Interaction Analysis, Synchronous CMC, & a Multi-Modal Unit of Analysis

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Abstract: The Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing (Gunawardena, Lowe, & Anderson, 1997) is one of the most frequently researched asynchronous interaction analysis models. This paper will explore the findings and difficulties of utilizing this conventionally asynchronous model to investigate collaboration in a synchronous audio-conferencing environment. Of particular interest, this study questions what is an appropriate unit of analysis for investigation of synchronous online interaction?

Introduction and Theoretical Background

Content and Interaction Analysis

Content analysis is a research methodology that entails that the segmenting of communication content into units of analysis, coding and assigning units into categories, and providing quantitative results for these categories (Rourke and Anderson, 2004). The nature of computer-mediated communication (cmc) provides an automated and readily available archive of communication data for content analysis research (Gunawardena et. al, 1997, Marra et. al, 2005; Rourke, Garrison, Anderson, & Archer, 2001). Content analysis that makes inferential findings from constructs (such as models of cognition) have been complicated by such research being time consuming, expensive, and difficult (Henri, 1992; Rourke et al., 2001; Rourke & Anderson, 2004; Henri, 1992).

Marra et al. (2004) point out that there are not many content analysis models available to researchers. Rourke and Anderson (2004) note the extreme investment that development of a coding instrument entails. Yet they also note a reticence for re-using existing instruments. Researchers that re-use content analysis models contribute to the validity of existing procedure, benefit from comparing results with other normative data, and skip the costly instrument development phase (Rourke & Anderson, 2004). While many of the existing content analysis models have been re-used and studied, two that have been frequently reused in varying research contexts have been Garrison, Anderson, Archer’s (2001) Communities of Inquiry Model and Gunawardena et al. (1997) Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing.

Interaction analysis is a mode of content analysis that investigates interaction of people within their situated environment (Gunawardena et al., 1997). In defining social interaction Van der Aalsvoort and Harinck (2000) note reciprocity of actions, reactions, and emotional expression within the process of interaction. Within instructional contexts interaction studies are based in an understanding that learning is a distributed, social process. Evidence of learning must be found in “understanding the ways in which people collaboratively do learning and recognize learning as having occurred” (Gunawardena et al., 1997, p. 403).

Unit of Analysis

Unit of Analysis in Asynchronous CMC Interaction Analysis

Before data within cmc transcripts may be analyzed and learner interaction categorized according to the researcher’s investigative instrument(s), transcripts must be divided into codeable units of analysis. Determining the unit of analysis is an important step before the final task of the actual analysis of conference transcripts begins (Garrison et al., 2001).

Content analysis researchers often choose the ‘message’, an individual threaded discussion post, as unit of analysis within asynchronous cmc (Garrison et al. 2001; Gunawardena et al. 1997; Gunawardena, et al. 1998; La Pointe & Gunawardena, 2004; Orrigun et al., 2005). This choice has been driven by the aspect that the ‘message’ is an objectively identified and demarcated unit of analysis where the length and content of the message are both decided upon by the participant and not the transcript coder, (Orrigun et al., 2005; Garrison, 2001).
Units of Analysis in Synchronous Conversation

The message as unit of analysis is not applicable to synchronous modes of cmc. To address a unit of analysis appropriate to synchronous interaction one needs to look to a discourses that focuses on the investigation of conversation. Conversation analysis (CA) is a form of content analysis that focuses on the investigation of conversational data (Markee, 2000).

Crookes (1990) describes conversation analysts as having utilized different units of analysis including turns, tone units, and utterances. The ‘utterance’ focuses upon a singular declaration of speech by a participant within a conversation in order to reflect and analyze the psychological processes that underlie speech production (Crookes, 1990). Markee (1991) critiques the utterance as taking a speaker’s, not hearer’s perspective of conversation analysis. This concept of conversation does not take into account the assertion by Sacks, Schegloff, & Jefferson (1974) that talk in interaction is fundamentally collaborative in nature and must address the natural pattern of talk in interaction. This critique supposes that a unit of analysis must not consider a single utterance in isolation, rather it must consider the collaborative context of conversation and provide a unit of analysis that is embedded within the reciprocal and ongoing interaction present in conversation.

The ‘turn’ embeds individual participants’ turns of speech within the context and pattern of conversation that occurs. Samara-Fredricks (1998) quotes Boden (1994) saying that the turn has become the “central focus of all researchers in CA,” (p.66). Crookes (1991) points out that the turn is “one or more streams of speech bound by speech of another, usually an interlocutor” (p.185).

Figure 1. Turns of Speech (Crookes, 1991, p.185)

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A: Are you going home?</td>
</tr>
<tr>
<td>2 B: Sure, I'll be leaving in ten minutes.</td>
</tr>
<tr>
<td>3 A: Great.</td>
</tr>
</tbody>
</table>

The example in Figure 1 exemplifies the bound context that each stream of speech has within the interaction pattern as a whole. In the example participant A has two turns, while Participant B has one turn. The turn may provide a useful unit of analysis within an investigation of synchronous audio cmc transcripts. A comparable aspect between the message and turn as unit of analysis is that the turn is self produced by the participants in the conference, not decided upon by the coder.

Research Purpose

This study investigates the use of the Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing (IAM) (Gunawardena, Lowe, & Anderson, 1997) in a synchronous audio-conferencing environment. Specifically the researcher focused on two research questions: 1) Can the IAM be used to provide evidence for the social construction of knowledge within a collaborative community of learners via synchronous desktop audio-conferencing audio artifacts? 2) Is the turn an appropriate unit of analysis for synchronous cmc-based interaction analysis studies?

Research Methods

Participants

A small community of learners comprised of three educational technology graduate students participated in an online study group with the objective to learn the web-based learning object authoring tool Pachyderm 2.0. Of the two female and one male participants, pre-study interviews indicated that only one had previously used audio-conferencing and instant message technologies. None of the participants were familiar with Pachyderm 2.0.

Procedures

The participants were charged to complete a collaborative project-based learning exercise. The objective of this exercise was to create an instructional resource using the Pachyderm 2.0 authoring tool. Utilizing the audio conferencing features of the instant message client iChatAV® to facilitate group communication, the participants were tasked to assign responsibilities to individual group members and self manage the process of resource development. Proscriptive constraints for the exercise included:

- The online resource should be designed and created within the audio-conferencing environment.
- The group should make all decisions about the design and creation of the resource collaboratively.
Five sixty-minute online CMC sessions were held over a twelve week period. Two face-to-face Pachyderm 2.0 authoring training sessions proceeded the online sessions. Due to difficulty maintaining a stable multipoint audio-conferencing connection using participant home internet connections, only the final two online sessions were analyzed for social construction of knowledge by participants. Each session was audio recorded and then transcribed.

**Instruments**

The IAM model depicts the phases of social cognitive processes learners move through during CMC interaction. The difference in content analysis model approach can be noted by the location of analysis. While investigations of the patterns of connection found within CMC messages seeks to decontextualize messages from their original context and recontextualize them into threads of related messages and units of meaning, the use of the IAM investigates interaction in the original context of the CMC transcript and seeks to understand the process of social construction of knowledge through the actual flow and pattern of interaction that took place during the conference (Gunawardena et al., 1997).

The IAM is broken into five phases of co-constructing knowledge that learners may negotiate during the process of interaction: Phase I Sharing and Comparing Information, Phase II Dissonance or Inconsistency of Ideas, Phase III Negotiation of Meaning/Co-construction of new knowledge, Phase IV Testing and Modification, Phase V Agreement and Application of New Meaning. Gunawardena et al. (1997) make a correlation between this model and Vygotsky’s concept of a learner’s movement from lower to higher mental functions. In this correlation, the model begins with participants working within lower mental functioning (the sharing and comparing of information) and moving through the phases into higher mental function (co-construction of new knowledge, testing, and application) (Gunawardena et al., 1997). It is at Phase III that evidence of socially constructed knowledge appears. Phase IV and V represent the testing, metacognitive statements of the social process in which the new knowledge was constructed, and the adoption of the new knowledge into the learner’s framework and schema.

Each phase in the model is composed of a series of sub-phases that represent types of operations that participants may move through during that stage. These sub-phases act as indicators for coders to infer group social cognitive processing. This is not a prescriptive coding scheme, rather a proscriptive model that needs to be interpreted and accommodated by a researcher that chooses to use it.

**Data Analysis**

Two raters coded the transcripts using the turn as the unit of analysis. After reaching 95% agreement test coding one of the earlier sessions not included in the results, the raters independently scored the final two sessions. A total of 1250 turns of speech were coded. Using Holst’s coefficient of reliability interrater reliability is $cr = .82$.

**Findings**

**Synchronous CMC and IAM**

The raters found just two instances, a total of 33 turns, of social construction of knowledge by the session participants. The agreement between coders for these 33 turns was $cr = .94$. The researcher expected a higher frequency of instances higher than phase III between session participants.

The first instance of social construction of knowledge falls within the domain of participant interaction with the authoring tool interface, the second creating group definitions for the difference between instructional technology and technology. The following excerpt from the first example illustrates the participants discovering that they cannot simultaneously edit a single page. Through the subsequent interaction they come to a shared understanding of the problem.
Figure 2. Example 1

<table>
<thead>
<tr>
<th>III/C</th>
<th>0128</th>
<th>C: So all of us can’t, I’m doubting that we can all be on it simultaneously editing it. We can try it but that’s kind of, that’s one issue.</th>
</tr>
</thead>
<tbody>
<tr>
<td>III/D</td>
<td>0129</td>
<td>A: If we can’t do it simultaneously it seems like. Um, we can, um, just take turns and then maybe we can watch while one person is doing it so we can actually see the editing going on.</td>
</tr>
<tr>
<td>IV/C</td>
<td>0130</td>
<td>B: Well they have to go through the save now process. I think this is like our server at school. We can’t all have the same file open at the same time working on it because not everybody’s changes will be accepted.</td>
</tr>
<tr>
<td>III/C</td>
<td>0131</td>
<td>C: Right.</td>
</tr>
</tbody>
</table>

Example 1 illustrates phase III interactions that follow initial phase I description of technical problems. The example demonstrates the group collaboratively coming to a new understanding about the web authoring environment.

The IAM is not prescriptive, but rather a proscriptive model that enables the researcher to interpret and accommodate its application and use within an experiment. This allowed for the its application into a mode of cmc other than the asynchronous mode it was initially designed for. The data show evidence that the IAM can be utilized to investigate synchronous audio transcripts for the social construction of knowledge, yet few interactions within this study passed into phase III of the model or beyond.

Task design may have influenced the high level of phase I interactions. While the design offered a collaborative outline for the group task, the participants chose to use labor division to break the task into individual sections that would be synthesized by the group at the culmination of the project. Since the majority of work was completed individually group interactions rarely left the sharing and coming stage of the IAM. As Blake (2000) demonstrates non-task related may have also effected the quality of interactions. Frustrations with technical difficulties and joking among participants accounted for a large number of session interactions.

The Turn

Benefits of the turn include enabling coders to objectively and precisely code the same number of units of analysis. Also discussed previously turns are determined by the participant speaker, not retroactively by the coder. When the interactants remained within the oral mode of communication the turn was found to be an adequate unit of analysis.

Communication, however, did not remain within the oral domain throughout the sessions. The following example demonstrates that participants also utilized the text-based chat to pass information to one another.

Figure 3. Example 2

<table>
<thead>
<tr>
<th>0229</th>
<th>C: So I just sent a test. I grabbed a //small//</th>
</tr>
</thead>
<tbody>
<tr>
<td>0230</td>
<td>A: Oh I see it.</td>
</tr>
<tr>
<td>0231</td>
<td>C: A small portion.</td>
</tr>
</tbody>
</table>

Between turn 0229 and turn 0230 participant C sent something. A text message was sent that briefly described one of the technologies the participants included in the final project. Participant C enters into the text chat: Unitedstreaming is a digital video-on-demand service, the largest and most current K-12 digital video/video clip library available today. Unitedstreaming continues to grow as new content and features are continuously being added. From the audio transcripts the coders are unable to identify what was sent, account for the contents, or allow for the interaction in their coding.

The dominant concept of the turn within conversation analysis research does not take into account communications that occur within visual or actional text-based channels (Lamy, 2004). Lamy (2004) discusses Mondada’s (2001) concept that the turn becomes increasingly fragile as non-verbal elements, and the material, spatial, and technological environments within which interactions are situated are taken into
account. To account for the multiple channels of communication that may occur during interaction one must consider multiple modes of communication that may transpire simultaneously. Jewitt, Kress, Ogborn, and Tsatsarelies define this as multimodal communication, the “ensemble of modes we regard as the normal condition of communication,” (2001, p. 6). Transcribing interaction through turns within oral channels of speech may not be the most appropriate choice for unit of analysis within synchronous cmc environments, because students must negotiate and interact through multiple communication channels including not only the auditory and oral channels, but also the visual channel (i.e. graphical interface, text-based communication) and the actional channel (i.e. manipulating interface and applications).

Methodological Challenges

Utilizing a multimodal unit within interaction analysis poses two unique methodological challenges, determining the unit of analysis and transcription. Multimodality focuses on the use of several semiotic modes to produce a semiotic product, with particular attention paid to the combination of these modes (such as how modes reinforce, compliment, or are hierarchically ordered) (Hampel, 2003). A multimodal unit of analysis needs to account for interactions that occur within multiple semiotic channels (such as auditory, oral, visual, actional). Contemporary synchronous cmc environments often synthesize many communication tools within a single interface (such as text chat, audio/video conferencing, whiteboard, and shared desktop). A multimodal unit of analysis also needs to count for the possibility of several technological modes of communication within a single semiotic channel.

Another significant challenge to utilizing a multimodal unit of analysis is transcription. Kress, Ogborns, and Martins (1998) suggest that actions, objects, materials, and gestures can become the central semiotic units within an interaction. Transcription of synchronous cmc must be able to demonstrate the interrelation of multiple semiotic modes, as well as the hierarchy within the meaning making process (Hampel, 2003). Transcribing a multimodal unit of analysis may include a sequence that runs across many turns (Lamy, 2004) that represent a semiotic product, while individual turns account for the multiple communication channels that contribute to the production of the semiotic product.

Conclusion

Evidence was found that the Interaction Analysis Model for Social Construction of Knowledge (Gunawardena, et al., 1997) can be utilized to investigate social construction of knowledge within a synchronous audio conferencing environment. The unit most often used in synchronous conversation analysis was found not to be adequate for analysis of interactions that occur within the multiple communication modes found in synchronous cmc. Further research to investigate elements of a multimodal unit of analysis, as well as its methodological application within the transcription, coding, and analysis phases of research is suggested.

References


LaPointe, D., & Gunawardena, C.N. (2004). Developing, testing, and refining of a model to understand the relationship between peer interaction and learning outcomes in computer-mediated conferencing. Distance Education 25(1). 83-106.


