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ABSTRACT

This document compiles five short papers that describe the history and implementation of the Arikara Language Project and the Nakoda Language Project, the development of computer tools for language documentation, and the creation of curriculum materials for these and other projects. These papers are: "Genesis of the Project" (Douglas R. Parks); "The White Shield Arikara Language Program" (Delilah Yellow Bird); "Nakoda Language Program at Fort Belknap College" (Selena Ditmar); "The Development of Linguistic Tools at the American Indian Studies Research Institute" (Wallace Hooper, Francis Flavin); and "Tradition and Innovation: Multimedia Language Preservation" (Julia Kushner). The papers describe a multimedia dictionary database program and multimedia language lessons developed for the Arikara, Assiniboine, and Pawnee languages, and the issues involved in developing computerized language lessons for an endangered or moribund language. The multimedia dictionary database was designed to develop "talking" dictionaries that incorporate sound recordings of words in dictionaries. The multimedia lessons will provide a means of studying a language by listening to native voices when there are no longer speakers to serve as language models. The lessons use sound recordings and corrective feedback and follow principles of second-language teaching and learning. Both aspects of the program help document and preserve endangered languages. Contains 25 references and sample computer screens. (Author/SV)

Documenting and Maintaining Native American Languages for the 21st Century: The Indiana University Model

Douglas R. Parks, Julia Kushner, Wallace Hooper,
Francis Flavin, Delilah Yellow Bird, Selena Ditmar

The five papers collected here describe the history of the Arikara Language Project and its implementation in the White Shield School in North Dakota, the Nakoda Language Program at Fort Belknap College in Montana, and the development of tools at the American Indian Studies Research Institute at Indiana University for computer language documentation and the creation of curriculum materials for these and other projects. The papers describe a multimedia dictionary database program and multimedia language lessons developed for the Arikara, Assiniboine, and Pawnee languages, and the issues involved in developing computerized language lessons for an endangered or moribund language. The multimedia dictionary database was designed to develop "talking" dictionaries that incorporate sound recordings of words in dictionaries. The primary goal of the multimedia lessons is to provide a means of studying a language by listening to native voices when there are no longer speakers to serve as language models. The lessons use sound recordings and corrective feedback and follow principles of second-language teaching and learning. Both aspects of the program help document and preserve the language.

Genesis of the Project

Douglas R. Parks

Today, many Native American communities have developed a language maintenance or language revival program. Among those programs, approaches vary in fundamental ways, but all have the same general goal: to maintain and perpetuate the language of a particular community by teaching it to younger generations. Generally that goal—sometimes explicit, at other times implicit—is to make speakers of individuals who are not speakers of a native language. To achieve that end, each program and the approach it takes depends on several variables:

- the number of contemporary speakers of the language, that is, the size of the community of speakers;
- the degree of community interest in language maintenance, that is, whether support for the program is strong, mild, or apathetic; and
- the talents and interests of the individuals who develop and implement the program—their educational background and skills, and the level of their knowledge of the language.

These variables have produced programs that differ dramatically in teaching materials, in pedagogical approach, and in effectiveness. Some programs take a more formal linguistic approach, constructing materials patterned on those used traditionally for teaching foreign languages; others take a more community-based approach, using materials or lessons created by a community member—often a fluent speaker—or utilize some form of the immersion model.

The program and approach that we will describe here is based on a linguistic model that has evolved over several decades and continues to develop as community circumstances and technology change. My efforts began in 1965, when, as a linguistics graduate student, I began fieldwork with Pawnee, a Caddoan language spoken in Oklahoma. At that time there were perhaps 200 speakers, although the number of fluent speakers was considerably less. (Today there are fewer than six fluent speakers.) My goal at the time was to work with the most fluent elders to document the language in as much detail as possible in order to compile a dictionary and a collection of native language texts (traditional stories) as well as to write a grammatical description of the language.

In 1969 an Arikara woman visiting a Pawnee friend with whom I worked invited me to come to North Dakota. She suggested that I document her language, just as I was doing with Pawnee, since no one had ever recorded Arikara and she knew several elders who would be willing to work with me. She succeeded in convincing me, and in 1970 I began that endeavor. Again, my goals for Arikara were the same: to compile a dictionary and collection of texts and to write a grammar. Those goals, I might add, are still integral to the project, since they provide the essential reference works for language maintenance and revival efforts as well as for preservation of a community's linguistic heritage.

In 1974, the project took on a new dimension when I was offered a position to head the North Dakota Indian Languages Program at Mary College (now Mary University) in Bismarck. The purpose of that program was to develop curriculum materials for supporting language instruction for the languages native to the state: specifically, for Arikara, Hidatsa, Mandan, and two Sioux dialects, Yanktonai (Dakota) and Teton (Lakota). The program itself had been established the previous year, just as Native American studies programs were beginning to develop both nationally and in the state. The Indian Languages Program was in large part the result of a survey carried out in the institutions of higher learning in North Dakota in which Native American students had ranked native language courses as their number one priority.

With limited staff—three linguists, one curriculum writer, and three native language resource people—our program was able to focus on only three languages, all spoken on the Fort Berthold Reservation: Arikara, Mandan, and Hidatsa. In each case we realized that to develop effective teaching materials we first had to document the languages by recording lexical and grammatical data and analyzing them. Only then could we create effective teaching materials. Hence, our efforts were balanced between linguistic documentation and curriculum development.

The most elaborate set of materials to come out of the program was that for Arikara. We wrote a post-secondary level textbook, *An Introduction to the Arikara Language*, that would support a two-year course in North Dakota colleges, including the developing Fort Berthold Community College. The other materials were designed to provide guidance and content for teachers at the White Shield School, which is at the seat of the Arikara community on the Fort Berthold Reservation. For the elementary and secondary levels we produced teacher's guides that would enable teachers in the White Shield School, as well as in other schools on the Fort Berthold Reservation, to offer yearlong courses. We also published a set of bilingual readers for use in elementary classes. Later, we compiled other materials, including an Arikara student dictionary. All of those materials were, of course, in printed format.

Significantly, many of the teachers at the White Shield School are members of the community, but none speak Arikara. For that reason, when the language program was established in 1976, the teachers had to rely on elders coming into the classroom to model pronunciation and serve as language resource people. The program in the school was staffed by two individuals, a younger teacher's aide who structured the language classes, and an elder who provided oral language material. The written materials served as instructional guides and resources.

During the 1980s and continuing to the present, the White Shield School has continued to offer instruction in Arikara in its elementary school. Over the past several years, the instructor has been an elder who is a native speaker and who now works independently of a teacher's aide. As of Fall 1998, however, the language program has been assigned to Mrs. Delilah Yellow Bird, who formerly was the teacher's aide and who now, after earning her bachelor's degree in education, is a teacher in the school. She will initiate a new, expanded language program that will utilize many new materials, especially those discussed below.

Today, the situation at White Shield is significantly different from what it was two decades ago, when Arikara language instruction was first begun in the school. There is now only one elder who has been teaching Arikara in the elementary school. She is the *only* person in the community who is a fluent speaker and who is able to teach in the school on a regular basis. Once she is no longer able to teach, there will be no fluent speakers who can provide classroom instruction. Future teachers will be individuals who learned Arikara as a second language, and, in order to develop their own language skills, they will have to depend on the documentary materials recorded today from the last fluent speakers of the language. Thus the critical need is to document the Arikara language as extensively as possible and to develop innovative and more effective learning tools while there are still fluent elders who can assist in creating them.

In 1995 I proposed to the White Shield School Board that it support revision of the Arikara language textbook, which was by then out of print. The textbook would be more effective if it were divided into four one-semester volumes for use in the secondary school and if it had more written exercises, as well as an accompanying set of cassette tapes. More significantly, though, multimedia technology was coming into its own at that time and was being applied to educa-

tional projects, so I further proposed that we develop a model for multimedia language lessons that would include sound and images to engage students interactively in language learning. The idea behind this proposal grew out of a recent development in my documentary linguistic work: namely, that linguists today should be utilizing current sound technology to preserve endangered languages in *oral* as well as in written form. In 1995 I began work on multimedia reference dictionaries of Pawnee and Arikara that would incorporate high-quality sound recordings of all the words in the dictionaries. It was a big step beyond the goal of printed dictionaries. Since users could hear native-speaker pronunciation of the words as well as see related illustrations, the multimedia dictionaries promised to serve as reference works that would be accessible to a wider audience and that would be more versatile than traditional printed ones.

The idea to create teaching materials that also incorporated sound recordings was an obvious next step. Sound recordings offer the only possible way to perpetuate the voices of contemporary native speakers of Arikara. Multimedia lessons enable students of present and future generations to hear and interact with those native voices, providing as closely as possible the language resources that students have had in the past but otherwise would not have in the future when the elders of today, the last fluent speakers of the language, are no longer alive.

During 1996, the first year of our multimedia language lesson project, we hoped to create a set of lessons that would serve a one-semester course. Those intentions, however, proved unrealistic. There was no model that we could follow for the multimedia lessons, and there was no software program that would easily enable us to create them. In other words, we had to develop our own model, utilizing a new software program and adapting it to our needs. The results of that first year of development were modest: two prototype units. On the surface, those units did not demonstrate much in quantity, but in reality they embodied prodigious research and development by a team of individuals with various computing, educational, and linguistic skills. The White Shield School Board provided additional funding during 1997, and with that support we have been able to complete an elaborate set of 16 lessons and at the same time we have been able to simplify the developmental process. Those lessons are discussed below by Julia Kushner.

At the same time that the lessons were being developed by our team at Indiana University, I have continued to expand the documentary linguistic record of Pawnee and Arikara by developing more elaborate multimedia dictionaries for those languages, including extensive archives of linguistic sound recordings and illustrations for dictionary entries. Here the effort is to create reference works that go beyond most dictionaries of Native American languages, incorporating more written information than one normally finds and, more significantly, incorporating spoken sound and illustrations. Here, too, there was no software program designed specifically for the creation of multimedia dictionaries, and there was no model to follow. Consequently, we have had to create our own.

That story will be told next by Wallace Hooper and Francis Flavin, who have been integral to the development of our dictionary databases.

Over the past ten years my colleague Raymond DeMallie and I have also collaborated on a similar documentary project with Assiniboine. Currently, we are working with Fort Belknap College in Harlem, Montana, to develop similar printed and multimedia teaching materials to support an Assiniboine language program in the college, and recently we have also begun a joint project with the Pawnee Tribe of Oklahoma to provide similar materials for teaching Pawnee in the local high school as well as in adult language classes.

Each of the programs shares the following goals:

- extensive, innovative language documentation that includes the creation of written and sound archives of Native American languages, thereby preserving for the future as much material as possible in a variety of formats;
- use of those documentary records as the basis for creating an array of teaching materials that will help preserve and revitalize these languages;
- use of the latest technology to create both documentary records and teaching materials; and
- a multidisciplinary approach to the creation of teaching materials that combines methods and insights from linguistics, anthropology, psychology, and education to produce the most effective learning tools possible.

What ties these goals together is a commitment to language preservation going hand-in-hand with language teaching, and a belief that utilizing current technology, including software research and development, enables us to produce more valuable documentary records and more effective teaching tools.

The White Shield Arikara Language Program

Delilah Yellow Bird (*Schituta*)

My name is Delilah Yellow Bird, and I am an enrolled member of the Arikara tribe on the Fort Berthold Reservation in west-central North Dakota. I am a teacher in the White Shield School, which is the seat of the Arikara community on the reservation. (There are two other tribes on Fort Berthold: Mandan and Hidatsa.)

In 1975 our school board instituted an Arikara language program in the White Shield Elementary School. The community wanted our language taught in the school as a means of preserving and reviving it. There were perhaps as many as 200 speakers of our language at that time, but no one under the age of 60 spoke it fluently.

The board directed that the program would be limited to the elementary school, specifically the primary grades, and that instruction would be for a period of 15 minutes per day. The staffing would consist of a teacher's aide, who was not a fluent speaker, and an elderly speaker who was fluent. Curriculum materials and teacher training came from the North Dakota Indian Languages Program at Mary College, Bismarck, North Dakota, where curriculum development was an ongoing activity (as described by Douglas Parks above).

During the first eight years our approach was basically an oral one. The elders who came into the classroom served as models, pronouncing words and sentences that students would repeat. That routine had limited results. The positive ones were that students learned to imitate speakers and hear Arikara actually spoken. In other words, they became familiar with the sounds and with the elementary vocabulary of Arikara, but, on the negative side, no one became a speaker.

Beginning in the mid-1980s we introduced writing into classroom instruction. We used a variety of media for this: coloring books with animal, plant, and object names; puzzles; and calendars. The introduction of writing had several positive effects. One was that, for the first time, our language was being written, and the community for the first time came to see that it was possible for us to have a written language. It also made teachers in the school aware that Arikara language instruction was a serious matter and that made teachers think about what they could do to help the program develop in positive ways.

Beginning in 1984 our school also purchased its first computers for classroom use, and we began to experiment with the use of computers in language instruction. We did this by creating the calendars, stories, and other activities. The introduction of computers is important because it marked the beginning of a period when we began our efforts to combine computer technology with bilingual education—teaching English to Limited English Proficient (LEP) students as well as experimenting with ways to utilize computers in teaching Arikara.

Over the first twenty-year period the Arikara language program was supported by a variety of funding. Initially, funding for the program came from school funds, but later it came from a variety of federal funding sources, specifically from Title IV (Indian education) and Title VII (bilingual education) grants. Once we moved to a program that depended on grants, the program experienced less stability. We had to write grants and then wait, depending on those that were actually funded. With this approach to maintaining a language program, the instructional program moved from one target group to another, as one grant targeted primary grade students, another upper elementary grades, and another high school students. It was impossible to establish a comprehensive program that progressed from kindergarten up to and through high school.

At the beginning of 1997 I was placed in a new position entitled Bilingual Education Coordinator and Teacher. My job now is to construct a comprehensive Arikara language program in our school system, one that includes preschool, elementary, and secondary levels and includes adults in the community as well. In short, I have been charged with the task of developing a program that serves

both our elementary and secondary schools and the community. The two major hurdles that we face are:

- There are no longer any native Arikara speakers who can come into the classroom. There are a precious few elders who speak our language, but their health prevents them from coming into the school regularly. Moreover, in another five to ten years there will be no fluent speakers remaining. Thus, the overriding question is how can we maintain the knowledge and voices of our few remaining speakers and see them shared with future generations of Arikaras?
- How can we construct a language instructional program that will serve the needs of our Arikara community over the coming decades? We are at a point in time when we either accomplish something for the future now, or we leave the community with very little.

The use of multimedia computer technology, we feel, offers us the best hope of preserving the speech of our fluent speakers in a way that students can actually learn and profit from significantly. Extensive sound recordings are essential. But no less essential are well-designed curricula that will take us beyond learning just words and a small number of sentence patterns. The multimedia Arikara lessons described here, together with the other resources being developed at Indiana University, offer a set of resources that we believe offers the solution we need.

As a final word, let me say that I have shared initial versions of the lessons with school board members, students at both White Shield School and Fort Berthold Community College, and parents and elders. The reaction was extremely positive. But what was most significant was the fact that adults and even elders were not intimidated by the computer. They used it easily. We have great hope.

Nakoda Language Program at Fort Belknap College

Selena Ditmar

I feel good to have come a long way to talk my tribe's language. Our young people now have forgotten or do not know how to speak our language. Today the Nakoda people are pitiful; we all speak the English language. Today we are gathered here to think about how we can teach them in a good way. We have all lost our Indian language so today we are here to talk about it.

The main objective of the Nakoda Language Program is to create curriculum materials for the Nakoda Language classes at Fort Belknap College. In addition, the Program strives to provide supplementary language materials to be integrated in other classes at Fort Belknap College, including Nakoda History and Culture. The current program is a collaborative effort between Fort Belknap

College and Indiana University with both institutions providing valuable and unique resources.

Approximately 25 to 30 people speak Nakoda at Fort Belknap. The language is often used for visiting at the senior center, and speakers talk whenever they have the opportunity. As a means of sustaining and reinvigorating indigenous language use on the reservation, Fort Belknap College requires students to take three credits (one quarter) of either Gros Ventre (Atsina) or Nakoda. Prior to 1996, the inaugural year of the Nakoda Language Program, language teachers at Fort Belknap had to teach the classes orally based on their individual knowledge of Nakoda. There were a few different writing systems in use, but no one used them consistently. Conversely, at Indiana University, Douglas Parks and Raymond DeMallie had collected words and stories for use in a dictionary about 15 years ago. They needed to find a way of bringing the material back into the community.

The average number of students in the Nakoda class is nine per quarter and approximately 30 students per year. Currently there are three quarters of Nakoda language instruction offered at the college. The largest classes are in the first quarter, and later classes have fewer students. One of the greatest successes of the program has been evening classes for community members. They seem to be the most interested in the classes and more motivated to apply themselves.

As part of the Nakoda Language Program, we are creating a textbook specifically for the classes at Fort Belknap College. It will include sufficient material for one full year of Nakoda instruction. We currently have eight completed units and have sketches for two more. Eventually there will be 12 units; four units will be covered each quarter. In order to reinforce pronunciation and provide additional practice, we have taped the first few lessons, and plans have been made to tape more.

We are also developing a workbook to accompany the lessons. Previously we had exercises in the lesson book, but we have decided that the workbook is easier for students to use since they do not have to mark in their texts or write on a separate sheet of paper. It also allows for more exercises to be included that reinforce both vocabulary and grammar covered in the text. So far this year, the students have responded well to the exercise books, often moving ahead of what is assigned.

Verbs frequently pose the greatest difficulty to students studying Nakoda. It is important to know if verbs are stative or active and whether pronomial subjects prefix or infix on the verb. Because of this, we decided that a verb paradigm book would be helpful for students. Last spring we came up with approximately 250 everyday verbs in Nakoda. The book shows the full conjugation for each verb in the four most common forms: the simple statement, a negative statement, a potential or future statement, and a negative potential statement.

There are plans to develop the lessons further for the students using new technologies. We have begun taping the lessons using a DAT recorder (Digital Audio Tape). These tapes include both the vocabulary and the conversations that begin each lesson. The recordings are currently being converted into sound

files to be used in multimedia lessons that follow the model developed for Arikara lessons at Fort Berthold. Fort Belknap has a full computer lab that will be able to use the CD-ROM technology. The hope is that the multimedia lessons will encourage students to practice Nakoda, especially those who may have been able to take one semester of the language, but have not been able to take any more because of degree requirements or scheduling conflicts. The goal is also to encourage students to become familiar with new computer technologies. In addition to the language lessons and verb paradigm dictionary, we are currently developing a multimedia reference dictionary that will serve the future. While the program is for the college, it is a community effort, involving most of the Nakoda speakers in our community. Non-college students have made recommendations in regard to the lesson plans. There is a strong interest in the language among our people.

The Development of Linguistic Tools at the American Indian Studies Research Institute

Wallace Hooper and Francis Flavin

The American Indian Studies Research Institute (AISRI) at Indiana University is engaged in projects to document several Native American languages and to work with Native communities in developing language-teaching materials. An integral part of our approach is to develop tools that allow scholars and language teachers to work with linguistic data. Each year AISRI employs some 20 individuals, many of them graduate students working part-time, others faculty and fuil-time professional staff members. AISRI's projects are based on the collection, processing, and analysis of three basic kinds of language data: vocabulary, oral and written text, and historical information.

Collection

The first step in the documentation process is recording language data from speakers. After vocabulary and other materials are elicited during interview sessions, the words and sentences are simultaneously transcribed into notebooks and tape recorded. Because a spoken language is best represented by a variety of speakers, both male and female voices of various age groups, we have worked with as many elders and other proficient speakers as possible. Students at Indiana University have entered into the computer linguistic data that were recorded by Douglas Parks from native speakers of Arikara, Skiri and South Band Pawnee, Assiniboine, and Yanktonai Dakota. These data are the foundation for dictionaries that have been under development from 1986 through the present. For the first several years, AISRI used ProTem's DOS-based database program Notebook II to store lexical data. However, owing to the limitations of the DOS user-interface and the numerous disadvantages of "flat-file" database structure, the decision was made to migrate to a database program that could handle and process data in a more sophisticated way and that could offer multimedia functions.

We chose Microsoft's *Visual FoxPro*, which has multimedia capabilities, the ability to handle complex relationally-structured databases, and a powerful set of programming features. Moreover, by migrating our data to a program that is both an industry standard and is produced by a major software company, we have ensured the long-term viability of our software.

Over the past three years a primary component of AISRI's activities has been the collection and processing of sound-recorded data to be integrated with the text data for these languages. Language material is recorded by consultants on Digital Audio Tape (DAT), which provides recordings at 44 KHz (44 thousand samples per second). The high sample rate is important for language recordings because it captures the full range of frequencies, including the characteristic whispered sounds of Arikara. The sound data recorded in the field are later archived and indexed on DAT, with copies also preserved on CD-ROM.

Another important element in AISRI's language documentation program is its focus on collecting and translating oral and written native language texts, including texts created at the beginning of this century by George Sword and George Bushotter, both Lakota speakers, and by Roaming Scout, a Skiri Pawnee. Parks has published a four-volume collection of Arikara narratives that he recorded from elders during the 1970s and also has collections of Skiri and South Band Pawnee texts resulting from his work in the late 1960s. Together, these native texts will make an important contribution to the documentation of their respective languages.

Processing

Once the data have been collected in both written and audio format, the next step is to convert them to computer format, after which the data are ready for processing. As described above, field work produces two types of data, written data and sound data. Both are input into a computer where they are refined independently, then combined by means of an appropriate database.

The written data are entered into a program called the Indiana Dictionary Database (IDD). This is the program created in *Visual FoxPro* by AISRI to serve as a lexical database. IDD is designed as a relational database with the primary table being the "entry form" table (figure 1) and with other lexical data being stored in various "associated tables." Associated tables contain data that are directly related to the entry form of the word. IDD includes associated tables for glosses, examples, idioms, paradigmatic forms, grammatical forms, historical citations, semantic classes, cross references, and a variety of other lexical categories (figure 2). Significantly, there are also associated tables for sound recordings, images, and video recordings. Each associated table contains several fields, and each field holds a unit of lexical data that is relevant to the category that the table represents. For example, the fields for a single entry in the sound table include the sound recording, part of speech, a translation, text source, name of consultant, a "comments" field, and the sound file name (figure 3). Because IDD is a relational database, it allows for "one-to-many" relationships: e.g., the

Figure 1. Sample of IDD Entry Form Screen

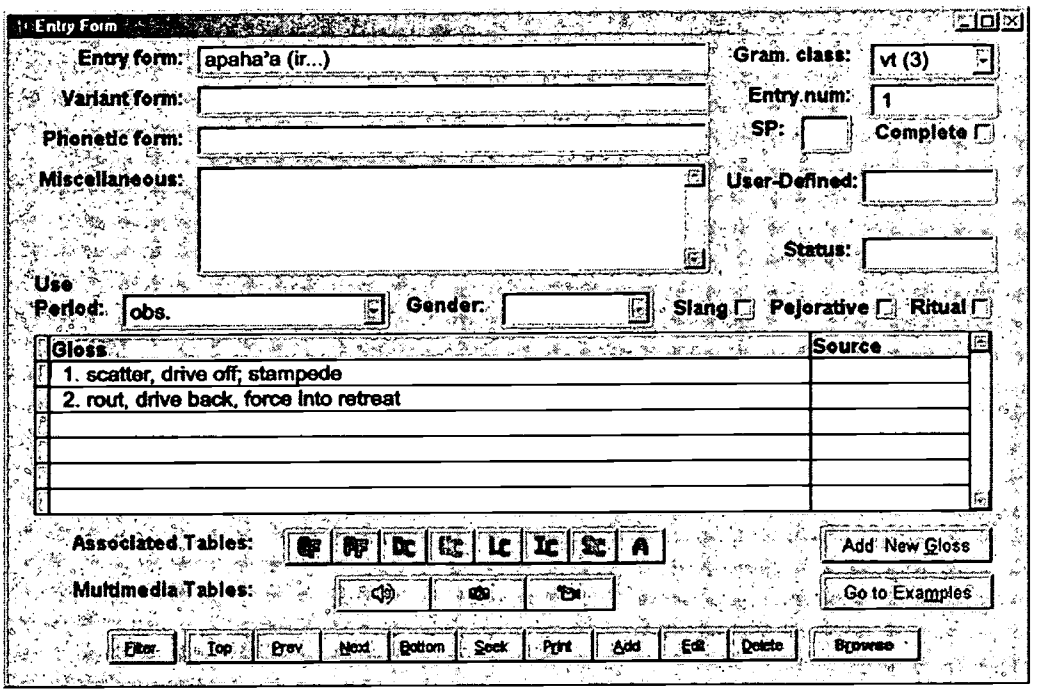


Figure 2. Sample of IDD Paradigmatic Forms Screen

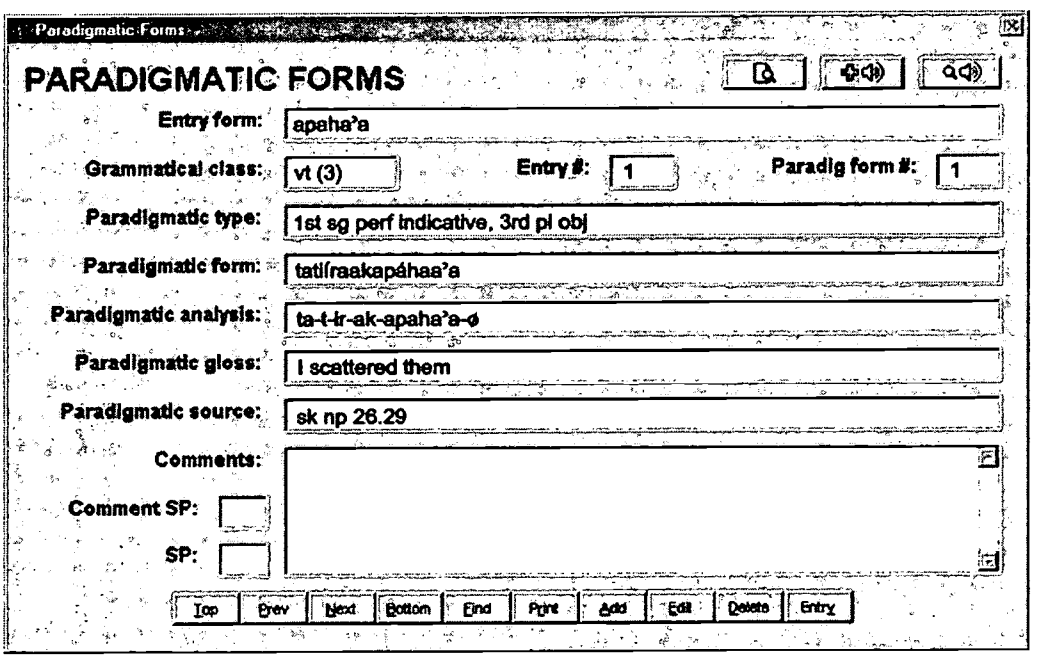


Figure 3. Sample of IDD Sound Screen

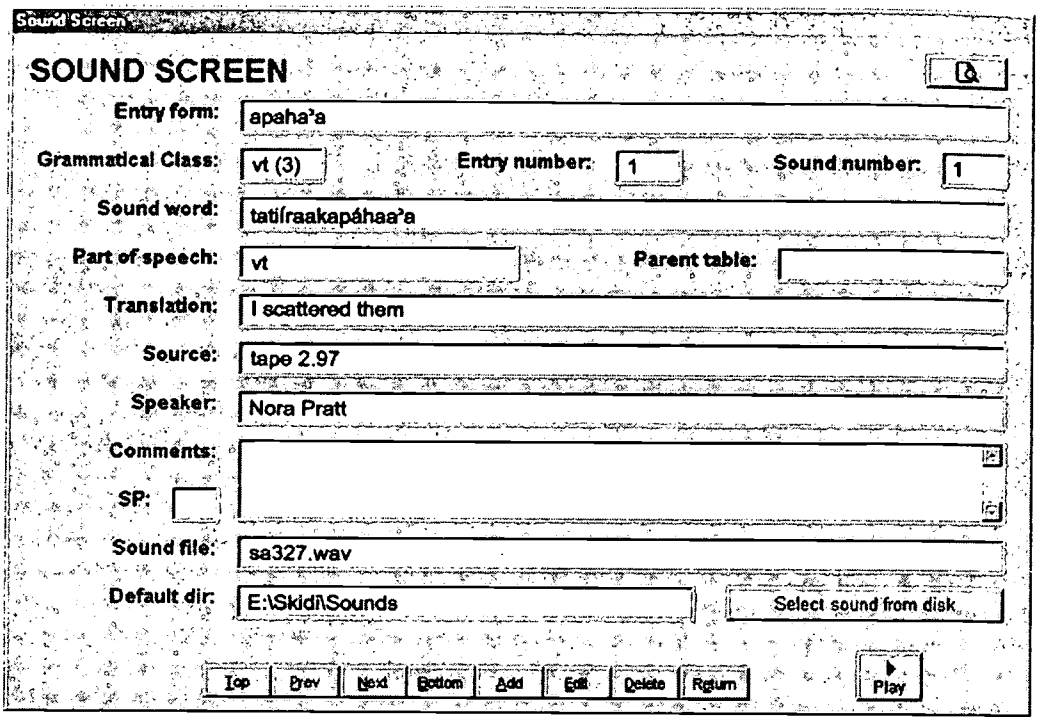
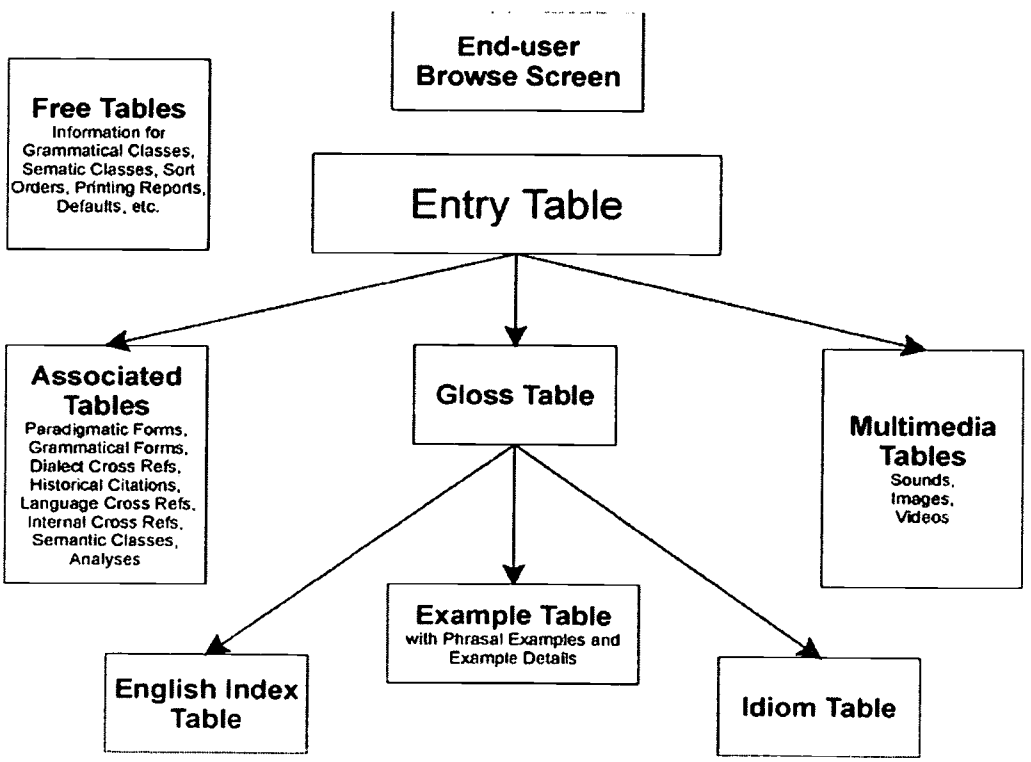


Figure 4. Simplified Schematic of IDD Data Table Structure



user is allowed to associate each entry with infinitely many sound records—likewise for glosses, examples, paradigmatic forms, and so forth (figure 4).

IDD also has sophisticated searching and printing functions. The search functions allow the user to perform complex queries on the data, and the printing functions allow the user to print out either the entire dictionary or some user-defined subset thereof. It is also important to note that the user may specify the order in which fields are printed and the font attributes—such as bold, italics, and small caps—that are assigned to each field. Further, the user may generate output to WordPerfect, RTF, HTML, or ASCII text formats, which allow the dictionary material to be quickly translatable into either camera-ready copy or pages for the world wide web.

Both the written data and the sound data from DAT recordings are integrated into IDD, as well as into other programs, such as the multimedia lessons described below by Julia Kushner. However, incorporating sound data into the programs requires special steps in order to transfer the sound data to computer format and refine the quality of the recordings. In its sound lab, AISRI has three computers with the capability of performing professional quality re-digitizing of DAT signals into WAV and AIFF files for use in computer environments. The equipment allows us also to digitize from cassette tape and reel-to-reel tape. We have access to materials in the Archives of Traditional Music at Indiana University, including early twentieth-century cylinder recordings. We are using Sonic Foundry's *SoundForge* as the main processing tool, but we also use *Digital Audio Restoration Technology* (DART) software to restore historical recordings and enhance their audio quality.

The *SoundForge* sound processing software is capable of creating graphs of the amount of energy at each frequency for each moment of time in a recorded utterance. Until recently, phoneticians have had to make major investments or rely on older software to produce such graphs. Although personal computer hardware and software are not inexpensive, processing sound clips on desktop computers has proven to be a cost-effective and powerful solution.

AISRI is also developing software to produce interlinear texts as part of its efforts to process written and oral texts. An interlinear format is standard for the presentation of traditional narratives and other linguistic texts. In such a format, the native base text is printed above lines of annotation, frequently a literal English gloss on one line and an English free translation on another line. The Institute's first software development project created an annotated text formatter based on the standard marking convention developed by the Summer Institute of Linguistics. The AISRI's program can change typefaces line by line and adjust the style and size of the font. Sometimes linguists add other lines of annotation. For example, in the George Sword Lakota texts the base line is a transcription of Sword's original, while the second line is a retranscription in modern orthography, followed by a line containing a word-by-word literal translation in English. With the capability to add extra lines of annotation, a morpheme-by-morpheme analysis can also be provided.

Analysis

As they currently stand, the sound archives and the Indiana Dictionary Database are valuable analytic resources in their own right. The sound archive contains a large amount of voice data that, when converted into PC format, can be subjected to a variety of software-based audio analysis routines. IDD allows the user to store lexical data and relate them to other lexical data in linguistically appropriate ways. Furthermore, IDD allows the user to perform sophisticated searches and to create subsets of the dictionary by filtering the data based on various querying criteria.

In the near future, AISRI plans to develop an interlinear text processor to retranscribe, gloss, parse, and analyze sound-recorded texts. This processor will be used to produce copy for publication, and it will also generate electronic interlinear texts that incorporate multimedia data. As we envision it, the text processor would be integrated with IDD, which will allow IDD and the interlinear text processor to share lexical data. This is important because IDD's data would be available to translators and analysts as they work on their texts, and, just as important, the linguistic material from the text can be automatically incorporated into IDD. Furthermore, the interlinear text processor would also be able to play sound clips and link them to passages in the text. The interlinear text formatter will be a valuable addition to the Institute's analytical tools and will produce output in both printed and electronic formats.

Conclusion

Future generations are going to need sound and written archives as well as dictionaries and textbooks. The smaller the number of active speakers still using the language, the more critical these extra resources become for anyone who is trying to teach or learn the language or who wishes to improve their proficiency.

Students must hear the words spoken by proficient speakers engaged in active discourse to become comfortable with the language. Grammars, dictionaries, and readers—perhaps as multimedia "talking books"—as well as music on audio cassettes or CDs are all valuable tools for learning. Students also need a record of the histories and other stories passed down by earlier speakers of the language, so they can hear the discourse of their parents and grandparents.

Software tools for the central tasks of dictionary building and annotated text processing were not initially available when AISRI began its language documentation and preservation efforts; consequently, we designed our own set of software tools. The tools needed to collect texts and basic linguistic data, build language archives, and then produce the readers, dictionaries, sound recordings, and textbooks are now all available and currently in use. The introduction of high-quality audio and video recording equipment together with the introduction of the multimedia computer has made it possible to develop, organize, and manage extensive collection and publication work. The tools we are developing at AISRI are both essential and invaluable in our efforts to document and preserve endangered languages.

Tradition and Innovation: Multimedia Language Preservation

Julia Kushner

The Arikara Multimedia Language Lessons were created in response to the White Shield School community's desire to have the Arikara language taught in their schools. The White Shield School is a K-12 school in Roseglen, North Dakota, located on the Fort Berthold Reservation. Currently there are no Arikara language teachers in the school, however, until last year there was one elder who taught basic words and simple phrases to students in the lower elementary grades.

The United Nations (Doyle, 1998) distinguishes between *endangered* languages, meaning those whose youngest speakers are middle-aged and children are no longer learning it, and *moribund* languages, or those that are spoken only by the elderly. Arikara is a moribund language, being spoken fluently by fewer than 10 elders. According to Fishman's (1991) 8-level classification system, Arikara is a Stage 8 language, that is, just one step from total extinction. In a Stage 8 language, "most vestigial users of [the language] ... are socially isolated old folks and [the language] ... needs to be re-assembled from their mouths and memories and taught to demographically unconcentrated adults" (p. 88).

Strategies usually recommended for language teaching and learning are not possible for a moribund language such as Arikara. For example, the successful immersion programs developed by the French Canadians have proved successful for some American Indian languages such as the Arapaho (Greymorning, 1997). However, this model cannot be used at White Shield since there is no community of speakers, textbooks, newspapers, radio programs, movies, or other "authentic" language experiences in which to immerse students. The language nests that have had such great success for the Maori (Smith, 1987) depend on elders who are physically and geographically able to come to school on a regular basis. For the same reason, the success of the Total Physical Response method (Asher, 1996; Littlebear, 1997) and mentoring programs (Brooks, 1998) are not viable solutions for students of Arikara.

A new model for teaching dead, endangered, or moribund indigenous languages needs to be devised. First, most American Indian languages lack the materials, tradition, prestige, and backing of publishing houses that languages such as Latin or Ancient Greek have. Second, the linguistic structures and sociolinguistic uses of Native American languages, including Arikara, are unique and complex, especially when compared to European or even other STLs (Seldomly Taught Languages), such that those models may not even be applicable. See Cumming, Burnaby, Hart, Daigle, and Corson (1995) for more on this issue.

Thus, the Arikara Multimedia Language Lessons are a response to the problem of how to design a language course for a complex language with no teachers, few materials, and even fewer speakers. The Arikara model is promising: the language has been meticulously documented by a linguist (Parks), and the lesson designs are informed by the literature on second language acquisition and computer-assisted language learning.

An ambitious project such as the Arikara Multimedia Language Lessons requires the close collaboration of a number of people. First and foremost is the expertise provided by elders who are fluent in the language. This project was fortunate to have as collaborators elders such as Ella Waters, Alfred Morsette, and Angela Plante, who, beyond being fluent speakers of Arikara, were also gifted in their ability to describe the nuances and uses of their language. The project was made possible by the support of the Arikara people and the White Shield School District. Essential to the success of the project were Lloyd Fandrich (Superintendent, White Shield School), Delilah Yellow Bird (Project Coordinator), and Max Dickens (White Shield School) as well as current and previous members of the White Shield School Board.

Design Rationale

Lesson Design

The Arikara Language Lessons follow a traditional, grammatical approach to instruction. This design is informed by the constraints described above and is supported by the language learning research. Realistic goals include preservation of the voices of the elders, Arikara's oral traditions and narratives, culture, and ceremonial uses of the language. In the absence of an Arikara-speaking community, it is judicious to fully document the language's phonological, syntactic, and semantic rules and its sociolinguistic and pragmatic uses, so that students of Arikara have the tools necessary to fully understand and maintain those traditions.

There is currently a debate in the literature regarding grammar teaching in particular. Some argue that grammar should never be *taught*; instead, students should learn rules implicitly by observing and interacting in naturalistic settings (Krashen, 1981; Krashen & Terrell, 1983). Other scholars point out that although some learners are facilitated by this kind of "data gathering," there are people who learn best by "rule forming" (Hatch, 1974, as reported in Larsen-Freeman, 1997).

A growing body of empirical research demonstrates the beneficial effects of grammar instruction in language learning. Ellis's work has focused on grammar teaching as "consciousness raising," that is, as making students more observant of the grammatical structures they come across and how the structures relate to meaning. Ellis (1995) calls this kind of exercise an *interpretation activity*. Note that the emphasis is on attending to input, rather than correct production. Others have found that students provided with explicit grammatical instruction progress more quickly than those without it (Pieneman, 1984), and that the effects are lasting (VanPatten & Cadierno, 1993). Finally, there is some evidence suggesting that repeated practice may be effective precisely because it leads to the internalization of rules (Paulston, 1992) rather than because it leads to appropriate response patterns as previously proposed by behaviorist theories.

The "rule-forming" approach taken in the Arikara Language Lessons is also supported by research on at-risk students and second-language learning. Students who have difficulty reading and writing in their first language often find it similarly difficult to learn a second language. Ganschow, Sparks, and Schneider (1995) describe several high schools which have had success teaching second languages to these at-risk learners using the MSML or *multisensory, structured, metacognitive language* program. The Arikara Multimedia Language Lessons, like the MSML, emphasize a metacognitive (self-monitoring) strategy to learning, a strategy which includes explicit attention to the rules and structures in language.

The technique focuses precisely on teaching three rule systems: (1) phonology and orthography, (2) grammar or syntax, and (3) the vocabulary and morphology of the target language. In so doing, students are learning and improving two languages at once: their first language (i.e., English) and the second (i.e., Arikara). The Arikara Language Lessons repeat practice with a word, rule, or concept in several modalities: visually, aurally, and verbally. Similarly, students get repeated practice in reading and writing in the new language. Exercises of this nature serve to reinforce students' metalinguistic skills (Schneider, 1996) and general verbal abilities.

Many Native American youths are monolingual English speakers with poor reading and writing skills and are classified as *semi-lingual* or not having mastered any language entirely (Leap, 1993). Therefore, these students' general linguistic abilities—including their English ability—may benefit from a program such as the Arikara Language Lessons.

Lesson content and structure

The Arikara Multimedia Language Lessons are adapted from and accompany a written text. These 16 lessons are primarily designed for high-school students, college students, and adults; however, they also can be adapted for middle- and primary-school aged children. Each lesson addresses six different segments of language learning and engage the student in a variety of tasks. The linguistic segments are: Written and Spoken sounds, Vocabulary, Conversation, Grammar, and Sentence Patterns. In addition, each lesson has an Arikara Culture segment that describes various aspects of Arikara history, culture, and society. The lessons are fully interactive, employing auditory, visual, and kinesthetic features. Pictures of people, places, items, and cultural artifacts are incorporated into the lessons, as are music and video. Each of the six segments is described below.

Written and Spoken Sounds. Students are introduced to basic phonetics to teach them to produce sounds that are not found in English and to have them more easily understand the need for an Arikara orthography. Afterward, students listen to sounds in isolation and embedded in words spoken by a native speaker of the language, record themselves repeating the words and immediately compare themselves to the speaker, and write words from dictation. Note that in this segment, students are not learning the meaning of any words, instead

they are asked only to attend to spoken and written sounds. Students learn increasingly complicated sounds or rules about sound. All of the activities are designed to sharpen the students' ability to accurately discriminate, produce, and transcribe Arikara sounds (figure 5).

Vocabulary. Students are introduced to vocabulary by learning words for everyday items and situations from Arikara culture so that they may immediately practice speaking in class and at home. These words include greetings, kinship terms, food items, common objects, weather, and expressions for time. While learning Arikara vocabulary, students' understanding of English parts of speech is also reviewed and enhanced. For example, to explain how to use the word *owaátkAt* (outside), a brief and simple explanation of locative adverbs is given. Similarly, students learn how Arikara words differ conceptually from English words, e.g., *nawanú* (a verb for being, also going or walking around), thereby gaining an insight into Arikara culture only afforded through language study. In the Vocabulary segment, students listen to words spoken by native speakers, learn the meanings of the words, record themselves repeating the words, and translate the words in both directions (from Arikara into English and later from English to Arikara). Students are also asked to sort vocabulary words into semantic categories (e.g., words for foods, kin, greetings) or to classify words into grammatical categories (such as granular, liquid, or solid) and to indicate all of the possible translations of the word—for example, the word *ápos* can mean "an apple," "the apple," or "the apples."

Conversation. The grammar of Arikara is not only distinct from English, but it is also complex. Thus, the strategy here is to introduce a few concepts at a time, i.e., by teaching several simple structures first and repeating these structures but adding variety by inserting new vocabulary. In the Conversation segment, students first listen to brief, two-sentence conversations spoken by native speakers. The students then record themselves as they repeat the conversation they just heard. The purpose of this exercise is to first model the sentence structure and intonation and then give the students practice in speaking complete sentences (figure 6). Next, students are asked to remember the meaning of the conversations and translate phrases modeled in the conversations into English and Arikara.

Grammar. The Grammar segment explicitly describes how words function in model sentences in the Conversation segment. However, the explanation is in nontechnical terms and is illustrated with examples in Arikara and English as necessary. This way, although the student may not fully appreciate the grammatical explanations, he or she may internalize the rule through repeated exposure to examples (figure 7). Then, the student engages in exercises practicing these rules with the content he or she has already learned.

Sentence Patterns. Now that students have learned the sounds, words, and grammar and had sentences modeled for them, they can test what they have learned by completing the Sentence Patterns exercises. Whereas the other segments promote some rote practice, this segment challenges students to abstract and apply what they have learned. Here, the students translate novel sentences

Figure 5. Sample Written and Spoken Sounds Screen

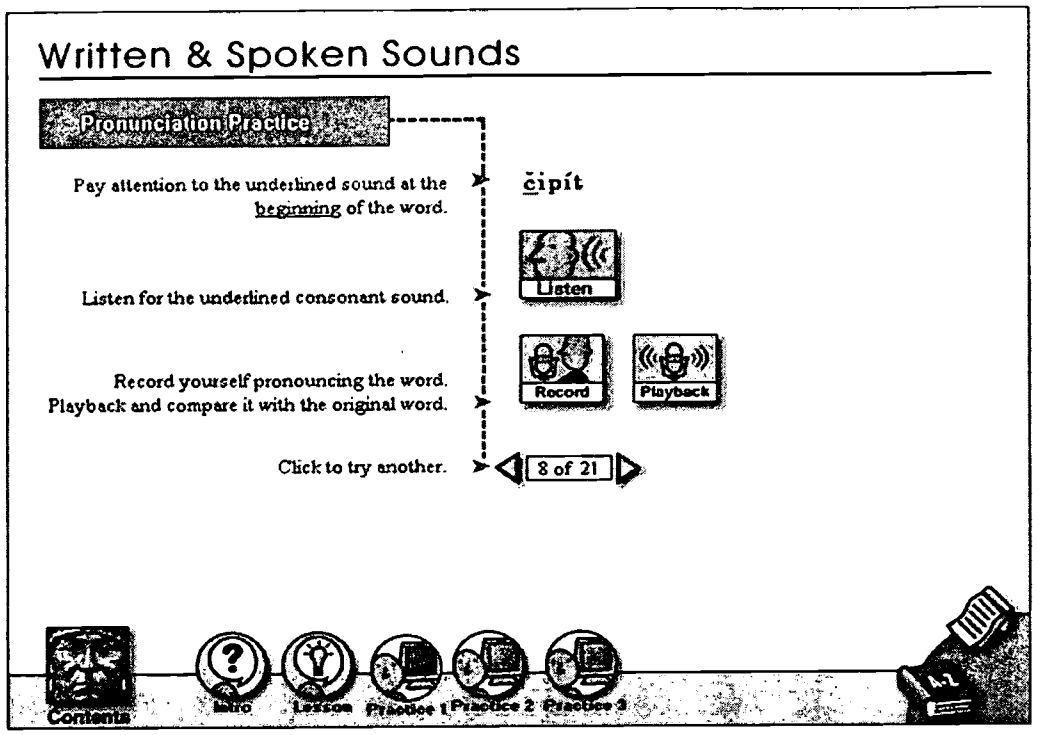
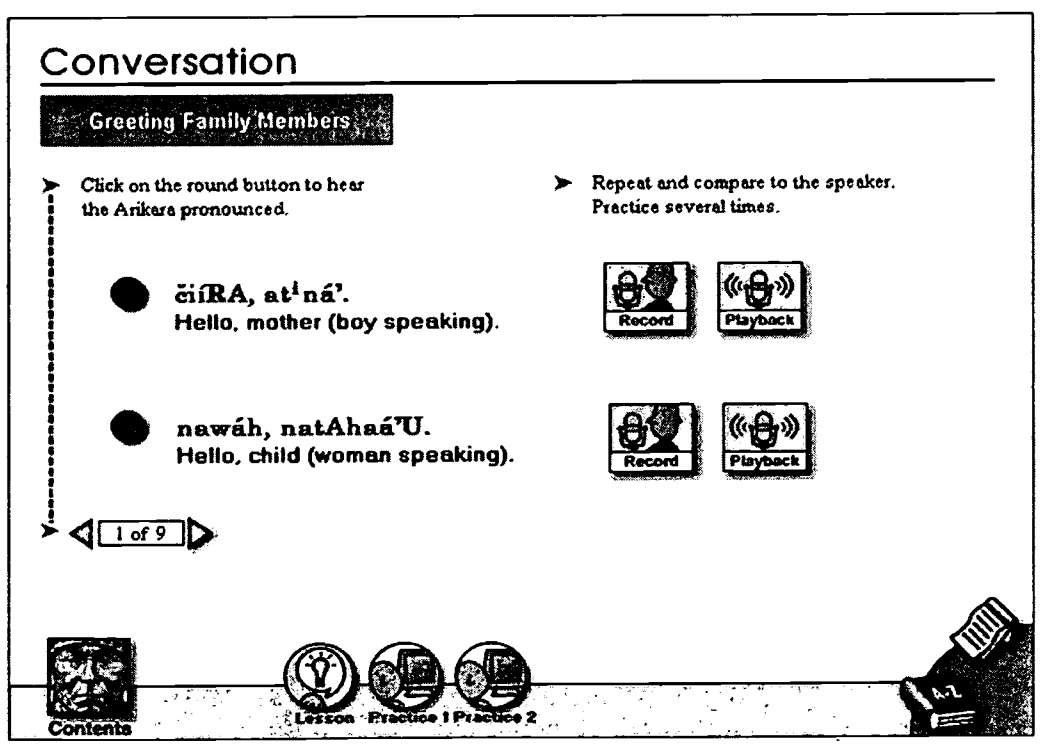


Figure 6. Sample Conversation Screen



not seen before, yet still employ the same structures and vocabulary taught in the current and previous lessons.

Culture. The Culture segment presents the students with vignettes about Arikara history and life, both before and after contact with Europeans, with narratives and oral traditions, stories from elders, descriptions of the organization of Arikara society, and so on. The vignettes are illustrated with archival and recent photographs, drawings, and video recordings, and incorporate recordings of Arikara music, words, and phrases (figure 8).

Computer interface

The design of the computer interface was informed by research in psychology and human-computer interaction to be both "user friendly" and pedagogically sound. "User friendly" simply means that use of the system is intuitive, that is, the student can easily figure out how to navigate through the system and engage in the exercises without difficulty. Although *using* the system is intuitive, *designing* such a system is not always such a straightforward task. Thus, the design team relied on previous research as well as our own empirical tests.

The steps involved in a typical design scenario are beyond the scope of this chapter. However, some of the more important steps are briefly described here. First, we had to specify what we wanted to teach (i.e., the linguistic components of Arikara: the sound system, vocabulary, and grammar), what skills we wanted the students to master (some speaking, listening, reading, and writing), and which cultural aspects to include to promote greater understanding of traditional Arikara society (e.g., kinship structure, oral traditions, and daily life).

These pedagogical goals dictated the system requirements needed. For teaching the sound system as well as speaking and listening skills, it was crucial that the lessons include sound recordings and as a self-record function to record and playback the voice of each student. The system also had to be able to check students' answers and provide corrective feedback. Furthermore, it had to support heavy graphics usage in the Culture segment of each lesson.

Previous research on computer-assisted instruction guided the design and implementation of these interactive features. For example, all interactions emphasize their functionality—all buttons look three-dimensional or "clickable." Consistent color mappings are employed so that blue Arikara text always means the text is "playable," red text always means it is "dragable." If an exercise involves more than one step (e.g., *listen*, *repeat*, *translate*), each step cascades down the screen only as the previous one is completed, focusing students' attention on each sub-task and promoting learning by reducing working memory load (Tarmizi & Sweller, 1988).

Moreover, good practice dictates that the system be tested by those for whom it is designed. In the early stages of development, the lessons were tested on-site at the White Shield School by 7th through 12th grade students. This proved a crucial step in the design process. We found that some of the exercises were not as intuitive as hoped, so they were redesigned and example pages were added. Many students breezed through the vocabulary exercises, but then found they

Figure 7. Sample Grammar Screen

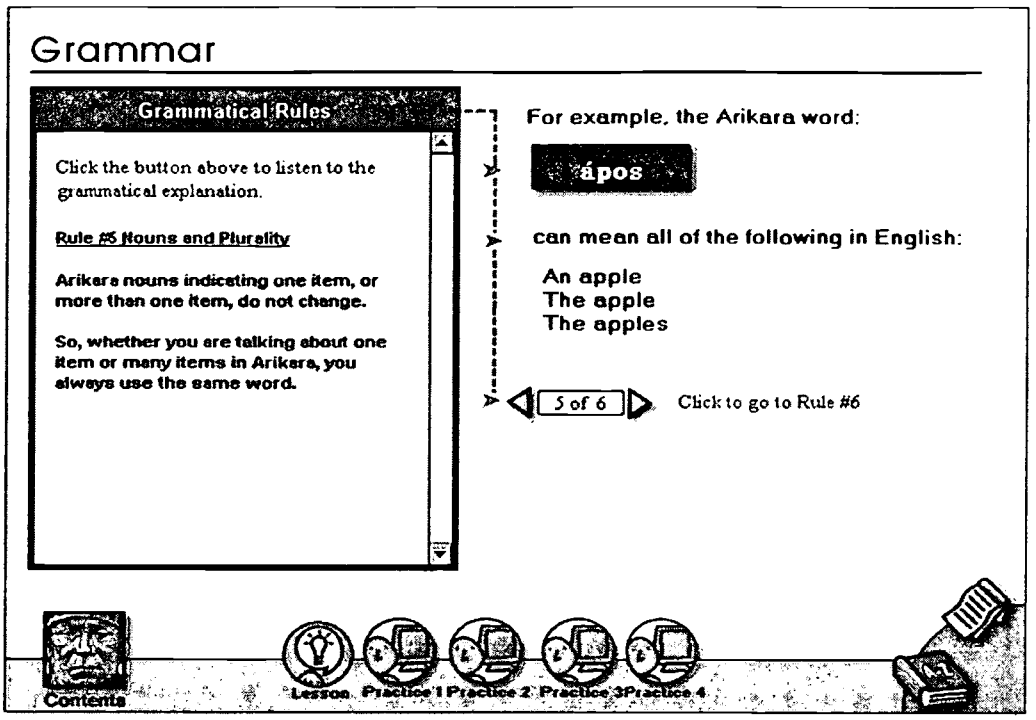
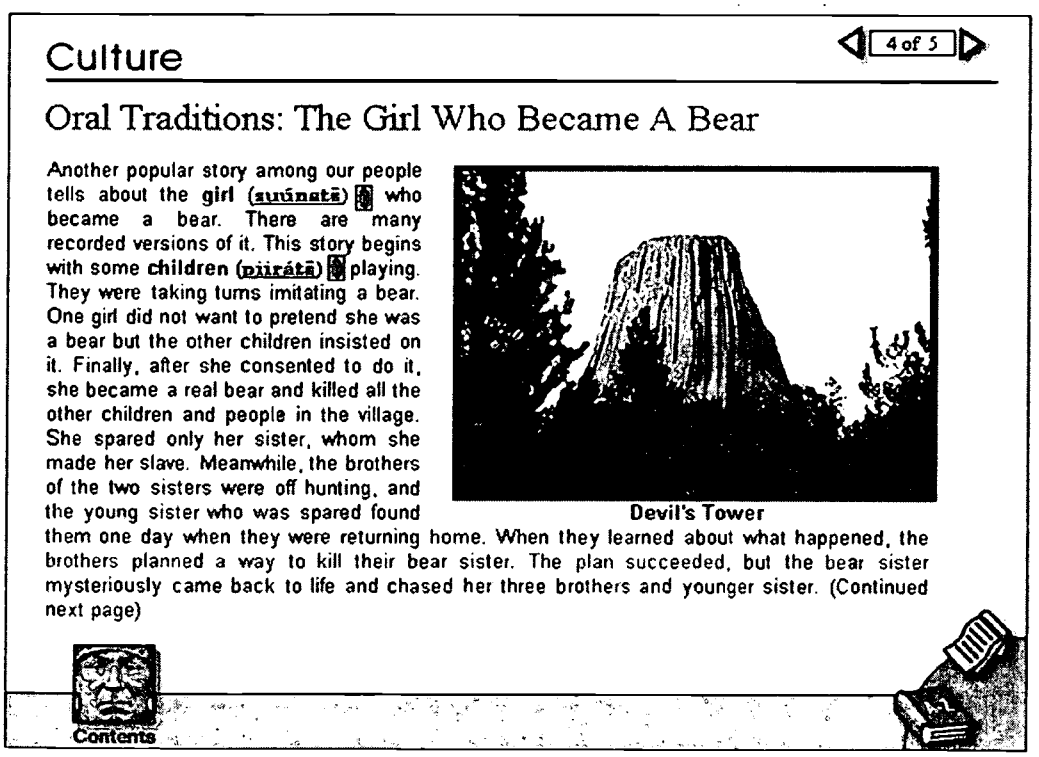


Figure Figure 8. Sample Culture Screen



had not paid close enough attention to spelling or meaning, so transcription exercises were included in the learning phase to prepare them for the recall phase. Students also collaborated in the design process directly by discussing and filling out questionnaires about the kinds of layout, exercises, and content they would like to see included. We responded to their requests by including more opportunities to listen to recordings of elders, to see more illustrations, to learn more about their own history, to be able to navigate backwards to review, and to use the keyboard more often, instead of relying solely on the mouse.

No program can be successful unless the user is taken into account in its design. Both the Arikara students' needs and preferences were included in the Arikara Language Lessons as much as possible.

Advantages of Computer-Assisted Instruction (CAI)

The computerized lessons are not a mere replication of the printed texts. Instead, they complement them by exploiting features that only computers can provide—above and beyond textbooks. For example:

Sound recordings: The most salient feature of computers that textbooks lack is the option of including sound recordings. Sound recordings preserve the language along with the voices of tribal elders and demonstrate correct pronunciation, intonation, and conversational style. Furthermore, computers can include a record and playback function that allows students to record and compare themselves to the Arikara speaker. Computers can also include music and video.

Feedback: Computers can provide immediate feedback about the correctness of a response, which improves the likelihood of learning (Anderson, Corbett, Koedinger, & Pelletier, 1995). Another advantage is that computer feedback increases student comfort-level, whereas teacher or peer correction can often make students feel overly self-conscious and inhibit learning. Students are more likely to learn without the fear of embarrassment (Schofield, 1995).

Repetition: Like learning to play an instrument, learning a language requires sustained practice. It is estimated that it takes an average of 60 exposures to a word to learn it and four to seven years to become truly fluent in a language (Collier, 1989). Repetition does not have to be the torturous drill that many remember in foreign language classes. In the Arikara Multimedia Language Lessons, exercises are designed to repeat concepts throughout a variety of activities, which increases learning and deepens understanding. Also, the system is patient—the student can hear and repeat a sound, word, or sentence indefinitely until it is mastered, something impossible to do in a classroom setting.

Access and Use of Time: One of the most robust findings regarding the effective use of computers in the classroom is that because students can work alone or in groups at the computer, the teacher's time is freed for individualized instruction. This is especially advantageous for students who need the most help. Both teachers and students benefit, and students' grades show marked improvement (Anderson, et al., 1995). Time-on-task is one of the greatest predictors of academic success. By inexpensively distributing the lessons on CDs to individuals, libraries, community centers, and tribal colleges, students and the whole

community can study outside of class, increasing their time spent learning, and students can learn at their own pace.

Preservation: The purpose of the lessons is to preserve the language by promoting its use. By using sound recordings, the language and the voices of elders are preserved forever, and the lessons are easily available to elders, parents, tribal colleges, community centers, and anyone interested in keeping the language alive.

Conclusion

Although immersion may be the ideal method for language preservation, it is not a viable alternative for many indigenous languages such as Arikara because of the lack of native speakers and environments where the native language is spoken. Computerized language lessons are a creative, workable alternative to immersion with great potential for both preservation and teaching. The Arikara Multimedia Language Lessons are programmed in modules and can be modified by teachers and students according to their needs, such as making the lessons age-appropriate for young students. "Plug-ins" can be added as desired. For example, the lessons currently link to an on-line dictionary; other possibilities include links to an on-line textbook or related web-sites. More volumes of lessons can be attached as completed, and the model can be extended to other languages. The computerized lessons are creative, interactive, and purposeful, and students who have worked with the lessons find them highly engaging.

The significance of using multimedia in language teaching could be prodigious. First, computerized lessons and dictionaries create a permanent record of the voices of tribal elders—native speakers of the languages—for future generations of Native Americans and others interested in Native American languages and cultures. Multimedia lessons also preserve the discourse patterns, songs, and ceremonial uses, so that they may be maintained. Second, only written and well-documented languages—such as Hebrew and Cornish—have been resurrected from near extinction. The meticulous documentation of the structure of all indigenous languages is likewise crucial to their preservation. Third, many North American tribes now lack speakers who can teach in the classrooms. If they do not currently face the same challenge as the Arikara, they are likely to do so in the near future. "Of the 175 surviving indigenous language in the United States, 155 or nearly 90 percent have no child speakers" (Krauss, cited in McCarty & Dick, 1996). The computer facilitates the preservation of the structure and sounds of the language and allows the dissemination of cost-effective lessons that are available to all members of the community—in venues such as classrooms, community centers, and homes. Students can study the language even without a teacher. Hopefully, other Native American tribes working to preserve their languages will be able to learn from the Arikara experience.

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