Navajo Linguistics: Part IV

Ken Hale

Massachusetts Institute of Technology

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I. Introduction—Navajo language study in a Science curriculum.

In the context of work done over the past five years in cooperation with speakers of American Indian languages engaged in linguistic scholarship and practice, both at MIT and elsewhere, an increasingly clear conception has developed of the educational potential of linguistic science in communities whose members have knowledge of a linguistic system different from the standard English which predominates as a vehicle of instruction in North American schools. Educators in a great many such communities have formulated an extremely concrete question, which may be paraphrased as follows:

What significant role can knowledge of a local language play in a person's formal education within a school system which seeks, among other things, to enable its students to gain mastery of an official standard language while, at the same time, making effective educational use of the intellectual resources of the local community, represented in large part by the richness of the local language and culture?

This question is relevant not only in relation to communities in which a language other than English is spoken, but also in relation to communities whose members speak a variety of English which differs from that represented in existing textbooks and other educational materials.

There are two rather opposed approaches to answering this question. One approach, which might be called the "transitional" conception of bilingual education, is based on the idea that the
acquisition of elementary educational skills is greatly facilitated if begun in a child's native language and that a wholesale transfer to the national language can thereby be accomplished with greater efficiency than would otherwise be the case. While I agree wholeheartedly with the educational benefits -- in fact, I would say, necessity -- of using a school-age child's native language in his or her education, and while I agree that the acquisition of literacy skills in a second language is facilitated by prior literacy in one's own, and that this is a strong argument in favor of bilingual education, I totally reject the conception of the local-language partner in a bilingual education program as a crutch to be eventually discarded, a bridge to be burnt once it has served its purpose of permitting more efficient access to the national language. This view of bilingual education -- i.e., that its goal is to phase out the local language -- is abhorrent to those community-based educators whose support of bilingual education is motivated precisely by the fact that, at long last, it provides an opportunity for rich and complex local languages to assume a significant and perpetual position in the academic education of children and young adults who speak them -- an opportunity ultimately to strengthen, rather than weaken, the position of local languages, and an opportunity to make greater use of existing intellectual resources in local communities by engaging increased numbers of talented and knowledgeable speakers of local languages in the teaching profession. Educators who reason in this way see the role of local languages as a permanent one -- the involvement of a local language in the education of a particular child does not cease after the first two or three years of schooling; rather, it continues throughout the student's tenure in the locally controlled school system. This is viewed as essential in the development of a truly bilingual person, a person who is able to use the two languages relevant to his or her life with equal effectiveness in all domains of discourse in which he or she is
competent to speak. This conception of bilingual education, in turn, is intimately related to the view that the goals of education are to strengthen and to reinforce the overall cultural integrity of the communities involved.

I am in agreement with this second approach to the question. But as a linguist committed to the scientific goals of theoretical linguistics, I must face the following question:

What role does the science of linguistics have to play in defining the educational function of a local language, or local variety of English, in a given community concerned with this issue?

The relevance of what might be termed "linguistic technology" to the educational concerns of bilingual communities is unquestioned, and there is a time-honored tradition of the application of linguistic expertise to such problems as orthography design, language engineering, second language teaching, dictionary making, the design of literacy programs and materials, and many others. But apart from its contribution to these activities, the relevance of theoretical linguistics is less obvious. I am convinced, however, that theoretical linguistics is directly relevant to the search for a perpetual and pedagogically powerful role for local languages in achieving the educational goals of bilingual communities. I base my belief on the following two premises:

(1) that linguistics is a science, and
(2) that an important purpose in modern education is to prepare students to enter careers which make use of the methods, concepts, and attitudes of scientific inquiry -- i.e., to enable them to gain experience in constructing and articulating abstract, testable, explanations for superficially mysterious and contradictory observations.

If these premises are accepted, then there is an educationally powerful use to which knowledge of a local language can be put in bilingual communities -- specifically, it can serve as the basis of a curriculum for teaching scientific method.
What I am proposing, then, is that the study of language should form a part of the science curriculum. Linguistic science has the advantage over other sciences that the data relevant to it are immediately accessible, even to the youngest of students, and it requires a minimum of material equipment. It is possible, using immediately accessible linguistic data, to exercise a student's ability to employ the scientific method in coming to grips with problems which compare in their theoretical complexity and importance with problems in the physical sciences whose study (i.e., empirical testing) can be carried out only with the most sophisticated and costly apparatus. Thus, this approach to science enables students to use their native language in activities which offer enormous intellectual challenge, a most important factor in early education. And most important, this approach makes effective educational use of the intellectual wealth which exists in the community to which the students belong, an essential resource which is all too often allowed to go unused in education systems conforming to the traditional model.

The problem is to design a program of study which will in fact encourage students to take an inquisitive attitude toward their native language, a program which, in so far as possible, will avoid the pitfalls of prescriptivism and blind application of a partially understood formalism belonging to some favored theoretical framework—the point is neither to teach the "grammar" of a language nor to teach a particular linguistic theory but, rather, to use the linguistic knowledge which students possess as a subject matter of science. The possibility that the study of language might enter into the science curriculum in elementary and secondary education is one which deserves to be taken seriously, in my judgment. And American Indian bilingual education programs may be particularly advantaged in this regard to view of the fact that the role of the local languages involved is not constrained by the weight of formal educational tradition—the role is still being defined and there is ample opportunity for creative invention in designing effective educational programs around language and developing the appropriate native-speaking teaching personnel.
I wish to devote the remainder of this introduction to a brief discussion of a conceivable program for the study of Navajo by Navajo-speaking students in elementary and secondary schools. This is meant to be a suggestion only, but many of the ideas have grown out of an involvement over a period of four years with a small number of Navajo-speakers engaged in the study of their language.

The program can be thought of as proceeding in roughly three stages: I, early elementary; II, late elementary; III, secondary. I will be concerned here solely with the program as it relates to the study of language as a science—it goes without saying that this is a small part of the total role of language in any school program; it is simply the focus of my attention here.

Stage I

Students at this level will be involved in acquiring literacy in Navajo; hence, language study at this stage will have to be designed with preliterates and incipient literates in mind. The primary effort at this stage should, I feel, be to encourage students to develop a consciously experimental attitude toward language and to learn to verbalize their observations about it. This might be achieved in large part by means of a wide variety of games and game-like activities which involve children in novel and unusual uses of linguistic form and which enable the teacher to focus their conscious attention on what they are doing with linguistic elements when they engage in linguistic play.

For example, as an initial step in drawing attention to the internal structure of Navajo verb words, a game can be constructed on the model of Lewis Carroll's Jabberwocky (or /na'abaash/, cf. Part I and Hale in Turner (ed.) Bilingualism in the Southwest, U of A Press, 1973). Basically, this involves the use of fictitious verb stems (e.g., /-baash/ 'to bosh'—meaning, let us say, 'to walk the way a robot does'; or /-keesh/ 'to cashe'—
'to fly the way Superman does') in combination with actual Navajo prefix sequences (e.g., /naashbaash/ 'I am boshing around,' /nishēbáázh/ 'I boshed there and back', /ch'íníshbáásh/ 'I am boshing out horizontally,' and so on.) The teacher, having illustrated the meaning of, say, /naashbaash/, might engage the students in dialogue which requires them to use the fictitious verb in forms they have not yet heard (e.g., the teacher, boshing, asks: /ha'át'íísh baa naashá/ 'what am I doing?', and the students answer: /nanibaash/ 'you are boshing around'; or, having boshed out the door, the teacher asks: /ha'át'íísh baa niséyá/ 'what did I do?', and the students answer: /ch'íníshbáázh/ 'you boshed out', or the like.). Alternatively, the teacher may use puppets or models to illustrate a variety of uses of such fictitious verbs—the possibilities are many. When the students learn to use such verbs and enter into the spirit of the game, which they do rather quickly, their attention can be drawn to the fact that the prefixal portion of the verb changes in the ways which correspond to changes in the situation and its participants. Gradually, a conscious awareness of the meanings contributed by the prefixes can be developed, and, most important, students can be induced to articulate their understanding of what is happening in the verb word. This is essential, since the development of a way of talking about language, a 'terminology', is a fundamental aid in their later work—the particular terminology does not matter—though, clearly, the teacher can help the students to arrive at an efficient one (cf. Becenti and Chee in DBN/NLR 1:39-51(1974)).

The ability to construct articulate generalizations about observed phenomena is an important one to cultivate for the purposes of any scientific inquiry. A great many language games are appropriate for exercising this ability. Navajo is especially well endowed in area of semantics by virtue of its classificatory verb stems, and any number of games can be constructed which will induce students to state the generalizations which relate, say, the subjects of /sité/ 'a slender stiff object is in position,' the instruments implied by the verb form /nídííhaal/
'I hit him with an elongated object', or the objects implied by /yishchozh/ 'I am eating greens'. The classificatory verb stems are ideal for involving students in the novel and imaginative use of their language. For instance, under normal circumstances, it would be incorrect to say /*ashkii nídiilá/ 'I picked up the boy', because the verb stem which is used implies that the boy is long and flexible, like a rope. The proper way to say it is /ashkii nídiilt/, using the verb stem which is appropriate for animate objects. One might, however, create an imaginary world, as in a science fiction story, in which the beings are totally unlike the human beings of our planet. One could then ask students to describe an encounter with these beings. An intelligent but rope-like being might be said to assume a stance more aptly described as /silá/ 'a long flexible object is in position' than as /sidá/ 'he is sitting', or /sit/ 'he is lying down', or /siz/ 'he is standing'; his method of taking hold of an object might be described as /yiyiilih/ 'he ropes it' rather than as /yiyiilíh/ 'he grasps it'; he might fall the way a rope does /naadee/ rather than the way a human does /hadaa/ 'he walks around'. A student might even allow himself to imagine that the being's gait should be described by the otherwise nonexistent verbal form /*naalé/ 'he "strings" around' instead of /naaghá/ 'he walks around'. In any event, imaginary play of this sort provides an excellent opportunity for students to give and to defend their various opinions about the proper linguistic usage in an entirely novel situation and, thereby, to come to grips in a rather direct way with certain semantic properties of Navajo.

The study of phonology can also begin at this stage. An awareness of the articulatory features of the sounds of one's own language is of considerable potential usefulness to students, not only as preparation for a formal study of the phonological rules which exist in the language, but also as preparation for an intellectual understanding of the principles which underly writing (particularly where the writing system—as the standard Navajo orthography does to some degree—reflects the feature composition of sound segments) and as preparation for the acquisi-
tion of the phonology of a second language. An appropriate initial step, it seems to me, would be to lead students to identify the most obvious organs of speech—-together with their Navajo names—-i.e., the lips, the tongue, the tip of the tongue, the back of the tongue, and so forth; this, in fact, is the foundation of a Navajo phonetic terminology which could be amplified and perfected as students proceed through their elementary schooling. It will be of value, as the study proceeds, to let the students become familiar with representational drawings of the speech organs. This involves, at the beginning, teaching them to identify the lips, teeth, tongue, tongue-tip, etc., in "x-ray" drawings of the type used by phoneticians. It may take some time to get younger children to the point where they can interpret such drawings with ease, but it can be done; and once this ability is acquired, it will prove to be of tremendous value as their study of phonetics continues. While this basic foundation is being developed, it is possible at the same time to have students begin to pay attention to, and attempt to describe verbally, the movements of the primary articulators (lips and tongue) in speaking. For example, the students could be asked to describe exactly what happens to the lips when one begins to pronounce such words as /mə'ii/, 'coyote', /máazo/ 'marble', /báán/'bread', and other words in their vocabulary which begin with bilabials. Once they are able to describe what happens—-i.e., to observe that the lips articulate against one another /hadaa' ahínínílá/ or /hadaa' aích'í' át'é/, or however they choose to express it), they can be taught to recognize this position of articulation in a drawing. And similarly for the other positions of articulation—e.g., the tongue-tip placed behind the upper front teeth, as when one begins to pronounce words like /naadáá'/ 'corn', /díbé/ 'sheep', and so on. The students should be helped to suggest an appropriate description of the articulation for themselves—-in this way, a phonetic vocabulary with which they feel comfortable will be developed. Once students are familiar with the four basic positions of articulation for Navajo consonants, it is possible to construct
a simple card game which will help them to become thoroughly comfortable with the idea of thinking of sounds in terms of their production. The game involves two sets of cards -- one set consists of x-ray pictures for each of the four positions of articulation (say, 5 cards for each, giving a deck of twenty); the other set consists of pictures of objects whose initial consonants represent the positions of articulation (say, thirty to fifty cards). The players (a small number) sit in a circle; each player is dealt a hand of four x-ray cards from a shuffled deck; the picture cards are placed face-down in a pile at the center of the circle. One of the players is chosen to start the game. This player turns the top picture card face-up and places it beside the pile; he then consults his hand of x-ray cards, and if it contains an x-ray picture corresponding to the position of articulation of the initial consonant in the word which the picture card represents, he takes it from his hand and places it face-up next to the picture card. If there are two x-ray cards which correspond to the initial consonant of the picture word, the player can place both of them down; if three, all three; and so on. When he has done this, the next player goes through the same procedure. The object of the game is to get rid of all the x-ray cards in one’s hand -- the winner of the game is the first player who gets rid of his hand. One can imagine several variations of this game -- the students will undoubtedly think of ways of changing it. Perhaps the most productive way to introduce this game to younger students is to teach it first to older children, around ten years of age, and have them teach it to the younger ones. This is a particularly good way to establish a terminology for talking about phonetics to younger children. The older group will, in all probability, have an efficient way of giving oral instructions to the younger group, and a great deal can be built upon the terminology they use. A more detailed description of the game and associated materials is presented in Part II, and a Navajo-language version by Hale and Honie will appear in DBN/NLR Vol. 2.
This game (and variations on it) helps not only to enable students to become familiar with the positions of articulation and the role which the articulators play in speech production, but it also helps to teach the fact that sounds belong to classes -- e.g., that /b/ and /m/ belong to the class of "lip-sounds", that /t/, /d/, and /n/ all belong to the class of "tongue-tip sounds"; and so forth. Once these observations are made, it is possible to begin to introduce the idea of manner of articulation. Students can be asked to think about, and to attempt to describe, the differences between sounds belonging to the same position of articulation -- e.g., the difference between /b/ and /m/; the difference between /d/ and /n/, and between /t/ and /d/, and so on. Their descriptions of these differences will suggest an appropriate Navajo terminology to be used in reference to the manner of articulation. It is possible to represent the manners of articulation in the form of x-ray pictures as well, by using an arrow to represent the flow of breath. When this dimension is added, and students become familiar with its role in speech production, the card game can be appropriately modified to incorporate it. And when the students have learned the alphabetic symbols, and have begun writing, the game can be further modified by replacing the picture cards with letter cards -- The game would proceed as before, but now the players associate an x-ray card with letters. This will help to teach the association between sounds, thought of in terms of how they are produced, and the conventional letters used to represent them.

These are but a few of many conceivable game-like activities which could be used at this stage to encourage children to manipulate linguistic material, to experiment with it, and, especially, to talk about it with ever increasing precision. The central aim of such activities is to create the attitude that linguistic form and meaning are things which can be consciously observed, to set the scene for the discovery of linguistic problems which require solution, something which the ordinary, every-
day use of language rarely does.

Stage II

The activities of the first stage are designed to make minimal appeal to the skill of writing -- in fact, they can be almost exclusively oral. At some point, however, it will be possible to take increasing advantage of the fact that the students are becoming literate in Navajo. This permits the use of activities requiring greater concentration and the handling of larger bodies of data.

The study of the internal structure of Navajo verb words, for example, can be greatly advanced by means of a form of "scrabble", using prefixes (rather than letters) to build words. In fact, just such a game can be used to introduce students to the idea that verb forms have an underlying morphophonemic representation which often differs radically from the form which is actually pronounced. Imagine a version of scrabble in which players are supplied with chips bearing Navajo prefixes together with numerical values associated with the frequencies of the prefixes. The object is to use the chips in constructing well-formed prefix sequences, in much the same way that words are built in alphabetical scrabble. In the Navajo version, the player is allowed to supply the stem of the verb (represented, say, by a blank chip). Assuming that the players are aware of the meanings of many of the prefixes, from their experiences in earlier games, the frequent disparity between underlying and surface forms can be introduced by pointing out that the presence of a particular meaning in a verb form does not necessarily guarantee the presence of a prefix of a particular shape -- e.g., while 'first person singular object' is typically /shi-/ as in /shiihozh/ 'he is tickling me', and 'second person singular subject' is typically /ni-/ as in /niibohz/ 'you are tickling him', the two together do not give */shiniibohz/, but rather /shiihozh/ 'you are tickling me', due to a process sometimes referred to as "ni-absorption"; and while 'first person singular subject' is typically /sh-/ as in /dishni/ 'I say', it does
not appear so in /diskos/ 'I cough', due to the process of "strident assimilation" whereby the underlying laminal is converted to an apical under the influence of the stem-final /s/. By playing the game in such a way as to reveal the most straightforward alternations, the teacher can introduce the notion of phonological rule. And, depending upon the students' ability to handle this idea, it can be incorporated into the game itself by granting a player extra credit for constructing an underlying representation removed from the surface form through the intercession of a phonological rule (e.g., as underlying /di-sh-kos/ is related to surface [diskos]). This would, particularly in the more sophisticated versions of the game, give students an opportunity to exercise their ability to construct arguments in defense of particular underlying forms.

While the central aim of the first stage is to create in the students an experimental attitude toward linguistic material, I see the primary focus of the second stage as being the development of an appreciation of language as a system of rules. Phonology, of course, provides ample illustration of the rule-governed nature of language, but syntax and semantics are particularly rich and readily accessible.

The game-like atmosphere which prevails in the first stage is gradually replaced in the second stage by a more laboratory-like atmosphere in which linguistic material is subjected to intense strain—the easiest way to reveal the existence of a rule is to break it. The use of ill-formed words and sentences, therefore, assumes considerable importance at this point. The general strategy in each instance is to present the students with data which reveal the existence of a rule and to encourage them to articulate the rule for themselves. I will content myself with a single example.

It has been suggested that Navajo possesses a rule whereby a transitive sentence of the form SUBJECT OBJECT yi-VERB can,
by a process not unlike the passive of English, be converted to
the form OBJECT SUBJECT bi-VERB (cf. Hale in Kachru (ed.) Issues
(1974)). The rule is illustrated by the pair of sentences /tʃʃ'
dzănééz yiztaí/ 'the horse kicked the mule' and /dzaanééz tʃʃ'
biztaí/ 'the mule was kicked by the horse'. However, it is a
fact about Navajo that this rule cannot apply freely to all transi-
tive sentences. Thus, for example, the sentence /lééchąą'į łaets'aa'
yiilnaad/ 'the dog is licking the plate' is the form SUBJECT
OBJECT yi-VERB, but it cannot be converted to OBJECT SUBJECT bi-
VERB. In other words, the "passive" counterpart /*läets'aa'
lééchąą'į biilnaad/ 'the plate is being licked by the dog' is un-
acceptable in Navajo. Moreover, there are cases in which the
rule must apply -- thus, the sentence /ashkiı tsis'ná biishish/
'the boy was stung by the bee', of the form OBJECT SUBJECT bi-VERB,
has no acceptable "active" counterpart of the form SUBJECT OBJECT
yi-VERB -- the form /*tsis'ná ashkiı yishish/ 'the bee stung the
boy' is unacceptable. Very roughly, the principle is this. Navajo
nominal concepts are ranked, with humans highest and inanimate and
abstract entities lowest. The rule applies optionally where the
subject and object are equal in rank; it must not apply where the
subject outranks the object, and it applies obligatorily where
the object outranks the subject. That is to say, in cases of
subject-object inequality, the rule applies or does not apply so
as to ensure that the higher ranking nominal be in initial, or
topic, position. This fact of Navajo provides a coherent prob-
lem which students could attempt to solve. They could be pre-
sented with well-formed and ill-formed transitive sentences illus-
trating the rule and asked to try to uncover, and to articulate, the
principle which governs its application.

Language is rich in material of this sort, and it is a rela-
tively simple matter to assemble data which will illustrate the
operation of rules of grammar. It is important, I feel, to use
this material in such a way as to enable students to formulate the
the principles for themselves -- the object here is not to
teach a list of rules, but rather to exercise the students' ability to express, as precisely as possible, the generalizations which inhere in the data presented to them.

Stage III

The primary concern at this stage is to confront students with linguistic problems, particularly problems which illustrate the fact that the "explanation" of observed contradictions in linguistic data requires the use of abstractions, or theories -- i.e., the postulation of a level of linguistic representation and design which cannot be directly observed, only defended on the basis of its success in predicting the observable behavior of linguistic form and meaning. The use of counterexamples assumes great importance in teaching at this stage.

The activities of the earlier stages are meant to prepare students to confront linguistic problems. Assuming that they have achieved some measure of skill in linguistic observation and some degree of comfort with the concept of grammatical rule, they are ready to consider counterexamples.

For example, having observed that a stem-initial fricative is typically voiceless when preceded by another voiceless segment (as in /yishxáád/ 'I am shaking it', with stem-initial/x/ instead of the voiced counterpart /gh/ appearing in /nigháád/ 'you are shaking it'), students are in a position to appreciate exceptions to this rule (as in /yishgháá/ 'I am eating it (meat)', with the voiced stem-initial fricative also appearing in /nilgháá/ 'you are eating it') -- cf. Part III and Hale in DBN/NLR Vol. 1, No. 4 (1974). And, having observed that where a so-called "classifier" appears in a second or third person form, it is regularly missing in first person forms (e.g., the classifier _l_ of /nilgháá/ is missing from /yishgháá/), they are prepared to entertain the possibility that the exceptional forms have an underlying representation which distinguishes them from the regular forms, an underlying representation which in some sense explains their exceptionality (e.g., /yishgháá/ is underlingly /yì-sh-l-gháá/; the classifier prevents the devoicing rule from
affecting the stem-initial fricative). Examples of this sort lead to a somewhat more abstract conception of linguistic phenomena and give the teacher an opportunity to illustrate what is involved in constructing and defending a theoretical proposal -- in this instance, not only is an abstract underlying representation (of first person forms of 1-classifier verbs) involved, but there is a problem of rule-interaction as well i.e., the rule which deletes the classifier must be related to the devoicing rule in such a way as to prevent the generation of the ill-formed \[*yishxa\] instead of the correct \[yishgha\]).

The rule of strident assimilation offers an excellent opportunity to explore the abstract nature of the putting together of linguistic forms. While the first person object prefix /shi-/ ordinarily assimilates to [si-] in [sizta\] 'he kicked me' (<shizta\]), it does not do so in [shésta\] 'it (a missile) struck me'. This is because the relative order positions of the object prefix in the two verb forms are different; in the first, the prefix occupies a position which is relatively closer to the stem than the position it occupies in the second. A strong juncture occurs in the second form while only weak junctures occur in the first--but this is an abstract notion since the junctures are inaudible and since, in terms of the surface representations, the prefix is the same distance from the stem in both forms.

The discovery of the relative morpheme order within the Navajo verb word -- together with the various phonological effects of relative distance -- is itself a challenging activity from which students can learn a great deal (cf. Platero "Strident assimilation in Navajo" MIT ms 1974).

I will conclude with a syntactic example. Once students have achieved a conscious awareness of the meanings of the semantically more perspicuous verbal prefixes and have come to appreciate the function of rules of agreement (e.g., that /sh-/'first singular subject' is construed with the subject /sh/ 'I' in /shí naashnish/ 'I am working'; that /da-/ 'plural' is construed with a plural subject in /hastiin dóó ashiiké ndaalmish/ 'the men and the boys are working'; and the like), they can be
faced with observations like the following. The sentence /*shí ndaashnish/ is ill-formed, for reasons which are obvious--the subject is singular, yet the verb contains the plural prefix /da-/; in other words, the verb form is internally contradictory in that the prefix /sh-/ implies a singular subject while /da-/ implies a plural subject. All of this follows from rules whose existence is obvious to any speaker of Navajo. But there are seeming counterexamples to these rules. Precisely the outlawed verb form appears in sentences like /(shí) ashiiké bití ndaashnish/'I am working with the boys', in which the verb agrees in person with the surface subject /shí/ 'I' while agreeing in number jointly with the subject and with the noun phrase of the comitative expression /ashii ashiiké bití/'with the boys' -- it is as if, from the point of view of number agreement, the subject were instead the compound noun phrase /shí dóó ashiiké/ (as in /shí dóó ashiiké ndeilnish/ 'I and the boys are working'). The verb form /ndaashnish/ as a first person form, and not the homophonous third person perfective--defies the ordinary understanding of the operation of the Navajo agreement rules. But it could be made consistent with them by proposing a somewhat more abstract derivation of comitative sentences than is obvious from their surface form. Suppose, for example, they were derived from sentences with compound subjects by means of a rule which elevates one of the conjuncts to subjecthood in its own right while creating a comitative phrase out of the remainder. If this rule were ordered after number agreement but before person agreement, the existence of the internally inconsistent first person verb form /ndaashnish/ would be explained. This particular example could also be used to illustrate the requirement that abstract rules of the type proposed here be independently motivated. By positing the rule which elevates a conjunct to subjecthood, it is possible to explain the existence of such internally inconsistent verb forms as /yish'ash/ (with first singular person agreement but a dual stem), appearing in /(shí) ashiiké biyish'ash/ 'I am walking with the boy', and /ahiistsą/ (with first singular person agreement together with the reciprocal object prefix /ahi-/), appearing in the well-formed sentence--well-formed in Navajo, but not in English translation--/(shí) ashiikí
"I saw each other with the boy." Thus, the rule is thrice motivated, by virtue of the fact that it must apply after provisions are made for (1) plural number agreement, (2) nonsingular verb stem selection, and (3) reciprocal objects, all of which require reference to nonsingular subjects—under the analysis proposed here, the sentences exemplified have compound, hence dual or plural, subjects at their most abstract representation, while at their surface representation, when person agreement applies, they have simple, singular subjects (cf. Part III and Hale in DBN/NLR Vol 2, No. 1 (1975)).

I do not wish to insist that the analysis of comitatives proposed here is the correct one—nor would it make sense to insist upon a particular analysis for any such problem. The object in teaching is not to present solutions but to illustrate what is involved in arguing for some solution—in this instance, the argument is based upon the fact that the analysis proposed permits the elimination of an identical exception clause from three distinct statements of agreement (i.e., except in comitative sentences, /da-/ is construed with a plural subject; etc.), at the cost, to be sure, of an abstract and somewhat unusual rule. The putative saving may, under further scrutiny, prove to be spurious—but this is the very point of linguistic science; the whole enterprise advances by means of the critical examination (and often the overthrow) of proposed solutions to problems, or through demonstrating that the problems themselves vanish under a more insightful and general conception of the issues involved.

To work out the details of a language study program of the type suggested in the foregoing will, of course, require an enormous amount of energy and talent—regardless of the language for which it is designed. And crucial to the implementation of any such program is the development of a linguistics personnel which has native command of the language studied.
Of the three stages described above, we know the most about stage III, for that is linguistics as it is currently taught and studied in colleges and universities around the country. And although the details of a Stage III program for Navajo remain to be worked out, we have a reasonably clear idea of what is needed. We are much less sure about the earlier stages, not only for Navajo but for any language. Very little has yet been written concerning the idea of using linguistic data in teaching the skills of scientific inquiry at the elementary level. I would like to devote the bulk of the following discussion to a more detailed description of a number of language-based games, game-like activities, and projects which could be used in the elementary classroom to engage Navajo-speaking students in the active study of their language, with the purpose of laying a secure foundation for the introduction of the scientific method. The activities to be described here belong primarily to stages I and II as outlined above, but many of them also engage students in exercising an important scientific skill—namely that of detailed observation. Most important, however, is the fact that they encourage students to develop a consciously experimental attitude toward language—an attitude which is of value not only in the scientific study of language but also in the creative and artistic use of it as well. In addition to these general goals, many of the activities relate also to more immediately utilitarian educational concerns, such as reading, vocabulary building, and the like.

1. Phonetic features.

I will begin with a discussion of a variety of activities relating to the teaching of the fundamentals of articulatory phonetics. This builds upon the activity described near the end of Navajo Linguistics: Part II, also briefly discussed in the introduction above (in the context of Stage I). A primary advantage of these phonetic-feature games and activities is that they can be used with pre-literate children, since the basic
materials involve pictures rather than written words—at the beginning, at least. The activities are graded from simple to complex.

The general educational purpose of these activities is that of developing the ability to make detailed observations, in particular, observations concerning the movements and positions of the organs of speech in the production of linguistic sounds. In addition, the activities are constructed to teach children to associate a graphic representation (e.g., a picture representing a certain position of articulation) with an actual phonological segment (e.g., the initial consonant of a Navajo word). At more advanced stages, they teach the principle that linguistic sounds are made up of phonetic features—in much the way matter is made up of particles—and that linguistic sounds belong to "families" or "classes" on the basis of sharing some property in common. It is important to grasp this principle, since it is central to the scientific study of sound systems. Moreover, it greatly increases the students' ability to come to grips with the phonetic peculiarities of sounds belonging to languages other than their own—this is sometimes a strong advantage in acquiring a second language.

1.1. Three positions of articulation.

At the most elementary level, students are taught to recognize x-ray drawings for the most obvious positions of articulation in Navajo: bilabial, apico-alveolar, and dorso-velar. The students must be carefully prepared for this, since the x-ray representation of the organs of speech will be novel to them. From the very beginning, an effort should be made to establish an elementary terminology for talking about the production of speech sounds.

These preparatory steps are described briefly in Navajo Linguistics: Part II. The teacher can devise a variety of exercises which will enable students to become comfortable with the idea of associating an x-ray picture with the positions of articulation which characterize particular consonants.
Materials. The basic materials at this point consist of x-ray drawings of the three positions of articulation, together with pictures of objects whose Navajo names begin in consonants corresponding to the positions of articulation being studied. A preliminary set of object pictures might include the following:

- **bilabial**
  - béégashii
  - béésh
  - bįįh
  - báah
  - bisóodi
  - béesó
  - móso
  - máázo
  - mogy
  - mą'ii

- **apico-alveolar**
  - dibé
  - dáádílkali
  - dóola
  - dził
  - tózis
  - télii
  - t'iiís
  - tsin
  - názhahí
  - náa'ahóohai
  - náshdíí
  - naal'eehí

- **dorso-velar**
  - gah
  - gáagii
  - gólízhii
  - gish
  - gad
  - ką'
  - ké
  - kin
  - k'aaz
  - k'áalóógií
  - k'éét'oh

Games and activities
(1) Classifying words according to their initial consonants.

As the students are shown a picture, they are asked to think of the word it represents and of the position of articulation of its initial consonant. The format of the activity can vary—the students may, for example, be asked to point to the appropriate x-ray picture or to describe the position of articulation in their own words; alternatively, each student may be dealt a number of cards on which object pictures are drawn and asked to put them into groups according to the position of articulation of the initial consonants of the words represented in the pictures. Another format involves preparing, for each student, a sheet of paper with object pictures on the left-hand side and the three x-ray pictures on the right-hand side. The students' task is to draw a line connecting each object picture to the correct x-ray picture:
The students themselves can be involved directly in the preparation of materials—e.g., they can draw the object pictures, or cut them out of magazines; they can also suggest new words to add to the preliminary list.

(2) Card games.

This entails preparing two decks of cards—a deck consisting of x-ray cards (enough so that each player has at least as many
cards as there are position of articulation under study), and a deck of object picture cards. One version of the game is described in the introduction— in this version, the picture cards are placed face-down in the center of the playing area. On his turn, each player turns one of the picture cards over and consults his own hand of x-ray cards to determine whether or not he has a card matching the initial consonant of the word represented in the picture. The winner is the first player to get rid of his hand. In another version of the game, the x-ray cards are placed face-down in the center of the playing area, and each player has a hand consisting of object picture cards. On his turn, each player turns over an x-ray card; if his hand contains a picture representing a word whose initial consonant corresponds to the position of articulation depicted on the x-ray card, he can take the picture card out of his hand and place it beside the x-ray card. Again, the winner is the player who gets rid of his hand first.

In another version, the x-ray cards are placed face-down in the center of the playing area. The object-picture cards are distributed evenly among the players. The players do not look at their cards, but hold them face-down in their hands. On his turn, each player turns an x-ray card over and places his top object picture card face-up beside it. If the x-ray picture corresponds to the initial consonant of the word represented in the object picture card, he picks the x-ray card up and keeps it. If not, he leaves the x-ray card lying face-up
and passes his turn to the next player, who repeats the same procedure. When a given player succeeds in matching an object picture card with an x-ray card, he picks up not only the x-ray card he himself turned over but also any x-ray cards left face-up by previous players. The winner is the player who possesses the largest number of picture cards at the end of the game—i.e., when all of the x-ray cards have been picked up.

(3) The "lotto" format.

This involves the use of a deck of x-ray picture cards—as in the card games described above—plus a number of lotto boards (of posterboard, roughly 10" X 10"). Each lotto board is divided into six squares, and the picture of an object is drawn in each square—the students themselves can prepare the lotto boards:

<table>
<thead>
<tr>
<th>béégashii</th>
<th>kin</th>
</tr>
</thead>
<tbody>
<tr>
<td>dibé</td>
<td>béésh</td>
</tr>
<tr>
<td>mósí</td>
<td>naadáá'</td>
</tr>
</tbody>
</table>

Each player is supplied with a lotto board—no player's lotto board should have exactly the same pictures as that of another player. The players are also supplied with six tokens (chips, coins, stones, beans, kernels of corn, or anything at all). One
person, either a student or the teacher, is chosen to take charge of the x-ray cards. This person thoroughly shuffles the deck, and places it face-down, and begins the game by picking up the top x-ray card and showing it to the players. The players consult their lotto boards to determine whether or not there is an object picture corresponding to a word whose initial consonant matches the position of articulation in the x-ray card—if so, the player places a token on the picture. This procedure is repeated until one of the players has placed a token on each of the six pictures on his lotto board. The first player to do this is the winner. The game can be varied in a number of ways—e.g., by merely increasing the number of pictures on the lotto board; an important variation, however, would be to have the person in charge of the x-ray card deck act as a "caller" and to announce verbally the position of articulation represented on the x-ray cards as they are drawn—this would have the effect of reinforcing the students command of the evolving phonological terminology. By using the terminology as much as possible, it will not only become familiar, but it can be gradually streamlined as the concepts involved become more and more commonplace—e.g., a descriptive phrase like /hadəa' aɪch'ɪ! āt'ē/ 'the lips are together', used in reference to the bilabial position of articulation, might be abbreviated to /daa'siɪch'ɪ'ii/ 'lip-together-kind', or even to /daa'ii/ 'lip-kind' (cf. the vocabulary described by Becenti and Chee in DBN/NLR 1:39-51 (1974)).

The lotto format can also be varied in a number of ways—e.g., by increasing the number of squares on the lotto board; and, when more phonological features are introduced, the format can be reversed by having x-ray pictures on the lotto board and object pictures in the hands of the caller. Also, the criteria for winning can be changed as the lotto board gets larger—the winner, for example, could be the first player to get a straight line of tokens from one edge or corner of the board to another; or the first to get a diagonal; and so on.

(4) Racetrack.

In addition to a deck of object picture cards, this game requires a number of cardboard strips—called "racetracks"—with
a starting point at the one end and a number of lines equally spaced along the remainder of the strip, dividing it into a dozen or more squares. In the squares, x-ray pictures are drawn; the three positions of articulation are rotated from one end of the strip to the other, as follows:

```
  start  bilabial  apico-alveolar  dorso-velar  bilabial  apico-alveolar  ...
```

Alternatively, the racetrack can be made circular, or winding. The object picture cards are divided equally among the players—the players hold them face-down. Each player also has a racetrack and a token to move along the track (plastic horse, toy car, or whatever)—this is placed in the starting position. The game proceeds as follows. At a starting signal, each player turns his top object picture card face-up, determines the position of articulation of the initial consonant of the word represented by the picture and moves his token to the first x-ray picture on the track which represents that position of articulation; he then turns over the next picture card and repeats the same procedure. The object of the game is to reach the end of the track; if a player has not yet reached the end of the track when all of the picture cards have been turned face-up, he recycles through the cards as many times as necessary until he succeeds in reaching the end. The winner is the first player to reach the end of the track. Obviously, this is a game of speed, not chance, since it would be impossible for any player to receive a hand of picture cards which would prevent him from reaching the end of the track.

1.2. Four positions of articulation.

The lamino-alveolar position of articulation is somewhat more difficult to represent on an x-ray card than are the other three positions. Like the apico-alveolar position it employs the front of the tongue, and some care must be taken to ensure that the students perceive that the blade, rather than the tip of the tongue, is in contact with the alveolar ridge (see, for example, the x-ray picture for this position given in Navajo Linguistics:
Part II or in Becenti and Chee, DBN/NLR 1:39-51 (1974)). It might be wise to begin by preparing picture cards for a number of words beginning in lamino-alveolar stops—for example, the following:

**lamino-alveolar**

· jádí
· jish
· chaa'
· chidí
· ch'íl
· jool
· chizh
· jaa'f
· chaha'ch
· ch'ah
· ch'áč

The students can be asked to consider the attitude and position of the tongue as they begin to pronounce one of these words and to contrast this position with the apico-alveolar position characterized by /d,t,t',n/. They can suggest a way of representing this position of articulation in an x-ray picture, and they can also be involved in suggesting a verbal description of it (e.g., /hatsoo bida'á hawoo wódahdég'ígí bine'dé'é binahji niñiñeéh/ 'one places the edge of the tongue behind the upper front teeth', or some such thing—to be abbreviated at a later point along the lines suggested in the Becenti-Chee article).

Once the students are familiar with x-ray representations of the lamino-alveolar position, it can be added to the stock of x-ray pictures and incorporated into the games and activities described in 1.1 above.

1.3. Fricatives.

In the activities described so far, the consonant sounds involved are produced by creating a complete closure at some point in the mouth—by closing the lips, by placing the tongue-tip or tongue-blade against the alveolar ridge, or by placing
the back of the tongue against the soft palate (or velum)—these
are called stop sounds. When these consonants are produced, the
air coming from the lungs is momentarily prevented from escaping
d out the mouth. There are other sounds, however, called frica-
tives or continuants, which are produced in such a way as to
allow the air to squeeze through a narrow opening. They are
produced in positions of articulation which correspond to those
of certain stop consonants—i.e., apico-alveolar, lamino-alveolar,
and dorso-velar—but in the production of a fricative the air is
allowed to pass through a narrow opening rather than being stopped
altogether. To introduce these fricative sounds to the students,
a number of object-picture cards can be produced for each posi-
tion of articulation:

<table>
<thead>
<tr>
<th>apico-alveolar</th>
<th>lamino-alveolar</th>
<th>dorso-velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>s’q’</td>
<td>shaazh</td>
<td>hał</td>
</tr>
<tr>
<td>sis</td>
<td>shash</td>
<td>hosh</td>
</tr>
<tr>
<td>seès</td>
<td>shoh</td>
<td>héél</td>
</tr>
<tr>
<td>sigháala</td>
<td>shizhoozh</td>
<td>haaz’éf</td>
</tr>
<tr>
<td>siil</td>
<td>shá bitl’óól</td>
<td>hastiin</td>
</tr>
<tr>
<td>sánanii</td>
<td></td>
<td>ghé’a’ask’idii</td>
</tr>
<tr>
<td>zas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the beginning, the students should be encouraged to try asso-
ciating these initial consonants with the positions of articulation
they already know and to associate them with the x-ray cards al-
ready drawn. They may have some difficulty with this at first,
because the tongue does not actually make a closure at the point
of articulation involved. But there are various tricks which
can be used to help them determine the position of articulation
accurately. Since these sounds are continuants, they can be
prolongued: sssssss; shshshsh; hhhhh. This in itself enables
the student to concentrate on how the sound is produced and to
determine the point at which the air passes through a narrow
opening. But it is also possible to teach the student to gradu-
ally close the opening, thereby producing a stop consonant in
the corresponding position of articulation: ssssst, shshshshch,
hhhhhk. This will make it quite easy to feel what the position
is and to relate each fricative sound to the correct x-ray pic-
ture. The students' understanding of the fricatives can be tested by engaging in a number of activities which involve classifying fricative-initial words in terms of position of articulation—e.g., grouping pictures, or drawing lines connecting object pictures with x-ray pictures (as described in 1.1 above).

Once the students are able correctly to recognize the positions of articulation of the fricatives, they can concentrate on the difference between stops and fricatives—this is their first introduction to distinctions in manner of articulation. Up to this point, they had concentrated only on distinctions in position of articulation. Differences in manner of articulation have to do with the way in which the airstream is manipulated—with a stop consonant, the airstream is momentarily shut off; but with a fricative, the airstream is forced through a narrow opening. (More detailed discussions of these concepts are to be found in Navajo Linguistics: Part II and in Hale and Honie, An Introduction to the sound system of Navajo, Part I: Articulatory Phonetics.)

The idea that stop consonants involve a complete shutting off of the airstream can be made obvious to students by means of a demonstration once described to me by William Morgan. The teacher holds a piece of chalk up in view of the students; he tells them to take a deep breath and get ready to pronounce some word, say /dibé/, and to actually pronounce the word when they see the chalk drop. The teacher does not immediately drop the chalk, however. Meanwhile, as the students are waiting to pronounce the word, they will be making a closure at the apico-alveolar position (for the initial consonant of /dibé/), and they will notice that pressure is building up behind the closure. Eventually, when the chalk drops, and the students say the word, the pressure will be released and the air will rush out of the mouth. Once this point is made, the students can be asked to suggest a way of representing the stop manner of articulation in an x-ray picture. (I suggested in Part II that an arrow might be used to represent the flow of air and that the head of the arrow could be turned back to represent stoppage at a particular position of articulation.)

The difference between stops and fricatives becomes even
more obvious when the two are compared. If the students are asked to take a deep breath and get ready to say a word like /spʰ/, they will notice that the tongue does not make a complete closure and that, therefore, there is no opportunity for air pressure to build up behind the apico-alveolar position. The most noticeable difference, however, is that a fricative sound can be sustained, or prolonged, as was mentioned above. (In an x-ray picture, the fricative manner can be portrayed by drawing an arrow which passes through the position of articulation and out the mouth; see Part II.)

Materials and activities. Navajo has fricatives at apico-alveolar, lamino-alveolar, and dorso-velar positions of articulation. It also has stops at these positions. Thus when x-ray pictures are made for stops and fricatives, there will be two distinct pictures for each of these positions of articulation—one for the stop manner and another for the fricative manner. This gives six distinct pictures to work with (leaving the bilabial position out for the moment). Clearly, it will be possible to construct many games with these six x-ray pictures on the model of the games described in 1.1.

In the course of playing the games, the students can be encouraged to suggest a way of expressing verbally the distinction between stops and fricatives—leading ultimately to abbreviated descriptive labels such as those suggested in the Bécenti-Chee article (i.e., /yolkal/ for stops, /yoltl'ah/ for fricatives), or to alternative abbreviations with which the students are comfortable. When the stop-fricative distinction is fully appreciated, an attempt can be made to introduce the central concept underlying the phonetic classification of sounds—namely, the idea that linguistic sounds consist of features and that distinct sounds can share certain phonetic properties. For example, the Navajo sounds /ch/ and /sh/ are distinct, but they have something in common—i.e., they are both lamino-alveolar. Similarly, the sounds /s/ and /sh/ are distinct, but they also share something—i.e., they are both fricatives. And the sounds /d/ and /j/, although distinct, share the property that they are stops. This idea that there are phono-
logical features and that they are combined to make up the actual sounds of a language is an important one in the scientific study of phonology. But it is a rather abstract idea, and students should be led into it with care—they should not be expected to grasp it immediately. They can begin to see the point, however, by undertaking to classify words according to shared properties. For example, each student can be given a selection of object picture cards and asked to put them into groups according to whether they begin in stops or fricatives. When they become familiar with this notion, it might be possible to begin separating the position features from the manner features in the x-ray cards. Thus, the fricative feature might simply be represented by an unimpeded arrow, indicating that the air is allowed to flow continuously out the mouth; while the stop manner might be represented by an arrow with the head turned back, indicating that the airstream is prevented from flowing out of the mouth. These arrows can be abstracted away from the x-ray pictures representing the positions of articulation. This in turn gives rise to another game which can be constructed in the lotto (or bingo) format. In this game, the player is supplied with a board on which the positions of articulation are represented by x-ray pictures along the top, and on which the two manners of articulation are represented by arrows on the left-hand side. Vertical and horizontal lines are drawn in such a way as to divide the board into six squares, as follows:

<table>
<thead>
<tr>
<th></th>
<th>apico-alveolar (x-ray)</th>
<th>lamino-alveolar (x-ray)</th>
<th>dorso-velar (x-ray)</th>
</tr>
</thead>
<tbody>
<tr>
<td>stop (arrow)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fricative (arrow)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Each of the squares should be drawn large enough to accommodate an object picture card. The players are given a selection of object pictures representing words beginning in stops and fricatives in apico-alveolar, lamino-alveolar, and dorso-velar positions. The players' task is to place each of the cards in the appropriate square—i.e., at the correct intersection of manner and position features. Thus, for example, if a player has a card depicting, say, /shash/, he places it in the square belonging to the fricative row and the lamino-alveolar column (i.e., the lower middle square), and so on.

I must emphasize again that the activity just described is highly abstract, and the students' grasp of the principle involved should be regarded as a goal to shoot for rather than as a skill which can be taken for granted. The activity involves first the principle that a linguistic sound can be subanalyzed into component phonological features and second the principle that the position features are logically independent of the manner features—thus, one can speak of the fricative or stop manner of articulation in general, without reference to a particular position of articulation. It is this logical independence which allows us to construct a table consisting of columns and rows on the model of the lotto board drawn above. The structure of this lotto board—i.e., with the manners features down the left-hand side and the position features along the top—conforms to the standard practice in phonetic charts, which are organized on the same principle (see, for example, the charts developed in Part II).

You will notice that no provision was made for the bilabial position of articulation in constructing the lotto board described above. Suppose we construct a new board to include the bilabial position:
<table>
<thead>
<tr>
<th>bilabial</th>
<th>apico-alveolar</th>
<th>lamino-alveolar</th>
<th>dorso-velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>stop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fricative</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This gives us a board with eight squares on which object picture cards could be placed in playing the game—in theory, that is. An interesting fact emerges, however. If the game is played correctly, no object picture card (representing an actual Navajo word) would ever be placed in the lower left-hand square. This is because Navajo does not have bilabial fricatives. That is to say, while the stop manner combines with all four positions of articulation, the fricative manner combines with only three of them—it does not combine with the bilabial position. But this is merely a fact of the Navajo language. It is logically and physically possible to produce a fricative at the bilabial position—e.g., the sound which is produced when one blows out a match is in fact a bilabial fricative; it just happens that it is not used as a consonant in the Navajo sound system. In the language of Jemez Pueblo, however, the bilabial fricative is a true consonant—it is represented by the Greek letter /ϕ/ in phonetic notation and it appears in such Jemez words as /ϕóó/ 'rope,' /ϕiiya/ 'fly', and /ϕa/ 'fur'.

We have already seen that Navajo does have bilabial consonants—the words /béésh/, /béeso/, /béégashii/, and /bááh/begin in bilabial stops. So Navajo combines the stop manner with the bilabial position. But it is a fact of the Navajo sound system that it does not combine the fricative manner with the bilabial position.
It is very common for languages to differ in the ways in which phonological features combine. For example, English does not combine the fricative manner with the dorso-velar position—thus, while English has dorso-velar stops (i.e., the initials in the words gum and come), it has no dorso-velar fricative corresponding to the initials of Navajo /hosh/ or /gház'ask'idì'/ (the sound written h in English is not a dorso-velar, but a laryngeal: see Part II). We will see other examples of logically independent phonological features, which could, in theory, combine to produce linguistic sounds but which, in a given language, are not used to do so. If students are able to comprehend the logical independence of position and manner features, and to learn how features can be combined, both theoretically and in the actual sound system of some language, they will be in an advantaged position when they are later confronted with the more abstract problems involved in the scientific study of the phonological laws of their own language, or of any other.

1.4. Nasals.

In the production of stops and fricatives, the airstream is either interrupted, or constricted at some position in the oral cavity. But there is another class of sounds which involves a different treatment of the airstream and, therefore, a different manner of articulation. These are the nasals. In the production of a nasal, the airstream is prevented from passing out the mouth, but it is allowed to pass through the nasal cavity. To introduce this manner of articulation to students, an exercise similar to that suggested by William Morgan can be used. For example, they can be told to take a deep breath and get ready to say a word like /ma'ii/ or /mós'/. As they are waiting to say the word, they will notice that their lips are closed but that air pressure does not build up in the oral cavity behind the lips. In fact, they can keep the lips closed and breathe out. When they do this, they will notice that air passes out the nose. Similarly, if they go through the same procedure with a word like /naadaa'/, they will notice that, while they are waiting to say the word, the tip of the tongue is in contact with the alveolar ridge behind the
upper front teeth, but that air pressure does not build up behind that closure. Moreover, if they keep the tongue tip in the apico-alveolar position and breathe out, the airstream passes out the нос или just as it did in the case of the initial consonant of /ма́йá/ and /мэсэ/. This exercise can be used to make the students fully aware of the distinction between stops, fricatives, and nasals and when they understand that the production of a nasal involves allowing the airstream to pass out through the nasal cavity, they can be encouraged to suggest a way of representing the nasal manner of articulation in an x-ray drawing (e.g., by an arrow passing through the nasal cavity and out the nostrils). X-ray pictures of the bilabial and apico-alveolar positions of articulation combined with the nasal manner can be incorporated into the games and activities described in 1.1 above, and the students' comprehension of the phonological distinctions can be tested and reinforced by involving them in these activities. Moreover, the physical mechanism involved in the nasal manner can be explained to the students (cf. Part II and the appropriate section of the Hale and Honie introduction to Navajo phonology), and an appropriate terminology can be developed for referring to the nasal manner (cf. the terminology suggested in the Becenti-Chee article).

Like the stop and fricative manners, the nasal manner is logically independent of the positions of articulation. It is possible, therefore, to abstract the nasal manner away from the position manners in the x-ray representation—the nasal manner can be represented merely as an arrow passing through the nasal cavity and out the nostrils. And the nasal manner can be worked into the lotto board designed on the model of a phonetic chart, as follows:
|                | bilabial (x-ray) | apico-
|               |                 | alveolar (x-ray) | lamino-
|               |                 | alveolar (x-ray) | dorso-
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th>velar (x-ray)</th>
</tr>
</thead>
<tbody>
<tr>
<td>stop (arrow)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fricative (arrow)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nasal (arrow)</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Again, each square should be large enough to accommodate an object picture card. The students are supplied with lotto boards and with object picture cards representing Navajo words beginning in stops, fricatives, and nasals. Their task, as before, is to place object pictures in the correct squares. For example, an object picture representing /mósí/ would be placed in the lower left-hand square (at the intersection of the row representing the nasal manner of articulation and the column representing the bilabial position of articulation); an object picture representing /gah/ would be placed in the upper right-hand square (at the intersection of the row representing the stop manner and the column representing the dorso-velar position); and so on.

The lotto board has twelve squares, each representing a theoretically possible combination of position and manner features. We have seen already that the fricative manner does not combine with the bilabial position in Navajo, hence the "zero" in that square—if the game is played correctly, no object picture card will be placed there. It will also be noticed, as the game
is played, that no object picture cards will be placed in the
two right-most squares in the bottom row--this is because, in
Navajo, the nasal manner does not combine with the lamino-alveolar
and dorso-velar positions of articulation. These are both logic-
ally and physically possible sounds, however, and the students
might be encouraged to try to make them--if they succeed in doing
so, they are clearly in command of the principles involved. It
can be pointed out to them that these missing sounds actually
exist in other languages -- the sound represented ny in English
canyon (or ñ in the original Spanish source, cañón) is a lamino-
alveolar nasal, and the sound represented ng in English sing and
song is a dorso-velar nasal. The latter sound, written /ŋ/ in
phonetic notation, is also common as an initial in the Hopi lan-
guage -- e.g., in such words as /ŋahi/ 'medicine', and /ŋimni/
'masa'.
1.5. Laterals.

The fricative consonants so far considered involve a median passage of the airstream--i.e., over the top of the tongue. Thus, for example, when one produces a prolonged s-sound -- ssssssss -- one notices that the airstream passes directly over the blade of the tongue; it is possible to feel the air strike the lower teeth and lower lip directly in front of the tongue-tip. But there is another kind of fricative which involves a different routing of the airstream. Consider the initial consonant of the word /ʃʃ'/. When this sound is prolonged -- ʃʃʃʃʃʃ -- the tip of the tongue is pressed against the alveolar ridge and the airstream passes around the sides of the tongue. This sort of fricative is called a lateral. In introducing this to students, a number of object pictures can be produced to contrast word-initial median and lateral fricatives:

<table>
<thead>
<tr>
<th>median</th>
<th>lateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>ʃɔ'</td>
<td>ʃʃ'</td>
</tr>
<tr>
<td>sis</td>
<td>ʃid</td>
</tr>
<tr>
<td>sees</td>
<td>ʃóó'</td>
</tr>
<tr>
<td>sid</td>
<td>ʃóód</td>
</tr>
<tr>
<td>sindáo</td>
<td>ʃoh</td>
</tr>
<tr>
<td>sánii</td>
<td>ʃéécháa'ʃ</td>
</tr>
</tbody>
</table>

The students can be encouraged to suggest an x-ray representation of the lateral manner of articulation -- e.g., an arrow which first bifurcates and then merges, indicating passage of the airstream around the sides of the tongue. Incorporated into the x-ray picture, the arrow might appear as follows:
But it may also be abstracted away from the x-ray picture to represent the lateral manner by itself:

Finally, the pictorial representations of the lateral manner can be incorporated into the activities described in the foregoing sections, and an appropriate terminology can be suggested for referring to laterals.

If the lateral manner of articulation is incorporated into the lotto board designed on the model of a phonetic chart, and if a lotto game is played as described earlier, it will be noticed that no object picture card will be placed at the intersections of the row representing the lateral manner and the columns representing the bilabial and dorso-velar positions of articulation. This is because the lateral manner does not combine with the bilabial and dorso-velar positions. There may, however, be some discussion among the students about whether the lateral fricative /ʃ/ is in apico-alveolar or lamino-alveolar position. In fact, speakers of Navajo differ in this regard -- for some it is apico-alveolar, for others it is lamino-alveolar.

Since the lateral manner involves allowing the airstream to pass around the sides of the tongue, it is obvious why there
is no bilabial lateral -- the tongue is not involved in producing bilabials, only the lips are involved. But a dorso-velar lateral is theoretically and physically possible; however only a few languages of the world have been reported to have dorso-velar laterals -- although they are relatively frequent in languages of New Guinea. The students might be encouraged to attempt to produce a dorso-velar lateral, to test their understanding of the principles involved.

1.6. Release features.

Up to this point in our discussion of stop consonants we have merely pointed out that they involve a complete interruption of the airstream at some position of articulation. Thus, when one prepares to say /gad/ or /k'ad/, the airstream is completely shut off at the dorso-velar position of articulation. The initial consonants in these two words are identical in this respect. They are both dorso-velar stops. However, the two sounds are not really the same; they differ in the way they are released. Thus, there is more to be said about a stop consonant than that it is produced at a particular position of articulation. One must also be aware of the manner in which the stop is released. A good pair of words to begin with is

\begin{align*}
g & \text{ish} \\
k' & \text{ish}
\end{align*}

because they differ only in the way the initial dorso-velar stop is released. The initial of the first word has what we might call a plain release, but the second is characterized by a rather loud snapping or popping sound. Sounds of this second type are called glottalized and are described briefly in Part II (and in more detail in Hale and Honie, Introduction). For initial teaching purposes, it is sufficient to refer to the difference in terms of the acoustic impression -- a plain release in the first case and a snapping or popping release in the second (see also the terminology suggested in the Becenti-Chee article).
Glottalization, and its attendant snap-like sound, combines not only with the dorso-velar position of articulation, but with apico-alveolar and lamino-alveolar positions as well. The following words may be used to illustrate the difference between plain and glottalized manners of articulation in word-initial stops:

<table>
<thead>
<tr>
<th>plain</th>
<th>glottalized</th>
</tr>
</thead>
<tbody>
<tr>
<td>dógó</td>
<td>t'óó</td>
</tr>
<tr>
<td>dághá</td>
<td>t'ágáji</td>
</tr>
<tr>
<td>dáádílkał</td>
<td>t'áádíl'í</td>
</tr>
<tr>
<td>diichií</td>
<td>t'iis</td>
</tr>
<tr>
<td>deeshgizh</td>
<td>t'eesh</td>
</tr>
<tr>
<td>jaa'í</td>
<td>ch'aal</td>
</tr>
<tr>
<td>jádí</td>
<td>ch'ah</td>
</tr>
<tr>
<td>jish</td>
<td>ch'il</td>
</tr>
<tr>
<td>jó</td>
<td>ch'ó</td>
</tr>
<tr>
<td>jeeh</td>
<td>ch'geh digháhii</td>
</tr>
<tr>
<td>gad</td>
<td>k'ad</td>
</tr>
<tr>
<td>gah</td>
<td>k'aa'</td>
</tr>
<tr>
<td>gish</td>
<td>k'ish</td>
</tr>
<tr>
<td>gágíi</td>
<td>k'aalógií</td>
</tr>
</tbody>
</table>

Many of the above words are appropriate for making object picture cards to be used in games and activities to test the students' ability to classify stop consonants in terms of plain and glottalized release. Some, however, cannot be represented easily in a picture but are nonetheless useful in illustrating minimal contrasts. For example, each of the following sets of words constitutes a minimal pair with respect to the contrast between plain and glottalized stops:

<table>
<thead>
<tr>
<th>apico-alveolar</th>
<th>lamino-alveolar</th>
<th>dorso-velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>dógó</td>
<td>jó</td>
<td>gad</td>
</tr>
<tr>
<td>t'óó</td>
<td>ch'ó</td>
<td>k'ad</td>
</tr>
<tr>
<td>gish</td>
<td>k'ish</td>
<td>k'ish</td>
</tr>
</tbody>
</table>

These pairs can be used to focus the students' attention upon the contrast and to illustrate the fact that the contrast is made in three positions of articulation.
Before suggesting a pictorial representation of these manners of articulation, I will first discuss another distinction which Navajo makes in its stop consonants. Consider the initial consonant of /tó/, and compare it with the initial consonant of /dóó/. Notice that they are both apico-alveolar, but they are nevertheless different. They differ in the way they are released. The initial of /dóó/ has a plain release, but the initial of /tó/ has what is known as an aspirated release (see discussion in Part II and in Hale and Honie Introduction). The aspirated release associated with the initial of /tó/ consists of a puff of breath which can be felt when the fingers are held close in front of the mouth as the word is pronounced. This puff of breath is absent, or at least greatly reduced, in the case of the plain release associated with the initial stop of /dóó/. The aspirated release of the initial consonant of /tó/ is also distinct from the glottalization associated with the initial of /t'óó/. Thus, while each of the words

\[
\begin{align*}
dóó \\
tó \\
t'óó
\end{align*}
\]

begins in an apico-alveolar stop, the manner in which the stop is released is different in each case.

Like glottalization, with its associated snap-like sound, aspiration, with its characteristic puff of breath, combines with the stop manner at three positions of articulation—apico-alveolar, lamino-alveolar, and dorso-velar—as illustrated by the initial consonants in the following words:

<table>
<thead>
<tr>
<th>apico-alveolar</th>
<th>lamino-alveolar</th>
<th>dorso-velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>tó</td>
<td>chizh</td>
<td>ké</td>
</tr>
<tr>
<td>télíí</td>
<td>chin</td>
<td>kin</td>
</tr>
<tr>
<td>táá'</td>
<td>chaha'oh</td>
<td>kq'</td>
</tr>
<tr>
<td>tééh</td>
<td>chaa'</td>
<td>kéyah</td>
</tr>
<tr>
<td>taaskaal</td>
<td>chá'ol</td>
<td>kóyaa</td>
</tr>
<tr>
<td>tázhií</td>
<td>chidi</td>
<td>kodi</td>
</tr>
<tr>
<td>teel</td>
<td>cháshk'eh</td>
<td>kóó</td>
</tr>
<tr>
<td>tin</td>
<td>chéch'il</td>
<td>cho</td>
</tr>
<tr>
<td>tooh</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
It is not particularly easy to find minimal pairs to contrast plain and aspirated stops in Navajo. One such pair is dééh t'één.

But the distinction can be illustrated by comparing the initial consonants of the following words:

<table>
<thead>
<tr>
<th>plain</th>
<th>aspirated</th>
</tr>
</thead>
<tbody>
<tr>
<td>dóó</td>
<td>tó</td>
</tr>
<tr>
<td>doo</td>
<td>tooh</td>
</tr>
<tr>
<td>dáádílkāi</td>
<td>táá'</td>
</tr>
<tr>
<td>diz</td>
<td>tin</td>
</tr>
<tr>
<td>jish</td>
<td>chzh</td>
</tr>
<tr>
<td>jaa'í</td>
<td>chaa'</td>
</tr>
<tr>
<td>jádí</td>
<td>chá'oí</td>
</tr>
<tr>
<td>jooí</td>
<td>choo'í</td>
</tr>
<tr>
<td>gah</td>
<td>kanaagháií</td>
</tr>
</tbody>
</table>

It is possible to create somewhat artificial minimal pairs by isolating the stem portion of certain verb forms and pronouncing them separate from the prefixes which normally accompany them. Thus, for example, the stems of /sígan/ and /líkan/, spoken in isolation, constitute a minimal pair:

gan
kan.

The ability to pronounce artificial and semi-artificial forms of this type is a good one to cultivate in students, since it will be extremely useful as their study of linguistic form continues. The verb stem, although it is not normally spoken in isolation, can be pronounced without its prefixes to provide a large number of minimal pairs—not only for the plain/aspirated contrast, but for the plain/glottalized and aspirated/glottalized contrasts as well:
plain
(ndoool)das
(yish)dee1
(didool)doo1
(deesh)jah
(deesh)jih
(si)gan
(li)gai
(naal)geed

aspirated
(yiidoohl)tas
(naash)tee1
(nihidoohl)tqool
(deesh)chaah
(yideesh)chih
(li)kan
(naal)kai
(dil)keed

plain
(deesh)dah
(nas)dis
(deesh)jah
(yidoon)jih
(doo)gaal
(yideesh)gah
(yiiz)gis

aspirated
(dideesh)tah
(k'ideesh)tih
(ninahal)tffh
(dineesh)chaal
(hidish)cheeh
(haidoo)kaal
(seel)kah

glottalized
(deesh)t'ah
(nas)t'is
(dideesh)ch'ah
(didoon)ch'ih
(yidoon)k'aal
(dineeesh)k'ah
(yiis)k'is

glottalized
(deesh)t'ah
(k'ideesh)t'ih
(nain)i)t'ffh
(deesh)chaal
(dilish)ch'eeeh
(yidoon)k'aal
(nel)k'ah

It is also possible, of course, to use forms which are entirely artificial -- i.e., nonsense syllables conforming to the Navajo patterns of syllable structure-- to illustrate phonological contrasts. For example, one could make up syllables like /gih, kih, k'ih/ and use them to test the students' ability to classify stop consonants according to release features. The teacher might pro-
nounce /k'ih/ and ask students to point to an object picture representing a word whose initial consonant shares the same manners of articulation as that of the artificial form, among pictures of /kin/, /k'ish/, and /gish/, for example.

As these features are introduced to the students, an effort should be made to develop an appropriate terminology and to use it often in the course of the activities employed to teach the contrasts involved. (See the Becenti-Chee article for suggested terms.)

I will turn now to the problem of devising a pictorial representation of the release features. Any graphic representation will be somewhat abstract, and it may take some time to teach students to relate a graphic symbol to actual features. It is perhaps easiest to suggest a representation for the aspiration feature. Since this involves a puff of breath, not unlike a gust of wind, it seems reasonable to represent it graphically as such—in whatever way the students might agree is appropriate for a blast of air coming out of the mouth. For example, aspiration might be represented by a picture such as the following:

![Diagram of aspiration]

I have found that the best technique for teaching a young child to associate this picture with the aspiration feature is to prepare another picture, identical to the above but without the
symbol representing the puff of breath:

The two pictures are placed before the child and he or she is given a deck of object picture cards representing words beginning in aspirated and unaspirated, or plain, stops. The child's task is to classify the object pictures according to whether or not the initial consonant, when released, is accompanied by a puff of breath. Some care must be taken to ensure that the child pays attention to the release of the consonant rather than its position of articulation. In this, it is helpful if the child can be taught to isolate the initial syllable of the word being tested and concentrate on the way in which the initial stop is released. The question the child must answer is whether or not there is a sufficiently energetic puff of breath to warrent associating the object picture card with the x-ray picture which has the puff of breath coming out of the mouth. The teacher can make the contrast vivid in various ways. For example, a lighted match can be held in front of the mouth while the words /tô/ and /dôô/ are pronounced—when /tô/ is pronounced, the flame is blown vigorously, and may even go out; but when /dôô/ is pronounced, the flame is only gently blown. It should be mentioned, of course, that there is a mild puff of breath associated with /dôô/ as well, since the production of any syllable involves an
outward moving airstream; but the puff of breath is much stronger in the case of /tʃ/, as with any syllable beginning in an aspirated stop. The child must learn to distinguish the energetic puff corresponding to aspiration from the more gentle puff associated with unaspirated sounds.

It is somewhat more difficult to suggest a pictorial representation for the glottalization feature. Although the physical mechanisms and gestures associated with glottalization are reasonably well known (see the informal description in Hale and Honie, Introduction), they involve a rather complex sequencing of events not easily depicted in a simple picture. It seems to me more reasonable to represent glottalization by means of a symbol related to its most noticeable acoustic feature—i.e., the snapping or popping sound, like the sound made by a stick being broken. I suggest therefore, that it be symbolized as a picture of a stick breaking, though the students being taught to symbolize the feature might be able to offer a more convincing representation, and should be encouraged to do so:

This representation, like that for aspiration, can be introduced to the students by contrasting it with the plain x-ray profile used to symbolize the plain release and by having them associate object picture cards representing words with plain and glottalized initial stops with the appropriate x-ray picture.
Once the students are able to associate the pictorial representation of a release feature with the corresponding feature on an actual stop consonant, the graphic representation of the release features can be made somewhat more abstract, by separating it from the profile itself—using merely

```
  \                     
  |                     |
```

to represent aspiration, and

```
  \                     
  |                     |
```

to represent glottalization. This leaves the plain release unsymbolized, of course, but this circumstance can be used to introduce an entirely abstract symbol—say a vertical oval (referred to, perhaps, as /ayəzhiː/ 'an egg', at first, then later as /ədɪn/ 'absent')

```
  \                     
  |                     |
```

—to represent the absence of a special release feature, in conformity with the traditional value (null) of this symbol—i.e., zero symbol.

With these symbols, a lotto board of the following design can be made:
<table>
<thead>
<tr>
<th></th>
<th>bilabial (x-ray)</th>
<th>apico-alveolar (x-ray)</th>
<th>lamino-alveolar (x-ray)</th>
<th>dorso-velar (x-ray)</th>
</tr>
</thead>
<tbody>
<tr>
<td>plain (oval)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>aspirated (puff)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>glottalized (breaking stick)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In playing a game with this board, the student is supplied with object picture cards representing words beginning in stop consonants. The player's task, as before, is to place each object picture in the proper square. In doing so, the player must determine not only the position of articulation of the initial consonant but the manner in which the stop is released as well. The first determines the column in which the picture will be placed, while the second determines the appropriate row. Thus, for example, an object picture representing /gah/ will be placed in the upper right-hand corner -- i.e., at the intersection of the column for dorso-velar and the row for plain release; but an object picture representing /ch'ala/ will be placed in the third square in the bottom row -- i.e., at the intersection of the lamino-alveolar column and the glottalization row.

If the game is played without error, it will be the case that no object picture card will be placed in the first square of the
middle and bottom rows. The reason for this is that Navajo
does not combine the aspiration and glottalization features with
stop in the bilabial position of articulation. The single bilabial
stop of Navajo (i.e. the initial of /bááh/, /bésó/) has the plain
release. Aspirated and glottalized bilabial stops are theoreti-
cally and physically possible, and the students should be encour-
aged to attempt to produce them. The sound symbolized /p/ in
English is an aspirated bilabial stop -- as in pot, pan, pine --
except when preceded by /s/, in which case it is unaspirated,
like Navajo /b/. In the Tanoan languages (e.g., Jemez, Taos, and
Tewa) there is a glottalized bilabial stop, symbolized /p'/, as
in the Jemez words /p'e/ 'mountain', /p'í't'o/ 'five', and /p'óó/
'path, road'.

Other games and activities
In addition to the basically classificatory activities de-
scribed so far in relation to the release features, it is possible
to modify certain games introduced in section 1.1 above for use
in exercising and reinforcing the students' understanding not only
of the release manner features and, more important, their grasp
of the concept that the sounds of a language can be thought of
as being made up of logically independent phonological features.
For example, the racetrack format can be adapted to this more
abstract conception of linguistic sounds by devoting each square
on the track to a separate position or manner feature. As before,
each player is supplied with a deck of object picture cards (repre-
senting consonant-initial words) and a token to move along the
track. At the starting signal, the player turns over the top
object picture and determines what phonological features are
associated with the initial consonant of the word represented in
the picture; the player then moves the token to the first square
along the track which contains one of the features of the initial
c consonant. The player repeats this procedure with the rest of
the object picture cards until the end of the track is reached -- the first
to reach the end is the winner.

In another version of racetrack (a version which is also
appropriate for the earlier stages of the students' study of
phonological features), each player is supplied with a deck of
object picture cards which is compiled ahead of time in such a
way as to ensure that all the phonological features appearing on the track occur at least once in the player's deck. At the starting signal, each player turns the top card up and determines whether or not the first feature symbolized on the racetrack is present in the initial consonant of the word represented by the object picture. If so, the player can move the token to the first square;

if not, the player continues to turn over object picture cards until a move is possible. All moves are done in this way, until one of the players is able to reach the end of the track -- that player is the winner.

It will be noticed, when this game is played, that there is room for argument in certain instances as to whether a move is possible. This is all to the good, since it gives the students an opportunity to voice their opinion about the relationships between phonological features and actual linguistic sounds. Consider the following situation, for example. A player turns over an object picture card representing /cha'a',/ and the next square on the race track contains the symbol representing the fricative manner of articulation -- e.g., an unimpeded arrow, representing the fact that the airstream is not interrupted but allowed to pass out through a narrow constriction. The question is whether the player is justified in moving to that square. That is to say, does the initial consonant of /cha'a'/ exhibit the fricative manner of articulation? Heretofore, of course, we have classified /ch/ as a stop, since as we have seen, when one prepares to pronounce a word like /cha'a',/ the airstream is in fact completely interrupted at the lamino-alveolar position of articulation. But the player might argue that /ch/ is also a fricative, because although it starts out as a complete closure, when the closure is released, there is a sound which, like a fricative, can be prolonged -- a sound identical to the fricative represented /sh'/. This is a good observation. In fact, the sound represented /ch/ in the Navajo writing system is complex -- it begins as a stop, but when the stop is released, it continues momentarily as a fricative, until the blade of the tongue is completely withdrawn from the alveolar ridge. Thus, Navajo /ch/ could,
in theory, be represented as a sequence consisting of a stop, say /t/, followed by the fricative /sh/ -- in fact, the linguist Herbert Landar (cf. his *Navajo Syntax*, Supplement No. 57 to the journal *Language*, Vol. 39, 1963) maintains that /ch/ is indeed a sequence of stop /t/ plus fricative /ś/ (his symbol for /sh/). Be this as it may, the player who recognizes that /ch/ can be associated both with the stop manner and with the fricative manner is correct. Navajo /ch/ (and the following as well: /j, ch', dz, ts, ts'/) belong to a class of consonants commonly called affricates; affricates are complex sounds which, from an articulatory point of view, consist of a stop followed by a fricative -- Navajo also has a class of lateral affricates (/dl, tl, t'l/), which from an articulatory point of view, consist of a stop followed by a lateral. Notice also that the Navajo writing system recognizes the complex nature of affricates in the case of those which are produced at the apico-alveolar position articulation -- that is to say, the writing system actually represents them as sequences (/ts/, /dz/, /dl/, and so on); it is partly for reasons of practicality -- e.g., a desire to avoid trigraphs -- that /ch/ and /j/ are not also represented as sequences (say /tsh/ for /ch/, and /dzh/ for /j/).

The card-game format can also be modified in a variety of ways to enable students to practice their understanding of the feature composition of linguistic sounds. One conceivable card game is constructed along the following lines. A number of cards are prepared for each of the features belonging to the general classes of phonological features so far introduced:

<table>
<thead>
<tr>
<th>Position of Articulation Features</th>
<th>Major Manner Features</th>
<th>Release Manner Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>bilabial</td>
<td>stop</td>
<td>plain</td>
</tr>
<tr>
<td>apico-alveolar</td>
<td>nasal</td>
<td>aspirated</td>
</tr>
<tr>
<td>lamino-alveolar</td>
<td>fricative</td>
<td>glottalized</td>
</tr>
<tr>
<td>dorso-velar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
If five cards are prepared for each feature, this will give a deck of fifty. To play the game, the deck is shuffled and each player is dealt five cards, face down. The remainder of the deck is placed face down in the center of the playing area. The object of the game is to have the best hand, where the "best hand" is defined in terms of combinations of phonological features -- if a player's hand contains cards which can be combined in a way which corresponds to the feature composition of an actual consonant, that is a good hand. If two actual consonants can be created, that is better still. But if the player's hand contains cards which cannot combine in a way which corresponds to the feature composition of an actual consonant, the hand is bad. The player might, however, be allowed one chance to improve his hand by discarding one or more cards and drawing new ones from the central deck. A hand which enables the player use all five cards in feature combinations is preferred over a hand which allows only a part of the total to combine. Thus, the hand containing

(1) apico-alveolar
(2) stop
(3) glottalized
(4) bilabial
(5) nasal

allows the player to use all five cards in constructing feature combinations corresponding to two actual sounds:

\[
\begin{array}{ll}
/t/ & \text{/m/} \\
apico-alveolar & \text{bilabial} \\
stop & \text{nasal} \\
glottalized & \\
\end{array}
\]

Therefore, this hand wins over one which contains, say

(1) apico-alveolar
(2) fricative
(3) dorso-
(4) nasal
(5) bilabial

because the latter hand, while it allows two combinations, can-
not use all the cards in the hand. Any combination will leave one of the cards uncombined.

There are many ways in which this format can be varied—in fact, quite elaborate card games can be constructed. This format also provides an excellent opportunity for students to engage in imaginative experimentation. For example, the rules of the game might be defined in such a way as to allow a player to use feature combinations—e.g. a glottalized bilabial, an aspirated nasal—which do not correspond to actual sounds of Navajo, or English, provided he can actually produce such sounds when challenged to do so by another player. Obviously, this is a reasonable way to give students an understanding of the manner in which certain sounds of English, or of any other second language, differ from certain sounds of Navajo. The contrastive and comparative use of x-ray and other phonological feature cards can be increased as the students acquire the second language, and the games can be modified to accommodate the second language as well as the students' native language.

1.7. Voicing.

Navajo fricatives are produced by holding the tip, blade, or back of the tongue against the alveolar ridge or soft palate in such a way as to allow the outward moving airstream to squeeze through a narrow passage—this mode of articulation is termed the fricative manner, as we have seen. But not all fricatives are alike in Navajo. The initial fricative of /zas/ and the initial fricative of /saad/ are both produced by forcing the airstream through a narrow constriction in the apico-alveolar position of articulation. However, there is a clear distinction between these two initials—the initial of /zas/ is a voiced fricative, while that of /saad/ is a voiceless fricative. The manner feature of voicing (described briefly in Part II and in Hale and Honie, Introduction) is related to the action of the muscle and ligament system located in the larynx—the system commonly called the vocal bands, or vocal cords, whose location is shown in the following picture:
The vocal cords are ligaments which are joined together in front (at the Adam's apple) and connected to cartilages (called the arytenoids) at the back. The arytenoids are capable of moving apart or moving together. When they move apart, they cause the vocal cords to spread apart also, as in the following schematic drawing.
But when the arytenoids are pressed together, this causes the vocal cords to press together as well:

![vocal cords](image)

When the vocal cords are together in this way, the trachea, or "windpipe" (which conducts air out from the lungs) is completely shut off, preventing the air from passing through the larynx and into the oral cavity. However, it is possible to hold the vocal cords loosely together so that when air pressure builds up underneath the larynx it can force its way through the vocal cords in short bursts, thereby setting the vocal cords in vibration. It is this vibration of the vocal cords which we refer to as voicing. When Navajo /z/ is produced, the vocal cords are held in such a way as to vibrate, as described above--/z/ is therefore a voiced fricative.

When the vocal cords are held apart, the airstream is allowed to pass through the larynx without hindrance--and without causing the vocal cords to vibrate. This is what happens when the Navajo fricative /s/ is produced--the vocal cords are held open, and therefore do not vibrate; so /s/ is a voiceless fricative.

The contrast between voiced /z/ and voiceless /s/ can be made vivid in the following way. If a prolonged z-sound is produced--zzzzzzz--the associated vibration can be felt by placing the hand on the throat; and it can be detected even more clearly if the hands are held over the ears. By contrast, when a prolonged s-sound is produced, no vibration can be felt. The contrast between voiced and voiceless in fricatives is not limited to the apico-alveolar position of articulation--the contrast is also made at lamino-alveolar position (/zh/ is voiced, while /sh/ is voiceless) and at dorso-velar position (/gh/ is voiced, while /h/ is voiceless). And the distinction between /l/ and /ɬ/ among Navajo laterals is also one of voicing--/l/ is voiced, while /ɬ/
is voiceless.

In x-ray profiles, phoneticians often represent voicing by means of the symbol \( \sim \sim \sim \sim \) (for vibration) drawn in the region of the larynx, as follows (for /z/)

![Diagram of voicing with vibration symbol]

By contrast, we might represent the absence of voicing by drawing the vocal cords in their open, or spread position. Thus, the profile for the voiceless fricative /s/ might be drawn as follows:

![Diagram of voicelessness with spread vocal cords]

And the pictorial representation can be made more abstract by separating out the portion depicting the larynx, to represent the presence or absence of voicing by itself:

- Voicing: \( \sim \sim \sim \sim \) (vibrating vocal cords)
- Voicelessness: (spread vocal cords)
Students can be tested in their ability to associate these pictorial representations with actual sounds by being asked to classify object pictures representing words beginning in voiced and voiceless fricatives and laterals:

<table>
<thead>
<tr>
<th>Voiced</th>
<th>Voiceless</th>
</tr>
</thead>
<tbody>
<tr>
<td>zas</td>
<td>sọ'</td>
</tr>
<tr>
<td>zahalání</td>
<td>sánii</td>
</tr>
<tr>
<td>zéédéét'i'i</td>
<td>séí</td>
</tr>
<tr>
<td>gháá'ask'idii</td>
<td>hastiin</td>
</tr>
<tr>
<td>lájish</td>
<td>习近平新</td>
</tr>
<tr>
<td>látsíni</td>
<td>习近平新</td>
</tr>
<tr>
<td>lók'aa'</td>
<td>习近平新</td>
</tr>
</tbody>
</table>

And the symbols for **voiced** and **voiceless** can be incorporated into the games described earlier.

The presence or absence of voicing is contrastive in Navajo fricatives. That is to say, there are two different fricatives in each position of articulation, a voiced one and a voiceless one.

<table>
<thead>
<tr>
<th>Apico-Alveolar</th>
<th>Lamino-Alveolar</th>
<th>Dorso-Velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voiced</td>
<td>z</td>
<td>zh</td>
</tr>
<tr>
<td>Voiceless</td>
<td>s</td>
<td>sh</td>
</tr>
</tbody>
</table>

Voicing is also contrastive in the laterals--/l/ is voiced, while /ɾ/ is voiceless--although both are produced in the same position of articulation.

However, voicing is not contrastive in Navajo stops--all stops in Navajo are voiceless. There are no opposing pairs on the basis of voicing--instead, Navajo has opposing triplets on the basis of the release features plain, aspirated, and glottalized. Nor is voicing contrastive in Navajo nasals--all nasals are voiced, as can be readily seen by testing for the vibration
while producing a prolonged /m/ or /n/: mmmm; nnnnn.
Vowels are also voiced, by the same test: aaaaa; eeeee; iiii; ooooo.

It is physically possible to produce voiceless nasals and vowels, and the students should be encouraged to try producing them—when one whispers, the nasals and vowels are voiceless, since whispering is achieved by leaving the vocal cords spread apart.

1.8. The glottal stop.

If one takes a deep breath and prepares to say the word /éé'/, and if one hesitates momentarily before actually saying the word, it will be noticed that the breath is trapped in the lungs and prevented from escaping out through the oral cavity. The reason for this is that the vocal cords are held tightly together so that no air can pass between them. This is exactly what happens when one holds one's breath; and it is also what happens when one produces a glottal stop. The glottal stop functions in Navajo like a true consonant—all words which are written in the current orthography as if they began in a vowel actually begin in a glottal stop:

\[ \begin{align*}
\text{abani} \\
\text{aghááí} \\
\text{ashkii} \\
\text{éétsoh} \\
\text{ilkááh} \\
\text{ix} \\
\text{ood} \\
\text{ólá}
\end{align*} \]

The glottal stop also occurs medially and finally—there it is represented by means of the apostrophe /', the same symbol that is used to represent the glottalization feature in stop consonants. The word /éé'/ has both an initial and a final glottal stop; a medial glottal stop appears in the word /chaha'oh/.

Whether the glottal stop is initial, medial, or final, it is produced in the same way—i.e., by bringing the vocal cords tightly together and thereby momentarily preventing the air from passing through the larynx (or, more accurately, the glottis, which is the
name given to the space between the vocal cords; it is from the word *glottis* that the term glottal stop is derived).

The glottal stop might be pictured as follows in an x-ray profile:

![Diagram of vocal cords](image)

The straight line in the larynx is meant to represent the vocal cords held tightly together.

Now that the larynx and the vocal cords have been brought into the discussion, and into the pictorial representations, it is possible to introduce students to a more sophisticated understanding of the production of glottalized stops. Glottalized stops are made by forming two closures—one in the oral cavity, at some position of articulation (this is the stop component); and the other at the larynx, by holding the vocal cords tightly together. The characteristic snapping sound is produced by means of a rather complicated gesture. First, the air trapped between the larynx and the closure in the oral cavity is compressed (by forcing the larynx upward); secondly, the closure in the oral cavity is released—that is what produces the snap-like sound (for a pictorial representation of this sequence of events, see Hale and Honie, *Introduction*). One can see from this a
part of the rationale behind the conventional representation of glottalized stops—i.e., an oral stop symbol accompanied by a glottal stop: /t', ch', k'/. Once this is understood by the student, a more realistic and accurate pictorial representation of glottalized stops can be used—e.g., the glottalized stop /t'/ can be represented as an x-ray picture depicting apico-alveolar stop combined with the picture of the larynx in which the vocal cords are closed; plain and aspirated stops differ from this in that the vocal cords are open.

1.9. Complex stops.

In section 1.6 above it was pointed out that certain Navajo consonants partake of both the stop manner of articulation and the fricative manner of articulation—these are the affricates, of which there are two sorts: those in which the fricative component is median, and those in which the fricative component is a lateral. In both classes, there are plain, aspirated and glottalized varieties:

<table>
<thead>
<tr>
<th>apico-alveolar</th>
<th>median affricates</th>
<th>lamino-alveolar</th>
</tr>
</thead>
<tbody>
<tr>
<td>plain</td>
<td>dz</td>
<td>j</td>
</tr>
<tr>
<td>aspirated</td>
<td>ts</td>
<td>ch</td>
</tr>
<tr>
<td>glottalized</td>
<td>ts'</td>
<td>ch'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>lateral affricates</th>
</tr>
</thead>
<tbody>
<tr>
<td>plain</td>
</tr>
<tr>
<td>aspirated</td>
</tr>
<tr>
<td>glottalized</td>
</tr>
</tbody>
</table>

As we mentioned above, the consonants are, from an articulatory point of view, sequences consisting of a stop articulation followed by a fricative articulation. This fact might be taken advantage of in playing the card game described at the end of section 1.6. Suppose, for example, a player receives a hand with the following cards in it:
(1) apico-alveolar
(2) stop
(3) fricative
(4) glottalized
(5) aspirated

The point of the game, recall, is to combine as many cards is possible in ways which correspond to feature combinations in actual linguistic sounds. Let us assume further that the value of a hand is determined by the cards which enter into combinations—for example, any card which enters into a combination is worth two points (represented, say, by beans or tokens of some sort), while a card which cannot be worked into a combination counts as a minus credit of one point. (This format is a useful way to integrate elementary arithmetic exercises into the game, incidentally). So what is the value of the above hand? How many of the cards can be worked into some combination? One possibility is the following:

apico-alveolar
stop
glottalized
totaling six credits. But the cards representing fricative and aspirated are uncombined; therefore two credits must be subtracted, leaving a score of four for the hand. Another possibility is

apico-alveolar
stop
aspirated

with fricative and glottalized uncombined. This gives the same score.

Suppose, however, we allow a sequential combination of the stop and fricative features, to represent an affricate. This would allow us to combine the cards as follows:
apico-alveolar
stop, fricative
glottalized

or as follows:
apico-alveolar
stop, fricative
aspirated.

The first of these corresponds to the glottalized affricate
/ts'/, and the second corresponds to the aspirated affricate
-ts/. In either case only one card is left uncombined—so the
value of the hand is eight (for the four combined features) minus
one (for the single uncombined card), that is, seven for the hand
as a whole. This is one of the many ways in which the card game
can be made more sophisticated so as to use a variety of skills
which the students are acquiring as their schooling progresses—
not only linguistic skills, but observational and arithmetical
skills as well.

There is another sort of complex stop in Navajo which should
be mentioned at this point. Consider the difference between the
following two words:

bitse'   'his stone'
btsx'e'   'he is strong'

In the first of these, the stem -/tse'/ begins in an apico-alveolar
aspirated affricate, but in the second, the stem—i.e., -/tsx'e'/
—begins in the same sort of affricate, but the affricate is
followed by a velar fricative (written/x/). The second word
illustrates a process known as velarization. Velarization sim-
ply means that when the consonant is released, the back of the
tongue is raised to create a constriction in the dorso-velar re-
gion—the degree of constriction is roughly the same as that in-
volved in producing a velar-fricative.

In the speech of many people, the aspirated apico-alveolar
stop is regularly velarized. And for all speakers it is possible
to velarize stops and fricatives optionally for special expressive
effect—as when /sq'/ is pronounced /sxq'/.

In some words, the
velarization of a consonant is an inherent feature—as in /bitsxe'/ and /yíchxq'/.

From an articulatory point of view, a velarized consonant is a sequence consisting of a stop or fricative (usually in apico-alveolar or lamino-alveolar position) followed by a velar fricative—the latter is typically voiced after a plain-release stop or after a voiced fricative, and it is voiceless otherwise.

1.10. Rounding.

Consider the difference in the way the initial velar stops of the following words are released:

<table>
<thead>
<tr>
<th>Word 1</th>
<th>Word 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>kii</td>
<td>kwii</td>
</tr>
<tr>
<td>ké</td>
<td>kwe'é</td>
</tr>
<tr>
<td>kanaaghá</td>
<td>kwa'ásini</td>
</tr>
</tbody>
</table>

In both sets, the initial is an aspirated dorso-velar stop; but there is a difference in terms of the attitude which the lips assume. Using William Morgan's method for drawing attention to consonantal articulations, one notices that while one is preparing to pronounce one of the words in the first column, the lips are in a relaxed position and assume a more or less oval shape:

![Lips in relaxed position]

But when one is preparing to pronounce one of the words in the second column, the lips are somewhat protruded and assume a more rounded shape:

![Lips in rounded position]

The initials in the second column—those represented /kw/ in the Navajo writing system—are called rounded velars, while those in the first column (represented simply /k/) are unrounded.

The feature of rounding can be represented graphically either by means of a picture of the rounded lips, as above, or by means of a symbol representing an object, say a wheel, which is also circular in shape:
I suggest also that a Navajo term for this feature can be based on the form /názbas/—e.g., an appropriate term might be /dáa'názbas/ (possibly streamlined to /dáa'bas/) 'rounded lips.'

The rounding feature in Navajo combines distinctively not only with the aspirated dorso-velar stop, but also with the dorso-velar fricative—so Navajo distinguishes an unrounded /h/, as in /hééí/, from a rounded /hw/, as in /hwéélí/. But rounding is also observed as an automatic feature of consonants preceding the rounded vowel /o/—the /t/ in /tó/, for example, is rounded; but the rounding is caused by the /o/ and is not an inherent feature of the consonant.

1.11. Vowels.

Our focus to this point has been on the articulatory properties of Navajo consonants, primarily because these represent the greatest variety and complexity of articulatory gestures, but also because they are amply represented in absolute initial position in Navajo words and are, therefore, relatively easy to focus attention on. We have so far said nothing about vowels, despite the fact that they constitute the central position in any actual Navajo syllable.

The distinction between vowels and consonants can be characterized in roughly the following way—the production of a consonant involves some degree of obstruction in the speech tract, while
the production of a vowel involves an entirely unobstructed speech tract, permitting the air from the lungs to pass entirely without hindrance through the oral cavity. The Navajo terminology discussed in the Becenti-Chee article (NLR Vol. 1, 1974) expresses the distinction accurately: consonants are designated /zatl'ah/ 'mouth obstruction', and vowels are designated /za'áán/ 'mouth aperture'. That is, with consonants, the mouth is, to some degree or other, obstructed; but with vowels, the mouth is more or less open. This suggests a good way to introduce the concept of vowel articulation to students. Consider what happens when the word /bááh/ is pronounced--the word is begun with the lips closed, but when the word is actually pronounced, the lips are drawn apart quickly and the mouth is opened wide. The sequence of events can be roughly depicted in the following x-ray pictures (leaving details of manner aside for the moment); the first of the pictures represents the bilabial stop /b/, and the second represents the vowel /áá/ (or more generally, the low back vowel /a/): 

```
/b/
```

```
/áá/
```

The initial consonant-vowel sequence of any Navajo word can be represented in this way by means of a sequence of x-ray pictures representing the initial consonant followed by a vowel. In any such representation, the picture corresponding to the consonant will depict some obstruction of the oral cavity (or else a constricted glottis, for words beginning in a glottal stop),
while the picture corresponding to the vowel will depict an open mouth.

While all vowels involve an articulation which might be loosely referred to as an 'open mouth', not all vowels are the same, of course. One way in which vowels differ is in terms of the degree of mouth opening (see Part II and Hale and Honie Introduction for a more detailed discussion). In the case of the vowel of the word /bááh/ (and any Navajo vowel written by means of the symbol /a/ in the traditional orthography), the mouth is opened quite wide--wider than for any other vowel. By contrast the vowel of the word /biil/ is produced with a much narrower opening--the mouth is still 'open', but no where near as much so as for the vowel of /bááh/. The initial consonant-vowel sequence of /biil/ can be roughly depicted in X-ray pictures as follows:

[Diagram showing /b/ and /i/]

The distinction between the open vowel and the 'close' vowel can be made vivid for the students by having them pronounce the two in isolation, one after the other:

/aa/       /ii/
They will notice that when they go from /aa/ to /ii/, the lower jaw rises sharply—thereby causing the oral cavity to become relatively narrow. Conversely, when they go from /ii/ to /aa/, the lower jaw drops, causing the oral cavity to open wide. This movement of the lower jaw, and of the tongue, gives rise to the technical names given to these two different vowel articulations—/ii/ is said to be a high vowel, because when /ii/ is pronounced the lower jaw, and consequently the tongue, is relatively high; and /aa/ is said to be a low vowel, because during its production the jaw, and tongue, are relatively low.

The distinction between high and low vowel articulations is easiest to perceive in long vowels (those written double in the orthography), and the students can be taught to associate these articulations with their x-ray representations by having them isolate the vowel in each of the following words and classify the corresponding object picture in accordance with the relative openness depicted in the x-ray pictures:

<table>
<thead>
<tr>
<th>high vowel</th>
<th>low vowel</th>
</tr>
</thead>
<tbody>
<tr>
<td>bill</td>
<td>bááh</td>
</tr>
<tr>
<td>t'iis</td>
<td>k'aa'</td>
</tr>
<tr>
<td>tl'iish</td>
<td>chaá'</td>
</tr>
<tr>
<td>siil</td>
<td>shaazh</td>
</tr>
<tr>
<td>tsiid</td>
<td>dláá'</td>
</tr>
<tr>
<td>chíih</td>
<td>táá'</td>
</tr>
<tr>
<td>Chíil</td>
<td>yaa'</td>
</tr>
</tbody>
</table>

The same procedure can be used for the corresponding short vowels (and the students might also be taught to represent the difference between long and short graphically—i.e., a single x-ray picture for short, a sequence of two for long, though this detail might be delayed until they are completely familiar with the primary articulatory features of vowels).

The distinction between high and low does not exhaust the contrasts among Navajo vowels. The vowel of the word /éé'/ is commonly called a mid vowel, because the relative degree of mouth opening is mid-way between that of the high vowel /ii/
and that of the low vowel /aa/. This can be detected easily by pronouncing the vowels

/ii/       /ee/       /aa/

in sequence. As one moves from /ii/ to /ee/ and then to /aa/, the jaw drops down in steps—and, correspondingly, the mouth opens wider. The reverse happens when the vowels are pronounced in the opposite order: /aa/, /ee/, /ii/. The mid vowel can also be represented by means of an x-ray picture—with a degree of mouth opening intermediate between that for /aa/ and that for /ii/—and the students can be tested in their ability to associate the x-ray representation with object pictures corresponding to the following words:

béésh
teeł
hééł
leezh
tl'ée'
tl'ée'
ée'
jeelh

A variety of activities can be developed to enable students to learn to associate actual vowels with x-ray representations of the three degrees of vowel height—high, mid, low—introduced at this point. It might be difficult for them to determine the intended vowel height in an isolated x-ray picture, but when the three x-rays are placed side by side, the relative tongue-heights (and associated degrees of mouth opening) can be discriminated, and students can learn to associate actual vowels with them fairly easily.

Navajo distinguishes two mid vowels. The mid vowel already discussed involves roughly the same tongue height, and the same degree of mouth opening, as does the vowel in the following words:
But this vowel of these words is clearly distinct from that written with the symbol /e/. The distinction is clear when the two are produced in isolation:

/ee/ /oo/

Notice that when one moves from /ee/ to /oo/, there is no upward or downward movement of the jaw. The most noticeable difference has to do with the shape of the lips—with /ee/ the lips are relaxed and form a more or less oval opening; but with /oo/ the lips are somewhat protruded and form a more rounded opening. This is exactly the same feature as that discussed in 1.10 above in connection with the distinction between /k/ and /kw/. That is to say, the distinction between /ee/ and /oo/ is partly in terms of lip rounding—/oo/ is a rounded vowel, while /ee/ is an unrounded vowel. An x-ray representation for this was suggested in 1.10.

There is, however, another way in which /ee/ and /oo/ differ. When /ee/ is produced, the tongue is relatively forward in the mouth—it is possible to actually touch the tip of the tongue by sticking the tip of the little finger between the front teeth; but when /oo/ is produced, the tongue is pulled back in the mouth. If one pronounces /ee/ and touches the tip of the tongue at the same time, one can feel the tongue withdraw when one shifts from /ee/ to /oo/.

This relative horizontal positioning of the tongue gives rise to another set of technical terms referring to vowel articulation—/ee/ is said to be a front vowel, while /oo/ is a back vowel. The high vowel /ii/ is also a front vowel; and the low vowel /aa/ is a back vowel. The x-ray representations can
be modified to portray these more exact characterizations of
the four positions of articulation among Navajo vowels.

In each of the four vowel positions, Navajo distinguishes
short /i, e, a, o/ from long /ii, ee, aa, oo/. In addition,
there is a distinction between nasalized and oral (non-nasalized)
vowels--nasalized vowels, like the nasal consonants /m, n/ in-
volve allowing the airstream to pass through the nasal cavity.
The same x-ray portrayal could be used for the nasal manner
associated with vowels as for that associated with the nasal con-
sonants (see also the Becenti-Chee x-ray representations as well
as those in Hale and Honie Introduction). Navajo vowels also
distinguish high and low tone. Since high and low tone corre-
pond in part to relative frequency of vibration of the vocal cords,
high tone might be represented by the symbol

intended to depict a rapid vibration, and low tone might be repre-
sented by the symbol

depicting a slower vibration.

At this point, and earlier as well, certain aspects of the
physical mechanics of speech-sound production could be introduced
to the students and analogies from other sound-producing devices
can be drawn. Some of this is discussed in a very informal way
in the Hale and Honie Introduction, but a great deal more could
could be introduced by adapting material from Peter B. Denes
and Elliot N. Pinson The Speech Chain, Bell Telephone Labora-
tories, 1963.

Before leaving the topic of vowels, I should mention the
class of sounds commonly referred to as semivowels or glides.
These are represented in the Navajo writing system as /y/ and
/w/, and they appear in the words

yaa'
waa'

For our purposes, we can think of the semivowels as being vowels
which function like consonants--e.g., they appear at the very
beginnings of syllables, just the way consonants do; and like
consonants, they are followed by real vowels. They are like
vowels in that they are produced with what we have termed an 'open mouth'. The semivowel /y/ is produced in roughly the same position as the high front vowel /i/. And the semivowel /w/ is produced in much the same position of articulation as the back rounded vowel /o/--but it is higher (i.e., the mouth opening is much narrower); like the vowel /o/, the semi-vowel /w/ is rounded. I suggest that the semivowels be represented in x-ray pictures in the same way as the corresponding vowels are.

There is one additional glide-like sound in Navajo. This is the sound written /h/ at the end of such words as

jeeh
bááh
tooh
chííh
tééh

Like the glottal stop, this is a laryngeal sound--i.e., it is produced in the larynx. Recall that the glottal stop is produced by holding the vocal cords together, momentarily, so as to prevent the breath from passing through the larynx. The laryngeal /h/, not to be confused with the dorso-velar fricative (also written /h/, and sometimes /x/), is produced by spreading the vocal cords apart, thereby allowing the breath to pass through the larynx without hindrance, and without causing the vocal cords to vibrate. The difference between the laryngeal /h/ and the dorso-velar /h/ is this: when the laryngeal /h/ is produced, there is no constriction whatsoever in the oral cavity (it is like a vowel in this respect); but when the dorso-velar /h/ is produced, a constriction is created at the dorso-velar position forcing the airstream to squeeze through a narrow passage at that point. The laryngeal /h/ can be portrayed by an x-ray profile showing an unobstructed oral cavity--as for a vowel--accompanied by an open glottis, i.e., spread vocal cords. By contrast, a vowel would be accompanied by a representation of the vocal cords in vibration.
Games and activities: word building

When students have mastered the material presented to this point, they are in a position to engage in a wide variety of activities which depend upon an understanding of the phonological features of the consonants and vowels of their language. Of great importance is the fact that they are now capable, in principle, of gaining an intimate understanding of the theoretical foundations of one of the most useful of all educational tools—namely, alphabetic writing. The principle underlying alphabetic writing is the relationship between a written symbol and a linguistic sound.
Students who have learned to depict sounds graphically—in terms of their feature composition—are in a position to write down words even before they have learned conventional alphabetic symbols. Assuming that they can associate x-ray pictures with actual linguistic sounds, the students can actually represent—crudely at first, but with increasing accuracy as their skill is exercised—whole words in a form of writing which correlates sounds and symbols. Thus, for example, students have at their command the knowledge required to write down a word like /gad/, or any other Navajo word, as a sequence of pictures representing the articulatory properties associated with the vowels and consonants contained in the word. To exercise this skill, the students might first attempt to represent whole words—monosyllables at first—as sequences of x-ray pictures depicting the positions of articulation corresponding to the beginning, middle, and end. Thus, a word like /gad/ might be represented in this minimal form as the following sequence of x-ray cards:

\[
\begin{align*}
/g/ & \quad /a/ & \quad /d/ \\
\text{dorso-velar} & \quad \text{low-vowel} & \quad \text{apico-alveolar}
\end{align*}
\]

A number of activities can be created to develop the skill of representing whole words as sequences of pictures representing the sounds of which the words are made up. When this skill is firmly established, the students are, in fact, in full possession of the underlying principle of alphabetic writing. The crude representation of words in terms of position features can gradually be embellished to include the total feature composition of each segment—so that the representation of /gad/ begun above would ultimately be elaborated to something like:

\[
\begin{align*}
/g/ & \quad /a/ & \quad /d/ \\
\text{dorso-velar} & \quad \text{low-vowel} & \quad \text{apico-alveolar} \\
\text{stop} & \quad \text{oral} & \quad \text{stop} \\
\text{plain} & \quad \text{low-tone} & \quad \text{plain}
\end{align*}
\]
in which each segment is represented as a stack of phonological features.

Presumably, however, students at this stage will have learned the alphabetic symbols normally used in the conventional writing system. But a knowledge of 'feature writing' will be of enormous benefit to them as well, since they will be able to come to grips with the fact that an alphabetic symbol--such as /g/, or /a/, or /d/--is merely a conventionalized representation of a particular linguistic sound; and a linguistic sound, in a very real sense, is made up of phonological features which correspond to articulatory gestures and states. A number of the games described in the foregoing sections can be modified to accommodate the students' acquisition of strictly alphabetic representations--letters and written words can take the place of object-picture cards, and written versions of the phonological features (e.g., using terms created by the students themselves, or the terms reported in the Beconti-Chees article) can replace the x-ray pictures and other graphic symbols.

Before concluding this section, I should point out that the relationship between 'feature writing' and the important skill of writing in general, and of reading, needs clarification. Feature writing, and an understanding of the sound-symbol relationship which underlies alphabetic writing, deals with only one aspect of the process of becoming literate. A fully literate person reads and writes with great speed--with a speed much greater than could ever be the case if the process made constant reference to the sound-symbol relationship. Although the sound-symbol relationship underlies alphabetic writing, the actual use of writing involves being able to comprehend sequences of alphabetic symbols as units--and this ability comes with practice and repetition. In total, the skill of literacy involves a combination of the alphabetic principle and the instant recognition of entire words, or entire meaningful sequences of alphabetic symbols. Both abilities are necessary, and the material in the foregoing sections should greatly strengthen the first, i.e., it should greatly
strengthen the students' intellectual grasp of the fundamental principle of a writing system which relates alphabetic symbols to linguistic sounds.

Be this as it may, an understanding of the feature composition of linguistic sounds is essential to our primary purpose here--i.e., that of preparing students to confront problems which are of interest in the scientific study of sound systems, as a part of the more general program in which the methods and skills of scientific inquiry are developed.

2. Words and sentences.

I will turn now to a discussion of a number of activities dealing with one of the most important, and most complicated, aspects of Navajo grammar--namely, the internal organization of the Navajo verb word and the behavior of the Navajo verb in the formation of grammatical sentences. While the activities described in sections 1.1 through 1.11 above dealt primarily with phonetics, those to be described here relate both to phonetics (or, more accurately, phonology) and to aspects of grammar which concern the formation of words (morphology) and of sentences (syntax). And while the activities so far described presuppose no knowledge of alphabetic writing on the part of students, the activities discussed below are rather intimately related to the students' developing competence in the use of the written form of their language.

The general format of these activities is similar to, and to some extent inspired by, the "Breakthrough to Literacy" model which formed a part of the United Kingdom Schools Councils Program in Linguistics and English Teaching, particularly as it has been adapted for use in bilingual education programs in Australia (and as reported by C.D. Metcalfe, "Breakthrough to vernacular literacy", in his address to the Bilingual Conference/Workshop, August 20-31, 1973, sponsored by the Australian Department of Education, Northern Territory Branch).
The format involves a "sentence maker"—basically a set of cards on which words and grammatical formatives are written—which is used to give beginning literates experience in the rapid creation and interpretation of sentences in a written representation. Use of the sentence maker allows students to manipulate linguistic forms with speed before they are able to write alphabetic symbols easily, and before they are able quickly to relate written representations to their phonetic values. In addition, the sentence maker format can be most effective in revealing the operation of grammatical rules, and can thereby help to lay the necessary foundation for the scientific study of language. Although this latter consideration is a primary one in the context of the present discussion, I will also devote a considerable amount of attention to the use of the sentence-maker format in developing and reinforcing basic literacy skills in Navajo.

The standard Navajo orthography is ideal for teaching the principle which underlies alphabetic writing, since it involves a consistent correspondence between sound and symbol. This makes it possible, in principle, for a student to learn to write words down without errors in a short period of time. There should, for Navajo, never be a "spelling problem" as there is for English, since once the alphabetic principle is learned and all the sound-symbol correspondences are mastered, a person should in theory be able to write down any word which he can pronounce; and he should be able to pronounce any word he sees written. And this proves to be true, in general, whenever there is a proper fit between the sound pattern of a language and the orthography used to write it. But this is not all that is involved in becoming fluent in the written form of a language, by any means. A fluent reader does not, in fact, make constant use of the alphabetic principle in reading, or even in writing, except perhaps when confronted with a new word—instead, a fluent reader instantly recognizes words and morpheme sequences as units, almost as if they were unanalyzable symbols. He is able to do this because of repeated practice in recognizing highly frequent words and mor-
pheme sequences. There is an analogy in simple arithmetic
--while an accountant understands the principles of addition
and multiplying any two numbers, it is most unlikely that an account-
ant would employ these principles and procedures in multiplying,
say, the number 9 by the number 3--instead, he simply knows that
3 \times 9 is 27; he has memorized it, either through repeated prac-
tice or by virtue of having, at some point, learned by rote the
multiplication tables from 1 \times 1 through 100 \times 100. Similarly,
the fluent reader, though he is in command of the alphabetic
principle, almost certainly does not use it directly in reading
highly frequent words and morpheme sequences--rather, he has
memorized, through practice, how they are pronounced. This is
what permits him to read with great speed; the same is true in
the case of fluent writing as well.

From this it follows that an effective literacy program
should not be limited to a phonics approach--even for a language
like Navajo in which the orthography is "phonetic". Rather, it
should, for any alphabetically written language, be a combina-
tion of the phonics approach and the sight-word approach. Both
the alphabetic principle and the instant recognition of experi-
enced vocabulary are essential in the fluent use of the written
form of the language.

If this is granted, and assuming that there exists an effec-
tive program for teaching the aspect of Navajo literacy which
makes direct reference to the alphabetic principle, the following
question arises in connection with the sight-word approach for
Navajo: What should be taught as "sight words" in Navajo? The
answer to this question is to be found in a consideration of the
premise that the sight-word approach is effective in enabling
students to learn to recognize recurrent elements instantly.
The locus of the problem in learning to read Navajo fluently is
in the verb word. The problem is this: verbs, as a class, are
highly frequent, but a particular verb word is not itself fre-
quent. It would be an insupportable burden on the memory to
teach individual verb words as sight-words--i.e., to attempt
to teach students to recognize large numbers of whole verb words as individual units. Rather, the verb word must be broken up into parts which themselves are highly frequent--i.e., the prefix portion and the stem portion. Consider, for example, the word /ndaانé/ 'they are playing.' This word is not particularly frequent as a unit. But the prefix portion /ndaæ-/ is very frequent indeed, since it combines with a great many other stems (e.g., /ndaабé/, /ndaabaah/, /ndaан'на/, /ndaакa1/, /ndaаtee1/); likewise, the stem portion /-не/ is of much greater frequency than the word /ndaанé/, because it combines with other prefix sequences (e.g., /naашнé/, /naанинé/, /naанé/, /naононé/, /njинé/ /ndaаjiné/, and so on). I propose, therefore, that prefix combinations and stems should constitute separate foci of concentration in giving students repeated practice in the rapid recognition of written forms and that the sentence-maker format for Navajo be designed to reflect this division within the verb word and to concentrate on it.

In the ensuing discussion, I will describe a sentence-maker kit, and its associated activities, which focuses upon the various verbal paradigms which involve the adverbal prefix /na-/ (glossed 'around, about'). Though I will limit my discussion to prefix paradigms involving /na-/; I wish to imply that, if such a program were to be used in teaching Navajo literacy, parallel sentence-maker kits would be constructed for all of the more frequent prefix paradigms (e.g., those listed in Young and Morgan The Navaho Language, in the section entitled "The Verb Paradigms", pages 77-111, as well as those occurring in the body of the dictionary). During the course of the following discussion, I will make reference to various linguistic points which the sentence maker helps to reveal and I will suggest activities which will enable students to focus their conscious attention upon rules of grammar and phonology.
An elementary sentence maker for na-paradigms

The materials of the sentence maker consist of (1) a set of cards, (2) a back-board, with pockets, in which the cards are stored, (3) a stand (stick with a slot in it) which holds the cards upright when a sentence is being made with them. For Navajo, cards are prepared for nouns (and pronouns), verbal prefixes, verb stems, and for other grammatical formatives (e.g., conjunctions, enclitics, particles, and postpositions). I suggest that the cards be color coded for each category—say, blue for verb stems, yellow for prefixes, (light) red for nouns, and white for other grammatical formatives. In addition to aiding recognition, this will provide an intermediate terminology for grammatical categories (i.e., verb stems can be referred to as "blues", nouns as "reds" and so on).

At the introductory level, a limited set of cards is prepared. This might include the following:

<table>
<thead>
<tr>
<th>Nouns</th>
<th>Conjunction</th>
<th>Prefixes</th>
<th>Verb Stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>ashkii</td>
<td>dóó</td>
<td>naa</td>
<td>ghá</td>
</tr>
<tr>
<td>at'eéd</td>
<td>(several</td>
<td>naal</td>
<td>'aash</td>
</tr>
<tr>
<td>hastiín</td>
<td>cards for</td>
<td>náa:</td>
<td>né</td>
</tr>
<tr>
<td>asdzání</td>
<td>this</td>
<td>(several</td>
<td>nish</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cards for</td>
<td>dloosh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>each prefix</td>
<td>geed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>bé</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>zheeh</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>chid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>'iz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>t'a'</td>
</tr>
</tbody>
</table>

With this collection alone, it is possible to make an enormous number of distinct sentences.

The prefix cards are prepared in such a way that the final letter of the prefix combination is adjacent to the right-hand edge of the card:
And the stem cards are prepared in such a way that the initial letter is adjacent to the left-hand edge:

\[ \text{ghá} \]

In this way, when a prefix is combined with a stem, they form a single written word (i.e., with no space separating the prefix from the stem), as is customary in the standard writing system:

\[ \text{naa} \text{ghá} \]

Nouns and conjunctions are placed on the cards in such a way that a margin of an inch or so remains before and after the word. Noun cards can be prepared in pairs, one card with an initial capital letter, the other with an initial lower case letter. In this way, the use of capitals at the beginning of sentences can be taught in the course of using the sentence maker.

The pockets on the storage board are labelled according to the cards they hold, so that students can return the cards to the proper pockets when they are finished making a sentence. This activity in itself serves to reinforce the students recognition of written forms.

The principal activity at this stage involves learning the simple mechanics of creating sentences with the cards. The teacher might begin the process by using a sentence whose written form the students already know, say

\[ \text{Ashkii naané.} \]

The teacher first makes the sentence by putting the cards in sequence in the stand. Each student reads the sentence. It is then dismantled, and the cards are given to one of the students who is asked to put it back together again. When this is done successfully by all the students, they are asked to form another sentence using the same verb but a different noun, whose written form the students know, say:

\[ \text{At'éd naané.} \]

In a similar fashion, the substitution of a different stem
can be introduced:

Ashkii naaghá.
Ashkii naabé.
At'éd naaghá.
At'éd naabé.

At each point, the relationship between the written form and its corresponding phonetic value can be reinforced by mentioning the pronunciation—the cards are constructed at this stage so that the forms are pronounceable whether or not they form actual words (e.g., the prefix combinations and the stems can be pronounced in isolation: "naa", "bé", and so on). Also, at each point, an effort should be made to ensure that the students can relate the sentences they create to a meaning—e.g., by associating the sentence to an appropriate picture, acting it out, or any other activity which would reveal the student's comprehension of the sentence.

An important aspect of the sentence-maker format is to engage students in the use of written representations to express ideas, even ideas which are absurd in the real world but which are nonetheless thinkable to the human mind, such as that expressed in the perfectly grammatical sentence

\[ L, L', n a a t ' a ' . \]

This is what language is all about; so it is what writing is all about, too, since writing is merely a way of putting language on paper and in books. Even with the limited vocabulary available in this elementary sentence maker, it is possible to indulge in the creative and imaginative, even poetic, use of the Navajo language in its written form.

There are many ways in which students at this stage can be involved in the use of the sentence maker—among them are the following: (1) the teacher makes sentences which the students read and interpret (and, perhaps, copy into their notebooks); (2) the teacher speaks a sentence, and a student makes it; (3) the teacher assembles a set of cards and a student makes a sentence with them; (3) the teacher assembles multiple sets of cards and distributes them among the students who make the sentences, copy them down, draw pictures representing the meanings,
and then exchange card-sets with other students until each
student has had a chance to make a sentence with each card-
set; (4) the teacher starts to build a sentence (at the begin-
ning, middle, or end) and the students finish it and interpret
it; (5) the teacher shuffles all the cards and deals them equally
among the students; each student makes as many sentences as he
can with the cards he is dealt; (6) the teacher draws a picture,
a student makes a sentence whose meaning corresponds to the event
depicted in the picture; and so on.

Certain elementary facts of Navajo grammar are exemplified in
the sentence maker at this stage. Notice that the prefix com-
bined in three distinct forms

naa
naal
naaž

The selection of one or another of these depends on the verb stem
thus, the stems /ghá, 'aash, né, bé, t'á'/ take /naa/; the
stems /nish, dloosh, ged, zheeh, 'iz/ take /naal/; and the stem
/chid/ takes /naaž/. The reason for this is that each verbal
theme, of which the stem is the basic part, requires a particular
classifier -- some stems require the zero-classifier, others the
1-classifier, and still others the 1-classifier (there is also a
d-classifier, not introduced into the elementary sentence maker).
The classifier enters into the prefixal portion of the verb word --
so /naa/ is the adverbial prefix /na-/ plus the zero-classifier,
/naal/ is the adverbial prefix /na-/ plus the 1-classifier, and
/naaž/ is the adverbial prefix /na-/ plus the 1-classifier. Stu-
dents will encounter this constantly as they become increasingly
competent in the use of the sentence maker, and their conscious
attention can be drawn to it by engaging in an activity which might
be called "sentence repair". In this activity, the teacher makes
a sentence, say

Ashkii naané.

And one of the students is asked to replace the stem /né/ with
another stem, say /nish/, giving

*Ashkii naanish.

The student is then asked to pronounce the sentence and to deter-
mine whether or not it is correct as it stands; if not, as in the
above case, the student must correct it -- in this instance, the sentence can be corrected by replacing the zero-classifier prefix combination /naa/ with the 1-classifier prefix combination /naal/, giving:

Ashkii naalnish.

Eventually, at more advanced stages in the use of the sentence maker format, when the phenomenon of the classifier is entirely familiar and commonplace to the students, due to repeated observation of it, the classifier can be abstracted away and represented as a separate prefix:

```
  adverbial  classifier
  prefix
```

```
naa          1
\_          \_
```

And certain rules accounting for the behavior of the classifiers -- e.g., their deletion after the first person singular subject prefix /sh-/ , the devoicing of the 1-classifier after the second person nonsingular subject prefix /oh-/ -- can be taught to the students. But this process of decomposing the prefix combinations should be delayed to more advanced levels of study; at the elementary stages, entire prefix combinations, pronounceable in isolation, are treated as units.

Another aspect of Navajo grammar which can be revealed in the course of using this elementary sentence maker is the phenomenon of stem selection. The facts might be brought to light in the following manner. The teacher makes the sentences

Ashkii naané.

At'éd dóó asdzání naabé.

and gives a student the stem cards for /ghá/ and /'aash/ . The student's task is to replace the stems in the teacher's sentences with the new stem cards in a way which will result in a grammatical sentence in each case. The student will notice that /ghá/ can be used in the first sentence, but not in the second:

Ashkii naaghá.

*At'éd dóó asdzání naaghá.
And conversely, /'aash/ can be used in the second, but not in the first:

*Ashkii naa'aash.
At'éd dóó asdzání naa'aash.

This illustrates the fact that certain intransitive verb stems -- of which the stems meaning 'to walk' are an example -- are selected in terms of the number category associated with their subjects. The stem /ghá/ requires a singular subject, while /'aash/ requires a dual subject. If the stem /kai/ is added to the list of verb stems in the sentence maker, the phenomenon of plural stem selection can be illustrated as well -- /kai/ requires a plural subject:

*Ashkii naakai.
*At'éd dóó asdzání naakai.
Hastiin dóó at'éd dóó ashkii naakai.

These facts can also be revealed by means of a version of the "sentence repair" activity. The teacher makes a sentence, say Ashkii naabé.

The students read it and indicate that they know its meaning. The teacher then replaces the stem with /'aash/ or /kai/ and asks a student to modify the rest of the sentence to make it grammatical (e.g., by creating a compound subject /ashkii dóó at'éd/ for /'aash/, or /ashkii dóó at'éd dóó asdzání/ for /kai/).

**Advanced sentence makers for na-paradigms**

The elementary sentence maker is restricted to sentences with third person verb forms and singular third person subjects (although nonsingulars can be created by the method of conjoining, to create compound noun phrases, as in /ashkii dóó at'éd (dóó hastiin).../).

An initial step in the development of more advanced versions of the sentence maker will introduce nonsingular nouns (for those Navajo nouns which have nonsingular forms) and the plural forms of the prefix combinations:

<table>
<thead>
<tr>
<th>nouns</th>
<th>prefixes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ashikké</td>
<td>ndaa</td>
</tr>
<tr>
<td>at'édké</td>
<td>ndaal</td>
</tr>
<tr>
<td>hastóí</td>
<td>ndaal</td>
</tr>
<tr>
<td>sánii</td>
<td></td>
</tr>
</tbody>
</table>
The sentence maker will also be augmented at this time by the addition of more nouns and more verb stems -- the students can contribute to this by offering their own additions.

The incorporation of these forms into the sentence maker not only greatly increases the number of sentences which can be created but also contributes to the central purpose of providing the students with additional prefix combinations to manipulate and thereby commit to memory. Moreover, an important rule of Navajo grammar can be brought to the conscious attention of the students—namely, the rule of plural number agreement (i.e., the use of the prefix /da-/ construed with a plural subject; cf. Part III and Hale in DBN/NLR Vol. 2, No. 1). This rule can be illustrated by means of the "sentence repair" activity, in which, for example, a sentence of the form */ashiiké dóó at'ééké naalnish/ is corrected to /ashiiké dóó at'ééké ndaalnish/ by replacing the incorrect prefix combination /naal/ with the correct /ndaal/. As the study proceeds, increased use will be made of the sentence repair activity to enable the students to observe the operation of a variety of grammatical rules; and at more advanced stages, the students will be encouraged to suggest verbal statements of the rules, as a part of the general effort to prepare them for their future confrontation with more complex problems in the scientific study of Navajo grammar.

With the forms included in this second-stage sentence maker, another fact of Navajo grammar can be revealed. The nonsingular forms of a noun (e.g., /ashiiké/, at'ééké, hastói, sáaní/) can refer either to two individuals or to more than two. The verbal prefix combinations, on the other hand indicate that the subject refers to one or two individuals (in the case of /naa, naal, naal/ or more than two (in the case of /nda, ndaal, ndaal/). This being the case, it is possible to use either set when the subject is a nonsingular noun:

Ashiiké naané.
Ashiiké ndaané.

Both of these sentences are correct, but they differ in meaning--in the first, the subject is understood as referring to
two individuals, while in the second, it refers to more than two. Students can test their understanding of this fact by associating sentences of this type with pictures depicting different numbers of individuals engaged in the activities designated by the verb.

The sentence makers so far developed involve intransitive sentences only—i.e., sentences with only a subject and a verb. A third level of complexity will be injected into the sentence maker format by the introduction of transitive verbs belonging to the na—paradigms, such as the following:

Ashkii tl'óčí
At'ééd awéé' heißté.
Hastlin chidi neibqas.
Ashliké tsé ndeiqah.

These sentences involve two separate noun phrases—a subject and an object—and they involve a new set of prefix combinations. The materials for this third-stage sentence maker might include (in addition to the nouns and conjunction of the elementary version) the following elements:

<table>
<thead>
<tr>
<th>nouns</th>
<th>prefixes</th>
<th>verb stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>tsé</td>
<td>nei</td>
<td>(zero-classifier)</td>
</tr>
<tr>
<td>naaltsos</td>
<td>neič</td>
<td>'á</td>
</tr>
<tr>
<td>tl'óčí</td>
<td>ndei</td>
<td>yé</td>
</tr>
<tr>
<td>tó</td>
<td>ndeild</td>
<td>jaah</td>
</tr>
<tr>
<td>hashtl'ish</td>
<td></td>
<td>lé</td>
</tr>
<tr>
<td>chidi</td>
<td></td>
<td>ti</td>
</tr>
<tr>
<td>beeldléí</td>
<td></td>
<td>tleeh</td>
</tr>
<tr>
<td>tl'oh</td>
<td></td>
<td>ká</td>
</tr>
<tr>
<td>awéé'</td>
<td></td>
<td>ch'id</td>
</tr>
<tr>
<td>áłchίnί</td>
<td></td>
<td>ch'qah</td>
</tr>
<tr>
<td>tsé'édq'ii</td>
<td></td>
<td>nil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1-classifier)</td>
</tr>
<tr>
<td>t'a'</td>
<td>joož</td>
<td>té</td>
</tr>
<tr>
<td>té</td>
<td>kaah</td>
<td>jid</td>
</tr>
<tr>
<td>tseos</td>
<td></td>
<td>tseed</td>
</tr>
</tbody>
</table>
I suggest that the transitive pattern be introduced rather gently, illustrating one point at a time. For example, the students might first practice with various sentences involving the verb stem /jaah/ 'carry several objects'—e.g.,

Hastiin tsé neijaah.

Ashkii naaltsoos neijaah.

and so on. They can then be shown that the rule of plural agreement operates here as well as in the intransitive sentences—with the verb stem /jaah/, the prefix combination /nde1/ is required when the subject is plural:

Hastóí dóó ashiiké tsé ndeijaah.

Ashiiké dóó at'ééké naaltsoos ndeijaah.

The form /neijaah/ would be incorrect here. Gradually, new verb stems can be introduced to the students, and the now familiar classifier phenomenon can be pointed out to them as well (e.g., the stem /jaah/ takes the zero-classifier, and therefore the prefix combinations /nei/ and /nde1/, while the stem /té/ 'carry single animate object' takes the i-classifier, and therefore the prefix combinations /nei1/ and /nde11/).

Once the students are comfortable with these basic facts, their attention can be drawn to the phenomenon of stem selection, which is abundantly represented in this third-stage sentence maker. The choice of a verb stem is, in many cases, governed by the nature of the object of the sentence. Thus:

Ashkii dibé neilíté.

*Ashkii dibé nei'á.

*Ashkii tsé neilíté.

Ashkii tsé nei'á.

Ashkii tl'óóól neilé.

*Ashkii tsé' neilé.

The use of the sentence repair activity for this will not only illustrate an important fact of Navajo grammar, but it will also provide an opportunity for the imaginative use of these verbs stems, and an opportunity for lively discussions—e.g., around such questions as whether the stem /lé/, as well as /té/, could
be used if the object of the sentence were /tl'iish/ 'snake'; or whether the stem /tin/ 'carry single slender rigid object' could be used instead of /lé/ if the object were /tl'óóí/ 'rope', provided the rope was extended and frozen solid.

With the grammatical variables which have been introduced by this stage, the sentence repair activity can be elaborated into a game which the students can play among themselves. The game proceeds as follows. An initial sentence is created, say Ashkii tsé nei'á.

One player replaces one of the cards with another. For example, the verb stem might be replaced by /té/, giving

*Ashkii tsé neité.

The next player determines whether the sentence, as changed, is correct—if not, he must correct it by means of another replacement (or two replacements, if necessary). But he cannot simply replace the original card; he must use one or more new cards. One possibility is to replace /té/ with /jaah/, giving

Ashkii tsé neijaah.

Another possibility is to replace /tsé/ with /dibé/ (or any other animate noun)—this gives

*Ashkii dibé neité.

This is still incorrect, but the player can then replace the prefix combination /nei/ with /neii/, giving the correct

Ashkii dibé neitité.

Having done this, and having received the approval of the other players as to the correctness of the sentence, he himself makes another change in the sentence and passes his turn on to the next player. For example, he might change the object from /dibé/ to /at'éeke/, giving:

*Ashkii at'éeke neitité.

The next player must then correct this—e.g., by changing the verb in some appropriate way, as in

Ashkii at'éeke neijaah.

Having received agreement from the other players that this is a grammatical sentence, this player then makes a new change—
say by replacing the prefix combination from /nei/ to /nde1/-
and passes his turn on to the next player. The latter is then
faced with the ill-formed sentence

*Ashkii at'éeéké ndeijaah.

which he must correct in some way--e.g., by replacing the sub-
ject with a nonsingular form, as in:

Ashiiké at'éeéké ndeijaah.

And so on. Many versions of this game can be conceived.
Whatever form the game takes, it will engage students in the
active manipulation of linguistic forms and in the active appli-
cation of rules of Navajo grammar, all of which contributes to
the goal of perfecting the students' command of the written form
of the language and to the goal of preparing them for the use of
linguistic material in acquiring the skills of scientific inquiry.

The introduction of transitive sentences prepares the ground
for another important rule of Navajo--namely, subject-object
inversion. Consider, for example, the sentence

At'éeéd awée' neilte.

There exists another form of this sentence in which the linear
order of the subject and object is reversed and the prefix com-
bination is replaced by /nabi/:

Awée' at'éeéd nabiite.

A large number of transitive sentences have these two alternate
forms, one exhibiting the order SUBJECT OBJECT VERB (or SOV, for
short), the other exhibiting the order OBJECT SUBJECT VERB (or
OSV). The two alternatives have the same meaning, basically,
except that the order of noun phrases affects the topic-comment
partitioning of the sentence--in the order SOV, the subject is
understood as the topic of discourse, while in the order OSV,
the object is understood as the topic. The two orderings differ
formally not only in terms of the relative position of the noun
phrases, but also in the form of the verbal prefixes.
The prefix combinations

nei
nei1
nde1
nde11
of the transitive na-paradigm are used when the sentence appears in the SOV order. In the OSV order the prefix combinations for this paradigm are

nabi
nabil
ndabi
ndabili

When these new prefix combinations are introduced into the sentence maker, the use of the two alternatives can be studied by the students. Their understanding of the semantic relationship (i.e., cognitive synonymy) between the two can be tested by having them associate the sentences with pictures. For example, a picture of a boy carrying a girl around is correctly associated either with

Ashkii at'eed neilté.

or with

At'eed ashkii nabilte.

And a picture of a girl carrying a boy is correctly associated with

At'eed ashkii neilté.

or with

Ashkii at'eed nabilte.

As the students experiment with this aspect of Navajo grammar, they will discover that while some transitive sentences may appear in either form, SOV or OSV, certain others can only appear in the form SOV, and still others only in the form OSV. Thus, for example, the sentence

Ashkii tsé'édo'ii neilitseed.

can appear in this form only—i.e., in the SOV form; the corresponding OSV form is unacceptable:

*Tsé'édo'ii ashkii nabilitseed.

On the other hand, the sentence

Ashkii lítít' nabiye.

can only appear in the OSV form; the corresponding SOV form is unacceptable in this instance:

*lítít' ashkii neiyé.
The principal involved here is discussed briefly in the introduction and in Hale, "A note on subject-object inversion in Navajo" (in Kachru, Braj B., et al. eds. Issues in Linguistics: Papers in Honor of Henry and Renée Kahane, University of Illinois Press, 1973) and more extensively in Creamer, Mary Helen, "Ranking in Navajo nouns" (DBN/NLR 1:29-38, 1974). At more advanced levels of study, when a number of different transitive paradigms have been examined, the students can be encouraged to discover the principle for themselves and to attempt to express the principle verbally.

To this point, the sentences which can be made with the elements included in the sentence maker are limited to those in which the subjects are third person. The complexity of the sentence maker can now be increased by introducing the first and second person pronouns (color-coded red, since their function in sentences is essentially the same as that of nouns). The use of a first or second person pronoun as the subject of a sentence requires a particular prefix combination in the verb word, since the verb must agree in person with its subject. Accordingly, the following elements must be added to the sentence maker kit in order to accommodate first and second person subjects:

<table>
<thead>
<tr>
<th>pronouns</th>
<th>prefixes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1st singular) shí</td>
<td>naash</td>
</tr>
<tr>
<td>(2nd singular) ni</td>
<td>nani</td>
</tr>
<tr>
<td>(1st nonsingular) nihí</td>
<td>naníí</td>
</tr>
<tr>
<td>(2nd nonsingular) nihí</td>
<td>neii</td>
</tr>
</tbody>
</table>

Thus, if the subject is /shí/, the prefix combination for this na-paradigm is /naash/, as in:

Shí naashné.
Shí tsé naash'á.

But if the subject is /ni/, the prefix combinations are /nani,
naníl, naníl/, depending upon the classifier which the verb stem requires:

Ni naníné.
Ni nanílnish.
Ni dibé nanílné.

And if the subject is /níní/, the prefix combinations are /neil/, neil/ where the first person meaning is intended, and they are /naoh, naol/ where the second person meaning is intended:

Níní neilnish.
Níní naolnish.

In the speech of some, the second person nonsingular prefix combinations in this na-paradigm are /naah, naal/, instead of /naoh, naol/ (cf. Young and Morgan, The Navaho Language, in which /naah, naal/ are consistently used). Notice also, that when the subject is first or second person, the same prefix combinations are used for intransitive sentences and for transitive sentences in which the object is third person—thus, the prefix combination /naash/ is used both in /shí naashné/ and in /shí tsé naash'á/. (At a much more advanced stage of analysis the students will learn that the reason for this is that the third person object marking prefix is regularly deleted from the verb word when the subject is non-third person; by means of this deletion, the hypothetical prefix combination */nabish/, with first person singular subject and third person object markers present, is reduced to the combination /naash/, identical to that which appears in intransitive sentences in which the subject is first person.)

At this stage, the principal point to be made is that the verb must agree in person with its subject, and the sentence repair activity can be used to illustrate the operation of this rule and to give the students extensive practice in applying it.

The sentence maker can also be augmented at this time by the introduction of the so called "fourth person" (termed "3a" in Young and Morgan, The Navaho Language, where it is discussed
in the section devoted to the deictic prefixes, p. 55). The fourth person pronoun and corresponding prefix combinations for this na-paradigm are as follows:

<table>
<thead>
<tr>
<th>pronoun</th>
<th>prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>nó</td>
<td>njî</td>
</tr>
<tr>
<td>njîl</td>
<td></td>
</tr>
<tr>
<td>njîlɛ</td>
<td></td>
</tr>
</tbody>
</table>

Navajo also possesses a third person pronoun /bî/--when this appears as a subject; it takes the same prefix combinations as do nominal subjects.

In addition to the rule of subject person agreement, a number of other linguistic points can be made with the material available at this stage. Consider what happens in the following situation, for example. A student wishes to make the sentence

Shí tl'óóí naashlé.

The verb stem appearing in this sentence is the same as that which appears in

Ashkii tl'óóí neilé.

But in the first sentence, the stem appears as /lé/ rather than as /lé/, the variant given on the card in the sentence maker kit. Assuming that the student recognizes that the stem in the verb form /naashlé/ is indeed /lé/, he will put the sentence together as follows:

*Shí tl'óóí naashlé.

This is absolutely correct, in a sense, and the student who makes this sentence should be commended. However, when the verb word is actually pronounced the initial consonant is /l/ rather than /l/. This is because of a regular rule of Navajo phonology:

A voiced fricative or lateral becomes voiceless when immediately preceded by a voiceless consonant.

So, although the initial consonant of the stem /lé/ is voiced, it becomes voiceless when preceded by the voiceless fricative /sh/ which appears in the prefix combination /naash/. In other words, the form */naashlé/ is correct in the sense that it
underlies the form which is actually pronounced--the latter is produced by the devoicing rule cited above. Precisely the same thing happens in the second person nonsingular form /nachlé/--this is derived from an underlying representation */naohlé/ by means of the devoicing rule. This rule, and a number of others relating to the phonology of the Navajo verb, are discussed in some detail in Part I and Part III (and the latter also appears in DBN/NLR 1:175-202, 1974). As more sentence makers are produced, incorporating more verbal paradigms, a large number of such phonological adjustments will need to be made in order to render the sentences in the form which is actually pronounced--in many cases, a simple juxtaposition of the sentence maker cards is not enough. Thus, the juxtaposition of /naash/ and the stem /lé/--i.e., */naashlé/--must be "corrected" by applying the devoicing rule, giving /naashlé/. Similarly, the juxtaposition of /naash/ and /yé/--i.e., */naashyé/ --must be corrected to /naashhé/ (sometimes written /naashxé/). This is another instance of the devoicing rule--the initial /y/ of /yé/ is actually a palatalized variant of the voiced dorso-velar fricative /gh/, so when the /sh/ precedes it in the verb form */naashyé/, the devoicing rule turns the voiced fricative to its voiceless counterpart /h/(or /x/).

Another phonological rule of Navajo can be observed when the first person prefix combination /neii/ precedes certain verb stems--for example, when /neii/ combines with the stem /yé/, the initial consonant of the stem mutates to /g/, giving /neiigest/; and when /neii/ combines with the verb stem /lé/, the stem-initial consonant mutates to /dl/, giving /neiiddlé/. The full range of these mutations are tabulated below:
The rule involved here is called the "d-effect" in the literature on Navajo (and other Athabaskan languages). At more advanced stages in their study of Navajo phonology, the students will consider a body of evidence in support of the hypothesis that the first person nonsingular subject prefix has the abstract underlying form /iid/ -- it is the final consonant of this prefix which causes the "d-effect". And they will also learn of the d-classifier, which has the same effect on stem-initial consonants.

A third phonological rule can be observed in verb forms in which the prefix combination /naash/ occurs with a stem containing an apico-alveolar fricative or affricate -- e.g., the stems /'iz, tsoos, bąşs, tseeed/. In such forms, the lamino-alveolar fricative /sh/ is changed to /s/. Thus, for example, the hypothetical forms */naash'iz/ and */naashtsoos/ are converted to /naas'iz/ and /naastsoos/. Actually, this rule is more general. Any median fricative or affricate appearing in the prefix portion of the verb will assimilate in position of articulation to another median fricative or affricate appearing in the stem. Consider, for example, the fourth person forms /nji, njil, njil/. These contain the lamino-alveolar affricate /j/ and are therefore subject to the assimilation rule -- accordingly, */njiltseed/ is converted to /ndziiltseed/, and */njiltsoos/ is converted to /ndziiltsoos/. The rule involved here has been called "strident assimilation", since the affected segments, and the conditioning segments, are classed
as stridents (see Hale and Honie, Introduction, for a discussion of this term; and for a detailed treatment of the rule, see Platero, Paul, "Strident assimilation in Navajo", MIT manuscript, 1974). For many speakers, the rule is optional except when the prefixal strident segment is immediately adjacent to a stem-initial strident -- so, the underlying forms /naash'iz/ and /njiltsoos/ may, for those speakers, remain as they are; for all speakers, however, the underlying form */naashtsoos/ is converted to /naastsoos/, because the strident segments are immediately adjacent.

The operation of these three rules -- devoicing, the d-effect, and strident assimilation -- will be observed with considerable frequency as more verbal paradigms are studied by means of the sentence maker format. The sentence repair activity can be modified in the following way to enable the students to gain experience in applying the rules directly. In addition to the sentence maker cards, a "repair kit" is prepared, consisting of cards upon which are written the various segments with which underlying representations are replaced in deriving the forms which are actually pronounced. When in the course of making a sentence, elements are juxtaposed in such a way as to require the application of a phonological rule, the repair kit is employed to make the necessary change. For example, if one desires to make the verb form /naashlé/, the prefix card for /naash/ is placed in front of the stem card for /lé/; and the resulting verb word is "repaired" by placing /ɪ/ over the stem-initial consonant, to represent the effect of the devoicing rule.

At a much later stage, of course, the students will be taught to decompose the prefix combinations into their constituent parts -- e.g., they will learn that the prefix combination /naash/ consists of the adverbial prefix /na-/, and the first person subject prefix /sh/, and that the prefix combination /neiʔ/ consists of the adverbial prefix /na-/ followed by the third person object prefix /yi-/; which is in turn followed by the classifier /-ʔi-/.
over, they will learn a great many phonological rules affecting 
these basic prefixal elements -- e.g., that /y/ often deletes 
between vowels (so that underlying */nayiː/ becomes */naiː/),
and that /a/ fronts to /e/ before /i/ (so that the intermediate 
representation */naiː/ becomes /neiː/, the form as it is actually 
pronounced); and that the classifier is regularly deleted between 
two consonants (so that the hypothetical form */naašite/ is converted 
to the actual /naašte/); and so on (see, for example, Part I, where 
a number of phonological processes are introduced). But this is 
for later; my purpose at present is merely to introduce the sentence 
maker format in the form which is appropriate for beginning 
literates.

A great deal more must be added to the sentence maker kit for 
the na-paradigms -- e.g., the prefix combinations for transitive 
sentences with non-third person objects (as in /ashkii nashilte/ and 
/(ší) nanište/, etc.); the prefix combinations for indefinite 
object (as in /ashkii na'alte/ and /(ší) na'ashté/, etc.); the 
prefix combinations for other tenses and aspects (e.g., the future, 
as in /hastiin ndoolnish/; the perfective, as in /ashkii naazne'/, 
etc.), and so on. And, of course, sentence maker kits will also be 
made for other common verbal paradigms.

At a relatively early stage, complex sentences can be introduced. 
For example, a number of grammatical formatives involved in subordina-
tion can be introduced into the sentence maker (color-coded white, 
say), and students could practice creating complex sentences out 
of pairs of simple sentences -- e.g., the formative /iɡiː/ can be 
used to create a relative clause out of the sentence /hastiin 
iɡiː/ nabiye/, and this can be inserted into a matrix clause, say 
/hastiin tsé'édó'ii neiltseed/, in place of the shared noun /hastiin/, 
thereby producing the complex sentence /hastiin iɡiː nabiye'igii 
 tsé'édó'ii neiltseed/. A great many complex sentence types can be 
learned in this way.

Finally, I would like to suggest that, at each stage, and for 
each sentence maker, a reader be prepared -- preferably in coopera-
tion with the students -- to be used in giving them ample opportunity 
to practice reading sentences in a connected text, and without the 
aid of the color-coding which they were able to refer to in using the 
sentence maker cards.