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down when it took place).

2 Tested Themes

2.1 Articulatory phonetics

This theme is an easy one, and I have used it as the first theme with a group. I wrote the letters of the alphabet on 3x5 index cards, and used them to elicit a description of the manner of pronunciation of the sounds they parallel (where "Y" means the articulator is involved in producing the sound):

	b	p	g	k
jaw	*	Y	*	*
lips	Y	Y	*	*
teeth	*	*	*	*
tongue	*	*	*	*
voicebox	Y	Y	Y	Y
gums	*	*	*	*
tonsils	*	*	Y	Y

We talked about the jaw, and what it meant to say that it was used in the production of sound. I convinced them that the tongue was used for [g] and [k]. Then we talked about the voicebox. I attempted to distinguish the voiced/voiceless pairs [b] and [p], and [g] and [k], on the basis of throat vibrations, and demonstrated how vibration gives rise to sound, using an elastic band. I talked a little about sound being carried in the air. Then I asked: "Why does the voice-box vibrate" -the brain tells it to. I showed, again using the elastic band, how air movement causes vibration, and thus introduced the lungs as part of the system of speech production.

We worked through some more of the consonants, and came up with a list of the parts of the body used to produce speech: jaw, teeth, lips, tongue, nose, voicebox, lungs, brain.

I got them to draw preliminary diagrams, to be integrated into a model, showing all and only the parts of the body which are used for speech, based on their list. Some diagrams included the heart, or the eye; the children also wanted to include blood vessels and put crinkles in the brain. This gave us an opportunity to talk about the fact that a diagram should contain only information relevant to the task at hand. I showed them that there are various ways of constructing a map of the world, and that these maps differ from a photograph of the earth, though all are ultimately pictures of the same thing.

We then took a 2x3 foot sheet of cardboard, and I drew a profile of a head, leaving out the jaw (because the jaw moves in speech), and allowing a gap at the nose; I drew in the stationary parts - the brain, and the walls of the vocal tract. The problem I set them next was: how shall we put in the moving parts so that they move accurately? This problem had to be solved for the jaw, lips, tongue, voicebox (vocal cords), and lungs.

Their solutions were: the jaw was cut out in cardboard, and attached to the head outline with a stud, which allowed it to be moved up and down; the lips were done similarly; the lungs were made of an oval piece of paper, folded several times like an accordion; the tongue was done similarly, and attached to the jaw; the voicebox was represented as a rubber band stretched across the vocal tract, and on a sliding stud, so that it could be stretched or loosened. As a final touch, I added strings running between the brain and the moving parts of the body; these represented the nerves, and illustrated that the brain was the prime mover.

We used the model to illustrate the production of individual speech sounds, which they were able to do quite well.

In going through the letter cards it is interesting to compare sounds from other languages such as Spanish or Greek (I had speakers for both). [q] and [x], single letters which correspond to combined phonemes, cause minor problems which they found easy to deal with, and

lead on to the issue of the relationship of sounds and letters. The vowels are difficult to classify; it is interesting to ask the children what the difference is between a vowel and a consonant, and how vowels are different from each other.

This theme taught the children about the production of sounds by the mouth (and incidentally some physics and biology). On the methodological level, they learned about diagrams.

2.2 What is a word?

This theme is more demanding, and is interesting to do with children, because it brings out their opinions about language.

I began by introducing definitions. I asked them to define words like 'chair' and 'blackboard', then I split up the definitions into parts: 'what is it made of', 'what is its purpose',...

Then I asked them "What is a word?" -Something that you say. "What about 'ugh'?" -Not a word because it doesn't make sense. "Why not?" -Because it wasn't made up yet. I pointed out that there are meaningful vocal sounds, like 'ugh', which are not words. -A word is a "group of sounds put together that usually mean something". This child felt that a word need not mean something.

In imitation of the definition of physical objects, I asked what a word is made of. They suggested letters, or sounds, or hands (the latter referring to sign language).

So - a word is defined according to how it is produced (you say it), what its function is (it means something), and what it is made of.

2.2.1 Do babies have language?

This question comes up because the way that a baby vocalizes is recognizably different from the way that a mature speaker vocalizes in that the baby can not be understood, and uses unusual sounds; in addition children are interested in babies, and often have contact with younger siblings.

In our discussion of what a word is, they introduced the 'word' "gagagoogoo". "Is a baby word like 'gagagoogoo' really a word?" -It's not a word because it doesn't mean anything. "Do babies have a language?" -If you can't write the words down it isn't a language. I discussed this with them and introduced the phonetic alphabet, showing that many baby-words can in fact be written down in this manner. Then I repeated the question: "How would we tell whether a baby speaks a language?" -language must be understood by more than one person. "Why do babies forget their language?" -Because it doesn't mean anything.

Thus baby-language raises interesting general questions.

2.2.2 Similar words (sound, shape, meaning)

The questions asked in this section aim to bring out the defining properties of words.

"How do you tell when two words are the same word? e.g. 'the DOG ate his food', 'I saw a DOG'." -because it's spelt the same. "So what about 'The dog is on a LEAD', 'there is LEAD in the pencil'?" -because they mean the same.

To approach the problem from a slightly different angle, I set up the following situation: I secretly wrote two words down, and asked them "What question would you ask me to find out whether the two words are the same?" The question I wanted was, "Do they mean the same?", and not "Do they sound the same" or "Are they spelt the same".

I asked: "Are there two different words that mean the same?"
 -'Maxwell' and 'coffee'. I elicited in the end an account of the non-identity of these, and drew a Venn diagram to illustrate how one included the other. Another answer to this question came from a Greek speaker, who provided two words from different dialects, both meaning 'poor'. This led to a discussion of dialect differences. The third answer was very interesting: -I' and 'me'.. but they are sort of different..you use them in different sentences. This led us into a very fruitful discussion of the determiners "the" and "a", and whether they meant the same thing.

Another question which I asked, relating to what a word is, was "can words be made of words?" Some answers which I got were:
-Pete/Peeters (the name of a sportsman). -saw/was and stop/pot (reversal). -raincoat, sailboat (compounds).

The theme "what is a word" gets the children to think about some basic issues in language. They also learn about definitions.

2.3 Part-of-speech

2.3.1 Articles

Our most fruitful work on part-of-speech developed from issues raised in the previous section, and involved the category 'article' (or determiner).

One child had looked up 'article' in a dictionary (for another project) and had found "articles are used before a noun to limit it in some way". This definition was very similar to the dictionary's definition of adjective, and I asked them to compare an article with an adjective -an article doesn't really describe something.. it describes in a different way.

One child, in explaining what 'the' meant, defined "the king"-

something or someone who is the only one of their own kind in a certain kind of space, for example "I am one of the three kings in my three inch space". This is a remarkable intuition on the child's part; the same child defined "my" as like "the.. to me". Another child pointed out a difference in meaning for 'a president' in "a president of the US should not..", and "a president of the US said that..".

We made a table, where the articles were displayed in comparison with each other:

a	a monster, *a monsters -"just one thing"	a monster -aren't supposed to know which one.
the	the monster, the monsters -"many things"	the monster -must know which one.
three	*three cat, three cats	don't know which ones
one	one cat, *one cats	"can be used as 'the' or 'a'"
my	my cat, my cats	"like 'the..to me'" doesn't always mean you own it: 'my friend' -you dont own.

2.3.2 Dictionary definitions

I wanted to get the children to think about the reason for assigning part-of-speech labels to words, and began by asking them to find dictionary definitions for noun, adjective, verb, article, and so on, using several dictionaries.

Then I asked them the following questions: How do the definitions differ? Which is best and why? What is the form of the definitions? (the ones we looked at gave a brief semantic definition, and examples in context). What is wrong with the definitions? Do we need to go beyond them? One child provided as a problem the example "I am going to have a walk" and said that if 'walk' was a noun in this sentence (one dictionary definition allows a noun to 'name an action'), then

should we say that "walk" is a noun in "I walk"? Finally I asked them, how do dictionary-writers know the meanings of words?

I believe that dictionaries are good things to discuss with children; they learn how definitions work, and also learn a critical approach to received knowledge.

2.3.3 Identifying and defining 'part-of-speech'

"Part-of-speech" is an issue that has come up repeatedly in work that I have done with the children. This is partly because part-of-speech is very important in description, and yet is a very difficult notion. Teaching a child that a particular word is a noun is only part of the task; the interesting problem is to get the child to understand why the word is so categorized, and why it should be categorized at all. Inventing category labels is quite fun; we had determiners as 'add-ons', "and" as a 'phrase-mixer', "then" as a 'cousin-verb', because it is like a verb but not a verb, and "eerrrr" as a 'noise phrase'.

The theme 'part-of-speech' gets the children to do some primitive semantics. They learn some more about definitions, and get to think about dictionaries.

2.4 Phrase structure

One of the first projects that I tried out was a phrase-construction 'game'. I made a set of cards, with words (determiners, nouns and adjectives) written on them, one word to a card, and also one card with "here is ____" written on it.

I asked them to make the longest possible sentence using these cards (I defined a sentence as "If I came into the room, would you just be able to say that to me?"). Most of the children were able to do this accurately, constructing a noun phrase out of the word cards to

fill the slot in "here is_". My aim was to get them to see that there were combinatorial constraints, and that the cards could be put into three groups. Of the group 1 cards (determiners; they used the term 'add-on', which we adopted in later work), one and only one must be used; of the group 2 cards (adjectives), any could be used, in any order; of the group 3 cards (nouns), at least one must be used, and there were in addition some words which the children thought were 'nouns like adjectives', which could be combined with another noun, e.g. "box" in "box shop". I provided a careful selection of cards, so that only these simple (and not fully accurate) generalizations about noun phrases could be discovered.

I introduced the term "noun phrase", saying that the words were clustered together, and the most important word was the noun. I handled this badly, failing to convey any justification for phrasal structure; one of the children picked up the wrong idea that the cluster of words was called a noun phrase because it ended in a noun, and in a tree diagram which he drew for me (see diagram 1) labelled "I was walking" as a VP because it ended in a verb, and "then I saw a dog" as an NP because it ended in a noun.

We discussed animal, fish and bird names, which often exhibit a modifier-noun structure; I got them to think about the fact that the modifier precedes the noun. Thus we have "hammerhead shark" - I asked, why is it called a hammerhead? What would a headhammer be? (they said, a hammer in the shape of a head). Spanish modifiers often follow the head, and I asked a Spanish speaker in my group to show this.

Taking an 'add-on' (their invented word for determiner) to be the first word (preceding adjectives) in a noun phrase, we discovered that numbers were add-ons, and then found that the phrase 'the people's' could also occupy this slot, and so was an add-on. I explained how a noun phrase could be suffixed with /-s/ and so be used as an add-on.

I emphasised that an aspect of part-of-speech was that words of the same part-of-speech could be substituted for each other in many contexts. Thus one child's claim that an adjective was 'a sort of add-on' would lead us to expect a sequence "the the car". This idea, of substitutability as an aspect of 'part-of-speech' was understood by at least one child, who criticized another child's claim that "was" and "then" were both of the same part-of-speech (labelled 'time'; see diagram 1), because it was possible to say "I was in the store", but not "I then in the store".

Next, I asked the children to make sentences with the word cards, and wrote out any card they asked me for (e.g. 'have', 'is', some more nouns, 'to'...). Then I asked them to construct sentences without using any verbs (I took the verb cards out) which they could not do, then without any nouns (they came up with imperative 'eat'). Then I briefly showed how a sentence has to contain a verb. I made an analogy between a sentence and a tree, saying that one tree could contain many branches, just as a sentence could have many words in it. Similarly, a tree with one branch is like a sentence which contains just a verb. I showed how tree structures could be used to display relationships, using a family tree as an example.

One child thought that my diagram of a sentence was more like a space-map (it was not like a tree, because the branches on a tree are not straight), and he came up with an alternative approach to a sentence structure diagram (diagram 1), based on a video game. Here the sentence is blown to pieces, and those pieces (phrases) are in turn exploded, ending up in words, which are exploded into letters. The diagram shows some interesting mistakes, such as the categorization of "was" and "then" as 'time', and the use of 'vp' and 'np' for nodes which are actually sentences. (On this latter point, the child insisted that they could not be sentences, because sentences could not be joined together with 'and' - one of the few cases where a child has cited prescriptive grammar.)

The child later changed his mind about the space map, because 'sentences can be said in different ways', so you get "the boy is in the garden" and "in the garden there is a boy." Much to my regret, I did not pursue this intriguing statement, which seems to show an intuition about transformational relationships.

This theme is a difficult and ambitious one, and though there were interesting results, I feel that I failed to convey certain basic issues; we will return to the reason for this in the conclusion. The children learned about part-of-speech, and learned to represent the structure of phrases and sentences by means of trees.

2.5 Writing systems

The theme of writing systems was suggested by the children. My aim was to teach them that language is not restricted to a single means of expression.

How many ways can you express something? A written sentence of English can be 'translated' into (1) sign language (different kinds of sign language), (2) a non-English natural language, (3) speech, (4) phonetic representation, (5) telegram English, (6) pictures, etc.

I had shown the children that the letter 'c' represented two sounds, [k] and [s]. They decided that 'c' was not needed as a letter of English; I asked them to produce an alphabet for English which contained fewer letters. They invented an alphabet containing ten symbols (1); each symbol represented one or more English letters (2). I pointed out the problem of homograms - on their system, 'rat' and 'bat' would be represented alike (3). They found two solutions to this. One was to use complex symbols (4); the other was to have homograms which would be distinguished in context - 'go' and 'Jo' would both be written 'go', but would be easily distinguished in context; in a sentence like 'go is my best friend', 'go' must represent 'Jo'.

(1) X ϕ ϕ α X ϕ q h → ▷

(2) X stands for Z E A N. ϕ stands for R B

so ZEBRA is written XX ϕ ϕ X

(3) ϕ X ϕ = 'bat' and 'rat'

(4) complex symbols; ZEBRA is written X X ϕ ϕ X
 η → η X ▽

The children were easily able to count the number of sounds (phones) in a word. I got them to compare the number of sounds and letters in given words in order to demonstrate that there is sometimes a mismatch, because sounds and letters are not always in one to one correspondence. I introduced the phonetic alphabet, where symbols and sounds are in one to one correspondence. An interesting suggestion was made in connection with the phonetic representation of 'three'. I demonstrated to the children that the 'th' sound is different in 'three' and 'them' and told them that the Greek letter theta (which they knew) was used for the 'th' in 'three'. I then asked them which one symbol should be used for the single sound represented by the 'ee' of 'three'. A child suggested that we should write three as in (5):

θ-r-D

She argued that the 'th' and 'ee' sounds were both contained in 'theta' (which she pronounced to rhyme with 'liter'), and so the symbol for theta, θ , should be used to represent 'th' and 'ee'.

I asked them whether they thought that there were a limited number of sounds that could be used in English words. To test this, I asked them if they could produce words that could not be words of English. They did this, and I asked them to write them down. One child had a word whose pronunciation involved a rapid movement of the tongue over the front of the upper palate, and the upper teeth, and wrote it as follows, inventing a complex symbol for the purpose:



The theme 'writing systems' taught the children that language can be realized in different ways.

2.6 Sign language

Many children have some familiarity with sign language, due to the television program "Sesame Street". The children in the classroom where I work have all been taught some ASL signs at school. Sign language is interesting to them, and is a good material to use in teaching about communication, because sign language has all the features of a natural language except that it is produced manually rather than verbally.

Peggy Speas, a linguist at MIT, twice came into the classroom and talked to the class about sign language. In both cases, the theme was very successful. Some interesting approaches which she took were:

- (a) When translating from signs into speech, is the translation direct?
- (b) Signs in ASL are often not iconic.
- (c) How would you write sign language?

She taught them a simple poem in sign language, and asked them how the poem 'rhymed'; the children were able to make the imaginative leap and see visually similar signs as 'rhymes'. (This had some impact on the children; some days later, they presented to the teacher some drawings of trees, made in art class, and told her that they were poems, where the rhymes were the parallel lines in the drawings).

3 Conclusion: 'Doing Grammar'

Traditionally, school work in one's first language means 'doing grammar'. Children are taught how to parse sentences, how to identify parts of speech and particular constructions (gerunds, relative clauses, etc), and they also learn about particular lexical items. It is generally argued that their knowing how to analyze language in this way will improve their writing and reading, and will help them learn other languages. In addition, it is often claimed that learning grammar exercises the mind, in that it involves understanding the workings of a formal system.

The mind-exercise argument has recently been used in connection with the introduction of current linguistic theory into traditional grammar teaching. The idea is that in the process of learning about the structure of their language, children also learn the scientific method if a problem-solving approach is taken to grammar. Thus

children learn not only how to parse a sentence, but learn why sentences have structure, and how to find the correct structure. On a primitive level, this is what we have attempted to do in our work with children. We consider valid the criticism of grammar put forward by the schoolboys of Barbiana: "Somebody or other even wrote a Latin grammar for you. It is a major swindle. Because for every rule, one should know when and where it really originates" (from "Letter to a Teacher", a critique of the Italian education system written by a class of Italian schoolboys). We have attempted to teach children the rules of language, by getting them to originate their own rules.

There are, however, problems. These arise in connection with issues such as parsing and the identification of categories and constructions, which are the traditional domain of grammar teaching and the basic tools of syntactic description. The problem is that the status of these can not be deduced straightforwardly from the data. How does one prove that a particular parsing is correct; that, for example, a group of words form a phrase? The test commonly used by linguists is movement; a constituent should be moved as a unit. However, the reason why movement is a test for constituency is far from simple.

Part of the problem is that labelled bracketings may form only an intermediate stage in a linguistic description, and are probably just a convenient way of representing relationships between lexical items. Parts-of-speech may not exist as such in mental representations, either because a part-of-speech is a bundle of features, or because parts of speech are 'squishy' (to use Ross' term). Thus the descriptions of sentences which we teach children to construct may simply be distant, perhaps distorted, representations of true linguistic structure. This makes them difficult to deduce in a simple and straightforward way.

We can see the extent of the problem when we consider certain grammar textbooks which have incorporated linguistic argumentation. There was a tendency in the sixties (exemplified by the Oregon

curriculum, and the Warriners course) to teach children transformational grammar, in the hope that this would adequately supplement grammar teaching. However, linguistic theory was introduced, fully formed, at too high a level, and was too far removed from anything which the children could verify for themselves. As such, linguistic theory was used in as a dogmatic fashion which recalled the dogma of traditional grammar.

The problem we are faced with is this. (a) We can conduct discussions with children about simple issues in language, where they are able to form conclusions by themselves. (b) We want to teach children how to construct structural descriptions. However, issues of type (b) are too complex to be simply deduced in the classroom. We feel that this is a major problem which must be solved by linguists who are interested in children's education. We must develop ways of explaining syntactic structure to children, so that they really understand.