on Instructional Interventions

The methods in this study can be used to examine, test and compare the effects of different *instructional interventions* on group interactions and outcomes. In this study, no interventions were presented in the discussions in order to establish a baseline measure for event frequencies and event probabilities. As a result, the implementation of the discussions can now be varied systematically to measure the outcomes of specific interventions. These outcomes can then be compared to the measures established in this study. Some of the possible interventions to test in future studies are:

1) *Polarizing Groups* - In this study, discussion groups were polarized so each group had an equal number of students on opposing sides. The effects of polarizing groups can be evaluated by repeating this study *without* polarizing the groups. Groups could also be polarized by gender or other demographic characteristics to examine the effects on group

interaction and critical thinking. Interactions could also be examined by individual difference in initial positions of issues.

2) *Playing Devil's Advocate* - Students can be assigned to polarized groups and then instructed to play devil's advocate by arguing for the opposing position. The findings can be compared with the results from this study to evaluate how this intervention affects group interaction and critical thinking.
3) *Anonymous Discussions* - Allow anonymous participation in discussions and examine differences in the frequency of disagreements and its impact on the critical thinking process.
4) *Breaking Discussions into Phases* - Explicitly prevent students from cross-arguing (volleying counter-arguments between threaded messages without addressing grounds of each argument) by structuring the discussions into discrete phases at different time periods. For example, instruct students to post *only* arguments to each position during a fixed time period. Then instruct them to evaluate the arguments in the next time period.
5) *Structuring the Messages* - Instruct students to post message titles that identify the messages' function using established codes the coding scheme. At the same time, instruct students to post messages to pre-configured discussion threads (created by the instructor) that mirror specific phases of critical thinking prescribed in existing models.
6) *Outlining the Discussion* - In the initial stages of discussion, instruct students to post positions and arguments in short sentences in *only* the titles of messages to create an outline for later discussion. Once a preliminary outline is established, instruct students to respond to the existing messages in the outline with supporting evidence and evaluations of the arguments.

Implications on Communication Technologies

Improving our understanding of the effects of different interventions on group interaction through analysis of events and event sequences will help advance the design and development of new communication tools for supporting group discussion and collaborative work. At the most sophisticated level, these tools and methods can be used to automate the diagnosis of group interactions and the delivery of empirically tested interventions (Derry & DuRussel, 1999). But at its most basic level, the methods developed in this study can be integrated into applications to generate real-time data to assist students, instructors or researchers in diagnosing group processes and in formal assessment of *processes* and *outcomes*.

On a broader scale, these potential applications may help today's communication technologies evolve into more sophisticated information management systems that will be capable of turning information generated in casual or formal electronic conversations into highly organized, useful, and readily accessible information. In fact, the coding and classification of messages/content is one of the latest endeavors to manage the wealth of information on the World Wide Web - using XML or Extensive Markup Language for tagging and categorizing individual pieces of information on the Internet to enable more advanced searches, organization, manipulation and access to information. Regardless of how the model and methods in this study are implemented, it is with great hope that the results of this study will contribute to constructivistic practices in education and co-construction of meaning through critical discourse.

Definition of Terms

Bulletin Board – An electronic network designed to support electronic group communication to allow exchanges independent of time and location. Contributions from group members are posted and accessible from a central and online depository of messages, organized by discussion threads and by chronology. Any individual in a discussion group can read and post messages at any time and from any location.

Co-authoring – A specific form of collaborative writing in which members of a group work integrally in discussion, decision-making, and writing of the group's ideas so that all thinking and decision-making are externalized and made explicit.

Collaborative writing – The meaningful interaction and shared decision-making and responsibility between group members in the writing of a shared document (Morgan et al., 1987).

Computer-mediated Communication (CMC) – The field of study that investigates the nature of computers as it impacts human communication processes and human behavior.

Computer-supported Collaborative Writing (CSCW) – An area of research that focuses on the research and development of computer tools to support the processes of collaborative writing as well as collaborative work.

Critical Thinking (CT) – A set of cognitive functions and skills used to better examine, reflect on and understand knowledge to construct beliefs and to direct behavior and action. See Gunawardena (1997) and Newman (1995 & 1996) for models of CT.

Dialogic Model of Writing – An approach to writing in which the assignment of specific roles is avoided so that there can be the sharing of goals and the blending of voices.

Dialogism – A theory of language (Bakhtin, 1981) that asserts that meaning is produced by the relationship between one utterance and another, and by the social context in which they exist. Meanings are affected, re-negotiated and reconstructed particularly through *conflicts* in ideas, viewpoints and underlying assumptions. Conflict is the energy that drives inquiry, reflection and articulation of individual viewpoints and their underlying assumptions, and social interaction is essential to producing *conflict* and the social construction of new knowledge and meaning.

Event Sequences – A series of messages created by exchanges among participants in a group discussion, linked together either by a thread within a discussion or by chronological order.

Face-to-Face (F2F) – A term commonly used to characterize the context in which humans communicate in close proximity, particularly through visual and oral communication.

Group Decision Support Systems (GDSS) – Computer tools or suite of integrated tools designed to support group decision-making. Such tools often include shared text editors, simple group messaging (without message threading), and automated voting and polling.

Interaction Analysis – A method designed for recording and analyzing classifications of social interactions, their frequency of occurrence, behavioral sequences, and possible cause-and-effect relationships.

Internet Relay Chat (IRC) - A multi-user implementation of a talk program in which several people can simultaneously participate in a discussion over a particular 'channel', or even multiple channels. There is no restriction to the number of people that can participate in a given discussion, or the number of channels that can be formed over IRC. All conversations take place in real time via typed text.

Lag - A term used to specify event sequences in which a given event is specified as an event at lag 0. A target event that immediate follows a given event is labeled as an event at lag 1. An event immediately following a lag 1 event is a lag 2 event and so on.

Sequential Analysis - A method designed for analyzing event sequences in terms of transitional probabilities that define how often or how likely one type of event is followed by another type of event.

State transitional diagram - A visual and graphical representation of the transitional probabilities between events in which circles represent codes, and arrows represent transitional probabilities between event sequences (see Figure 2).

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Table 1
Interaction Analysis Model and Coding Scheme for Examining Critical Thinking in Computer Conferencing

Phase 1: Sharing/comparing of information (92.7% of observed events)

A. A statement of observation or opinion
B. A statement of agreement from one or more other participants
C. Corroborating examples provided by one or more participants
D. Asking and answering questions to clarify details of statements
E. Definition, description, or identification of a problem

Phase II: The discovery and exploration of dissonance or inconsistency among ideas, concepts or statements. (2.4% of observed events)

A. Identifying and stating areas of disagreement
B Asking and answering questions to clarify the source of extent of disagreement
C. Restating the participant's position, and possibly advancing arguments or considerations in its support by references to the participant's experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point of view.

Phase III: Negotiation of meaning/co-construction of knowledge (1.9% of observed events)

A. Negotiation or clarification of the meaning of terms
B. Negotiation of the relative weight to be assigned to types of argument
C. Identification of areas of agreement or overlap among conflicting concepts
D. Proposal and negotiation of new statements embodying compromise, co-construction
E. Proposal of integrating or accommodating metaphors or analogies

Phase IV: Testing and modification of proposed synthesis or co-construction (1% of observed events)

A. Testing the proposed synthesis against "received fact" as shared by the participants and/or their culture
B. Testing against existing cognitive schema
C. Testing against personal experience
D. Testing against formal data collected
E. Testing against contradictory testimony in the literature

Phase V: Agreement statements/applications of newly-constructed meaning (1.9% of observed events)

A. Summarization of agreements
B. Applications of new knowledge
C. Metacognitive statements by the participants illustrating their understanding that their knowledge or ways of thinking (cognitive schema) have changed as a result of the conference interaction.

Total number of messages observed was 206 in Gunawardena's study.
Source: Gunawardena, 1997

Table 2
Decision Function Coding System for Evaluating the Impact of Group Decision Support Systems on Group Interactions

1. Problem definition
   - A. Problem analysis: statements that define or state the causes behind a problem.
   - B. Problem critique: statements that evaluate problem analysis statements (may be assigned positive or negative valence).

2. Orientation
   - A. Orientation: statements that attempt to orient or guide the group's process. These also include simple repetitions of others' statements or clarifications.
   - B. Process reflection: statements that reflect on or evaluate the group's process or progress.

3. Solution development
   - A. Solution analysis: statements that concern criteria for decision making or general parameters for solutions.
   - B. Solution suggestions: suggestions of alternatives.
   - C. Solution elaboration: statements that provide detail or elaborate on a previously stated alternative. They are neutral in character and provide ideas or further information about alternatives.
   - D. Solution evaluation: statements that evaluate alternatives and give reasons, explicit or implicit, for the evaluations. They may be assigned positive (+) or negative (-) valence. Statements that ask for evaluations or are bivalent are coded as neutral (/).
   - E. Solution confirmation: statements that state the decision in its final form or ask for final group confirmation of the decision. They may be assigned positive valence if they argue for confirmation or a neutral valence if they merely ask for confirmation. Negative responses to 3e statements are corded 3d-.

4. Non-task: statements that do not have anything to do with the decision task. They include off-topic jokes and tangents.

5. Simple agreement.

6. Simple disagreement.

Source: Pool (1993 p.195)

Table 3
Conflict Interaction Process Variables and Measurements Used for Conflict Management Behaviors in Group Decision Support Systems

Conflict Level: (coded with Group Working Relations Coding System)

1. Low
   - A. Focused work
   - B. Relational Integration

2. Moderate
   - A. Critical work
   - B. Open discussion

3. High
   - A. Opposition

Conflict Management Behavior: (coded with Interpersonal Conflict Interaction Coding System)

1. Avoidance
   - A. Denial and equivocation
   - B. Topic management
   - C. Noncommittal remarks
   - D. Irreverent joking

2. Distributive
   - A. Confrontative remarks
   - B. Disagreement

3. Integrative
   - A. Analytic remarks
   - B. Conciliation

4. Mixed Avoidance & Distributive

5. Mixed Avoidance & Integrative

6. Mixed Integrative & Distributive

7. Mixed Avoidance, Distributive & Integrative

Source: Poole (1991, p. 931)

Table 4
Seven Strategies for Coordinating Collaborative Writing

1. Team or group plans and outlines, each member drafts a part, team or group compiles the parts, team or group revises the whole.

2. Team or group plans and outlines, one member writes the entire draft, team or group revises the whole.

3. One member plans, outlines and drafts the whole text, team or group revises the whole

4. One member plans, outlines and writes a draft, draft submitted to one or more persons who revise draft without consulting original writer.

5. Team or group plans, outlines and writes a draft, draft submitted to one or more persons who revise draft without consulting original writers.

6. One member assigns writing tasks, each member carries out individual tasks, one member compiles the parts and revises the whole.

7. One person dictates another person transcribes and revises.

Source: Posner, 1991

Table 5
Writing Activities by Posner (1991)

Researcher	Gathers information from sources external to the group
Planner	Creates outline for document, and divide work among members
Writer	Transforms ideas into text
Editor	Make changes to the text
Reviewer	Generates comments about the text

Table 6
Coding Scheme for Examining Group Processes in Collaborative Writing

Strategy and Planning

1. Talk about who will write the essay
2. Talk about content, focus of the essay
3. Talk about content or scores of prior essays
4. Reads/discusses ideas from own individual essay

Interactive Composition

1. Discusses how to get ideas on the floor
2. Discusses how to organize, integrate ideas
3. Requests review or additional input
4. Reviews or discusses another member's input
5. Agrees with or encourages another's contribution
6. Disagrees with another's contribution
7. Reads or summarizes what has already been written
8. Composes publicly (aloud or in message box)
9. Composes and recites aloud (FTF)
10. Composes silently on paper or in message box
11. Makes overt statement of completion, or finishes with no comment

Mechanics of the Production Process

1. Talks about non-substantive details of the production process (e.g. asks for quiet, corrects spelling, asks other member to talk slower)
2. Talks about time
3. Talks about how to do something on the computer or about problems using the equipment.

Off-Task Interactions

1. Talks about matters pertinent to the group and the class in which these work groups were embedded.
2. Talks about non-intimate matters pertinent to own or other's life outside the group and the class (e.g. week-end activities)
3. Talks about intimate personal or interpersonal matters
4. Talks about intellectual topic not related to the group's task activities

Source: Lebie, Rhoades, and McGrath (1996)

Table 7
Coding Scheme for Examining Group Processes and Conflict in Face-to-Face Collaborative Writing

Composing		
	CR	requesting text content
	CT	literal suggesting of text
	CM	mechanics
Strategic thinking about process task representation		
	STD	difficulty
	STA	audience
	STP	purpose/stance
	STR	requirements/content
	STG	genre
	STW	meta-writing talk
Planning		
	SPCG	content global
	SPCL	content - local
	SPSG	structural - global
	SPSL	structural - local
	SPR	requesting ideas
Revising		
	SRCG	content - global
	SRCL	content - local
	SRSG	structural - global
	SRSL	structural - local
	SRR	requesting ideas
Procedural suggestions		
	PT	time management
	PS	status of the text
	PG	group functioning/directives to group
Affective elements		
	AA	personal associations
	AP	positive
	AN	negative
Miscellaneous		
	RR	rereading text
	OT	off task
	U	unclear
	INC	incomplete
	SRT	study-related talk
Tag codes used throughout		
	/A	alternative idea/phrasing
	/C	asking for clarification
	/E	elaboration
	/EV	evaluation
+	positive/agreement	
-	negative/disagreement	
?	uncertain/indifferent	

For example, "CT/EV+" is recorded for a student that offers a comment during text composition that expresses a positive evaluation of another group member's idea or suggestion. *Source:* Dale (1994)

Table 8
Coding Scheme with Indicators of Critical and Uncritical Thinking for Evaluating Quality of Group Discussions in Computer Conferencing

R+- Relevance
- R+ relevant statements
- R- irrelevant statements, diversions

I+- Importance
- I+ Important points/issues
- I- unimportant, trivial points/issues

N+- Novelty. New info, ideas, solutions
- NP+ New problem-related information
- NP- Repeating what has been said
- NI+ New ideas for discussion
- NI- False or trivial leads
- NS+ New solutions to problems
- NS- Accepting first offered solution
- NQ- Squashing, putting down new ideas
- NQ+ Welcoming new ideas
- NL+ learner (student) brings new things in
- NL- dragged in by tutor

O+- Bringing outside knowledge/experience to bear on problem
- OE+ Drawing on personal experience
- OC+ Refer to course material
- OM+ Use relevant outside material
- OK+ Evidence of using previous knowledge
- OP+ Course related problems brought in (e.g. students identify problems from lectures and texts)
- OQ+ Welcoming outside knowledge
- OQ- Squashing attempts to bring in outside knowledge
- O- Sticking to prejudice or assumptions

L+- Linking ideas, interpretation
- L+ Linking facts, ideas and notions
- L+ Generating new data from information collected
- L- Repeating information without making inferences or offering an interpretation.
- L- Stating that one shares the ideas or opinions stated, without taking these further or adding any personal comments.

A+- Ambiguities: clarified or confused
- AC+ Clear, unambiguous statements
- AC- Confused statements
- A+ Discuss ambiguities to clear them up
- A- Continue to ignore ambiguities

J+- Justification
- JP+ Providing proof or examples
- JS+ Justifying solutions or judgments
- JS+ Setting out advantages and disadvantages of situation or solution
- JP- Irrelevant or obscuring questions or examples
- JS- Offering judgments or solutions without explanations or justification
- JS- Offering several solutions without suggesting which is the most appropriate.

C+- Critical assessment
- C+ Critical assessment/evaluation of own or others' contributions
- C- Uncritical acceptance or unreasoned rejection
- CT+ Tutor prompts for critical evaluation
- CT- Tutor uncritically accepts

P+- Practical utility (grounding)
- P+ relate possible solutions to familiar situations
- P+ discuss practical utility of new ideas
- P- discuss in a vacuum (treat as if on Mars)
- P- suggest impractical solutions

W+- Width of understanding (complete picture)
- W- Narrow discussion. (Address bits or fragments of situation. Suggest glib, partial, interventions)
- W+ Widen discussion (problem within a larger perspective. Intervention strategies within a wider framework.)

(+- is an attempt to render the plus-or-minus sign in ASCII)
Source: Newman (1995 & 1996)

Table 9
Results from Evaluation of Critical Thinking in Computer Conference Group Discussions versus Face-to-Face Discussions

Scoring criteria	Ratios CC	Ratios f2f	Statements CC +	Statements CC -	Statements f2f +	Statements f2f -
R+- Relevance	0.88	0.85	48	3	137	11
I+- Importance	0.89	0.35	33	2	29	14
N+- Novelty. New info, ideas, solutions	0.37	0.59	24	11	65	17
A+- Ambiguity and clarity/confusion	*	-0.05	2	2	20	22
O+- Bringing outside knowledge/ experience to bear on problem	1.00	0.76	35	0	89	12
L+- Linking ideas, interpretation	0.80	0.06	18	2	27	24
J+- Justification	0.69	0.48	27	5	80	28
C+- Critical assessment	0.89	0.93	35	2	143	5
P+- Practical utility (grounding)	*	0.88	1	0	15	1
W+- Width of understanding	*	0.06	1	0	9	8

CC= computer conferencing. f2f=face-to-face.
* Not calculated because sample is too small.

Source: Newman (1995, p 71)

Table 10
Revised Coding Scheme Used in the Current Study

POSITION (+/-):	A statement explicitly citing the individual's position. Assign valences for pro (+), con (-) on the position debated by the group. If valence is unclear, omit from code. P = "I am against mandatory drug testing" P = "I am in favor of random drug testing" P = "Certain companies should be required to test for drugs" P = "I would test him for drugs" P? = "Would you drug test him?" P = "I am not sure if I am for mandatory drug testing"
AGREE**:**	A statement of agreement. A = "I agree with you" A = "I agree that //…" A = "Yes, //" A = "Indeed, //" A = "I do not dispute that //"
DISAGREE	A statement of disagreement D = "I don't agree with your position on drug testing" D = "I disagree //"
A**R**GUMENT	A statement containing information to develop or support a position. Arguments can be in the form of: 1) predicted **consequences, implications, or problems** through hypothetical or analogical reasoning (e.g. "they would, he could); 2) proposed **solutions** to resolve or mitigate problems challenging the position; 3) personal **beliefs, principles** or **set of assumptions**; and 4) **factual information** describing events, objects and circumstances. R = "Drug testing ensures the safety of workers in the work environment" R? = "Would you work on site with a guy in charge of explosives who is doing cocaine?" R "If an employee performs, then the company has no reason to discriminate against him" R = "I believe in the fifth-amendment" R = "I think everyone deserves a second chance" R = "I don't like the way drug testing is handled in companies" R = "If they decide they don't want people to drink because they are less productive, then they have the right to stop hiring people who drink" R ="If you don't want to be tested, you *can* work for a different company". R ="If you believe in the fifth amendment, then testing violates individual privacy" R? = "What **problem** are corporations really trying to solve with testing?" R? ="If they test for drugs, what rights might they infringe upon next?" R? ="How do we control what is or is not to be tested?" (problematic point) R = "I believe companies cannot fire someone on the spot for failing one drug test" R = "This employee passed the drug test when he applied at the company", "The employee has been working with a clean record without problems", "He learned from his mistakes". R? = "What policies are in place in your company?"
E**X**PERIENCES	A description of 1) events, objects, or circumstances drawn from personal experiences, actions & observations; 2) emotional reactions/feelings to an issue. X= "I worked for a different company when they wanted to test me for drugs" X= "Mandatory drug testing makes me feel uncomfortable" X= "My father is a production manager & owner of a manufacturing company".
LITERATURE	Information drawn or cited from literature and reports, including TV & radio. L= "The article by Smith found that 50% of companies do drug testing"

L= “If you look at the statistics…” INF! = “I don’t have the statistics on hand”
continued…

DA**T**A — Information or observations drawn from formal data ***collected by participants*** (**not** cited from literature).
T= “In our group poll, 60% of us worked in companies that test for drugs”
T= “In my survey, I found that…” DAT = “In my research, I found that…”

HYPOTHET-ICAL ACTION — A statement describing a *personal preferred* course of **action** used to evaluate the extent and validity of predicted consequences and implications. Look for “**I would, I will**”. For example:
H = “I *would* offer him help to solve the pending accusations”
H = “He *could* reapply for the job after the trial”
H= “No need to *deny* him a job” = “I wouldn’t *deny* him the job”
H = “I *would* put him on leave without pay”, “I would *be* cautious”.
H? = “How *would* you react on a larger scale (not just regarding this individual)?”
H? = “Why would you *do* that?”

EVALUATE — A statement that *judges* the accuracy, likelihood, validity, logic, relative importance or value of an argument or claim by 1) making explicit judgment with words like “good”, “true”, “not likely”; 2) raising **alternative viewpoints** from which to make judgments.
E= “It’s an absolutely **true** story” “That would be great”
E= “When this discussion started, I didn’t see privacy as an issue”
E= “In *another country*, this might not be true”
E= “Well, for some this might seem as a *naïve* answer”, “That’s a *tough* question”
E= “You make a **good** point”, “This is a good summary of the issues”.
E= “That would be highly **unlikely or improbable**”
E = “This issue is **more important** than the other issue”
E= “I don’t think your argument is valid”
E= “I don’t think we need to worry about that issue”
E?= “Are you *sure*?”, “Is that really *true*?”
E= “I think we should not judge before we know the whole story”
E= “What is more important - rights of the individual or the corporation?”

SUMMARY — A statement to **review** or **summarize** points raised in discussion.
S = “From *most of the people* in favor of drug testing, I sense that they are most concerned with the interests of the corporation as it pertains to productivity and safety”
S= “Here are the issues that we so far have touched upon”
S? = “Could someone summarize the pros and cons?”

NEGOTIATE — A statement that relates to the negotiation of : 1) meanings or definition of terms; 2) terms or conditions of an agreement/compromise on solutions to a problem or positions on an issue. Look for statements that declare a position on the issue with given terms, limits or conditions. Look for words **consensus, compromise, agreement** & **should, must, need to, ought to**.
N = “If a company performs tests, job applicants *must* be informed before hand”
N = “I support drug testing but under certain conditions only”
N= “The situation *should* be handled in a sensitive manner”
N = “I guess it’s a fair agreement for all of us” “About half of us agree on that point”
N = “I do not intend to change my position in the future”
N = “From the discussion, I am now against drug testing”
N = “You’ve convinced me that companies should do drug testing”
N = “Let’s see if we can arrive at a group consensus”
N = “Let’s see if we can work out a solution with concessions on both sides”.
N? = “Can we agree on a middle ground?”

COMMENTS — A statement addressing issues related to the discussion *process* rather than the discussion *content*. These statements address: **1)** group procedures and participant

interactions (if not already included in any codes listed above); **2)** personal train of thought or flow of written text; **3)** the acknowledgment of member contributions.
C = “I don’t know why *I* didn’t think to bring this up earlier”
C = “But let me see” “Here is an example for you to wrestle with.”
C = “Here is my opinion”
C = “After some exchange of opinions, I thought about it”
C = "Thanks for the comment" “You have a point”
C = “Can we come back to this point later?” “I hope you understand my point”
C = “When this discussion started, I didn’t see privacy as an issue”
C = “Let’s see if we can come to a consensus”
C = “I don’t appreciate that remark!” “That remark was insulting”

==========TAG CODES to add as suffixes to codes ==========

If a statement requires multiple tags, enter the tags in the order listed below.

? **Question & Requests:** Add tag after code for any unit that ends with a *question mark*, or any statement in which its function is to pose a question or to make a request.
E? = “Are you sure your facts are correct?”
R? = “Does it matter if somebody consumes drugs?”
R? = “But do we not all deserve a second chance?”
R? = “Why do you believe that?”
H? = “Why *would* you do that?”
N? = “Should we try to come to a consensus?”

Table 11
Excerpt from Coding Sheet of Group 1 Recorded in Microsoft Excel

A1	**GROUP 1: Companies should be allowed to do mandatory drug testing to its employees.**			
A2	In favor of corporate drug testing	P+	0	P+ P+ E R R
A3	by AE			
A4	I believe that drug testing should be mandatory especially in certain professions.	P+		
A5	This is especially crucial in professions where your actions have implications on other peoples safety etc.	E		
A6	for instance truck drivers and airline pilots.	R		
A7				
A8	I also believe that it should be mandatory for public servants like teachers.	R		
A9	Posted on Nov 14, 2000, 8:06 PM			
A10				
A11				
A12	..In favor	P+	1	P+ A C E R E
A13	by JH			
A14	I agree with	A		
A15	// AE's comments.	C		
A16	In these jobs, I feel it is especially important to drug test.	E		
A17	I also feel that it is within the right of any employer to require employees pass drug test as a condition of hire.	R		
A18				
A19	Random testing after hire is a little more difficult...	E		
A20	Posted on Nov 17, 2000, 1:43 PM			
A21				
A22				
A23	....So, we all agree?	A?	2	A? A R E R E
A24	by JE			
A25	I also agree.	A		
A26	Anyway, it would be interesting to know why people doesn't...	R		
A27	Maybe you think that it's obvious,	E		
A28	but remember that not all of us have the same cultural backgrounds.	R		
A29	For example, privacy here in the States seems to be more important than in South America.	E		
A30				
A31	JE.			
A32	Posted on Nov 19, 2000, 6:09 PM			

Table 12
Excerpt from Compiled Coding Sheet of Group 1 for Executing Sequential Analysis

A2	In favor of corporate drug testing	P+	0	P+ P+ E R R
A12	..In favor	P+	1	P+ A C E R E
A23	....So, we all agree?	A?	2	A? A R E R E
A36	The opposition speaks...	D	0	D X X X X R X H X R? X R R
A54	..Disagree	D	1	D P+ R R
A62	....I agree with	A	2	A C A R E R R N R H?
A76	....Drug testing is NOT a right	R	2	R A N R N N R C R R R N? R R D R R
A97	......Some questions....	R	3	R C R R R R H? H? H? H? H?
A114	........What would you do?	H?	4	H? N? H N R N R R H? H? R R R E? H? E
A136	..........OK, this is my answer...	C	5	C C E R R E X X X C H H H
A154	..........Yes, I'd Care!	H	5	H H R R R E R R R
A167	..Agree	A	1	A A C R R
A176	..agree with	A	1	A C A C N? R? R R X R A N
A192	....Some good points	E	2	E C E E C R N N C R X
A208	....Alcohol as a drug	R	2	R A N R L C R R

Table 13
Different Methods for Analyzing Event Sequences in Threaded Discussions

	2-Event	3-Event	4-Event
Within Message	$T_0 \rightarrow U_{0,1}$ $U_{0,1} \rightarrow \#U_{0,2+}$ $U_{0,0} \leftrightarrow U_{0,1}$	$(T_0 \rightarrow U_{0,1}) \rightarrow U_{0,2}$ $(T_0 \rightarrow U_{0,1}) \rightarrow \#U_{0,2+}$	$(T_0 \rightarrow U_{0,1} \rightarrow U_{0,2}) \rightarrow U_{0,3}$ $(T_0 \rightarrow U_{0,1} \rightarrow U_{0,2}) \rightarrow \#U_{0,3+}$
Between Messages	$T_0 \rightarrow T_1$ $T_0 \rightarrow \#T_{1+}$	$(T_0 \rightarrow T_1) \rightarrow T_2$ $(T_0 \rightarrow T_1) \rightarrow \#T_{2+}$	$(T_0 \rightarrow T_1 \rightarrow T_2) \rightarrow T_3$ $(T_0 \rightarrow T_1 \rightarrow T_2) \rightarrow \#T_{3+}$
Combin-ation	$T_0 \rightarrow T_1 + U_{1,1+}$ $T_0 \rightarrow \#(T_1 + U_{1,1+})$	$(T_0 \rightarrow T_1) \rightarrow U_{1,1+}$ $(T_0 \rightarrow T_1) \rightarrow \#U_{1,1+}$	$(T_0 \rightarrow T_1 \rightarrow T_2) \rightarrow U_{2,1+}$ $(T_0 \rightarrow T_1 \rightarrow T_2) \rightarrow \#(T_{3+} + U_{3+,1+})$

T Title-event (note: $T_0 = U_{0,0}$)
U Unit-event
$\rightarrow$ Compute frequencies and transitional probabilities
$\rightarrow\#$ Count number of title-events or unit-events or both
$\leftrightarrow$ Compute conditional probability
+ Compute across all remaining events from current location

Table 14
Number of Messages and Threads Observed in Threaded Discussions

	# Messages	# Threads	#Messages per Thread	n
Group 1	61	8	7.63	9
Group2	58	12	4.83	9
Group3	46	7	6.57	9
Group4	43	6	7.17	8
Total	208	33	--	35
Mean	52	8.25	6.30	
STD	8.83	2.63	1.22	

Number of messages counted with Excel macro CountNumberOfMessages ()

Table 15
Frequency and Percentage of Event Categories for Title and Unit-Events Combined

		Group 1		Group 2		Group 3		Group 4		Total	
Code	**Category**	**Freq**	**Pct**	**Freq**	**Pct**	**Freq**	**Pct**	**Freq**	**Pct**	**Freq**	**Pct**
P	Position Statement	12	2.2	11	2.3	6	1.4	1	0.3	30	1.6%
A	Agreement	31	5.7	24	4.9	18	4.2	16	4.3	89	4.9%
D	Disagreement	7	1.3	1	0.2	5	1.2	1	0.3	14	0.8%
R**	Arguments	218	40.4	199	41.0	300	70.8	207	55.3	924	50.7%
X	Personal Experience	23	4.3	28	5.8	13	3.1	21	5.6	85	4.7%
L	Literature	2	0.4	16	3.3	7	1.7	1	0.3	26	1.4%
T	Formal Data	0	0.0	0	0.0	0	0.0	1	0.3	1	0.1%
H**	Hypothetical Actions	43	8.0	6	1.2	2	0.5	8	2.1	59	3.2%
E	Evaluative	56	10.4	24	4.9	18	4.2	20	5.3	118	6.5%
S	Summary	9	1.7	5	1.0	1	0.2	1	0.3	16	0.9%
N	Negotiate	69	12.8	61	12.6	23	5.4	46	12.3	199	10.9%
C**	Commentary	70	13.0	110	22.7	31	7.3	51	13.6	262	14.4%
	Total Codes:	540		485		424		374		1823	

** In three event categories, significant differences were found in the frequency distributions *between* the four discussion groups. Chi-Square statistic was used to test for significant differences between the groups. The results show that Arguments were found at significantly higher frequencies in Group 3 than in other groups, X^2 (3, n =207.5) = 11.92, $p < .05$. Hypothetical Actions were observed at significantly higher frequencies in Group 1 than in other groups, X^2 (3, n = 11.8) = 11.81, $p < .05$). Comments were observed at significantly higher frequencies in Group 2 more than any other group, X^2 (3, n = 56.6) = 8.57, $p < .05$).

Total number of events with question mark ? tag was 241 (not including Evaluation events).

Results in table were computed with Excel macro CountCodeFrequencies ( ).

Table 16
Percentage of Event Categories by Title-Events Only

Event Category	Frequency	Percentage
Position Statement	10	5.1%
Agreement	22	11.3%
Disagreement	5	2.6%
Arguments	72	36.9%
Personal Experience	5	2.6%
Literature	2	1.0%
Formal Data	0	0.0%
Hypothetical Actions	6	3.1%
Evaluative	14	7.2%
Summary	0	0.0%
Negotiate	18	9.2%
Commentary	41	21.0%
Total message pairs	195	100%

Note: 13 messages were omitted because they were not titled and therefore not coded.

Frequencies for each event were taken from the marginal column totals in Table 18.

Table 17
Distribution of Messages Across Thread Levels in Discussion Threads

Thread Level	Frequency	Percent of messages
Level 0	33	15.9%
Level 1	61	29.3%
Level 2	43	20.7%
Level 3	25	12.0%
Level 4	16	7.7%
Level 5	15	7.2%
Level 6	9	4.3%
Level 7	4	1.9%
Level 8	2	1.0%
Total Messages	208	100%

The frequency of messages across thread levels were taken from the marginal totals in each thread level in Table 18.

Table 18
Distribution of Event Categories Across Thread Levels

	Event Categories												
Thread Level	Pos	Agr	Dis	Arg	Exp	Lit	Dat	Hyp	Eval	Sum	Neg	Com	Total
0	.09	.06	.03	.42	.03	.03	.00	.00	.00	.00	.12	.21	33
1	.11	.13	.04	.20	.04	.02	.00	.02	.09	.00	.11	.25	55
2	.02	.16	.02	.37	.05	.00	.00	.02	.09	.00	.09	.16	43
3	.00	.09	.00	.45	.00	.00	.00	.05	.09	.00	.05	.27	22
4	.00	.07	.00	.40	.00	.00	.00	.13	.07	.00	.13	.20	15
5	.00	.08	.08	.38	.00	.00	.00	.08	.08	.00	.08	.23	13
6	.00	.22	.00	.67	.00	.00	.00	.00	.00	.00	.00	.11	9
7	.00	.00	.00	.67	.00	.00	.00	.00	.33	.00	.00	.00	3
8	.00	.00	.00	1.00	.00	.00	.00	.00	.00	.00	.00	.00	2
Total	10	22	5	72	5	2	0	6	14	0	18	41	195

Frequencies of events within each thread level were computed with Excel macro GetCodeFrequenciesAcrossThreadLevels( ).

Table 19
Conditional Probabilities for Event Combinations Within Messages

	Conditional Event													
Given Event	Pos	Agr	Dis	Arg	Exp	Lit	Dat	Hyp	Eval	Sum	Neg	Com	n	msg%
Position		.17	.08	.71	.13	.08	.00	.00	.25	.00	.33	.54	24	11.5%
Agree	.06		.13	.88	.17	.05	.02	.11	.44	.05	.69	.66	64	30.8%
Disagree	.15	.62		.92	.15	.00	.00	.15	.31	.00	.38	.62	13	6.3%
Arguments	.10	.33	.07		.15	.06	.01	.15	.39	.06	.49	.53	170	81.7%
Experiences	.10	.38	.07	.90		.07	.03	.21	.38	.07	.52	.52	29	13.9%
Literature	.15	.23	.00	.85	.15		.00	.00	.46	.08	.38	.62	13	6.3%
Formal Data	.00	1.00	.00	1.00	1.00	.00		.00	.00	.00	1.00	.00	1	0.5%
Hypoth Actions	.00	.25	.07	.93	.21	.00	.00		.54	.04	.46	.54	28	13.5%
Evaluate	.08	.37	.05	.87	.14	.08	.00	.20		.07	.51	.68	76	36.5%
Summarize	.00	.25	.00	.83	.17	.08	.00	.08	.42		.83	.67	12	5.8%
Negotiate	.08	.44	.05	.83	.15	.05	.01	.13	.39	.10		.59	100	48.1%
Comments	.11	.36	.07	.77	.13	.07	.00	.13	.44	.07	.50		117	56.3%

n The number of messages in which the given event at lag 0 was observed.
msg% Percentage of messages (208 total messages) that contained the given event.

Computed with Excel macro ComputeCondProbForEventsWithinMessage( ).

Table 20
Transitional Probabilities for Two-Event Sequences of Title-Events

	Lag 1 Events													
Lag 0 Events	Pos	Agr	Dis	Arg	Exp	Lit	Dat	Hyp	Eval	Sum	Neg	Com	Total	Freq
Position	**(.33)**	.17	.00	.33	.00	.00	.00	.00	.00	.00	.00	.17	6	10
Agree	.00	.22	.00	.33	.00	.00	.00	.00	.11	.00	.22	.11	9	22
Disagree	.00	**(.38)**	**(.13)**	.38	.00	.00	.00	.00	.00	.00	.00	.13	8	5
Argument	.01	.16	.03	**(.49)**	.03	.00	.00	.04	**(.04)**	.00	.06	**(.13)**	69	72
Experience	.00	.00	.00	.00	**(.50)**	.00	.00	.00	**(.50)**	.00	.00	.00	2	5
Literature	.00	.00	.00	.00	.00	.00	.00	.00	**(1.00)**	.00	.00	.00	1	2
Data	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	0	0
HypothAct	.00	.00	.00	.00	.00	.00	.00	**(.75)**	.00	.00	.00	.25	4	6
Evaluate	.00	.20	.00	.20	.00	.00	.00	.00	**(.40)**	.00	.20	.00	5	14
Summary	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	0	0
Negotiate	.08	.04	.00	**(.20)**	.04	.00	.00	.00	**(.20)**	.00	.16	.28	25	18
Comment	.06	**(.03)**	.03	.30	.00	**(.03)**	.00	.00	.03	.00	.09	**(.42)**	33	41
Total	7	20	4	58	4	1	0	6	14	0	14	34	162	195

Table 21
Z-Scores for Transitional Probabilities of Two-Event Sequences

	Lag 1 Events												
Lag 0 Events	Pos	Agr	Dis	Arg	Exp	Lit	Dat	Hyp	Eval	Sum	Neg	Com	Total
Position	**(3.56)**	0.33	-0.40	-0.13	-0.40	-0.20	0.00	-0.49	-0.77	0.00	-0.77	-0.26	6
Agree	-0.66	0.93	-0.49	-0.16	-0.49	-0.24	0.00	-0.61	0.27	0.00	1.49	-0.75	9
Disagree	-0.62	**(2.22)**	**(1.88)**	0.10	-0.46	-0.23	0.00	-0.57	-0.89	0.00	-0.89	-0.60	8
Argument	-1.55	1.20	0.30	**(3.08)**	0.30	-0.86	0.00	0.37	**-(1.68)**	0.00	-1.11	**-(2.14)**	69
Experience	-0.30	-0.53	-0.23	-1.06	**(4.36)**	-0.11	0.00	-0.28	**(2.09)**	0.00	-0.44	-0.73	2
Literature	-0.21	-0.38	-0.16	-0.75	-0.16	-0.08	0.00	-0.20	**(3.26)**	0.00	-0.31	-0.52	1
Data	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
HypothAct	-0.43	-0.76	-0.32	-1.51	-0.32	-0.16	0.00	**(7.65)**	-0.62	0.00	-0.62	0.20	4
Evaluate	-0.48	0.53	-0.36	-0.75	-0.36	-0.18	0.00	-0.45	**(2.53)**	0.00	0.92	-1.17	5
Summary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Negotiate	0.98	-1.38	-0.87	**-(1.79)**	0.54	-0.43	0.00	-1.07	**(2.20)**	0.00	1.42	0.94	25
Comment	0.55	**-(1.82)**	0.23	-0.74	-1.02	**(1.98)**	0.00	-1.26	-1.29	0.00	0.10	**(3.39)**	33
Total	7	20	4	58	4	1	0	6	14	0	14	34	162

Z-score > 1.65 for statistical significance of .10 or less (for exploratory research)

The values enclosed in parenthesis identify z scores at $p < .10$ for frequencies significantly *above* the expected frequency. The values enclosed in parenthesis and underlined identify z scores at $p < .10$ for frequencies significantly *below* the expected frequency.

Table 20 and Table 21 were computed in Excel with macro ComputeTwoEventSeqWithTitlesOnly ( )

Table 22

Response Rates and Average Number of Threaded Responses for Event Categories

Event Category	Frequency	With Reply	Number Replies	Response Rate	Threaded Responses
Position	10	5	6	50%	1.20
Agree	22	7	9	32%	1.29
Disagree	5	4	8	80%	2.00
Argument	72	43	69	60%	1.60
Experience	5	1	2	20%	2.00
Literature	2	1	1	50%	1.00
Data	0	0	0		
Hypothetical Actions	6	3	4	50%	1.33
Evaluate	14	4	5	29%	1.25
Summary	0	0	0		
Negotiate	18	11	25	61%	2.27
Comment	41	20	33	49%	1.65
Untitled	13	3	3	23%	1.00
	208	102	165	49%	1.51
		Totals	:	Ave.	Ave.

Response Rate = With Reply / Frequency
Threaded Responses = Number Replies / With Reply

Frequency of given events were taken from column totals in Table 18.
Number of given events with at least one reply were hand counted.
Number of replies for each given event were taken from the column ‘Total’ in Table 22.

Table 23
Transitional Probabilities Between Given Title-Events and All Events in Target Message

	Lag 1 Event												
Lag 0 Event	Pos	Agr	Dis	Arg	Exp	Lit	Dat	Hyp	Eval	Sum	Neg	Com	Total
Position	**(.14)**	.08	.00	.42	.00	.00	.00	.00	**(.14)**	.00	.03	.19	36
Agree	.00	.06	.00	.53	.01	.01	.00	.02	.08	.01	.15	.14	106
Disagree	.01	**(.12)**	**(.02)**	.52	.01	.00	.00	.01	.10	.00	.13	**(.07)**	83
Argument	**(.00)**	.06	.01	**(.56)**	**(.05)**	.01	.00	**(.05)**	.06	.00	**(.09)**	**(.10)**	559
Experience	.00	**(.20)**	.00	**(.20)**	**(.40)**	.00	.00	.00	**(.20)**	.00	.00	.00	10
Literature	.00	.00	.00	**(.00)**	.00	.00	.00	.00	.25	.25	**(.50)**	.00	4
Data	.00	.00	.00	.00	.00	.00	.00	.00	.00	v	.00	.00	0
HypothAct	.00	.03	.00	**(.26)**	**(.14)**	.00	.00	**(.34)**	.09	.00	.06	.09	35
Evaluate	.00	.07	.00	.44	.00	.00	.00	.00	.07	.00	**(.22)**	.20	41
Summary	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	0
Negotiate	.03	.03	.01	.53	**(.02)**	.00	.00	**(.01)**	.08	.01	.11	**(.18)**	183
Comment	**(.03)**	.04	.00	.48	.02	.01	.00	**(.01)**	**(.03)**	.01	.13	**(.22)**	218
Total	18	73	10	659	49	9	1	47	85	7	143	174	1275

The values enclosed in parenthesis identify probabilities that are significantly *higher* than the expected probabilities (z-score > 1.65, p < .10). The values enclosed in parenthesis and underlined identify values that are significantly *lower* than the expected probabilities (z-score < -165, p < .10).

Table 24
Z-Score for Transitional Probabilities Between Title to Title and Unit Events

	Lag 1 Events											
Lag 0 Events	Pos	Agr	Dis	Arg	Exp	Lit	Dat	Hyp	Eval	Sum	Neg	Com
Position	**(6.44)**	0.68	-0.54	-1.22	-1.22	-0.51	0.00	-1.19	**(1.76)**	0.00	-1.63	1.03
Agree	-1.29	-0.03	-0.96	0.25	-1.62	0.31	0.00	-1.03	0.38	0.00	1.32	0.16
Disagree	-0.17	**(2.56)**	**(1.74)**	0.02	-1.29	-0.79	0.00	-1.24	1.12	0.00	0.61	**-(1.76)**
Argument	**-(3.78)**	0.48	0.39	**(2.94)**	**(2.50)**	0.71	0.00	**(2.21)**	-0.97	0.00	**-(1.73)**	**-(3.66)**
Experience	-0.38	**(1.95)**	-0.28	**-(2.01)**	**(5.97)**	-0.27	0.00	-0.62	**(1.70)**	0.00	-1.13	-1.26
Literature	-0.24	-0.49	-0.18	**-(2.07)**	-0.40	-0.17	0.00	-0.39	1.47	0.00	**(2.46)**	-0.80
Data	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HypothAct	-0.72	-0.74	-0.53	**-(3.12)**	**(3.26)**	-0.51	0.00	**(9.74)**	0.46	0.00	-1.05	-0.89
Evaluate	-0.78	0.45	-0.58	-1.01	-1.30	-0.55	0.00	-1.27	0.17	0.00	**(2.21)**	1.11
Summary	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Negotiate	1.64	-1.54	0.51	0.39	**-(1.68)**	-1.23	0.00	**-(2.44)**	0.90	0.00	-0.13	**(1.87)**
Comment	**(2.47)**	-1.43	-0.60	-1.29	-1.31	1.30	0.00	**-(1.99)**	**-(2.25)**	0.00	1.07	**(3.95)**

The values enclosed in parenthesis identify z scores at p < .10 for frequencies significantly *above* the expected frequency. The values enclosed in parenthesis and underlined identify z scores at p < .10 for frequencies significantly *below* the expected frequency.

Table 23 and Table 24 were computed with Excel macro ComputeTitleToTitlePlusCodes

Table 25
Frequencies for Observed Three-Event Sequences

	Third Event at Lag 2														
Event Pair	Pos	Agr	Dis	Arg	Exp	Lit	Dat	Hyp	Eval	Sum	Neg	Com	Replies	Freq	Rate of Response
EN	0	1	0	0	0	0	0	0	2	0	0	0	3	1	300%
DC	0	0	0	1	0	0	0	0	0	0	1	0	2	1	200%
DD	0	1	0	1	0	0	0	0	0	0	0	0	2	1	200%
PC	0	0	0	1	0	0	0	0	0	0	0	1	2	1	200%
PP	0	1	0	1	0	0	0	0	0	0	0	1	3	2	150%
RN	0	0	0	2	1	0	0	0	0	0	0	2	5	4	125%
AA	0	1	0	1	0	0	0	0	0	0	0	0	2	2	100%
AC	0	0	0	1	0	0	0	0	0	0	0	0	1	1	100%
CD	0	0	0	0	0	0	0	0	0	0	0	1	1	1	100%
CE	0	1	0	0	0	0	0	0	0	0	0	0	1	1	100%
CN	0	0	0	3	0	0	0	0	0	0	0	0	3	3	100%
E	0	0	0	0	0	0	0	1	0	0	0	0	1	1	100%
EA	0	0	0	0	0	0	0	0	0	0	1	0	1	1	100%
PR	0	1	0	0	1	0	0	0	0	0	0	0	2	2	100%
RD	0	0	0	2	0	0	0	0	0	0	0	0	2	2	100%
RH	0	0	0	0	0	0	0	2	0	0	0	1	3	3	100%
RR	0	4	1	17	0	0	0	2	1	0	2	4	31	32	97%
NC	1	1	1	0	0	0	0	0	0	0	1	1	5	7	71%
AR	0	1	0	0	0	0	0	0	0	0	0	1	2	3	67%
DA	0	0	0	1	0	0	0	0	1	0	0	0	2	3	67%
DR	0	0	0	2	0	0	0	0	0	0	0	0	2	3	67%
RE	0	0	0	1	0	0	0	0	1	0	0	0	2	3	67%
CR	0	1	0	2	0	0	0	0	1	0	1	1	6	10	60%
NR	0	0	0	3	0	0	0	0	0	0	0	0	3	5	60%
CC	0	0	0	3	0	0	0	0	0	0	0	5	8	14	57%
AN	0	0	0	0	0	0	0	0	1	0	0	0	1	2	50%
C	0	0	0	1	0	0	0	0	0	0	0	0	1	2	50%
RC	0	0	0	2	0	0	0	0	0	0	1	1	4	9	44%
NE	0	0	0	0	0	0	0	0	1	0	1	0	2	5	40%
NN	0	0	0	0	0	0	0	0	1	0	0	0	1	4	25%
RA	0	0	0	1	0	0	0	0	0	0	0	1	2	11	18%
R	0	0	0	1	0	0	0	0	0	0	0	0	1	8	13%
AE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
CA	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
CL	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
CP	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0%
EE	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0%
ER	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
H	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0%
HC	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%

HH	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0%
LE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
N	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0%
NA	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
NP	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0%
NX	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
PA	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
RP	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
RX	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0%
XE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
XX	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0%
												Average			59.36%

**	Untitled and uncoded target events at lag 1.
Total	The number of responses at lag 2 for given event pair.
Freq	The number of times each event pair listed in each row was observed.
Rate of Response	(Total / Freq) x 100

Event Pair Codes
P = position statement
A = agreement
D = disagreement
R = argument
X = personal experience
L = literature
T = data
H = hypothetical actions
E = evaluate
S = summary
N = negotiate
C = comment

Frequencies were tallied with Excel macro ComputeTitleTitleThreadLength ( ).

Table 26
The Total Number of Messages Following a Two-Event Sequence

	All Events at Lag 1,2,3 …														
Event Pair	Pos	Agr	Dis	Arg	Exp	Lit	Dat	Hyp	Eval	Sum	Neg	Com	Total	Freq	Ave
DD	0	1	0	2	0	0	0	2	0	0	0	1	6	1	6.0
PC	0	1	0	2	0	0	0	0	0	0	0	2	5	1	5.0
CN	0	0	1	11	0	0	0	0	0	0	0	1	13	3	4.3
PP	0	2	0	3	0	0	0	0	0	0	0	3	8	2	4.0
RC	0	3	1	19	0	0	0	0	2	0	2	5	32	9	3.6
CD	0	0	0	1	0	0	0	0	0	0	1	1	3	1	3.0
EN	0	1	0	0	0	0	0	0	2	0	0	0	3	1	3.0
RR	0	6	1	46	0	0	0	4	8	0	2	7	74	32	2.3
AC	0	0	0	2	0	0	0	0	0	0	0	0	2	1	2.0
CE	0	1	0	0	0	0	0	0	0	0	1	0	2	1	2.0
CR	0	4	0	7	0	0	0	0	2	0	2	5	20	10	2.0
DC	0	0	0	1	0	0	0	0	0	0	1	0	2	1	2.0
DR	0	0	0	2	0	0	0	2	0	0	1	1	6	3	2.0
NR	0	0	1	8	0	0	0	0	0	0	0	1	10	5	2.0
RD	0	0	0	3	0	0	0	0	0	0	1	0	4	2	2.0
RN	0	0	0	2	1	0	0	0	0	0	0	4	7	4	1.8
CC	0	3	0	11	0	0	0	0	0	0	1	7	22	14	1.6
NC	1	1	1	2	0	0	0	0	0	0	2	3	10	7	1.4
NE	0	1	0	0	0	0	0	1	3	0	1	0	6	5	1.2
AA	0	1	0	1	0	0	0	0	0	0	0	0	2	2	1.0
E	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1.0
EA	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1.0
PR	0	1	0	0	1	0	0	0	0	0	0	0	2	2	1.0
RH	0	0	0	0	0	0	0	2	0	0	0	1	3	3	1.0
AR	0	1	0	0	0	0	0	0	0	0	0	1	2	3	0.7
DA	0	0	0	1	0	0	0	0	1	0	0	0	2	3	0.7
RE	0	0	0	1	0	0	0	0	1	0	0	0	2	3	0.7
RA	0	1	0	3	0	0	0	0	0	0	0	2	6	11	0.5
AN	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0.5
C	0	0	0	1	0	0	0	0	0	0	0	0	1	2	0.5
EE	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0.5
NN	0	0	0	0	0	0	0	0	1	0	0	0	1	4	0.3
R	0	0	0	1	0	0	0	0	0	0	0	0	1	8	0.1
AE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
CA	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
CL	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
CP	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.0
ER	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
H	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.0
HC	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0

HH	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.0
LE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.0
NA	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
NP	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.0
NX	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
PA	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
RP	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
RX	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.0
XE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
XX	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.0
													Average =		1.2

**	Untitled and uncoded target events at lag 1.
Total	The number of responses at lag 2 for given event pair.
Freq	The number of times each event pair listed in each row was observed.
Ave	The average number of messages following event pair (Total / Freq).

Event Pair Codes
P = position statement
A = agreement
D = disagreement
R = argument
X = personal experience
L = literature
T = data
H = hypothetical actions
E = evaluate
S = summary
N = negotiate
C = comment

Frequencies were tallied with Excel macro ComputeThreeEventChainsWithTransProb( )

Table 27
Illustration of Elaborating with Examples in Argument→Argument Event Sequence

Employers have a right to protect their corporate image	R
by KW	
I believe that employers have the right to take action against employees for conduct occurring outside the workplace.	P+
For example, if an employee makes racially insensitive comments outside the office which causes harm to the corporation's reputation then I believe that the corporation has the right to take action against the employee.	R
That said, I do not believe that companies should be able to use this as a means to discriminate against individuals who do not share their beliefs.	N
Rather, I believe that the corporation needs to demonstrate that it has been harmed by the employees conduct prior to taking action.	R
..Some employers may take this too far	R
by AS	
I agree with //KW that	A
	C
//employers have a responsibility to protect their corporate image and something that an employee does outside of work can have a profound effect on the corporation.	R
Who was the sportscaster that was caught in a compromising S & M situation?	R?
Anyway, couldn't have looked too good for the network.	R
I think this is particularly true for so-called public figures,	R
//such as TV personalities, CEOs and spokespeople.	R
I think Seagrams dropped Bruce Willis after he received some bad PR.	R

Table 28
Illustration of Counter-Arguments in an Argument → Argument Event Sequence

....How do you decide what is illegal?	R?
by DC	
I agree that	A
//one should not do anything illegal	N
//and so companies should try to take precautions.	N
But it is not right to give this discretion to the companies.	R
What if a company decides that people who drink too much tend to be less productive and so it wants to hire only people who are non-drinkers.	R?
Where would you draw the line then?	N?
This might be an extreme scenario but not impossible.	E
.....taking drugs is illegal	R
by AM	
Companies have the right to follow their own guidelines (as long as they respect the law,	R
// If they decide they don't want people who drink because they are less productive then they have the right to stop hiring people who drink.	R
After all, its their business	R
//and they will do everything they think will help them succeed.	R
Here we are talking about drug testing	R
//and for society and companies consuming drugs is illegal.	R

Table 29
Illustration of Elaborating Arguments Using Question-Answer in an Argument→Argument Interaction

.....Beliefs aren't evident, //but can be uncovered	R
	R
by GR	
You are right that	E
// these beliefs don't become apparent until after employment.	R
My point was, if it is okay for the company to fire someone for those beliefs, should it then also be okay for them to attempt to uncover those beliefs before hiring?	N?
Is it acceptable to ask "do you belong to any race supremacist groups?" on a job application,	R?
//and consequently not hire that person, if that person could be fired later for said membership?	R?
.....Not okay to uncover beliefs in an interview	R
by AS	
I think attempting to uncover beliefs in a job interview is NOT okay,	R
//because it leads to discrimination.	R
And how incredibly boring to work in a place with people who all think alike.	R
I stand by my original opinion,	N
// that co.'s can only fire if it interferes with productivity in some way, e.g. if the employee is harassing other employees.	R

Table 30
Illustration of Yes-Butting Interaction in an Argument→Argument Interaction

....Drug testing is NOT a right	R
by JK	
I do agree that	A
//if performance is being affected that something should be done.	N
However, this is the case for anything that may be affecting performance.	R
If someone is having family problems which are affecting performance perhaps he or she should have counseling.	N
If someone is an alcoholic he or she should receive help for that too.	N
If someone has a performance problem it is the manager's job to get to the root of it and help that person out.	R
This is my point:	C
// This takes place AFTER you learn that the person has a problem, NOT before as in the case of drug testing.	R
Let's take the case of having family problems...	R
say a manager for some unlucky reason has the misfortune of having had several employees with family problems that affected performance.	R
Then with your line of reasoning shouldn't he be able to do a background check on you and your relationships??	N?
Performance may be affected!	R
//He has the right!	R
//No he doesn't.	D
Drug testing is not a manager's right.	R
Rather, it infringes upon our own rights.	R
.....Some questions....	R
by JE	
I understand your point,	C
// but let's say you start your own business after graduation: a restaurant.	R
You hire a cashier who will work for you full time,	R
// you are going to pay him x dollars.	R
You know that x is not enough money for a person to live AND consume drugs.	R
Wouldn't you be concerned about the possibility that your cashier could be cocaine addict?	H?
If he is but you don't know, how long will you wait before you do something?	H?
What would you do if you find he's an addict?	H?
Fire him or help him?	H?
Don't you think that it would be better to help him before you loose money?	H?

Table 31
Excerpt Illustrating Cross-Arguing in a Disagree→Disagree Event Sequence

The opposition speaks...	D
by JK	
I have experienced mandatory drug testing at my last job	X
//and I not only found it humiliating,	X
// I also found it to be degrading.	X
It communicated to me a lack of trust from my managers.	X
I believe mandatory drug testing to be against personal rights.	R
Even though I do not do drugs	X
// and will never do them	H
// I believe it is not the corporation's business to know what I choose to do outside of work.	X
If they test for that what rights will they feel inclined to infringe upon next?	R?
I do not need 'big brother' accusingly looking over my shoulder.	X
We are all grown adults	R
//and are be able to make rational decisions without having to rely on the corporation to tell us what we can and cannot do outside of work.	R
Posted on Nov 19, 2000, 7:52 PM	
..Disagree	D
by AM	
I think every employer has the right to perform mandatory drug testing since our performance might be affected if we are on drugs.	P+
After all, the reason we get hired and paid is to get results	R
// and definitely being on drugs can affect your performance at work.	R
Posted on Nov 19, 2000, 8:28 PM	

Table 32
Excerpt Illustrating Use of Questions to Evaluate Arguments

.....Some questions....	R
by JE	
I understand your point,	C
// but let's say you start your own business after graduation: a restaurant.	R
You hire a cashier who will work for you full time,	R
// you are going to pay him x dollars.	R
You know that x is not enough money for a person to live AND consume drugs.	R
Wouldn't you be concerned about the possibility that your cashier could be cocaine addict?	H?
If he is but you don't know, how long will you wait before you do something?	H?
What would you do if you find he's an addict?	H?
Fire him or help him?	H?
Don't you think that it would be better to help him before you loose money?	H?
JE.	
Posted on Nov 20, 2000, 6:30 PM	
.....What would you do?	H?
by JK	
Why should I worry that someone I'm hiring is a cocaine addict?	N?
If he showed signs of that during an interview I would not hire him.	H
I should also not like to have someone working for me that beat his wife or cheated on his taxes // but I cant exactly do an FBI check on him.	N
	R
I believe that you should give your employees a certain amount of dignity and respect	N
// and if they show signs of problems to find some way to help them if they want it.	R
If they don't, let them go.	R
But what would you do?	H?
If you tested someone and found out they were on drugs what would you do?	H?
I'll tell you what most companies do.	R
FIRE THEM.	R
Even if they are not on drugs but for whatever reason decide not to take the test they are fired.	R
Are you telling me that this test is out of the goodness of your own heart?	E?
You would "help him before you loose money"?	H?
I'm not so sure...	E

Table 33
Excerpt Illustrating Use of Hypothetical Actions to Critically Assess Arguments

.....What would you do?	H?
by JK	
Why should I worry that someone I'm hiring is a cocaine addict?	N?
If he showed signs of that during an interview I would not hire him.	H
I should also not like to have someone working for me that beat his wife or cheated on his taxes // but I cant exactly do an FBI check on him.	N
	R
I believe that you should give your employees a certain amount of dignity and respect	N
// and if they show signs of problems to find some way to help them if they want it.	R
If they don't, let them go.	R
But what would you do?	H?
If you tested someone and found out they were on drugs what would you do?	H?
I'll tell you what most companies do.	R
FIRE THEM.	R
Even if they are not on drugs but for whatever reason decide not to take the test they are fired.	R
Are you telling me that this test is out of the goodness of your own heart?	E?
You would "help him before you loose money"?	H?
I'm not so sure...	E
.....Yes, I'd Care!	H
by JH	
I would completely worry about someone I hired who had a cocaine addiction or an addiction to some other uncontrolled substance because of personal safety issues, especially in manufacturing work.	H
Not only do people on some drugs act violent occasionally when they are high (or when they CAN'T get their stuff), but	R
strong stimulants or depressants also affect physical response & judgment, which could affect safety of the user, those around him, and with certain products, the end user.	R
Furthermore, I believe that American companies CANNOT fire someone on the spot for failing one drug test	R
// I may need to be corrected on this one.	E
I know for alcohol problems, the employer has to offer counseling, etc.,	R
// and cannot do anything specifically unless there are performance issues.	R
Companies CAN refuse to hire someone based on a negative drug test prior to hire.	R

Figure 1
Example of a Threaded Bulletin Board Discussion on the World Wide Web

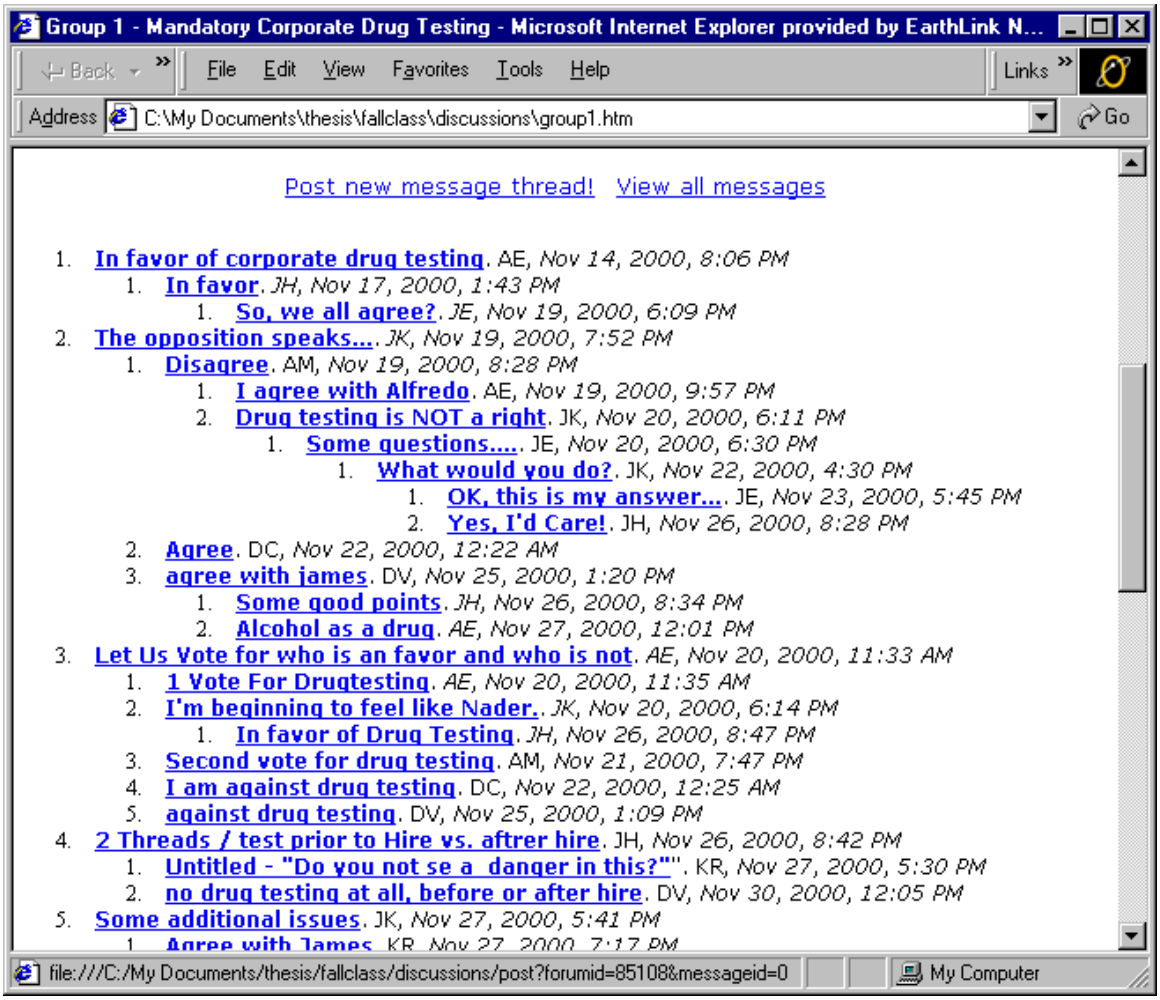
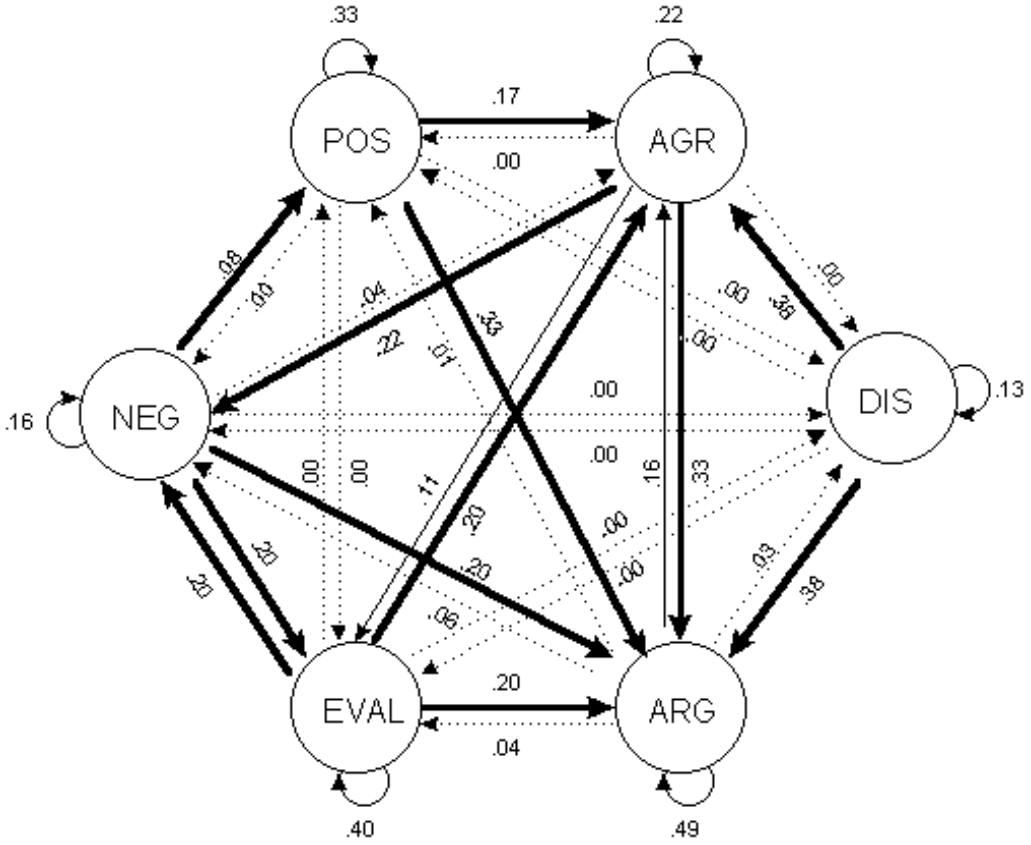


Figure 2
State Transitional Diagram from Transitional Probabilities of Two-Event Sequences by Title-Events



The circles in the diagram represent codes, and the arrows represent transitional probabilities among them.

Pos = Position statement
Agr = Agreement
Dis = Disagreement
Arg = Argument
Neg = Negotiation
Eval = Evaluation

Appendix A - Student instructions with assignment and requirements

Assignment: Group Discussions on Classroom Debates & Topics

Description:

After each oral debate in week 6 & 7, there will be small group discussions to provide you the opportunity to review, digest and synthesize the arguments presented in the debates with members of your class. The purpose of the group discussions is to reflect on insights gained from the debate, to share your own personal views and knowledge, to explore multiple viewpoints and contexts, and to apply arguments and viewpoints toward a joint recommendation on how to address the ethical issue at hand.

Group discussions will be held out of class on an electronic bulletin board via the Internet (see example on page 2 or go to practice bulletin board at http://network54.com/Hide/Forum/57061). You will receive instructions in week 6 that provide a dilemma related to the debated issue. The instructions will include your group assignment, directions on how to post messages to your group's bulletin board. In all, you will be participating in four online discussions for each of the four issues debated in class.

Please Note: The discussions will be monitored and evaluated by a graduate researcher, Allan Jeong, as part of a Ph.D. research study. You will be presented a consent form and essential details about the study prior to the group discussions.

Assignment Time & Dates:

Each discussion will begin after each oral debate presented in class on weeks 6 and 7. You have one week to participate and contribute to each group discussion. Below are the following dates for each discussion:

Discussion #1 – May 2 to May 9
Discussion #2 – May 4 to May 11
Discussion #3 – May 9 to May 16
Discussion #4 – May 11 to May 18

Requirements & Grading Criteria:

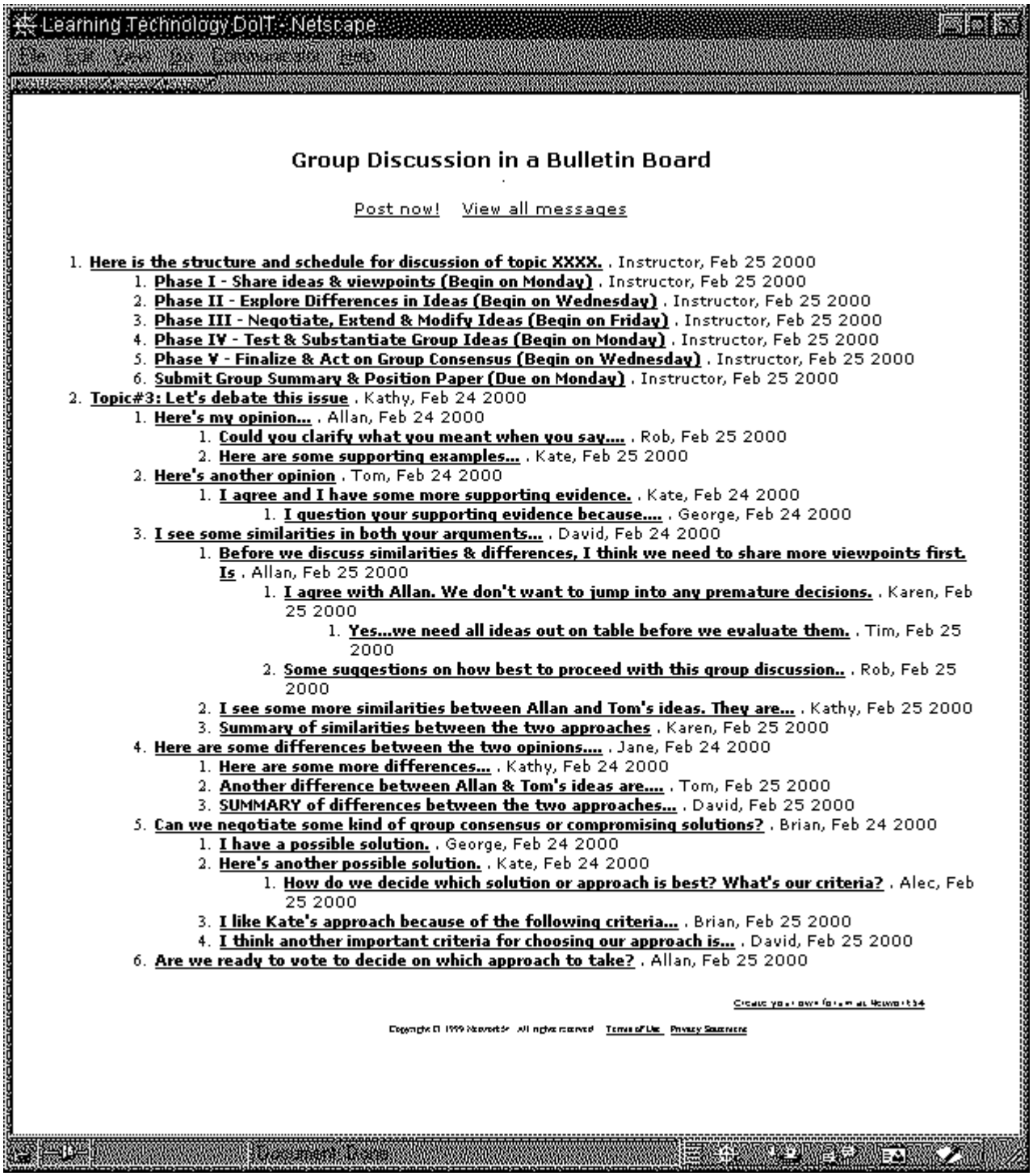
Participation is graded in each of the four group discussions, making up 25% of your course participation grade. Your participation and group performance in each group discussion will be graded on a 4-point scale. Your grade for each group discussion will be graded on the following criteria:

Individual Participation (0-2 points) You will receive 2 points for substantial contributions to the group discussion, 1 point for satisfactory contributions, and 0 points for no contributions.

Group Performance (0-2 points) Receive 1 point for a discussion that reflects thought and analysis. Receive 2 points for discussion that is insightful, critical, creative, balanced, practical, expansive, which applies the ideas expressed to the business world in an in-depth analysis, reflects upon the potential consequences, and performed professionally. See page 3 for suggestions on how to make substantial contributions to group discussions.

Appendix B - Student instructions with example bulletin board

You will be using an electronic bulletin board like the one below for your group discussions. The discussion depicted in the illustration is organized and structured according to tips and recommendations detailed on page 3. Note how features of the bulletin board (e.g. meaningful titles in message headers, indentation of messages written as replies to a previous message) can be used deliberately to construct a clear and well-organized group discussion. The organization is no different than that of an outlined written document. Additional guidelines on how to and how not to post messages to the bulletin board are presented on page 4.



Appendix C - Student instructions with discussion roles

Suggestions on how to contribute to group discussions.

Share & Compare Ideas

1) State observations, opinions, ideas
2) State agreements
3) Corroborate examples
4) Ask & answer questions to clarify ideas
5) Define, describe or identify a problem

Compare & Explore Differences in Ideas

1. Identify and state areas of disagreement
2. Ask and answer questions to clarify the source and extent of disagreement
3. Restate the participant's position, and possibly advance arguments or considerations in its support by references to the participant's experience, literature, formal data collected, or proposal of relevant analogy to illustrate point of view.

Negotiate, Extend & Modify Ideas

1. Negotiate or clarify the meaning of terms
2. Negotiate the relative weight to be assigned to types of argument
3. Identify areas of agreement or overlap among conflicting concepts
4. Propose and negotiate new statements embodying compromise and co-construction of ideas and concepts

Test & Substantiate Group Ideas

1. Test the proposed ideas against supporting information shared by group members
2. Test proposals against existing understanding of concepts and ideas
3. Test proposals against personal experiences
4. Test proposals against formal data collected. Test proposals against contradictory testimony in the literature

Finalize & Act on Group Consensus

1. Summarize agreements
2. Make group consensus
3. Apply ideas to problems

Manage Group Processes

1. Encourage member participation
2. Encourage & allow members to perform different roles
3. Encourage sharing of different viewpoints
4. Focus discussion on ideas, not personalities
5. Manage and encourage acceptance of the consensus making process

Destructive Roles & Behaviors

1. Avoidance through denial & equivocation
2. Avoidance by changing topics
3. Avoidance with noncommittal remarks
4. Avoidance with irreverent joking
5. Confrontative remarks with contempt
6. Confrontative remarks with name calling
7. Confrontative remarks with hostile humor
8. Confrontative remarks w/ mockery sarcasm
9. Confrontative remarks through gestures e.g. sneering, rolling eyes, curling upper lip
10. Criticism with personal attacks
11. Criticism by blaming
12. Defensiveness through denial of responsibility
13. Defensiveness by making excuses
14. Defensiveness with negative mind-reading
15. Defensiveness by cross-complaining
16. Defensiveness by trading blame
17. Defensiveness by saying "yes...but..."
18. Defensiveness by repeating self
19. Defensiveness by whining
20. Defensiveness by stone walling
21. Defensiveness through body language e.g. crossing arms

Appendix D - Student instructions with tips and guidelines

Guidelines for Posting to Messages to the Bulletin Board

Below are some important guidelines to help you and your group members take maximum advantage of the organizational features of the threaded bulletin board. Please read thoroughly and keep this handout as a reference as you post messages to the bulletin board.

1. **Posting a message** – To post a message to the bulletin board, *you must first click on a message* to read its contents. In the message window, you will find a link "*Respond to this Message*". Click on this link to compose your message to add to the threaded discussion. Note how all responses are indented directly below the responded message on page 2.

2. **Starting a new thread** – To start a new thread, or topic of discussion, you must click on the very top and first most message on the bulletin board. Then click on "Respond to this Message" to compose a message to initiate your new discussion thread.

3. **Limit one paragraph per posting** - Keep your contributions concise and to the point. Limit each response to only one paragraph. If more paragraphs are necessary, post them to the bulletin board as a series of messages that reflects the organization structure (or outline) of your ideas and written text.

4. **Message titles in subject headers** – Title your messages and replies so that they clearly describe the purpose or intent of your posting. This will help you and others follow the structure and course of the discussion. Refer to page 2 to see examples of descriptive titles.

5. **Don't repeat yourself** - Don't needlessly repeat yourself or repeat what others have said. Elaborate on what others have said, share an opposing viewpoint, compare viewpoints, provide suggestions, and so forth. Minimal, perfunctory responses are not acceptable.

6. **Concluding a discussion** – To help bring some closure to each discussion, commit to negotiating a group consensus on the issue, or recommend a strategy or solution to address the issues as one would apply in a real-world situation. Or, simply review the discussion and explain how the discussions have influences your personal position on the issue.

Bulletin Board Practice:

It is highly recommended that you experiment and practice using the bulletin board *before* **participating in your group discussions. You can practice posting messages on a practice bulletin board at the following WWW address:** http://network54.com/Hide/Forum/57061

If you have any questions about the bulletin board, you can email allan.jeong@doit.wisc.edu for assistance.

A copy of this handout can be downloaded at
http://www.wisc.edu/learntech/eval/bulletinboard/bus710.doc

Appendix E - Human consent form

Dear Participant,

I am conducting a research project studying the use of web-based bulletin boards for small group discussions as an instructional tool. This study is being conducted for my Ph.D. thesis here at the University of Wisconsin – Madison. One of the course assignments in Ethics & Social Responsibility (General Business 710) will involve your participation in a series of experimental group discussions on the ethical issues detailed in the group project and team debate assignment.

The experimental group discussions will take place on an electronic bulletin board over the Internet immediately following each project presentation and debate. Please refer to your course handouts for details on the discussion assignment. Your contributions to the group discussions posted on the bulletin board will be archived for research and analysis. These records of the discussions will allow me to analyze the nature and quality of the communication process in bulletin board discussions. In addition, you will be asked to complete a student questionnaire to obtain general background information and your feedback and reactions to using the bulletin board for group discussion.

Only I, my advisor Michael Streibel, and the course instructor, will have access to the data collected in this project. With your consent, you agree to unlimited use of your bulletin board messages for the purpose of this dissertation and subsequent articles. To protect your right to individual privacy, your name will not appear in the written dissertation or subsequent articles or in any of the actual transcripts of discussions displayed in the written reports.

Participation in this project is voluntary and your participation will not expose you to any risks to your personal health or individual privacy. You may withdraw from the study at any time with no negative consequences and no affect on the outcome of your performance or grade in the course. However, withdrawing from the experimental discussions will require a written and graded paper on the topics discussed in the experimental discussions as a suitable substitute for not participating in the discussions.

If you agree to participate, please sign in the appropriate place below and provide the requested information about your self. Please include your email address and phone number so that I may contact you when necessary. Feel free to contact me if you have any questions or concerns. If you are interested in the results of this study, I can email you the a summary of the study's findings and conclusions upon request. Look forward to working with all of you, and thank you for participating!

Sincerely,

Allan Jeong allan.jeong@doit.wisc.edu
PhD. Candidate (608) 752-7708

Please check ALL THREE OF THE FOLLOWING to express consent to participating in this study:

_____ Yes, I consent to participate in the discussions on the bulletin board over the Internet.
_____ Yes, I consent to participate in two student questionnaires before and following the group discussions.
_____ Yes, I understand that I may withdraw from the research project at any time with no negative consequences. If I do withdraw from the experimental discussions, I will required to write a written and graded paper on the topics discussed in the experimental discussions as a suitable substitute for not participating in the discussions.

NAME: _____ Signature: _____

Email: _____ Phone: _____

Today's Date: _____

Appendix F: Example discussion from pilot study

Post new message View all messages Go back

1. **Start here** . Allan Jeong , Apr 28 2000
2. **monitoring: a self-referential observation** . KV, May 02 2000
    1. **being electronically monitored ?** . CM , May 02 2000
        1. **time differences** . KV, May 02 2000
3. **cultural differences?** . KV , May 02 2000
    1. **Response** . DC, May 03 2000
        1. **too much in favor of employers?** . KV, May 03 2000
        2. **response to DC** . VP, May 03 2000
4. **Monitoring: Absolutely Justifiable !!!** . CM, May 02 2000
    1. **alternative scenario** . KV, May 02 2000
        1. **As DC said ...** . CM , May 03 2000
            1. **Untitled** . BT, May 04 2000
    2. **response to CM** . VP, May 03 2000
5. **Productivity vs. shirking** . KK, May 03 2000
    1. **Types of jobs** . VP, May 03 2000
        1. **autonomy is critical** . KV, May 04 2000
        2. **Escaping from the freedom to show off** .DB, May 04 2000
6. **Untitled** . RS, May 03 2000
    1. **response to RJ** . DC, May 03 2000
        1. **the beginning of monitoring for productivity assessment** . VP , May 03 2000
            1. **optimistic?** . KV, May 04 2000
                1. **Employee monitoring - Optimistic?** . TC, May 04 2000
                    1. **autonomy** . Anonymous , May 05 2000
                    2. **in addition, self-efficacy** . VP, May 08 2000
    2. **Untitled Untitled** . CM, May 03 2000
        1. **theft** . KV, May 04 2000
            1. **Money** . RS, May 04 2000
7. **Intensified work time monitoring** . DB, May 04 2000
    1. **Time doesn't matter** . RS, May 04 2000
        1. **Monitoring for value - TC** . TC, May 05 2000
    2. **intensified times only....** . KV, May 04 2000
        1. **Let's work hard for the good of all the people** . DB, May 05 2000
            1. **changed perspectives with a view from "the top"** . KV, May 06 2000
        2. **For you, KV** . DB, May 05 2000
            1. **for you, DB (others feel free to jump in, too)** . KV, May 06 2000
            2. **response to DB** . VP, May 08 2000
8. **All the time?** . KK, May 08 2000
9. **Monitoring..NO WAY...** . JG, May 09 2000

Appendix G: Coding scheme in pilot test

Code	Description
OPINION	State personal opinion, a belief or conclusion held with confidence, but not substantiated by positive knowledge or proof
OBSERVATION	A statement of observation or inference or judgement that is acquired from or based on observation & information shared.
CLAIM	A statement of something as a fact, an assertion of truth
EVALUATE	Evaluating or making a judgement on the value of an idea or argument
AGREE	Overt statement of agreement or acceptance of ideas
EXAMPLE	Corraborate examples - state instances, cases & illustrations that support/confirm or test truth/accuracy.
COMPARE	Comparing information, examples, opinions, etc.
PROBLEM	Defines, describes, or identifies a problematic situation or circumstance that present uncertainty, perplexity or difficulty with an observation or opinion.
SOLUTION	A statement containing an idea that is meant to shed light on a problem, or to clear up uncertainty or difficulty in a position.
ASK	Ask a question or request responses and feedback.
QUESTION	To question statements, assumptions or positions; to raise doubt or uncertainty.
DISAGREE	Overtly express, identify or state areas of disagreement relative to previous statements
CONDITIONAL	State special conditionals, consequences, circumstances, considerations, assumptions, or points of view to advance an argument or position. Look for "if" "however" "BUT" or "point of view".
EXPERIENCE	Relate to personal experiences, preferences or feelings to provide advancing arguments or considerations
LITERATURE	Advancing arguments or considerations in its support by references to literature
DATA	Advancing arguments/considerations in its support by references to formal data collected
VIEWPOINT	States a viewpont, a criteria or frame of reference for making a judgement on a position or issue.
CHANGE	Metacognitive statements illustrating change in opinion or understanding
PROCEDURAL	Metacognitive statement about the course, the process, direction, or quality of the discussion; prefacing following statements.
COMMENTARY	Comments to maintain positive group dynamics, e.g. "Thanks for the comment", "I understand".

Appendix H: Excerpts of coded transcript in pilot study

6 Intensified work time monitoring		db	1	322
by DB		db	1	323
		db	1	324
I like to negotiate between two parties but	PROCEDURAL	db	1	325
I am a little bit more in favor of monitoring.	OPINION	db	1	326
So,I suggest here, that we implement intensified work time monitoring.	OBSERVATION	db	1	327
'Intensified work time monitoring' is monitoring workers only at busy working time.	OBSERVATION	db	1	328
For example, from 10:00 AM to 11:00 AM and from 1:00 PM to 2:00 PM is very critical time for doing the business in companies, so everybody is supposed to have busy time at that time.	EXAMPLE	db	1	329
Only two hours of monitoring!!!	OBSERVATION	db	1	330
Employees will enjoy privacy at the rest of the time except that intensified work time.	OBSERVATION	db	1	331
It will satisfy employees and company owner at the same time because employee will have a substantial private time and company owner will have a chance to monitor.	OBSERVATION	db	1	332
Actually, it has been successful in my country and few people resent it.	EXPERIENCE	db	1	333
What do you think? <DB>	ASK	db	1	334
		db	1	335
6 1 Time doesn't matter		rs	1	336
by RS		rs	1	337
		rs	1	338
While limiting monitoring as much as possible is a good thing, it should not be time influenced.	OPINION	rs	1	339
I know that at my work, I did my best work at night when nobody else was around.	EXPERIENCE	rs	1	340
Does that mean I wasn't busy or that I wasn't working during the busy time?	QUESTION	rs	1	341
I would hope not.	OPINION	rs	1	342
Time isn't the issue.	OBSERVATION	rs	1	343
Besides, if you know you will be monitored for those two hours, why not look as busy as possible then, and slack the rest of the day?	QUESTION	rs	1	344
The issue is whether monitoring is ethical or not.	OBSERVATION	rs	1	345
Clearly it is spying on individuals at work, either with or without their knowledge.	OBSERVATION	rs	1	346
Monitoring for productivity just allows managers to be more punitive and lazy, because technology will do their job for them.	OBSERVATION	rs	1	347
		rs	1	348
6 1 1 Monitoring for value - TC		tc	1	349
by TC		tc	1	350
		tc	1	351
I agree RJ, I think that monitoring should not be time influenced.	AGREE	tc	1	352
I worked in MIS and my job was either very busy or very slow, depending on how many problems people had.	EXPERIENCE	tc	1	353
BUT the goals was to have a smooth running system, so if people did not have problems and I was not terribly busy fixing problems, then that meant that I was actually doing my job!	EXPERIENCE	tc	1	354
And how do you monitor jobs like that?	ASK	tc	1	355

One answer might be monitoring for value, for example, my manager could follow up with a client that I served to see if I was courteous, responsive and if I did in fact fix their problem.	SOLUTION	tc	1	356
There's no technology in that, just human interaction.	OBSERVATION	tc	1	357
So maybe monitoring should be used to create some sort of value for both the manager and the worker, and maybe it should be performanced based, instead of spying just to be spying.	OBSERVATION	tc	1	358
		tc	1	359
6 2 intensified times only....		kv	1	360
by KV		kv	1	361
		kv	1	362
DB,	PROCEDURAL	kv	1	363
		kv	1	364
This is an interesting compromise proposal.	EVALUATE	kv	1	365
		kv	1	366
What time of work is monitored during intensified times?	ASK	kv	1	367
All types of work?	ASK	kv	1	368
How is the information collected and used?	ASK	kv	1	369
		kv	1	370
Do you think people are "better behaved" during those hours or does it not matter?	ASK	kv	1	371
		kv	1	372
I'd like to hear more.	ASK	kv	1	373
KV		kv	1	374
		kv	1	375
6 2 1 Let's work hard for the good of all the people		db	1	376
by DB		db	1	377
		db	1	378
Thank you for commenting on my idea., KV.	COMMENTARY	db	1	379
I and you will become the future manager, some time later.	OBSERVATION	db	1	380
I thought it was the best.	OBSERVATION	db	1	381
You are going to say that you are in favor liberty but things will change when you become a part of top management.	OBSERVATION	db	1	382
What would you think at that top position?	ASK	db	1	383
You would be acting differently any how	OBSERVATION	db	1	384
When I go back to my country, I would think both things - what I would do for the company and workers at the same time.	OBSERVATION	db	1	385
My philosophy for my idea is that something is better than nothing.	OPINION	db	1	386
You can not act in favor of workers all the time and also you can not work in favor of the top management of company all the time.	OBSERVATION	db	1	387
My idea of implementing 'intensified work time monitoring' is the only one method for the good of all the people (I think). DB	OBSERVATION	db	1	388
		db	1	389
6 2 1 1 changed perspectives with a view from "the top"		kv	1	390
by KV		kv	1	391
		kv	1	392
DB,	PROCEDURAL	kv	1	393
I honestly hope that I will never change my fundamental negative view of employee monitoring.	OPINION	kv	1	394
I've been a middle manager for several years and hope that these lessons will not be lost as I "move up the ladder," assuming that's what I ultimately choose to do.	EXPERIENCE	kv	1	395
		kv	1	396

But you have a point.	COMMENTARY	kv	1	397
I have deliberately developed a skill set that will keep me pretty far from industries that favor monitoring.	EXPERIENCE	kv	1	398
In fact, I once turned down a Customer Call Center job because I didn't want to listen in on other's conversations.	EXPERIENCE	kv	1	399
		kv	1	400
Time will tell, but - with all do respect - I hope it proves you're wrong.	DISAGREE	kv	1	401
		kv	1	402
p.s. I think our interchange is revealing some fundamental differences in our values -	OBSERVATION	kv	1	403
I am not a big fan of the "good of all people" approach to decision-making.	OPINION	kv	1	404
I'm more of a champion for the excluded, and take a more individualistic "distributive justice" approach to evaluating stuff. (in case you haven't already guessed.	VIEWPOINT	kv	1	405
		kv	1	406
6 2 2 For you, KV		db	1	407
by DB		db	1	408
		db	1	409
In the work situation in my former work place, ten to twelve and one to three are regarded as the most important work time. Of course it is mainly about financial companies.	EXPERIENCE	db	1	410
Also, manufacturing company report tells that that time is the most productive time for workers.	LITERATURE	db	1	411
(Except time right after the lunch time).	LITERATURE	db	1	412
And about the better behavior comment, think about the time when we are giving a presentation when many people are watching us!!!!!	OBSERVATION	db	1	413
It is the human nature that we want to look better when others are watching.	CLAIM	db	1	414
DB	PROCEDURAL	db	1	415
		db	1	416
6 2 2 1 for you, DB (others feel free to jump in, too)		kv	1	417
by KV		kv	1	418
		kv	1	419
Hey, thanks for the note.	COMMENTARY	kv	1	420
		kv	1	421
Regarding monitoring during most important work time & looking better when others are watching:	PROCEDURAL	kv	1	422
		kv	1	423
- If monitoring was truly consensual between employer and employee, then it might make sense to "turn on the recorders" during peak times.	OBSERVATION	kv	1	424
My problem is that most monitoring situations are non-consensual in that management dictates who/when/where to monitor.	CLAIM	kv	1	425
Was your work monitoring consensual?	ASK	kv	1	426
		kv	1	427
I consider class presentations a form of consensual monitoring.	OBSERVATION	kv	1	428
We all know that, going into a US-style MBA program, presentations are expected from us.	OBSERVATION	kv	1	429
By attending class, we tacitly agree to being watched.	OBSERVATION	kv	1	430
		kv	1	431
- actually, not all of us do perform better when others are watching.	OBSERVATION	kv	1	432
There are several personality types in our work world who prefer a solitary, individual environment (the stereotypical programmer comes to mind, and perhaps the science researcher).	CLAIM	kv	1	433
In MBA school and perhaps in management, I think we run into more people who "like to be watched."	OBSERVATION	kv	1	434

But, we shouldn't make the mistake of assuming everyone is like us in this regard.	OPINION	kv	1	435
		kv	1	436
6 2 2 2 response to DB		vp	1	437
by VP		vp	1	438
		vp	1	439
Two points:	EXPERIENCE	vp	1	440
1. If employees know that they will be monitored at certain times, what will stop them from "slacking" the time they are not being watched?	QUESTION	vp	1	441
Sure, they can be on their best behavior when being watched, but will they ALL of the time?	QUESTION	vp	1	442
		vp	1	443
2. As KV said, I am not sure that everybody works best when being watched.	CLAIM	vp	1	444
I know that I am one of these people...	EXPERIENCE	vp	1	445
Also, I think it would stress out some individuals to be watched during certain times!	CLAIM	vp	1	446
This could negatively impact their work and it can in the long run, cause health problems.	CLAIM	vp	1	447
This has been shown in the financial world, where young executives have heart conditions due to stressful life styles.	EXAMPLE	vp	1	448
I know this may sound extreme, but it is an issue to be considered seriously.	EVALUATE	vp	1	449

Appendix I: Event category “OPINION”

Imagine if, after class, I also had to go to a workplace that electronically monitored my actions.	OPINION	kv	1	19
Yuck.	OPINION	kv	1	20
but the policy always struck me as pretty extreme and dictatorial.... even compared to, say line workers in the US, who still have access to phones during their breaks.	OPINION	kv	1	49
I think the American culture goes a little bit too far in their expectations of what their "rights" are in the workplace.	OPINION	dc	1	62
Therefore, I think they have a right to monitor for well-intentioned purposes, such as protecting against theft, improving customer service, etc.	OPINION	dc	1	71
Perhaps we do expect too much from employers .	OPINION	kv	1	87
Which is why I feel that monitoring, while economically justifiable, is still wrong...	OPINION	kv	1	93
Monitoring for productivity is simply too invasive,	OPINION	kv	1	95
I really do believe that these obligations go beyond providing a safe environment, etc.	OPINION	vp	1	102
I think that the employer should provide a challenging job and the employee should take initiative if the job is not providing this for them.	OPINION	vp	1	103
I am a big proponent of "growth of the individual" at the workplace	OPINION	vp	1	104
and if work does not provide this for the individual, then they are not fulfilling their obligations.	OPINION	vp	1	105
As DC said: "Employers should, however, conduct monitoring in a reasonable fashion.	OPINION	cm	1	131
(Note that monitoring for safety purposes is acceptable, ie. a camera in a 24 hour video store could actually protect a late-night employee from harm.	OPINION	kv	1	194
If you can't trust your employees to do the right thing, then those employees should not work for you, or you are doing something wrong.	OPINION	rs	1	216
Unfortunately, I think employees are fully aware of the ethical implications of productivity monitoring,	OPINION	kv	1	248
Not only is this operational decision unethical, but it's also reactionary.	OPINION	kv	1	255
However, VP, I think you're giving technology innovation too much of the blame -	OPINION	kv	1	260
people understand the implications of what they're doing and are continuing anyway.	OPINION	kv	1	261
I suspect the numbers are pretty low on the grand scaled of things.	OPINION	kv	1	310
I am a little bit more in favor of monitoring.	OPINION	db	1	326
While limiting monitoring as much as possible is a good thing, it should not be time influenced.	OPINION	rs	1	339
I would hope not.	OPINION	rs	1	342

Appendix J: Event category “OBSERVATION”.

1) the media is full of one-to-one e-marketing techniques and lawsuits	OBSERVATION	kv	1	6
Yes, it's confidential and yes, I agreed to the study and yes, I'm helping a fellow student perform research...	OBSERVATION	kv	1	16
You are always being electronically monitored.	OBSERVATION	cm	1	26
2) my workspace, beyond perhaps a secure keycard or security at the door, is a more private place, one that I feel should not be monitored.	OBSERVATION	kv	1	37
One comment in today's presentation struck me as perhaps, very American.	OBSERVATION	kv	1	42
It was the comment that we should all be able to do personal work at work.	OBSERVATION	kv	1	43
I understand that people might do a better job if they are treated well and properly motivated, but this says nothing about the employer's obligations.	OBSERVATION	dc	1	65
(Although it is probably in their best interest to do so because they are subtly competing for their labor force, and unhappy laborers are free to pursue other job opportunities).	OBSERVATION	dc	1	68
As far as monitoring goes: Employers provide the ultimate service in that, in exchange for your labor, they provide the resources to survive (e.g. money).	OBSERVATION	dc	1	70
But, at some point this "subtle competition for human capital" evolves from a perk to an expectation, at least in the mind of many employees.	OBSERVATION	kv	1	89
To me, this evolution indicates that there is more than just economic reason driving our expectations.	OBSERVATION	kv	1	91
mostly because fallible people design the system and might make wrong decisions about what level of monitoring is required to perform a "well-intentioned" effort to protect assets.	OBSERVATION	kv	1	96
This means monitoring soley for the purposes intended".	OBSERVATION	cm	1	132
The unethical behavior of the employeer is another issue that anyone can experience with or without monitoring.	OBSERVATION	cm	1	134
Either you are monitoring or you are not.	OBSERVATION	bt	1	141
It is impossible to be selective as to only monitor work related items.	OBSERVATION	bt	1	142
Employment practices being what they are today, employees must now mix so much more of their personal lives in with work.	OBSERVATION	bt	1	143
You cannot simply rely on the tapes that were provided.	OBSERVATION	vp	1	151
After all, a video tape will not show emotions....	OBSERVATION	vp	1	152
However, each group focused only on one of them (the one which serves their end).	OBSERVATION	kk	1	159
Giving an employee autonomy is simply one way of showing respect for them.	OBSERVATION	kv	1	183
by allowing staff to listen to music at work, by letting staff personalize their workspace with photos or other knick knacks, by ensuring that decision-making occurs at all levels of the company.	OBSERVATION	kv	1	185

Appendix K: Event category “CLAIM”.

Monitoring is a way to safeguard you from injustices.	CLAIM	cm	1	29
Plus, I guess I differentiate between public and private places:1) the grad lab, the bank, the public library are all public places that have potentially more safety risks.	CLAIM	kv	1	36
I believe that employers are only obligated to provide a safe environment (for both long and short term safety hazards), and to pay wages on time and for agreed-upon rates.	CLAIM	dc	1	66
Employer's have no obligation to go any further than this.	CLAIM	dc	1	67
In reality, the company should assess the combined effect of the two and maintain a balance between them.	CLAIM	kk	1	160
That is why I believe that we must take this on a job by job basis.	CLAIM	vp	1	175
Employers can carve out autonomy in even the most rigid jobs -	CLAIM	kv	1	184
Monitoring destroys autonomy.	CLAIM	kv	1	190
People like that are willing to be watched!! <DB>	CLAIM	db	1	206
It is the human nature that we want to look better when others are watching.	CLAIM	db	1	414
My problem is that most monitoring situations are non-consensual in that management dictates who/when/where to monitor.	CLAIM	kv	1	425
There are several personality types in our work world who prefer a solitary, individual environment (the stereotypical programmer comes to mind, and perhaps the science researcher).	CLAIM	kv	1	433
2. As KV said, I am not sure that everybody works best when being watched.	CLAIM	vp	1	444
Also, I think it would stress out some individuals to be watched during certain times!	CLAIM	vp	1	446
This could negatively impact their work and it can in the long run, cause health problems.	CLAIM	vp	1	447
I am sure this is not the case.	CLAIM	kk	1	456
It would consume an unjustified amount of organizational resources.	CLAIM	kk	1	457
However, the threat that something illegal or unethical could be discovered later prevents employees from doing it.	CLAIM	kk	1	463
If there is no trust between the employer and employees, there will be no future for the company.	CLAIM	jg	1	477
There could be lots of inefficiency if they don't trust each other in the company.	CLAIM	jg	1	478
I still need some help with regards to the fact that as consumers within society we don't seem to mind much when we're monitored in the grocery stores, or via cookies on the web.	CLAIM	yd	2	489
I suspect they would be.	CLAIM	se	2	559
In the debate yesterday, the FOR team, proposed certain arguments supporting EM as EM reduces stress and improves productivity.	CLAIM	rm	2	565
Many employers face legal lawsuits due to actions of their employees.	CLAIM	rm	2	581
These are costs to the company and to the customer indirectly and supports EM.	CLAIM	rm	2	582

Appendix L: Event category “EVALUATE”.

You bring up really good points.	EVALUATE	kv	1	84
Your argument is rational	EVALUATE	kv	1	85
I think KVs example of the person infected with HIV is very timely to our discussion and should be examined.	EVALUATE	bt	1	144
In fact, both groups are right - both of these effects occur.	EVALUATE	kk	1	158
Your point of view isn't enough for us to remedy the situation.	EVALUATE	kv	1	189
The cultural point is a good one, and it was an American comment based on American companies.	EVALUATE	rs	1	211
Good point.	EVALUATE	dc	1	222
Okay, this example is a little extreme, but you get the idea.	EVALUATE	kv	1	258
Extremely well put!!	EVALUATE	vp	1	288
This is an interesting compromise proposal.	EVALUATE	kv	1	365
I know this may sound extreme, but it is an issue to be considered seriously.	EVALUATE	vp	1	449
I wonder about that too.	EVALUATE	se	2	501
I am glad you brought up this point in this discussion as I was not too convinced in class.	EVALUATE	rm	2	516
In our debate yesterday, I was really surprised that the team arguing FOR had now arguments based on the legal implications.	EVALUATE	rm	2	579
I think this is an important issue when considering EM.	EVALUATE	rm	2	580
Good point CC.	EVALUATE	da	2	661
One could argue that you are oversimplifying the issue.	EVALUATE	cw	2	692
But sometimes we have to do just that to help us make a decision.	EVALUATE	cw	2	693
Especially, when there are valid arguments on both sides.	EVALUATE	cw	2	694
All of these comments makes me want to start my own business, so I don't have to worry about being monitored!	EVALUATE	kh	2	705
Regarding SE's question about 1984, I read the book in the late 1980s, and my classmates and I were amused at Orwell's "predictions."	EVALUATE	kh	2	714
I think that if an employer chooses to monitor their employees, then the time an employee comes to work should not be much of a factor in deciding how much to monitor them.	EVALUATE	se	2	738
I particularly liked the example of monitoring customers requests for changing their long distance phone carriers	EVALUATE	sc	4	1156
Since customers do deny the changes they themselves had requested earlier, that itself is a very strong proof that EM is needed under certain scenarios.	EVALUATE	sc	4	1157
I was surprised that some of the numbers were so high.	EVALUATE	ks	4	1190
Of course, if the employers really want to provide better services and increase company’s productivity through EM, it appears to me a little bit weird.	EVALUATE	sk	4	1205

Appendix M: Event category “AGREE”.

I agree with your point...	AGREE	vp	1	149
I agree with KK's points and I do agree that productivity does increase and decrease as a result of monitoring.	AGREE	vp	1	174
I agree, to some extent with KV.	AGREE	tc	1	267
Well put, TC I couldn't agree more.	AGREE	?	1	282
Yes, monitoring will convince a thief to find a stealthier way and/or a place to steal!	AGREE	cm	1	297
I agree.	AGREE	kv	1	302
I agree RJ, I think that monitoring should not be time influenced.	AGREE	tc	1	352
As someone said in class, I agree that it's a matter of trust.	AGREE	jg	1	471
But I agree with you in the sense that companies are there to make a profit.	AGREE	cw	2	695
I agree with MS.	AGREE	kh	2	729
I agree with JB.	AGREE	yl	3	805
I agree with JL that electronic monitoring is only a tool and is not good or bad.	AGREE	jf	3	846
I agree with you that management through goal-setting and motivation is more efficient and effective than direct monitoring.	AGREE	yl	3	874
I agree in theory that the most effective way to manage is through trust and mutual respect.	AGREE	jf	3	886
Therefore, I sort of agree with JL and JF.	AGREE	hc	3	959
I agree that you can never fully trust those who are eavesdropping on you.	AGREE	jf	3	1051
I agree for EM under certain scenarios- e.g. in daycare centers.	AGREE	sc	4	1094
I agree that there are many situations for which electronic monitoring can be beneficial.	AGREE	ks	4	1102
I completely agree with SX's message.	AGREE	sl	4	1111
I agree.	AGREE	ks	4	1129
I agree	AGREE	bm	4	1142
I totally agree with everyone that have posted their responses in favor of EM under specific scenarios.	AGREE	sc	4	1155
I agree that not expanding the EM is better than using EM.	AGREE	sk	4	1198
I have to agree though that some kind of monitoring way be necessary in some cases, especially when employees interact with costumers, for training and security reasons.	AGREE	np	4	1266

Appendix N: Event category “EXAMPLE”.

Did you ever go to the Grad Computer Lab or to a bank?	EXAMPLE	cm	1	27
Imagine the following situation: you are the owner of a major hospital and a customer complains that on a particular day one of your employees did not provide the proper care and the patient died.	EXAMPLE	cm	1	114
Then, you get the tapes from that day and realize that the employee did a good job and that it was not the employee fault.	EXAMPLE	cm	1	115
Imagine this scenario - you just found out that circumstances beyond your control have infected you with HIV.	EXAMPLE	kv	1	122
Your employer monitors your short conversation with a co-worker as you return from your appointment.	EXAMPLE	kv	1	123
Based on the conversation that was on tape, you're laid off shortly thereafter.	EXAMPLE	kv	1	124
Imagine the following scenario (the numbers denote benefits that employees provide to their employer):	EXAMPLE	kk	1	162
With Monitoring: Productivity 10, Shirking (-1), Net benefit to the employer: 9	EXAMPLE	kk	1	163
W/o Monitoring: Productivity 12, Shirking (-4), Net benefit to the employer: 8	EXAMPLE	kk	1	164
While both effects occur, in this scenario the first one is stronger, so the employer might choose to monitor.	EXAMPLE	kk	1	166
Of course, in other cases the reverse may be true, and the employer will choose not to monitor.	EXAMPLE	kk	1	167
I would think if you looked at a communist society they would not oppose monitoring as much because they are used to being watched anyway.	EXAMPLE	rs	1	213
For example, from 10:00 AM to 11:00 AM and from 1:00 PM to 2:00 PM is very critical time for doing the business in companies, so everybody is supposed to have busy time at that time.	EXAMPLE	db	1	329
This has been shown in the financial world, where young executives have heart conditions due to stressful life styles.	EXAMPLE	vp	1	448
One individual is probably not able to monitor effectively more than 5-10 others, so a company with 1,000 employees would have to have 100-200 "monitors".	EXAMPLE	kk	1	458
For example, in a customer/shopkeeper relationship, the shopkeeper does not have as much power over the customer as an employer does in the employee/employer relationship.	EXAMPLE	se	2	505
The shopkeeper can not fire the customer.	EXAMPLE	se	2	506
If the shopkeeper judges the customer, that will have no influence on the customer's livelihood, as it might in the employee/employer relationship.	EXAMPLE	se	2	507
The only real power the shopkeeper has is the power of the law, which is a power that is over the customer all the time anyway.	EXAMPLE	se	2	508
In the presentation we cited the example of the chevron employee.	EXAMPLE	yd	2	589
For instance, I as an employee can break into IBM's computer network.	EXAMPLE	rm	2	596
This causes a legal issue for the company from another company.	EXAMPLE	rm	2	597

Appendix O: Event category “COMPARE”.

One group said that productivity is decreased by monitoring, while the other said this is not so, and further added that monitoring reduces stealing and shirking.	COMPARE	kk	1	157
However, we should acknowledge that monitoring has diverse effects that should be accounted for in relation with one another, and not in isolation, as the two groups did.	COMPARE	kk	1	168
One job may require much autonomy and another may require less- the former will probably be negatively affected by monitoring and the latter less.	COMPARE	vp	1	176
Are they different?”!?	COMPARE	lk	3	865
But this case is definitely different from other electronic monitoring situation such as recording voicemail, searching employee’s e-mail.	COMPARE	sk	4	1226

Appendix P: Event category “PROBLEM”.

What if you did not have taped the situation?	PROBLEM	cm	1	116
What protection do you have from circumstances like these?	PROBLEM	kv	1	126
Now are we saying that we need to make sure that employees don't abuse their empowerment?	PROBLEM	tc	1	274
because, in my opinion, it only serves the purpose of taking back the autonomy we gave workers in order to make them more productive in the first place.	PROBLEM	tc	1	277
Monitoring will also damper the enthusiasm of the well-intentioned, trustworthy employee.	PROBLEM	kv	1	304
There's a tradeoff: which price do you want to pay?	PROBLEM	kv	1	306
If the employer didn't trust him/her, why did the employer hire him/her?	PROBLEM	jg	1	473
I haven't had the fortune of being monitored at work, but shouldn't it bother us to the same extent as when we are monitored as consumers (off the job)?	PROBLEM	yd	2	490
If the issues at hand are rights and privacy, well then aren't our rights and our privacy stripped whether we're an employee or a consumer?	PROBLEM	yd	2	491
I know I'd probably be a little irate to find my boss peeping in on my activities at work, but why don't I get mad at all the other vehicles of monitoring that i'm subjected to daily as a consumer?	PROBLEM	yd	2	492
I am unfamiliar with the study that you cite, but it seems somewhat contradictory.	PROBLEM	jm	2	630
It does not mean to use surveillance camera to monitor employees everywhere at the work place, for example, locker room.	PROBLEM	sx	4	1066
The challenge for employers is to find the proper balance between the two.	PROBLEM	sl	4	1115

Appendix Q: Event category “SOLUTION”.

One answer might be monitoring for value, for example, my manager could follow up with a client that I served to see if I was courteous, responsive and if I did in fact fix their problem.	SOLUTION	tc	1	356
I believe that communication is key to achieving this balance.	SOLUTION	sl	4	1116
So communication is key.	SOLUTION	sl	4	1124
Companies can involve the employees in decisions regarding monitoring from the beginning.	SOLUTION	ks	4	1135
Let them have a say in what should be monitored and how.	SOLUTION	ks	4	1136
We should think about the long- term effects as well as short-term effects form using EM.	SOLUTION	sk	4	1215
If employers worry about theft and wrongdoing of employees, they can enforce recruiting process and focus on more education for its employees.	SOLUTION	sk	4	1219
The employers however, should carefully evaluate all these cases separately before they decide to monitor their employees.	SOLUTION	np	4	1267
In these cases, there should be given some time to the employees, maybe during lunch hour (even though I don't think it would be sufficient), when all the monitoring systems would be shut down so they could do their private activities in privacy.	SOLUTION	np	4	1282

Appendix R: Event category “ASK”.

So my question is: - how much do cultural attitudes influence the attitude toward monitoring?	ASK	kv	1	51
how much does access to inexpensive resources influence the attitude toward monitoring?	ASK	kv	1	52
Your thoughts?	ASK	kv	1	54
I would be interested in hearing other perspectives, especially those who think my position might be too much in favor of employers.	ASK	dc	1	75
What do you all think of autonomy and the how monitoring affects this aspect?	ASK	vp	1	178
Lost $$ through theft or lost $$ through formerly motivated staff?	ASK	kv	1	307
Hey, does anyone have any idea how much $$$$ is saved through deterring theft?	ASK	kv	1	309
How do you measure a deterrent?	ASK	rs	1	316
What do you think? <DB>	ASK	db	1	334
And how do you monitor jobs like that?	ASK	tc	1	355
What time of work is monitored during intensified times?	ASK	kv	1	367
All types of work?	ASK	kv	1	368
How is the information collected and used?	ASK	kv	1	369
Do you think people are "better behaved" during those hours or does it not matter?	ASK	kv	1	371
I'd like to hear more.	ASK	kv	1	373
What would you think at that top position?	ASK	db	1	383
Was your work monitoring consensual?	ASK	kv	1	426
Where is your space vs. the employer's space?	ASK	da	2	536
Where did my previous biases come from?	ASK	se	2	544
Do you know this book?	ASK	se	2	548
Did you ever read Orwell’s 1984?	ASK	se	2	554
Did you read it before the actual year?	ASK	se	2	555
Are there any surveys that show EM does reduce stress and improve productivity.	ASK	rm	2	567
Could you clarify the results of the study for me?	ASK	jm	2	634
Does a company have a right to monitor you as much as they choose?	ASK	da	2	679
And then, what?	ASK	cw	2	697
I wonder if you have taken MHR 701 or 702 (Motivation and leadership effectiveness).	ASK	lk	3	863
I wonder if you have ever read Luthans' "Successful vs. Effective Real Managers" or Kotter's "What leaders really do?" or Zaleznik's "Managers and Leaders:	ASK	lk	3	864
Any thoughts?	ASK	lk	3	1045

Appendix S: Event category “QUESTION”.

Why the workplace should be different?	QUESTION	cm	1	28
I would like to challenge your point of contractual obligations of employers and employees.	QUESTION	vp	1	101
Would you blame your employee ?	QUESTION	cm	1	117
If there is nobody or few people, will you be motivated?	QUESTION	db	1	204
But at what cost?	QUESTION	tc	1	269
Does that mean I wasn't busy or that I wasn't working during the busy time?	QUESTION	rs	1	341
Besides, if you know you will be monitored for those two hours, why not look as busy as possible then, and slack the rest of the day?	QUESTION	rs	1	344
1. If employees know that they will be monitored at certain times, what will stop them from "slacking" the time they are not being watched?	QUESTION	vp	1	441
Sure, they can be on their best behavior when being watched, but will they ALL of the time?	QUESTION	vp	1	442
I can’t say exactly where this learning came from.	QUESTION	se	2	546
Do you think people who grew up being comfortable with bank surveillance cameras and ATM cameras and so on are more comfortable with monitoring then those who remember a day without these devises?	QUESTION	se	2	557
Do you think people who grew up with shows like MTV’s Real World (where there is always a camera in your face) are more comfortable with monitoring then people who grew up when video cameras were not as common?	QUESTION	se	2	558
What about the study we included in our paper and which you mentioned in the rebuttal on Monday:)	QUESTION	se	2	617
Where do we draw the line?	QUESTION	da	2	662
In particular, I am skeptical about the phrase "email is the company's property", as if it were a physical thing.	QUESTION	da	2	664
If I am having a conversation with my wife at work on the phone, does the employer own that conversation.	QUESTION	da	2	667
If it does not own it, and I do, then I wonder if they have a right to monitor something that I own.	QUESTION	da	2	668
Let's pretend that the evidence is overwhelming and we all agree that monitoring leads to profits.	QUESTION	da	2	686
If so, would we still allow firms to monitor us as much as possible, or is our privacy worth the sacrifice of profits?	QUESTION	da	2	687
Just a thought: do you think that companies should only monitor employees who work the 9-5 shift, same as other businesses, to ensure employees are focusing on work and not personal calls?	QUESTIOn	kh	2	732
What about employees who work the night shift?	QUESTION	kh	2	733

Appendix T: Event category “DISAGREE”.

I don't understand where this notion of workers have the "right" to meaningful work, take care of personal matters at work, etc.	DISAGREE	dc	1	63
You don't get it.	DISAGREE	bt	1	140
I disagree with employee monitoring	DISAGREE	tc	1	272
I disagree with those who feel that monitoring increases productivity	DISAGREE	tc	1	276
Time will tell, but - with all do respect - I hope it proves you're wrong.	DISAGREE	kv	1	401
I don't agree with you.	DISAGREE	ex	3	914
I do not agree with you.	DISAGREE	ex	3	939
I do not agree it to be a strong argument	DISAGREE	sx	4	1064
I think that the opposite is true.	DISAGREE	ks	4	1134

Appendix U: Event category “CONDITIONAL”.

Employers should, however, conduct monitoring in a reasonable fashion.	CONDITIONAL	dc	1	72
This means monitoring soley for the purposes intended, and forewarning employees about monitoring logistics.	CONDITIONAL	dc	1	73
except for basic security.	CONDITIONAL	kv	1	94
On monitoring, I think that certain jobs (high-level jobs that require decision making and intiative and self-direction) in which autonomy is necessary to complete the job to its fullest, monitoring is wrong!!!	CONDITIONAL	vp	1	107
However, in jobs where the job may be pretty straightforward and the level of trust between the employer and employees is low, monitoring may be acceptable.	CONDITIONAL	vp	1	108
And of course, employees would be aware of the monitoring.	CONDITIONAL	vp	1	109
If you don't, then you simply do not accept the job.	CONDITIONAL	kh	2	711
Instead, you find a company that you would like to work for that does not monitor its employees.	CONDITIONAL	kh	2	712
Unless the company has detected an increase in "missing property" (for example) during a certain shift.	CONDITIONAL	se	2	739
so far as it informs the employees that they will be monitored at work and also tell them to what extent they will be monitored.	CONDITIONAL	yl	3	807
If, after a company informs you of everything you need to know about EM, you still decide to take the job, then I do not see anything wrong here.	CONDITIONAL	yl	3	808
However, we must not be blind to those who will act opportunistically.	CONDITIONAL	jf	3	887
If everyone is the same, of course, we do not need any monitoring methods.	CONDITIONAL	ex	3	918
However, it depends on the situation the employer is facing.	CONDITIONAL	ex	3	941
If your answer is no, you should not ask the company give up its right to have similar concerns.	CONDITIONAL	hc	3	957
Therefore, if direct supervision is the main kind of control being used in an organization.	CONDITIONAL	kn	3	1015
If employers desire to use certain monitoring methods, they must effectively communicate the parameters and limits of the monitoring to the employees.	CONDITIONAL	sl	4	1117
If employees are informed about the potential benefits of monitoring to themselves, the company, and the customers, they are less likely to resent it.	CONDITIONAL	ks	4	1130
First, I would say EM is needed under certain circumstance.	CONDITIONAL	ch	4	1168
But if you set EM in the lab or office of a professor who is working on quite important reaserch or invention (the improper use of the result would cause a lot of damage to society), extensive monitoring would increase the chance for other people to get t	CONDITIONAL	ch	4	1174
Just as SL said, the monitoring is acceptable, but with limitation.	CONDITIONAL	ch	4	1176
But it is more possible for employers to use EM in order to control theirs employees.	CONDITIONAL	sk	4	1204
Through concertation and by giving the chance to personnel to agree on the level of privacy they are willing to give up, electronic monitoring can be implemented successfully.	CONDITIONAL	tf	4	1255

Appendix V: Event category “EXPERIENCE”.

Some days I feel like everyone is watching me,	EXPERIENCE	kv	1	4
not because I'm paranoid, but because	EXPERIENCE	kv	1	5
2) it's the end of the semester and I'll fill out approximately 10 university-related evaluation forms in the next 5 school days	EXPERIENCE	kv	1	7
3) I'm participating in a class that has chosen to use virtual interaction as part of a research study	EXPERIENCE	kv	1	8
This interaction was much more appealing and interesting to me before I realized that I would be part of a study.	EXPERIENCE	kv	1	10
Don't get me wrong, I LOVE virtual communication.	EXPERIENCE	kv	1	12
It saves me time and is another way of staying in touch with friends (via ICQ) or classmates (via First Class)or getting help (via IT-related bulletin boards).	EXPERIENCE	kv	1	13
What bothers me is that, this time, my comments and observations may end up as an insightful quote in someone's phd thesis.	EXPERIENCE	kv	1	14
but I also am reaching a saturation point.	EXPERIENCE	kv	1	17
I guess the workplace is different because I'm there longer than the few hours in the grad lab or a few minutes at the bank.	EXPERIENCE	kv	1	34
My experience working in the Caribbean showed me that not every corporate culture believes this is true.	EXPERIENCE	kv	1	45
Several companies track the number of minutes employees spend on the phone, for example.	EXPERIENCE	kv	1	46
If the job description does not require phone access, the employee does not have the right to use the employer's phone.	EXPERIENCE	kv	1	47
Part of the reason for this is that telephone expenses are actually a significant percentage of a Caribbean companies variable costs,	EXPERIENCE	kv	1	48
I would like to respond your first question, but not necessarily answer it, because I have only worked in the U.S. and have no other frame of reference.	EXPERIENCE	dc	1	61
I know that if I was monitored at work, which required autonomy, I would definitely be less productive.	EXPERIENCE	vp	1	177
Of course I saw many people who lost their productivity by being monitored.	EXPERIENCE	db	1	201
But also there are many people who want to achieve high performance while being watched.	EXPERIENCE	db	1	202
For example, while growing up I had to work part time at some jobs some might call "unglamorous", like working in a factory or a grocery store.	EXPERIENCE	dc	1	227
I can say firsthand, without question, that 90% of employees working in this scenario, given the chance, would take a break all afternoon!	EXPERIENCE	dc	1	228
The inherent claimerties of the work itself are just not something people naturally want to do, and I can't blame them.	EXPERIENCE	dc	1	229
However, in different positions, like working in an office, I can see that higher levels of trust may naturally occur because the nature of the work itself is more fulfilling.	EXPERIENCE	dc	1	231

Appendix W: Event category “LITERATURE”.

This is a really important paradigm of work motivation and a lot of empirical research has recently been done on this topic.	LITERATURE	vp	1	290
It has been shown in many studies that stress decreases self-efficacy which decreases your productivity.	LITERATURE	vp	1	291
Also, manufacturing company report tells that that time is the most productive time for workers.	LITERATURE	db	1	411
(Except time right after the lunch time).	LITERATURE	db	1	412
But while researching for this debate I actually found survey results stating the contrary.	LITERATURE	rm	2	566
There is a study which suggests it is possible to have reduced stress with EM.	LITERATURE	se	2	573
It is a study by Nebeker and Tatum.	LITERATURE	se	2	620
The article says that the results of their study indicate that EM (with feedback) leads to increased performance with little effect on work quality satisfaction or stress.	LITERATURE	se	2	621
The study goes on to say that when employers use EM "with proper design" it is possible to gain the benefits of increased productivity, increased satisfaction and reduced stress all at the same time.	LITERATURE	se	2	622
This info is from the American Business Review, January, 2000.	LITERATURE	se	2	624
My understanding of that study is that Nebeker and Tatum concluded that "with proper design" EM could decrease stress (implying that if only feedback were used then EM could have little effect on stress).	LITERATURE	se	2	640
They say that proper design is: "moderately high standards when no rewards are offered, and easy standards when rewards are offered."	LITERATURE	se	2	641
This week's issue of Time magazine had some interesting statistics on employee monitoring:	LITERATURE	ks	4	1181

Appendix X: Event category “DATA”.

We tried to find numbers for money saved by deterring theft, but they aren't readily available.	DATA	rs	1	315
I looked around a bit to see if there was an data that could support our contention that EM may reduce stress.	DATA	yd	2	603
As you too found, it ain’t out there.	DATA	yd	2	604
54% of companies surveyed monitor internet connections	DATA	ks	4	1183
38% store and review email messages	DATA	ks	4	1184
31% store and review computer files	DATA	ks	4	1185
15% video record job performance	DATA	ks	4	1186
12% record an review phone calls	DATA	ks	4	1187
7% store and review voice mail messages	DATA	ks	4	1188

Appendix Y: Event category “VIEWPOINT”.

and makes sense from an economic point of view.	VIEWPOINT	kv	1	86
but I really think that you need to evaluate why the customer had complained in the first place.	VIEWPOINT	vp	1	150
I'm more of a champion for the excluded, and take a more individualistic "distributive justice" approach to evaluating stuff. (in case you haven't already guessed.	VIEWPOINT	kv	1	405
I think answering this question starts by deciding what the purpose of a firm is.	VIEWPOINT	da	2	681
I happen to believe along the same lines as Freedman, that the purpose of the firm is to profit, period.	VIEWPOINT	da	2	682
For the manager's point of view, I think monitor is not a bad idea to improve productity.	VIEWPOINT	ex	3	920
Form the company's point of view, the only question is "to be or not to be."	VIEWPOINT	hc	3	963
4) By personal libertarianism,	VIEWPOINT	sx	4	1081
By universalism, employers should do what is the best for the majority people.	VIEWPOINT	sx	4	1084
By universalism, we can do if can be universal rule, in this case, Do you really think EM keeps the right of privacy, right of free speech and right of due process?	VIEWPOINT		4	1229
Isn't what matters the most the outcome?	VIEWPOINT	np	4	1275

Appendix Z: Event category “CHANGE”.

No examples of metacognitive comments on
self learning or change in opinions found in pilot study.

Appendix AA: Event category “PROCEDURAL”.

Thanks, DC	PROCEDURAL	dc	1	77
DC,	PROCEDURAL	kv	1	82
CM,	PROCEDURAL	bt	1	139
DC	PROCEDURAL	vp	1	239
TC-	PROCEDURAL	vp	1	287
I like to negotiate between two parties but	PROCEDURAL	db	1	325
DB,	PROCEDURAL	kv	1	363
DB,	PROCEDURAL	kv	1	393
DB	PROCEDURAL	db	1	415
Regarding monitoring during most important work time & looking better when others are watching:	PROCEDURAL	kv	1	422
Because we had to argue the benefits of EM, we did not get a chance to project many of our true feelings about the issue.	PROCEDURAL	yd	2	488
YD	PROCEDURAL	yd	2	495
YD,	PROCEDURAL	da	2	527
Hello YD and RM,	PROCEDURAL	se	2	614
YD:	PROCEDURAL	se	2	616
RM:	PROCEDURAL	se	2	619
SE,	PROCEDURAL	jm	2	629
Hello JM,	PROCEDURAL	se	2	639
In the future, you should note that listing names of books and courses only makes you look inexperienced.	PROCEDURAL	jf	3	900
Using a questioning, sarcastic tone will not help you build trust and mutual respect with your employees.	PROCEDURAL	jf	3	901
In fact, after reading your message, I think I am going to take an extra long lunch break, and call in sick tomorrow.	PROCEDURAL	jf	3	902
However, I want to suggest another possibility for using EM.	PROCEDURAL	sk	4	1201
Because EM basically came from employer’s distrust against employees, we need consider different possibilities besides benefits of EM as you already mentioned.	PROCEDURAL	sk	4	1206

Appendix BB: Event category “COMMENTARY”.

Hi KV,	COMMENTARY	dc	1	59
Otherwise, a fine job, thanks for the interesting presentations!	COMMENTARY	kk	1	169
Thank you for commenting on my idea., KV.	COMMENTARY	db	1	379
But you have a point.	COMMENTARY	kv	1	397
Hey, thanks for the note.	COMMENTARY	kv	1	420
Hope everybody out there got something out of the presentation today.	COMMENTARY	yd	2	487
have a good night's sleep	COMMENTARY	yd	2	494
Yes, it was a good debate yesterday.	COMMENTARY	rm	2	515
I was in the group which debated for electronic monitoring.	COMMENTARY	se	2	541
Here is one of issues which piqued my interest while researching the paper:	COMMENTARY	se	2	542
I was in the group that argued against EM.	COMMENTARY	rm	2	564
Hello,	COMMENTARY	se	2	572
I wrote about it in a message below called "There is a study that shows reduced stress."	COMMENTARY	se	2	574
I can show you the American Business Journal article it came from if you like.	COMMENTARY	se	2	644
I hope that helps.	COMMENTARY	se	2	645
Hi guys.	COMMENTARY	da	2	674
5.1.2.1 Thanks for the "tip"	COMMENTARY	lk	3	904
Hope you will get better soon :)	COMMENTARY	lk	3	907
I basically understand SX’s opinion.	COMMENTARY	sk	4	1200
Amis du jour, bonjour,	COMMENTARY	tf	4	1238

Appendix CC - Survey for grouping students in pilot study

Name: _____

Email: _____

Gender: M or F

1. Please rate your level of experience with using computers
   Very Low 1…2…3…4…5 Very High

2. Have you ever used a bulletin board? YES NO

3. How much access do you have to computers and the Internet/WWW?
   Very poor access
   Somewhat poor access
   Somewhat good access
   Very good access

4. Do you have access to the Internet from your home? YES NO

Appendix DD - Student assignment

Group Project & Discussions (25% course grade)

The purpose of the group project is for those with substantially different opinions, attitudes, and beliefs to negotiate an agreement of common ground, such as happens in labor negotiations. Discussion and negotiations will be conducted on a threaded electronic internet bulletin board for a period of three weeks. At the end of the three weeks each group will write up a summary of its activities reviewing 1) the range of views; 2) their supporting arguments and theories, and 3) the areas of common ground. Students will be graded based on the performance of the group.

The class will be divided into four groups of equivalent size and assigned an ethical issue for discussion and negotiation. The class will work with the instructor to identify a number of suitable topic areas for which the students hold very strong views. The groups will be formed around an assigned topic for which the group has a roughly equal number of strong supporters and opponents.

Your group will then discuss the issue on a threaded bulletin board over the Internet for a period of three weeks. Bulletin boards will be used for your group negotiations in order to provide each member of your group the maximum time, flexibility, and opportunities to express personal viewpoints and supporting arguments. It will also help you share, reflect, review, compare, elaborate, and evaluate stated viewpoints, experiences, and supporting arguments between members of your group. In the process of negotiating common ground within your group, be sure to identify and explore the full range of viewpoints and differences, along with their supporting arguments based on your experiences and existing literature/research.

For this assignment, the discussions and negotiations will analyzed by a doctoral student in Curriculum & Instruction. He will use the analysis and findings for part of his doctoral dissertation. While both the instructor and the doctoral student will monitor the efforts of each group, neither will participate in any of the group activities. To provide privacy, each group's electronic bulletin board will be password protected.

Main requirements

1. The paper should be a minimum of **four pages** (double spaced) summarizing the group discussions and reviewing the range of views and areas of common ground.
2. For each week, you are expected to contribute a **minimum of three messages** to your group's bulletin board.
3. *At least two of your* weekly contributions should be **replies to** thoughts posted by other members in your group. Visit the bulletin board at *different* times of the week to read and respond to each others thoughts and contributions. This will encourage deeper and more extended discussions on the issues.
4. Avoid posting non-substantive, repetitious or perfunctory contributions to the bulletin board discussions.

Appendix EE - Survey for grouping students

Name: _____ Email: _____

Gender: Male or Female

Please rate your level of experience with using computers
Very Low 1…2…3…4…5 Very High

Have you ever used a bulletin board or message forum on the Internet? YES NO

On average, how many days of the week do you use email, the Web or the Internet?
0…1…2…3…4…5…6…7 Days per week

Please indicate your relative position on each of the following ethical issues *AND* rank their relative importance:

Email & Internet monitoring at work Opposed 1...2…3…4…5 In Favor Importance? low medium high	More laws to limit targeted advertising: Targeted advertising without contraints. Opposed 1...2…3…4…5 In Favor Importance? low medium high
Mandatory drug testing for its prospectus and current employees. Opposed 1...2…3…4…5 In Favor Importance? low medium high	Pregnancy testing at work Opposed 1...2…3…4…5 In Favor Importance? low medium high
Medical record privacy Opposed 1...2…3…4…5 In Favor Importance? Low medium high	Assigning jobs based on gender Opposed 1...2…3…4…5 In Favor Importance? low medium high
DNA testing for insurance companies Opposed 1...2…3…4…5 In Favor Importance? low medium high	Stricter environmental protection laws Opposed 1...2…3…4…5 In Favor Importance? low medium high
Commercial access to personal information Opposed 1...2…3…4…5 In Favor Importance? low medium high	Prohibit the use of cloning Opposed 1...2…3…4…5 In Favor Importance? low medium high
Prohibit low labor & wage practices Opposed 1...2…3…4…5 In Favor Importance? low medium high	Stricter laws on sexual harassment Opposed 1...2…3…4…5 In Favor Importance? low medium high
Hiring employees based on age Opposed 1...2…3…4…5 In Favor Importance? low medium high	Prohibit job loss based on conduct outside of work: Purchase of products from sweatshops OR firing ba on outside activities. Opposed 1...2…3…4…5 In Favor Importance? low medium high

Appendix FF - Post survey

The student post-survey to obtain student response to using bulletin boards for group discussions.

Name: _____

1. Imagine you did not have access to the Bulletin Board used in this course, how would that change your educational experience? What specific benefits were gained from using the Bulletin Board?

2. I feel that the discussions on the Bulletin Board has encouraged me to think critically about the topics. (i.e. sharing of viewpoints, discussing differences between viewpoints, re-examining viewpoints, identifying supporting arguments, evaluating viewpoints and arguments, integrating viewpoints, etc.).

   Strongly Agree 1…2…3…4…5 Stongly Disagree
   ___ *No basis for judgement*

3. I am more comfortable sharing and discussing differences in opinions and viewpoints in this course, than I am in other courses.

   Strongly Agree 1…2…3…4…5 Stongly Disagree
   ___ *No basis for judgement*

4. Did your original position on the issue change as a result of your participation in the group discussions? ___ Yes ___ No

5. List below the three things that are the greatest barriers to your successful use of the Bulletin Board as it was used in this course (please list in order of priority)?

6. Overall, how useful is the Bulletin Board in this course?

   Very Useful 1…2…3…4…5 Not at All Useful

7. Do you have other comments or suggestions on the use of Bulletin Board in this course?

Appendix GG - Coding Manual

Introduction

This coding manual provides detailed instructions on how to parse and code transcripts from the group discussions. The instructions are detailed in order to establish inter-coder reliability. Both the researcher and second-observer will code a sample transcript taken from one group discussion. A comparison between the codings between researcher and second observer will establish the inter-rater reliability for the coding scheme outlined below. The acceptable level of inter-rater reliability will be 90%.

General Procedures

Here is the sequence of tasks to complete the test of inter-coder reliability:

1. The researcher and second observer will practice coding together to review coding procedures and rules.
2. Both researcher and second observer code transcripts individually.
3. Research and second observer reviews codings and identify discrepancies, ambiguities, and units that are difficult to assign to a specific code. Codes and coding procedures must be discussed and clarified until all units can be assigned with some confidence to a specific code in the coding scheme.
4. Once researcher and second observer are confident in the clarifications and/or modifications made to the coding scheme and coding procedures, the researcher and second observer will take another uncoded copy of the transcripts and will re-code the entire transcript a second time.
5. The second coding will be compared between researcher and second observer to compute inter-coder reliability.

Rules of Parsing Units of Thought

Each entry in the discussion transcripts must be parsed into separate units of thought so that each unit can be assigned a code. Below are the rules for parsing the transcripts into units of thought:

1. **Unit of Thought:** A phrase will be parsed as a unit if it contains a subject and verb, and can stand alone as a sentence. It may also have an implied subject. i.e. “Here’s an example for you to wrestle with, //I don’t know why I didn’t think to bring this up earlier – //it is an absolutely true story”.
   (**1.1**)Statements of agreement like Yes, I agree that…, Indeed, Disagree, Right, will be coded as separate units. For example: “Indeed, //you have the right to work in a drug-free environment”. Unit 1 is “Yes”, and unit 2 is “you have the right to work in a drug-free environment”.
   (**1.2**) Exclamations that do *not* end with a punctuation mark and run on to the next sentence are to be also coded as separate units.

2. **Compound Sentences:** Compound sentences are to be divided into separate units as long as there is an implied pronoun established from a previous sentence (use of ***and, but, or***). **For example**, “This employee was an upstanding worker //and had reportedly been completely clean and sober for almost a year”, “My father is a production manager // and part owner of a small manufacturing company”, “His wife was also arrested // and immediately fired from her secretarial job”.

3. **Clauses:** Sentence clauses with complete subject (or implied subject from previous clauses) and verb are to be coded as separate units. (3.1) Clauses stated in the conditional tense using words like “if, when, since, as long as” are **not** to be coded as separate units. For example:
   FACT>FACT = “This employee was an upstanding worker // who passed a drug test when he applied at the company”.
   REAC>FACT = “Since he has not been convicted yet, I would put him on leave without pay // because he would not be able to deal with the day to day problems of work and a pending jail sentence”
   ARG- = “If they test for drugs, what rights might they infringe upon next?”
   HYP = “If I suspect drug use, I *will* keep a close eye on the employee”
   HYP? = “As his employer, what *would* you do?”

FACT = “One of this workers was recently arrested at work by federal drug authorities for his part in a drug-trafficking ring a year or so before he was hired”

4. **Embedded Clauses:** Embedded clauses or comments between parenthesis which contain subject and verb are parsed as a unit of meaning. For example, “He had reportedly been sober for almost a year //(they found out after the arrest) prior to the start of his employment”. The first unit coded is “He had reportedly been sober for almost a year…prior to the start of his employment”. The following unit to be coded is “They found out after the arrest”. **Note:** the last clause/phrase in the sentence, “prior to the start of his employment”, was included and coded as part of *unit 1* (not unit 2) in accordance to rules of graphing sentence trees. See next parsing rules on *dangling clauses*.

5. **Dangling Clauses:** Clauses at the end of a sentence are to be coded *with* (not coded separately) the preceding sentence in which the clause is intended to qualify. For example, “He had reportedly been sober for almost a year, prior to the start of his employment”. The last clause is not a complete sentence but is a clause. Therefore, the clause is not to be coded as a separate unit.

6. **Bulleted Points:** Each bulleted point under a heading is to be scored as a separate unit. For example, bulleted points are usually a list of ARGUMENTS, either with a + or - valence.

7. **Headers to Lists or Bulleted Points:** Headings to lists or bulleted points are to be coded as a unit.
   ARG-! = “Cons:” or “Here is a list of some of the disadvantages:”
   ARG+! = “Pros for drug testing:”
   ARG! = “Here is a list of the pros and cons”

<u>Assigning Codes to Units of Thought</u>

The coding scheme was used to code the transcripts of the group discussions. Before coding the transcripts, the messages must be parsed into separate units of thought. A unit of thought may be a single sentence, phrase, or even a word that meaningfully fits into one of the coding categories in the coding scheme. Below are the rules of parsing the contents of the discussion transcripts into units of thought.

1. **Mutually Exclusive Codings:** Every unit must be assigned to one and only one code listed in the coding scheme. Each unit should be coded independent of the context of units preceding it. In other words, each unit should be coded as if they were viewed independently. Exceptions are taken when units are parsed from the same sentence, in which case units are clauses from a single sentence where a pronoun is shared between clauses or phrases.
2. **Forcing Code Assignments:** In cases where a parsed unit cannot be clearly assigned a specific code, remember to make all attempts to code the unit separate from its context or preceding units. Review the coding scheme and select possible codings. Then force a best choice, but also highlight the entry in your records to mark the unit for later discussion between coders. Be sure to include your comments and thoughts concerning the difficulties in assigning a code to the unit. Your notes and entries will be reviewed and discussed to determine what code is best assigned to the given unit, and to clarify coding procedures and the distinctions between codes in the coding scheme. If no match is determined, the coders will together construct and add additional codes to the coding scheme to accommodate units that could not be coded successfully.
3. **Precedence of Verbs:** In all cases, the code suggested by the verb always takes precedence over the code suggested by any adverbs. For example, “I *should* not *judge* before I know the whole story (30)” is to be coded as EVALUATE! and not NEGOTIATE.
4. **Incomprehensible Entries:** If an entry is incomprehensible due to poor grammar or type errors, omit entry from coding and analysis.

Appendix HH - Example algorithm in Visual Basic

```
'***********************************************
'TWO-EVENT ANALYSIS PLUS UNITS
'COMPUTES T1 -> T2 + units
'***********************************************
Sub ComputeTitleToTitlePlusCodes()
   OUTPUT = "TitleCode"
   Sheets(OUTPUT).Select  'RESET TITELCODE SHEET
   Range("U2:AF13").Select
   Selection.ClearContents
   Range("U34:AH45").Select
   Selection.Copy
   Range("B2:O13").Select
   ActiveSheet.Paste
   ComputeTitleToTitlePlusCodes2 ("Group1")
   ComputeTitleToTitlePlusCodes2 ("Group2")
   ComputeTitleToTitlePlusCodes2 ("Group3")
   ComputeTitleToTitlePlusCodes2 ("Group4")
   Sheets("Test").Select ' EMPTY BLANK SHEET
   Columns("A:G").Select
   Application.CutCopyMode = False
   Selection.ClearContents
   Sheets(OUTPUT).Select
End Sub

Sub ComputeTitleToTitlePlusCodes2(Group)
   OUTPUT = "TitleCode"
   Sheets("Test").Select ' EMPTY BLANK SHEET
   Columns("A:G").Select
   Application.CutCopyMode = False
   Selection.ClearContents
   Sheets(Group).Select ' COPY ONLY MESSAGE TITLE CODES & THREAD LEVELS TO BLANK SHEET
   Selection.AutoFilter
   Selection.AutoFilter Field:=4, Criteria1:="<>"
   Columns("A:E").Select
   Selection.Copy
   Sheets("Test").Select
   Range("A1").Select
   ActiveSheet.Paste
   Rows("1:1").Select 'Delete empty row 1
   Selection.Delete Shift:=xlUp
   Sheets(Group).Select
   Selection.AutoFilter
   Numberoflines = CountNumberOfLines("Test")
   i = 0
   While i < Numberoflines - 1
      Sheets("Test").Select
      i = i + 1               'GET TARGET CODE and Thread Level
      Range("D" + i).Select
      LevelTarget = ActiveCell.FormulaR1C1
      Range("C" + i).Select
      CodeTarget = Mid(ActiveCell.FormulaR1C1, 1, 1) ' Get only first character
      If CodeTarget <> "" Then 'COUNT FREQUENCY OF CODE
         Sheets(OUTPUT).Select
         RowGiven = GetRowNumber(CodeTarget)
         Range("O" + RowGiven).Select
         If ActiveCell.FormulaR1C1 = "" Then ActiveCell.FormulaR1C1 = 0
         ActiveCell.FormulaR1C1 = ActiveCell.FormulaR1C1 + 1
      End If
      If LevelTarget > 0 Then 'Search for Given only if level > 0
         Sheets("Test").Select
         Range("A" + i).Select
         LocTarget = ActiveCell.FormulaR1C1
         Range("E" + i).Select
```

```
        CodesInTarget = ActiveCell.FormulaR1C1
        Found = "no"
        j = i
        While Found = "no"
          j = j - 1            'Search backwards until you find GIVEN EVENT
          Range("D" + j).Select
          LevelGiven = ActiveCell.FormulaR1C1
          Range("C" + j).Select
          CodeGiven = Mid(ActiveCell.FormulaR1C1, 1, 1)
          Difference = LevelTarget - LevelGiven
          If CodeGiven = "" Then Found = "yes" 'Skip if Given is uncoded
          If Difference = 1 And CodeGiven <> "" Then
            Found = "yes" 'FOUND GIVEN EVENT
            If CodeTarget <> "" Then
              RowGiven = GetRowNumber(CodeGiven) 'Record location of Target event
              XXX$ = GetColumnLetterLoc(CodeTarget)
              ZZZ$ = XXX$ + RowGiven
              'Range("G1").Select
              'Temp$ = i + " LocT=" + LocTarget + " G=" + CodeGiven + " CodeT=" + CodeTarget + " Row=" + Str(RowGiven) + " Col=" +
XXX$ + " RC=" + ZZZ$
              'ActiveCell.FormulaR1C1 = Temp$
              Sheets(OUTPUT).Select
              Range(ZZZ$).Select
              ActiveCell.FormulaR1C1 = ActiveCell.FormulaR1C1 + LocTarget
            End If

            NumberOfCodes = Len(CodesInTarget)  'Tally all codes in Target event
            K = 0
            While K < NumberOfCodes
              K = K + 1
              Codek = Mid(CodesInTarget, K, 1)
              If Codek <> " " And Codek <> "?" And Codek <> "+" And Codek <> "-" Then
                XXX$ = GetColumnLetter(Codek)
                YYY$ = GetRowNumber(CodeGiven)
                ZZZ$ = XXX$ + YYY$
                Sheets(OUTPUT).Select
                Range(ZZZ$).Select
                ActiveCell.FormulaR1C1 = ActiveCell.FormulaR1C1 + 1
              End If
            Wend
          End If
        Wend
      End If
    Wend
End Sub 'ComputeTitleToTitlePlusCodes2
```