

Gesture, Information Flow, and NP Form

LORRAINE E. KUMPF

California State University, Long Beach

0. Introduction

This paper attempts to join streams of research that have heretofore not been joined: those of information flow and gesture in classroom discourse. In this effort, I want to suggest the importance of genre in examining the relationships among pragmatics, grammar, and gesture. The term information flow is used as Chafe (e.g. 1994) uses it to refer to the changing status of information in ongoing talk, particularly the changing form and cognitive status of referents along the new/given continuum. In Section 2, I will report on results of work (Kumpf to appear) on the information flow characteristics of referents used by some teachers in American public high school science classes. This work correlates NP form and the given/new status of NPs and demonstrates some fundamental properties of NP distribution, clausal syntax, and information status in the teachers' discourse. It provides the basis for the consideration of gesture.

The analysis of the gestures used by the teachers constitutes the present study, in Section 3. The study is confined to their "deictic" (pointing) gestures. It will be demonstrated that these gestures are closely tracked with the flow of information. The general questions guiding this study are: How do the teachers use gesture to support the teaching of science content in the classroom? What kind of information accompanies deictic gestures, and what is its grammatical form?

The teachers' talk I sampled has grammatical and pragmatic traits which relate directly to their primary concerns in communicating the science content: teachers must make the content available to a large group (30-35 students); they must keep the students' attention focused on science content; and they must create the conditions for the students' retention of the content. This, they do in talk by the staging and highlighting of key items and processes. I will show that the teachers' deictic gestures interact with NP form and information status to support these classroom goals.

1. Previous research

The literature on information flow is extensive. Chafe's research in this area (e.g.1987, 1994) has included considerations of the cognitive status of informa-

tion from the perspective of what the speaker assumes the hearer to know or have in mind. Research influenced by Chafe integrates notions of the relative activation of speaker and hearer consciousness regarding the referent under discussion. He employs a three-part analytic system to represent the activation status of concepts: given information (concepts which the speaker assumes that the hearer has in active consciousness), new information (concepts which the speaker first brings to the hearer's consciousness), and accessible information (concepts which are available to the hearer through prior mention, inferencing, or evoking a frame). New information is typically expressed in full lexical nouns; given information may be attenuated (proforms or zeros in English), though a full range of structural possibilities can express givenness (Givon 1990, Ariel 1990, Chafe 1994). Another influential taxonomy for given/new, which does not include implications of consciousness, is offered by Prince (1981, 1992). Related studies on noun phrase accessibility (e.g. Ariel 1990) and on topic continuity in discourse (e.g. Givon 1983) lend perspective to this study.

Virtually all information flow research presupposes the interaction of a single speaker and hearer. In this study, it will be shown that some of the usual assumptions regarding information status and NP form may not apply to the genre of classroom discourse. Genre differences may thus call into question the way in which information flow analysis proceeds.

Analysis of classroom language is dominated by ethnographic approaches. Ethnographers have, for example, described recurring patterns such as the resilient formula "teacher initiates, student responds, teacher evaluates"—the "IRE sequence". Research on the language that teachers use in the classroom has often been concerned with speech acts, and especially the use of questions and directives (e.g. Heath 1982, Dillon 1990). Approaches addressing grammar or structural correlates to pragmatics in the classroom are scarce: Chaudron (1985), for one example, looks at the structure of topics in the classroom. There are apparently no studies on information flow in teachers' talk, excepting Kumpf (to appear), summarized below. A thorough review of classroom discourse is outside the scope of this paper; see Cazden (1988) for a summary.

Of the extensive literature on gesture, the work of MacNeill (e.g. 1992), Kendon (e.g. 1995), and Goodwin (1994, n.d.) have been most helpful in understanding deictic gestures. Gesture studies which incorporate information flow are rare. Kendon (1995) concludes that gesture falls on the new information in speech; this is a generalization that will be re-examined in the present study. Gesture in the classroom has been examined (summarized in Gullberg (1998)), but not in relation to information status.

In this study, it is assumed that the teachers' gestures and the characteristics of grammar and information flow in their language will relate directly to their goals in communicating science. Classroom research such as Cazden's (1988) define those goals: 1) to establish joint attention with the group; 2) to make information maximally accessible; and 3) to facilitate the retention of content.

2. Information flow in science teachers' talk: the background study

In this section, I will summarize relevant results from a larger study of information flow in the classroom (Kumpf to appear). The purpose of this study was to link grammatical form and pragmatic status of NPs in classroom discourse. That is, NP form (lexical, pronominal, or zero) was correlated with the information status of the NP (new, given, or accessible), thus showing the typical argument patterning in the teachers' discourse. (See Du Bois (to appear) for general implications of these argument structure correlations.) Since teachers tended to build on the known, and since referents were accessible through their visible presence in the classroom, it was hypothesized that there would be few new mentions. A second hypothesis stated that there would be a high degree of lexical mentions in the discourse, regardless of their information status.

The data used in the analysis were four classes of tenth grade life science: two classes on genetics, one on electricity, and one on ecology. The students were 15-16 years of age, and there were 30-35 students per class. The teachers were experienced, recognized as competent, and taped at the suggestion of their principals. In the segments chosen for analysis, teachers spent most of the class time lecturing or reviewing material. That is, the classes were "teacher-fronted" and the teacher did almost all of the talking.

Relevant to the present study, NPs were coded for form (lexical, pronominal, zero), for grammatical role (subject of the intransitive, agentlike NP of the transitive, object, indirect object, and so on), and for the information status of the concepts the NP referred to: new, given or accessible). (See Kumpf (to appear) for other sampling and coding details.)

Results were that, as hypothesized, new information, in the form of new nominal referents, was quite rare in the data. Referents were given (active in the immediate context) or accessible (available through prior mention or through their visible presence in the speaking context). These were referents that the teacher assumed the students could identify. Second, also as hypothesized, the proportion of lexical mentions was very high; non-new nominals tended to be expressed as full lexical items. In fact, the discourse was very "nouny"; the proportion of lexical mentions was higher than in English conversation or narrative (Kaarkainen 1996; Kumpf 1992).

It was also shown that teachers used argument structures which allowed for the "staging" of referents, that is, the placement of referents in positions of salience in the clause. In accomplishing this staging, teachers favored a particular clause type using "low-content" transitive verbs (clauses which are transitive in surface syntax but do not express the prototype of agent/action/affected object). Of these verbs, HAVE when used as an existential ("On page 400 we have a diagram") was prominent, but FIND, SHOW, SEE, GOT, and others were used. These verbs are used to present, point out, display, emphasize—important pedagogical functions in the science class. It is not surprising that deictic gestures accompany this kind of talk.

The use of full lexical nouns rather than reduced forms relates to the teachers' goals of attention and retention. Here, models presented in research on information flow, which are limited largely to dyadic conversation, need recasting. Most of these models say that the speaker judges what the hearer knows or has in mind. However, the teacher (or presumably anyone addressing a large audience) cannot assume that any one hearer has a particular piece of information in mind. To ensure maximum accessibility of the NP, the teacher mentions it in full form. Also, the teacher aims for retention of lexical items; repeating them in full form supports this goal.

Thus this type of discourse, centered on demonstration, uses grammar to achieve the syntactic staging of nominals through the choice of verb and the use of low-content transitives, existentials, deictic expressions, and other marked syntax. Along with the morphosyntax of staging for show, teachers use many symbols and representations, usually written on the board, as well as authentic materials and visual aids. It is the presentational or demonstrational character of the discourse that to a great extent defines the use of gesture by the teachers. Deictic gesture, as we shall see, supports reference to particular concepts and relationships in the science material.

3. Gesture and NPs in the teachers' talk: indicated NPs

It is obvious upon viewing the teachers in action that referent staging is achieved in gesture as well as talk. In fact, their physical behavior which supports the presentation of nominal referents is energetic and compelling.

In this study, I look at the characteristics of nominals which are expressed along with deictic gesture. I call these nominals "indicated NPs." The aim is to relate the gesture to the form and information status of those nominal referents. Deictic gesture is a term widely used to refer to pointing movements, especially employing the index finger. MacNeill (1992) includes in this category other means of pointing, and the use of manipulated objects for the purpose of indicating. It is assumed that the teachers use explicit gestures in order to bring objects or representations into the students' visual focus and to direct their attention.

3.1. Indicated NPs

In the lesson on electricity, the teacher, while explaining series circuits, walks to the board in the front of the room and touches the words "circuit" and "series," which are listed there, as he says them. "Series" and "circuit" are thus "indicated NPs." In order to be coded as an indicated NP, the teacher's verbalized lexical item must clearly accompany the gesture: the verbalization and the gesture must overlap in real time. The most typical gestural act occurring with indicated NPs in the data is pointing to a representation on a whiteboard, usually in the front of the classroom. Figure 1 is illustrative. In the caption, square brackets indicate the point of overlap of the teacher's words and her deictic gesture.

Figure 1.



Teacher: what is ^in ... [those sperm and egg cells.]
[T INDICATES DRAWING ON BOARD]

3.2. Research Questions

1. What type of referent is an indicated NP, in terms of its scope of reference (i.e., specific, generic, identifiable, etc.)?
2. What is the information status of indicated NPs?
3. What is the grammatical form of indicated NPs?

3.3. Methodology

The data for this study is a subset of the science class data used for the information flow analysis summarized above. Three of the teachers' tapes were analyzed. The transcripts were amended to note the gesture; sets of square brackets indicate the overlap with talk. Each teacher's data were sampled until 50 occurrences of indicated NPs were recorded. The teachers' gestures that are not deictic, and do not point to particular nominal referents, were not analyzed.

For all NPs (indicated or not), the following points were coded: 1) scope of reference of NP (general, generic, identifiable, exemplar, etc.); 2) information status of the concept expressed in the NP: given, new, or accessible. The information status was arrived at by textual analysis. A concept was coded *given* when continuous in reference. First and second person referents were assumed given. A concept was *new* when first mentioned. A concept was *accessible* by prior mention, with the arbitrary limit of 20 clauses prior, or if the referent was in the physical environment, visible to speaker and audience, or if the referent could be inferred on the basis of shared frames or general knowledge. (This last was rare in these data.); 3) Grammatical form of indicated NP. NPs were found to belong to the following categories: indefinite lexical NP, demonstrative with lexical NP, definite article with lexical NP, possessive with lexical NP, demonstrative pronoun, unstressed pronoun, and other.

3.4. Results

3.4.1. Teachers' deictic gestures used in indicating NPs

Gestures typically take place at the board. The teachers:

- point with the index finger at a representation or object, especially using the whiteboard or chalkboard.
- touch, underline use a pointer or otherwise indicate an NP that is on the board, including slapping or hitting the board, or using sawing motions under the representation.
- trace, usually with the index finger, a line, representation or figure.
- pick up an object or representation and hold it for the class to see, while pointing.
- use other movements or body parts to indicate a nominal.

All of these actions are considered to be in the class of deictic gestures in McNeill (1992), Goodwin (1994), and others. I noted that, while talking, teachers would sometimes write illegibly or draw uninterpretable representations on the board in movements which were gestural and probably deictic, but these, as well as some other actions that were difficult to interpret, were not included in this study.

3.4.2. Three explicated illustrations

In Figure 2, the teacher is explaining a formula on the board and is naming an element of the formula ("amperage") while pointing to its representation (I). This is part of a longer presentation, in which he names the terms repeatedly, while pointing to the relevant symbols. Several times, he reiterates the combined action of pointing directly under the symbol in the formula and naming its referent. In addition to the referents, he thus expresses the relationships of the concepts in the formula. These concepts challenge the students; hence, the explicit repetition. With his actions, the teacher is also addressing the goal of student retention.

Figure 2.



Teacher: Power equals ^voltage times [^amperage.]
[T TOUCHES BOARD UNDER LETTER 'I']

Gesture, Information Flow, and NP Form

The next example is meant to illustrate that the deictic “point” may also be abstract, that is, may point “to” a concept that is not present, to an abstraction that is not concretized in a representation, or to a conceptual space. Such a gesture may be accompanied by an indicated NP. MacNeill (1992) and others have shown these gestures to reflect the thought process of the speaker, but I suggest that in the classroom, they may also act as “pointers” to the hearer. In Figure 3, the teacher is specifying a value of the formula that he wants the students to find. As he points “to” the abstract NP as a focus of attention, the downward trajectory of the teacher’s index finger stops with stressed syllable of the NP.

Figure 3.



Teacher: I want you to look for the [[^]voltage].

[T’S INDEX FINGER STOPS
ITS DOWNWARD TRAJECTORY]

In the final example, the teacher is talking about the joining of male and female chromosomes. Figure 4 shows her using objects (models of chromosomes)

Figure 4.



Teacher: ...with [^]her [chromosomes]

[T PUTS MODEL CHOMOSOMES ON BOARD]

straightforward way, e.g. “Here we see chromosomes.” The concepts may also be encoded in other ways, as in “I have my power source,” where the teacher means any power source. This appears to be a basic strategy in teachers’ science talk

An analysis of *non-indicated* NPs is not included here; however, a preliminary analysis of such NPs, excluding first and second person references, shows that about one-fourth of non-indicated NPs are exemplars. Put another way, the great majority of NPs that are mentioned without indication are not exemplars of a class of nouns. If verified, this result shows that teachers use the gestures significantly less often with non-exemplars. Regardless, the data in Table 1 demonstrate that teachers show a preference for using deictic gestures with NPs representing the key science content.

3.4.4. What is the information status of indicated NPs?

Table 2 shows that most NPs that are indicated are also given or accessible. The teachers are pointing to representations that have been mentioned or are visible in the context.

	Given N (%)	Accessible N (%)	New N (%)	Total
Teacher A	35(70)	15(30)	0	50
Teacher B	42(84)	7(14)	1(2)	50
Teacher C	28(56)	21(42)	1(2)	50
Total	105(70)	43(29)	2(1)	150

Table 2. Information Status of Indicated NPs

Regarding the rest of the data, the information status of non-indicated NPs distributes comparably: given information is 74%; accessible, 20%; and new, 6%. Thus, as was mentioned in section 2 above, there is very little new information in the discourse, in the form of new mentions.

3.4.5. What is the grammatical form of indicated NPs?

Looking at the forms in Table 3, we see that, of the NP forms which occur in the data, the largest number of indicated NPs is contained in the category Indefinite Lexical NP, at 40% of the total. Though indefinites are commonly used, we note that the other form categories represent definite NPs, and taken together, 60% of the indicated NPs are definite. One might assume indicated NPs to be expressed as definite, since they are identified. However, the picture is more complex, and the nature of these referents needs further specification.

	Indef LNP N (%)	Demon +LNP N (%)	Poss +LNP N (%)	Def Art +LNP N (%)	Demon PN N (%)	Unstr PN N (%)	Other N (%)	Total
Teacher A	17(34)	5(10)	10(20)	4(8)	6(12)	8(16)	0	50
Teacher B	26(52)	5(10)	3(6)	5(10)	8(16)	0	3(6)	50
Teacher C	18(40)	9(18)	5(10)	8(16)	6(12)	1(2)	3(6)	50
Total	61(40)	19(13)	18(12)	17(11)	20(13)	9(6)	6(4)	150

Table 3. Grammatical form of indicated NPs

Table 3 also reflects the general finding that indicated NPs are lexical. They occur as lexical in indefinites, with a demonstrative, with a definite article, and with possessives. In total, seventy-six percent of indicated NPs are lexical.

4. Discussion

Many discourse analysts have made claims about the relative lightness of given or identifiable information. For example, Ariel (1990) claims that the most attenuated NP possible for the context will be the preferred one. But the teachers violate this, in light of their goals of student attention and retention. Although they are constantly monitoring for attention, the teachers presumably cannot be sure that any one student will be focused on the referent. Thus, the NP is repeated in full form, and likely with gestural support. The teachers monitor the attention of students and modify their strategies “on line.”

Retention in the complex classroom context is a challenging goal. Since pronouns are not memorable, lexical NPs are repeated. Gesture also supports retention. In his research in this area, Pavio (1986) refers to “dual coding systems,” the verbal and the visual. When material is coded in both systems in one communicative context, memory for the material is strongest.

As suggested above, many of the findings regarding information flow have been established by studies of oral narratives or dyadic conversation; these findings cannot easily be applied to classroom language. In the literature, it is claimed that referents are accessible and identifiable when present in the context, but co-presence in the classroom is not enough. It is also necessary to get that referent into play—to get it from “the context” into shared consciousness. Clearly, deictic gesture is vitally important in what I have called the staging of the referent.

Getting the referent into play is a much greater challenge for a teacher than for speakers in a conversation or narrative. Besides the factors of student attention and size of audience, the type of referent needs to be considered. In the science classes teachers talk about abstract concepts and make general references. They talk in language that is far removed from the daily life of students, and they make relationships between abstract referents which are challenging to understand. It is not surprising that teachers encode material in as many ways as they can.

5. Conclusion

Whereas this study has shown some typical relationships between gesture, NP forms and the information status of nominals in the classroom, there are a number of limitations. Gesture is continual in the teachers' presentations, and many other types of gestures are present. I have severely limited this examination of gesture and NPs in order to express one small aspect of a very complex communicative situation. By insisting that the NP vocalization be synchronized with the gesture, I eliminated many other gestures that may be interpreted as deictic, and may support science content. Also, by limiting the study to deixis, I have ignored possible ways in which other gestures support the information.

Complex gestural behavior may serve many functions. For example, often a gesture that is iconic may also have a deictic function. (MacNeill (1992) discusses this multi-functionality.) Again, such complexity was avoided by limiting this study. Similarly, I set aside problems of the scope of the gesture vis a vis the accompanying talk, by insisting on the clear referentiality of the pointing behavior. A gesture may relate more approximately to the talk, for example, by relating to a complex of ideas or a series of clauses. Also, a given deictic gesture may not be simultaneous with the vocalization. Furthermore, additional ways in which gesture can relate to the talk were unexamined. Some deixis, for example, had no speech accompaniment, even though the referent was clear. Thus the narrowness of the present study leaves much of the teachers' gestural behavior to be examined. These limitations notwithstanding, the study has begun to look at the ways in which gesture, status of information and grammatical form work together to realize the management of information in the classroom. The norms of the genre define the specific shape of this achievement.

References

- Ariel, Mira. 1990. *Accessing noun-phrase antecedents*. London: Routledge.
- Cazden, Courtney. 1988. *Classroom Discourse*. Portsmouth, NH: Heinle & Heinle.
- Chafe, Wallace. 1994. *Discourse, consciousness and time*. Chicago: University of Chicago Press.
- Chafe, Wallace. 1987. Constraints on information flow. In R. Tomlin, ed., *Coherence and grounding in discourse*. Amsterdam: John Benjamins.
- Dillon, J. T. 1990. *The practice of questioning*. London: Routledge.
- Du Bois, John. To appear. Discourse and grammar. In M. Tomasello, ed., *The New psychology of language: Cognitive and functional approaches to language structure, Volume 2*. Hillsdale, NJ: Lawrence Erlbaum.
- Du Bois, John, Lorraine Kumpf, and William Ashby, eds. To appear. *Preferred argument structure: Grammar as architecture for function*. Amsterdam: John Benjamins.

Lorraine E. Kumpf

- Du Bois, John, et al., eds. 1993. Outline of discourse transcription. In J. Edwards and M. Lampert, eds., *Talking data: Transcription and coding in discourse research*. Hillsdale, NJ: Lawrence Erlbaum.
- Givon, Talmy. 1990. *Syntax: A functional-typological introduction, Volume 2*. Amsterdam: John Benjamins.
- Givon, Talmy, ed. 1983. *Topic continuity in discourse*. Amsterdam: John Benjamins.
- Goodwin, Charles. 1994. Professional vision. *American Anthropologist* 96(3): 606-33.
- Goodwin, Charles. N.d. Pointing as situated practice. Ms.
- Gullberg, Marianne. 1998. *Gesture as a communication strategy in second language discourse*. Lund: Lund University Press.
- Heath, Shirley. 1982. Questioning at home and school. In G. Spindler, ed., *Doing the ethnography of schooling*. New York: Holt, Rinehart and Winston.
- Kendon, Adam. 1995. Gestures as illocutionary and discourse structure markers. *Journal of Pragmatics* 23(3):247-79.
- Karkkainen, Elise. 1996. Preferred argument structure and the subject role in American English conversational discourse. *Journal of Pragmatics* 25(5): 675-701.
- Kumpf, Lorraine. To appear. Genre and preferred argument structure. In J. Du Bois, L. Kumpf, and W. Ashby, eds., *Preferred argument structure: Grammar as architecture for function*. Amsterdam: John Benjamins.
- Kumpf, Lorraine. 1992. Preferred argument structure and second language discourse. In *Studies in Language* 16(2): 369-403.
- McNeill, David. 1992. *Hand and mind: What gestures reveal about thought*. Chicago: University of Chicago Press.
- McNeill, David, ed. 2000. *Language and gesture*. Cambridge: Cambridge University Press.
- Pavio, A. 1986. *Mental representations: a dual coding approach*. Oxford: Oxford University Press.
- Prince, Ellen. 1992. The ZPG letter: Subjects, definiteness, and information status. In W. Mann and S. Thompson, eds., *Discourse description*. Amsterdam: Benjamins.
- Prince, Ellen. 1981. Toward a taxonomy of given-new information. In P. Cole, ed., *Radical Pragmatics*. New York: Academic Press.

Department of Linguistics
California State University, Long Beach
Long Beach, CA 90840

lekumpf@csulb.edu