Third Misconceptions Seminar Proceedings (1993)

Paper Title: Using Multiple Representations of Ethnographic Data to Integrate
        Interdisciplinary Research Perspectives
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Keywords:
General School Subject:
Specific School Subject:
Students:

Macintosh File Name: Gay - Ethnographic Data
Release Date: 2-9-1994 E, 11-7-1994 I

into a modern format was supported by the Novak-Golton Fund, which is administered by the Department of Education at Cornell University. If you have found this collection to be of value in your work, consider supporting our ability to support you by purchasing a subscription to the collection or joining the Meaningful Learning Research Group.

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Using Multiple Representations of Ethnographic Data
To Integrate Interdisciplinary Research Perspectives

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User acceptance and usability of a computer system are major issues in the development of systems for networked collaborative design and problem solving. It has been suggested that user acceptance would increase if tools were informed by reliable information about the needs and desires of potential users, and the setting in which systems are intended to be used. One approach to building effective online systems is to collect descriptive, qualitative information on complex real work settings. Video-based data is particularly suited for representing such qualitative information because it captures information at several levels of expression (speech, actions, milieu) and thus lends itself to multiple interpretations.

At the Interactive Multimedia Group (IMG), we have been investigating the use of ethnographic techniques in the process of building databases and simulations to help researchers document and analyze thickly layered data evident in these complex problem solving environments. In this paper, we describe and discuss the use of video-based data in an electronic spreadsheet (Quicktime movies, transcripts, hypermedia annotations and interpretations) which promotes communication among researchers from various disciplines who each lend their perspectives to the analysis of a design problem solving exercise.

DOCUMENTING DESIGN PRACTICES IN A THICKLY LAYERED COMMUNICATION ENVIRONMENT

Description of Primary Data

The primary data for this investigation were generated in the course of a collaborative design exercise. The purpose of our analysis was to gain an understanding of the design communication practices (Minneman, 1991) which evolved over computer linked networks as students engaged in communicative activity to solve design problems . Of particular interest for our research was the use of online resources in support of the problem solving discourse. Videotapes of three teams of collaborating students and the tracking records generated by the computer's graphical screen recorder provided the raw data for analysis. A 13 minute videotaped segment of the collaboration was transcribed in order to be able to analyze communication in detail. The segment begins approximately 47 minutes into the design activity, a point when students had completed their orientation and were actively engaged in the task.

The practical problems of transcribing spoken conversations have been extensively documented (cf.. Stubbs, 1983). Estimates of transcription times have varied but estimates such as 1 hour of transcription time to one second of spoken conversation are considered efficient. Transcribing three videotape records was exceedingly time consuming and difficult. To get a sense of the overall record of the multi-stranded intergroup and intragroup work inherent in the collaborative design exercise required that we synchronized three monitors and played the videos simultaneously. To do this we used a SONY V-Box. Transcribing the videos for intergroup and intragroup talk required watching (and transcribing) one video and then switching to another to achieve a chronologically accurate account of the collaborative work. Although several software packages have been designed to analyze a single video record (Rochelle, 1991; Goldman-Segal, 1992), no tools currently exist to coordinate or annotate or transcribe multiple, concurrent video records generated by the networked environment used for this design exercise.

In addition to the practical problems inherent in a faithful representation of the chronology of video events we encountered other problems in preparing the transcription. We needed to find a way to represent the multiple levels of expression captured on the videos. Also, the networked problem solving situation under study required a variety of perspectives (engineering design, communication, educational psychology, anthropology) be brought to bear in analyzing the complex events on the video. In order to address these representation issues we began experimenting with the use of an electronic spreadsheet program. This spreadsheet, described in detail below, enabled us to integrate the written transcript, pointers to video segments, analysis categories, and comments from a variety of researchers into one electronic document.

TECHNIQUES FOR ANALYZING MULTI-STRANDED DISCOURSE

Expanding the Notion of a Basic Transcript

The electronic spreadsheet software (Excel 4.0) we used for analysis allowed us to greatly expand the notion of a basic transcript. Formerly, a basic transcript referred to the text produced as speech was transformed into a written document. This, therefore, did not include the procedures and notational systems that the transcriber chose to catalogue the discourse dimensions of the speech, for instance turn taking, interruptions, pauses and the like (cf. Stubbs,1983). Now, using the electronic spreadsheet, the basic transcript has been transformed and expanded. It can include not only the written transcription of the video, but a digitized version of the actual video segments, as well as cells for coding the visual and text records.

Figure One shows an example of this spreadsheet which accommodates multiple data formats and allows for cross referencing of text and digitized video data (Gay and Mazur, 1993). In Figure 1 the time codes are located in column A, text transcriptions are shown in columns B, problem solving episodes were logged in column C, design communication practices were coded in column E-H, discourse categories are shown in column M, cognitive content codes are in column P, and a reference frame to a digitized QuickTime movie in column Q. Clicking on the reference frame shows the digitized videotape segment which corresponds to the interactions transcribed and coded in the spreadsheet (Gay and Mazur, 1993). Comments from the psychologist appear in column R. In the course of transcription and spreadsheeting we became aware of practical and theoretical methodological issues which would have a direct bearing on the analysis.

In this expanded form, multimedia data presented in the basic transcript hold the potential to more adequately represent for analysis the complex verbal and non-verbal events of the collaboration. Several features of the expanded basic transcript bear directly on the discussion of the case study which follows. These are:

a)   thickly layered data are presented in multiple formats – text, video, and graphics – that support multiple interpretations,

b)   in electronic form, the data in the spreadsheet are easily manipulated using the cut-and-paste functions of the spreadsheet,

c)   interdisciplinary researchers can comment upon data and annotate each other's work on the spreadsheet,

d)   the transcript is no longer a linear document; it can be a hypertext, a non-linear document which incorporates linked chunks of multimedia information.

CASE STUDY

A case study of the analysis of the video segment showed that researchers from several disciplines were able to communicate using the spreadsheet (cf.. Gay & Mazur, n.d.). A variety of perspectives on the same event could be annotated and linked using the

hypertext capabilities of the spreadsheets. Linked in this manner, the researcher's dialogues shaped narratives from which themes that characterized the design communication practices of the student collaborators emerged.

DISCUSSION: EXPLORING NEW METHODS

The process of analyzing naturalistically obtained data can viewed as essentially a synthetic process "in which the constructions that have emerged (been shaped by) inquirer-source interactions are reconstructed into meaningful wholes" (Lincoln & Guba, 1985 p. 333). For researchers working in the naturalistic context of inquiry, several methodological benefits derive from the use of the expanded electronic transcripts. The linking features of the electronic spreadsheet create a hypertext in which researchers' comments on the primary data can be cross-linked and annotated. The spreadsheet provides a data space rich in possibility for the triangulation of data, cross validation, and reinterpretation of rich, multilayered data.

In the context of investigating the complex of interactions in collaborative network activity, the refinement of methods which employ these electronic expanded spreadsheets may yield new perspectives on the nature of collaborative, interdisciplinary research and communication. The electronic spreadsheet enables an interdisciplinary team of researchers to examine and annotate video-based data. Continued investigation, observation, and collaboration among researchers may begin to shed light and dispel assumptions about the educational benefits of, and problems associated with, the use of these networked environments in educational settings.

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