

## **Analysing Verbal Data: Principles, Methods, and Problems**

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### **ABSTRACT**

This chapter formulates the issues and choices researchers should be aware of when adopting or adapting various methods of analysing verbal data such as transcripts of classroom discourse and small group dialogues, talk-aloud protocols from reasoning and problem solving tasks, students' written work, textbook passages and test items, and curriculum documents. It discusses the basic principles of linguistically precise discourse analysis including transcription, the role of context, and intertextuality. Semantic content analysis (thematics), rhetorical-interactional analysis (e.g., speech act theory), and structural-textural analysis (segmentation and cohesion) are distinguished as complementary procedures. Finally, problems of generalisability, interpretation, and cultural bias are briefly addressed, along with a note on extensions of the methods to multimedia and video.

**KEYWORDS** Verbal data · Interaction analysis · Discourse analysis · Generalisability · Textural analysis · Multimedia

Increasingly, the data of science education research are verbal data, including transcripts of classroom discourse, small-group dialogues, video, and interaction in online environments; talk-aloud protocols from reasoning and problem solving tasks, students' written work, textbook passages, test items and curriculum documents. Researchers wish to use data of these kinds to describe patterns of classroom and small-group interaction, development and change in students' use of technical language and concepts, and similarities and differences between school and community cultures, school science and professional science, the mandated curriculum and the delivered curriculum.

In this chapter, it is not possible to demonstrate actual state-of-the-art techniques of linguistic discourse analysis. My purpose here is to formulate the issues and choices of which researchers should be aware in adopting and adapting any method of analysis of verbal data for their own work. Along the way, I cite examples from my own published work and other sources which I personally find useful.

Discourse analysis is a very large subject; its principles embody a theory of meaning-making that is nearly co-extensive with a theory of human behavior and human culture (Lemke 1995a). Other useful introductions to discourse analysis and classroom discourse study include Cazden (2001), Christie (2002), Rymes (2009), Coulthard (1994), and Edwards and Westgate (1994).

In the sections that follow, I will begin by discussing the processes of data generation and contextualization, and then outline a general scheme for analyzing the three major dimensions of discursive meaning: semantic presentation, social orientation, and textual organization. I will end by briefly discussing issues of generalizability, interpretative bias, and educational usefulness of discourse analysis methods and their extension to multimedia and video analysis.

## HOW RESEARCHERS CONSTRUCT VERBAL DATA

The language that people speak or write becomes research data only when we transpose it from the activity in which it originally functioned to the activity in which we are analysing it. This displacement depends on such processes as task-construction, interviewing, transcription and selection of materials, in which the researcher's efforts shape the data. Because linguistic and cultural meaning, which is what we are ultimately trying to analyse, is always highly context-dependent, researcher-controlled selection, presentation and recontextualisation of verbal data are critical determinants of its information content. Data are only analysable to the extent that we have made them a part of our meaning-world and therefore also data about us.

Selection of discourse samples is not governed by random sampling. Discourse events do not represent a homogeneous population of isolates that can be sampled in the statistical sense. Although discourse events are unique, researchers aggregate them for particular purposes and by stated criteria. There are as many possible principles of aggregation as there are culturally meaningful dimensions of meaning for the kind of discourse being studied. The basis for aggregation ultimately is covariation: some change in the context or circumstances is associated with a systematic change in discourse features of interest to the study. Normally, because this cannot be known until the end of the study, it is wise to collect a larger and more diverse corpus of verbal data than ultimately will be used to support the analysis.

The basis of discourse analysis is comparison. If you are interested in covariation between text features and context features, you should not collect data only for the cases of interest, but also for cases that you believe will stand in contrast with them. For example, if you are interested in phenomena specific to women, to third-graders, to small-group discussions in laboratory settings, or to a particular curriculum topic, you also should collect potential comparison or reference data, in small amounts, for other genders, grades, settings or topics.

Discourse analysis is also contextual. If you are interested in the language of any particular kind of event or text, you also should collect 'around' it its probably relevant intertexts (see below). If you are studying how students write up their laboratory work, in addition to the texts that they write, you also will need data on how the same topics have been discussed in whole-class sessions, what the textbook says on the topic, any relevant written handouts, and perhaps also interviews with the teacher and the students.

All analysis is reductive. Information from the original data is discarded in the process of foregrounding the features of interest. Wise researchers preserve the original data in a form that can be reanalysed or consulted again from different viewpoints, posing different questions. Spoken language never is analysed directly. It is not even analysed directly from audio or video recordings, but from written transcriptions. The process of transcription creates a new text whose relations to the original data are problematic. What is preserved? What is lost? What is changed? Just the change of medium from speech to writing alters our expectations and perceptions of language. What sounds perfectly sensible and coherent can look in transcription (any transcription) confused and disorganised. What passes by in speech so quickly as not to be noticed, or is replaced by the listener's expectations of what should have been said, is frozen and magnified in transcription. Normal spoken language is full of hesitations, repetitions, false starts, re-starts, changes of grammatical construction in mid-utterance, non-standard forms, compressions and elisions, etc. The tendency in transcription is to 'clean it up', dismissing most of these features as irrelevant. Very often, some of them turn out not to be irrelevant at all. I recommend transcribing large portions of the corpus at the 'lexical' level (preserving the sequence of whole, meaningful words and meaningful non-lexical vocalisations) for survey purposes, and then smaller portions at still more detailed levels for more intensive analysis.

The simplest transcriptions attempt to preserve information at the level of the word, but language only occasionally constructs meaning with single words. What matters is how the words are tied together, and that often includes intonation contours. Whether two phrases represent self-paraphrase or contrasting meanings often can be determined only from intonation. Transcription at the level of the word also erases information about emphasis, value-orientation, degree of certainty or doubt, attitude of surprise or expectability, irony, humour, emotional force, speaker identity, and speaker dialect or language background. Many of these features may be coded redundantly in the words as well, but some will not be. In addition, information about the timing of speech (length of pauses, simultaneous speech, sudden breaking-off of fluency, overlaps, etc.) is frequently important.

Written texts also carry considerable visual information such as handwriting forms, page layout, typography and accompanying drawings and illustrations. This information, which can be very important for interpreting the meaning of verbal text, should not be lost to the analysis. Videotapes obviously contain a wealth of relevant visual information on gaze direction, facial expression, pointing and other gestures, contextual artifacts referred to in the verbal text, positional grouping, relative distances and directions, etc. Along with field notes, they help us to reconstruct the social situation or cultural activity type within which some meanings of the verbal language are very much more likely than others.

For useful discussions of transcription, see Erickson (1982), Ochs (1979) and Sacks, Schegloff and Jefferson (1974). For the role of intonation, see Halliday (1967) and Brazil, Coulthard and Johns (1980). On visual information in text, see Kress and van Leeuwen (1996), Lemke (1998a) and Tufte (1983).

## THE CONTEXTS OF VERBAL DATA

Language is always used as part of a complex cultural activity. Verbal data make sense only in relation to this activity context and to other social events and texts with which we normally connect them, their intertexts. Meaning is not made with language alone. In speech, it is accompanied by gestural, postural, proxemic, situational and paralinguistic information and, in writing, it is accompanied by choices in the visual coding of words and other graphical information. The meaning of any text or discourse event always depends on how we connect it to some (and not other) texts and events (on general intertextuality, see Lemke 1993).

What the teacher is saying now makes sense in part in relation to what she said ten minutes ago or yesterday, what we read in the book, the question that you missed on the last quiz, etc. It also makes sense differently depending on whether she is reviewing or introducing new material, whether it is addressed to one student or to the whole-class, and whether it relates to a diagram on the board or not. What a student says can make meaning in relation to the past history of his dialogue with this teacher, the group dynamics of the class, his boredom with the topic, and his personal relations with other students.

There are many schemes for systematising the probably relevant contextual factors of a text or discourse event (see, for example, Erickson and Shultz 1981), including the participants and their social and physical relationships, material objects and semiotic representations in the immediate physical environment, the cultural definition of the activity type or situation and its roles and expectations, and the channel or medium of communication. More important than such lists are (1) the principle that the discourse itself can create a context, make a part of the environment newly relevant, or even change its meaning, and (2) that the context is itself a kind of text that must be 'read' from the viewpoint of the verbal discourse. Verbal data, including particularly written or printed texts, always make sense in relation to (1) a context of production, or the circumstances in which they were written or spoken, and (2) a context of use, or the circumstances in which they are read or heard. For written texts, these two can be very different (see Lemke 1989).

Texts and discourse data index or point to relevant contexts in a variety of ways (e.g., Wortham 2005). The simplest is through deictic forms such as this, that, the other, over there, now, as we saw before, and mine. These forms indicate to the listener that meaning must be made jointly with the textual and the relevant contextual information. In addition to the context of situation, there is also more generally the context of culture (e.g., Halliday and Hasan 1989) that is indexed by a text. Much of this is a presupposition of familiarity with other texts, cultural norms, genre conventions (see below), etc. in a particular community.

Nonverbal signs, which co-occur with spoken language, especially 'body language' signs form, with speech, a single integrated meaning-making and interpersonal communication system. Very little really is known yet on how the different channels of this system modulate each other's meaning effects (see Kendon 1990).

## THE DIMENSIONS OF VERBAL MEANING

Language in use always creates three interdependent kinds of social and cultural meaning. It constructs social relationships among participants and points-of-view; it creates verbal presentations of events, activities and relationships other than itself; and it construes relations of parts to wholes within its own text and between itself and its contexts.

Presentational meaning is the most familiar and most studied. This aspect of meaning often is referred to as representational, propositional, ideational, experiential or thematic content. This is the function of language for presenting states-of-affairs (i.e., for saying what is going on). It presents processes, activities and relationships, as well as the participants in these processes, and attendant circumstances of time, place, manner, means, etc. It defines entities, classifies them, ascribes attributes to them and counts them. In relation to these semantic functions, its grammar has been described usefully by Halliday (1985). My own work on thematic patterns or formations (e.g., Lemke 1995b) applies Halliday's analysis to textual and intertextual patterns in discourse (see below).

Oriental meaning can be even more fundamental developmentally. This aspect of meaning, also called interpersonal or attitudinal, constructs our social, evaluative and affective stance towards the thematic content of our discourse, towards real and potential addressees and interlocutors, and towards alternative viewpoints. It includes: the language of formality/intimacy, status and power relationships, and role relationships; speech acts, such as promising/threatening, joking, insulting, pleading, requesting/demanding and offering; evaluative stances towards the warrantability, normality, normativity, desirability, seriousness, etc. of thematic content; construction of affective states; and construction of alliance, opposition, etc. between one theory or viewpoint about a matter and others available in the community. Useful sources on these aspects of orientational meaning are available in many sources (e.g., Lemke 1998b).

Organisational meaning is not perceived always in our culture as meaning, but analysis shows that it is an integral member of the team, functioning together with, and indeed enabling, the other two. Organisational meaning includes the ways in which language creates wholes and parts, how it tells us which words go with which other ones, which phrases and sentences go with which others and how, and generally how a coherent text distinguishes itself from a random sequence of sentences, phrases or words. Organisational meaning in language generally is created through simultaneous use of the two

complementary principles of (1) constituency structure, in which a larger meaning unit is made up directly of contiguous smaller units and (2) cohesive structure, or 'texture', in which chains of semantic relationships unite units which could be scattered through the text. Constituency structures can be interrupted and resume, and are at least in principle 'completable'. Cohesion chains, which have neither of these properties, are built on a variety of chain-membership principles, all of which specify a particular kind of relation of meaning among the items (e.g., synonyms, members of a common class, contrast, agent-action, action-means, attribute-item).

Constituency structures (genres, genre stages, rhetorical formations, adjacency structures, clause-complexes, clauses, phrases, groups, etc.) create local meaning relationships among items, which also generally belong to cohesion chains, and they provide one means for creating new bases for cohesive relations. Real texts, especially extended complex discourses, often change genre types or other constituency strategies many times, creating sub-units within a text. Cohesive relationships provide a principal means of creating semantic continuity across these segmental boundaries within a text.

Some forms of meaning depend about equally on two of these three semantic functions, so that, for example, logical relationships (because, if . . . then) normally function both presentationally and organisationally. For useful discussions of organisational meaning, see Halliday (1978), Halliday and Hasan (1989), Hasan (1984), Lemke (1995b), Martin (1992) and Matthiessen (1992).

## SEMANTIC CONTENT ANALYSIS

How can we characterise what a text says about its topics, or even what its topics are, better or more concisely than the text does itself? This is possible only to the extent that the text repeats the same basic semantic patterns, makes the same basic kinds of connections among the same basic processes and entities again and again. In our culture and most other cultures, not only do we repeat these thematic patterns, or formations, again and again in each text, merely embroidering on the details, we also do so from one text or discourse event to another.

This is especially true in the sciences and other academic subjects for which there are accepted, canonical ways of talking about topics. Most textbooks tell you much the same thing about atoms, alternating current or Mendelian inheritance. However they present it, we expect that what teachers say about these topics will contain this same information, and that, when students reason, talk, write or take

tests, their discourse will fit these patterns too (at least eventually). The common techniques of concept mapping are based on our ability consciously to abstract the essential meaning relations among key terms in scientific discourse. Discourse analysis, however, can produce the same patterns, and be more semantically explicit about their content, from free-form classroom or small-group talk, or from written materials of any kind. This means that these direct uses of scientific concepts directly can be sampled, assessed and compared. The basic technique for doing this is described in Lemke (1990) and its linguistic basis and extensions are discussed more fully in Lemke (1995b).

Other forms of modern semantic content analysis are statistical, corpus-based and collocational. Given the present limitations of computer analysis of natural language texts, these analyses are based on forms rather than meanings. They can tell you a text's frequency distributions and, more importantly, the joint distributions for pairs (or n-tuples) of words or fixed phrases. They cannot tell whether a given word is used with the relevant meaning in which you are interested in any particular instance. Thematic analysis, correspondingly, must be done by hand, but it enables you to see that the same concept or relationship can be expressed by many different verbal forms and grammatical constructions, and to exclude cases for which the form is right but the meaning in context is not. To do thematic analysis properly, you need to be familiar with both the subject matter content of the discourse or text, and with the semantics of at least basic lexical and grammatical relations at the level of Halliday (1985) and Hasan (1984).

## RHETORICAL INTERACTION ANALYSIS

All language in use, whether spoken or written, is explicitly or implicitly dialogical; that is, it is addressed to someone and it addresses them, and its own thematic content, from some point-of-view. It does rhetorical and social work, producing role-relationships between author-speaker and reader-hearer with degrees of formality and intimacy, authority and power, discourse rights and obligations. It creates a world of value orientations, defining what is taken to be true or likely, good or desirable, important or obligatory.

Some useful questions to guide rhetorical analysis include: What are these people trying to accomplish here? What are they doing to or for one another? How is the talk ratifying or changing their relationships? How is it moving the activity along? How is it telling me what the speaker/writer's



viewpoint is? What is it assuming about my viewpoint and other viewpoints? How does it situate itself in relation to these other viewpoints? What is its stance towards its own thematic content, regarding its truth or probability, desirability, frequency or usuality, importance, surprisingness, seriousness, naturalness or necessity?

Rhetorical analysis needs to be done at each organisational level of the text. What is the function of the choice of genre as a whole (see below), of each stage in the unfolding of the genre, of the local rhetorical formation and each move within it, of the sequencing of formations and topics, of various interruptions, digressions and the timing of returns, of grammatical constructions, of word choices, of pauses, intonations and marked pronunciations?

Those features of a rhetorical analysis that rely, as thematic analysis does, on patterns that commonly are found in many texts tend to be agreed on by different analysts. But rhetorical analysis must deal with situations unique to the text at hand much more often, and these are more ambiguous and subject to different interpretations. In these cases, the multiple forms of evidence needed to support interpretations include word choice, intonation, grammatical choice, and contextual information about the situation or activity. Even the participants in a discourse could disagree about the rhetorical meanings of particular features, or change their minds in retrospect or with additional information. The 'intention' of the speaker, as revealed in a retrospective interview, is just one more piece of data; it does not settle the question of what a feature meant for any participant at the time. Evidence of how participants followed up the appearance of the feature might be more persuasive.

In and of themselves, discourse forms do not 'have' meanings; rather, they have a range of potential meanings. Words, phrases and sentences are tools that we deploy in complex contexts to make more specific meanings, to narrow the potential range of possible meanings down to those reasonably or typically consistent with the rest of the context. Even in context, at a moment, an utterance or phrase might not have a completely definite meaning. It could still express a range of possible meanings, differently interpretable by different participants or readers. This is very often the case at the point where it occurs. The context needed to specify its meaning very often at least partly follows its occurrence. So it might seem to have a more definite meaning retrospectively than it has instantaneously. In fact, depending on what follows, its meaning as participants react to it can be changed radically by what follows (retrospective recontextualisation). Analysing a text to see what is

happening to meanings moment-to-moment yields a dynamical analysis; when all is said and done, the overall net retrospective meaning yields the synoptic analysis.

For a variety of good examples of rhetorical or speech act analysis, see Gee (2007), Green and Harker (1988), Lemke (1990), Mann and Thompson (1988), and Wortham (2005). For discussions of evaluative and affective meaning, see Lemke (1998b) and Martin and White (2007). For viewpoint analysis, see discussions of heteroglossia in Bakhtin (1935) and Lemke (1995a). For discussions of social voices, see Wertsch (1991). For dynamic and synoptic analysis, see Lemke (1991) and Martin (1992).

## STRUCTURAL-TEXTURAL ANALYSIS

Verbal data has social meaningfulness only as text, not as collections of isolated words or phrases (except statistically). How does a coherent, cohesive text differ from a random collection of grammatical sentences? How are texts and discourse events unified and subdivided into wholes and parts? How can we define the boundaries of a unit or episode of a text or verbal interaction? What binds the units of a text together?

Structural analysis of texts needs to be both 'top-down' and 'bottom-up', that is, it needs consistently to reconcile analyses that begin from the smallest units of meaning (normally phrases and clauses) and look for how these aggregate together into larger units, with analyses that begin from the largest units (normally activities and episodes or genres and their stages) and look for how these are composed of functional constituents. The largest unit of analysis for a spoken discourse text is the socially recognised activity-type in which the discourse is playing a functional part, or the smallest episode or sub-unit of that activity which contains the entire discourse event. A classroom lesson is a typical activity-type of this kind. An episode of Going-Over-Homework or Working-in-Groups can form the more immediate context. The largest unit for a written text is normally the whole genre of which it is an instance.

A genre is a text-type specified by identifying a common structure of functional units (obligatory and optional) that is repeated again and again from text to text. A speech genre generally is a highly specific activity-type accomplished mainly by verbal means. The term genre is used more often for types of written texts because they are more structurally standardised in our culture. A genre has a constituency structure in which each constituent plays a functional role in the whole and has specific

functional meaning relations to the other constituents on its own level. The largest units often are called stages, and they can be composed of smaller units, and these of still smaller ones, etc. Each constituent at each level of analysis should be defined in a way that is unique to the genre. A science laboratory report, as a written genre, might have major stages such as Title, Author, Class, Statement of Problem, Description of Apparatus, Description of Procedures, Record of Observations, Analysis of Data, Conclusions, etc.

Some constituents of some genres have an intermediate level of organisation between genre-specific units and grammatical ones. These often are called rhetorical structures or formations (e.g., Lemke 1988). They are found in essentially the same form in many different genres, but they have an internal functional or rhetorical structure in addition to the structure of their grammatical units. The most famous example in classroom discourse analysis is the IRF structure, typically realised as Teacher Question, Student Answer, Teacher Evaluation (see Lemke 1990). More common and widespread examples include the simple Question-Answer adjacency pair or other structures such as Examples-Generalisation, Event-Consequences, Syllogisms, etc.

Below the level of smallest genre-specific units and the moves within a rhetorical formation, we find the level of grammatical structure. Analysts should be aware that there are multiple simultaneous grammatical units structuring the same set of words, and that some of these can depend on intonation as well as word sequence. The boundaries of these different units are not necessarily the same.

The classic problem of textual structure is segmentation. Can a text be divided definitively at word boundaries into its constituent units at any level of analysis? The answer is: only sometimes. The same word can function as an element in different units, for different functions and on different scales. The boundary, particularly of a large, high-ranking unit (e.g., genre stage, rhetorical move) can be indeterminate in terms of lower-level grammatical or word units because it is defined by several simultaneous criteria, each of which results in drawing the boundary in a slightly different place in the text. As a general rule, units of meaning can have fuzzy boundaries in terms of units of form (or even in terms of units of meaning at a different level of analysis).

Some texts are more rigidly structured than others. Some maintain, repeat and complete particular genre patterns or rhetorical formations more consistently than others. Many texts frequently shift genre pattern or rhetorical strategy, with or without completion of those already started. Conversational

discourse is notorious in this respect, as are written texts by young writers who have not learned yet the genre conventions and borrow from the norms of conversational organisation. The way in which such texts maintain their coherence largely is by topic continuity or, more generally, by maintaining cohesion chains, whose members have no consistent structural-functional relations. If a structure looks like A-B-C-D, a chain looks like A-A-A-A. Chains can be of many kinds. Lexical chains consist of words each of which can be the same word, have the same meaning in context, refer to the same referent, belong to the same semantic domain, etc. A short lexical chain can be accidental; a long one rarely is.

Larger units than words can form chains or strands. A structural pattern can be repeated (cf. rhetorical parallelism): A-B-C-D, A-B-C-D, A-B-C-D, etc. More commonly, and very importantly, a thematic pattern can be repeated, and varied, at different levels of abstraction (see Lemke 1995b for an extended analysis). Chains also normally interact with one another; that is, in each instance from two different chains, there is the same structural relation each time between the member of one chain and the corresponding member of the other. Not just chains of individual lexical items, but chains of whole thematic formations, can interact. It can take only a clause or nominal group (noun phrase) structure to tie members of two lexical chains together, but it can take much larger and more complex grammatical or rhetorical structures to do this between large thematic formations (see Lemke 1995b).

For further discussions of genre analysis, see Bazerman (1988), Hasan (1989), Martin (1992), Lemke (1991), and Swales (1990). For cohesive organisation, see Halliday and Hasan (1976), Hasan (1984) and Lemke (1995b).

## CASE STUDIES AND THE PROBLEM OF GENERALISABILITY

How can verbal data and discourse analysis be used in studies of individual episodes and lessons, classrooms and small groups? What is the value of such studies and how can we determine the generalisability of their findings?

Discourse analysis studies are often best when they examine a particular community in depth. Discourse analysis produces its greatest insights when rich contextual information can be factored into the analysis of each text or episode. For this reason, longitudinal designs or case studies are well suited for discourse analysis methods. Here we may learn a great deal about a particular class, seeing repeated patterns within the data and a variety of strategies that create variations on those patterns.

It is not true that science should be only about generalised properties of classes of phenomena and not about unique properties of individual instances. The balance between these two approaches must be struck differently depending on the nature of the phenomena. Electrons seem to have no individuality that matters; biological systems do, but a great deal of their structure and behaviour remain constant for a species or variety. Developmental phenomena show a wide range of individual pathways. Human communities and cultures are often more interesting for what is unique to them than for what they all have in common. Moreover, one of the important properties of any class is precisely the specification of how the members of the class differ from one another.

Discourse analysis will not tell us a lot about how all classrooms or all science writing is alike (though it will tell us something), but it provides us with the tools to analyse and understand more exactly what is going on in any particular discourse or text we wish to analyse. That is as much as any theory really does for us in practice.

#### PROTOCOL ANALYSIS AND THE PROBLEM OF INTERPRETATION

When task activities differ significantly from normal cultural routines, how will cultural patterns of language use be distinguishable from idiosyncratic constructions? What is the object of study that we construct from such data?

One important form of verbal data is generated when researchers construct special task activities that differ significantly from normal cultural routines. This follows the traditions of the natural sciences in devising tasks meant to reveal particular aspects of phenomena, but it encounters the risk (minimal for electrons and molecules, but already significant for organisms) that behaviour under task conditions differs in important and unknown ways from that in normal routines. The essential context-sensitivity of meaning-based phenomena (meaning is selective contextualisation) strongly suggests that, if we are interested in a classroom phenomenon, we should study it in situ. If we supplement this with artificial tasks, it is then necessary to establish empirically that the differences between the task context and the natural context do not alter the phenomena of interest, or to identify in exactly what ways they do alter them.

Current models of situated cognition call into question the assumption that meaning-making processes can be assumed independent of local contexts, or even that 'cognition' is a process in a system

limited to the organism itself (as opposed to one that includes the organism's tools and the elements of the environment with which it interacts, cf. Lemke 1997). Discourse analysis assumes that the resources and strategies (lexis and grammar, rhetorical formations, typical cultural narratives, genres, thematic formations, etc.) used in producing discourse events and texts are characteristics of a community, rather than unique to an event in that community. They are part of its general cultural resources (and so differ from culture to culture and from one community or subcommunity to another). But what it means to have a culture is that we preferentially deploy some of these resources in some contexts rather than in others; how we use the resources is essentially context dependent.

The analysis of the covariation between situational features and the lexical and grammatical resources typically deployed in them is the subject of register theory (e.g., Halliday 1978), which can also be adapted to analyse the clause-to-clause shifts in meaning that take place through a text (phasal analysis; Malcolm 1985).

## COMPARATIVE STUDIES AND THE PROBLEM OF CULTURAL BIAS

When we use discourse analysis and verbal data to compare males with females, middle with lower class subjects, widely differing age groups, different cultural and linguistic groups, and school practices with home, community or professional practices, we necessarily introduce our own viewpoint, which invariably is closer to that of one of the categories compared than to the others.

Discourse data are not only sensitive to the context of immediate task and situation, they also are sensitive to the wider context of cultural norms and assumptions, knowledge, beliefs and values. The analysis of discourse data or its interpretation is itself just more discourse from the point-of-view of the researcher's community. Our research communities and their historical traditions emphatically are not balanced equally by gender, age, social class or ethnic culture. Even studies which strive mightily for even-handedness and neutrality of description necessarily are read by other researchers who will project their own values regarding what is better and what is worse onto what were originally mere descriptions of difference. In many other studies, even the questions which are asked of the data are asked from a narrow range of human viewpoints.

Discourse analysis is always interpretation and it is just as viewpoint dependent as any other instance of discourse. The canonical procedures of discourse analysis briefly sketched here provide a means for

different analysts to compare systematically the many interdependent grounds of their respective interpretations. Whether they reach consensus or not is probably less important than that procedures be clear enough for others to enter into the discussion on common ground. These procedures, of course, are themselves the product of a relatively narrow range of human viewpoints. We can hope that this range will widen as the field of discourse analysis, and our own society, mature towards more inclusiveness and respect for the value of diversity.

## VIDEO AND MULTIMEDIA

Video data today come not just from classrooms and face-to-face group interactions, but also from screen-captures of learners working in online or more generally computer-mediated virtual environments. It may also be video created by students and teachers. This video often contains verbal data, but its interpretation may depend critically on how it is mutually contextualized with visual signs, movements, actions, etc. recorded in the video. Many of the techniques discussed here apply to video and more generally to multimedia or multimodal data. In particular the principles in Lemke (1998a) regarding how cross-contextualization influences meaning between verbal and visual elements are useful.

For a general discussion of video analysis for education research see Goldman et al. (2007). For examples of the analysis of multimedia data relevant to science education see Lemke (2002).

## CONCLUSION

The methods of discourse analysis of verbal data can be used to compare curriculum documents, textbooks and tests with classroom dialogue, teacher discourse, student writing, etc. They make possible rich descriptions of the lived curriculum, its relation to official curriculum plans, and to the web of intertextuality among all the spoken and written language in which education is framed. They also make it possible to analyse how individual students use scientific language and concepts in a variety of situations, and to make this a basis for evaluative assessments. They will become even more important as components of future interactive virtual learning environments, which will enable students to explore new information worlds more successfully. Researchers of the next generation will help to determine

whether discourse analysis methods will be used to empower students in the new century, or to control them more strictly.

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