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ABSTRACT

The second of a three-volume final report presents results of three studies on indexing systems for tape recordings used by blind persons. Study I is explained to have compared five tonal index codes in order to identify a code that required minimal display time, that had easily discriminable characters, and that could be easily learned. Results are seen to indicate that the code with variations in duration surpassed all others in ease of learning. Study II reports on an experiment in which 21 legally blind Ss in grades 7-12 who, after receiving two hours training in this code, learned to find indexed parts of a textbook in an average time of 2 minutes and with 92% accuracy. Described in Study III is a comparison of three vocal index systems used by 24 legally blind Ss in grades 7-12. The three systems are said to include recording index information on the same track as text content, use of four-track systems to provide index information, and use of the Zimdex (number) system. Accuracy of use and location times for all three systems are reported to have met standards for practical use. Among general conclusions of the studies cited is that the system with vocal information recorded on the same track as the content appears superior. (Author/CL)

Final Report

Grant No. OEG-0-73-0642

Facilitating the Education of the Visually Handicapped through Research in Communications

15 November 1972-30 April 1976

Part Two

Indexes for Tape Recordings

Carson Y. Nolan, Editor

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Department of Health, Education, and Welfare

U.S. Office of Education
Bureau of Education for the Handicapped

TABLE OF CONTENTS

FOREWORD

The three studies that follow represent a rare formal attempt to develop and compare indexing systems for tape recordings. The growing use of tape cassette recordings of both text and trade books by the blind and physically handicapped, as exemplified by the library program for this group supported by the Library of Congress, easily justifies research efforts in this direction. Recent advances in cassette player design by the American Printing House for the Blind (APH) in which the playing head of the device remains in contact with the tape during fast-forward and rewind modes and which make possible four-track recordings on narrow tapes, provided opportunities for design of a variety of indexing systems. The development of these systems and their evaluation was a collaborative project between the Department of Educational Research of APH and the Perceptual Alternatives Laboratory of the University of Louisville.

Carson Y. Nolan
Project Director

ACKNOWLEDGEMENTS

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STUDY I

THE COMPARATIVE EVALUATION OF SIMPLE INDEX CODES FOR THE IDENTIFICATION OF LOCATIONS IN TAPE RECORDED TEXTS

Emerson Foulke, Rebecca Hollyfield, and

Carson Y. Nolan

Abstract

Five six-character tonal index codes were compared for ease of learning using sighted college students as subjects. Each character of all codes was composed of one or two elements. The elements used in the first code were long and short tones, those in the second code were low- and high-pitched tones, and those used in the third code were tones ascending and descending in pitch. The dimensions used in the first two codes were combined to form the characters in the fourth code while dimensions from all the first three codes were combined to form the fifth code. Five comparable groups of 20 subjects were used. Each group was taught the names of the characters of one code using the paired-associates learning method. Two consecutive errorless trials was the criterion for learning. The code composed of long and short tones far surpassed all others in ease of learning.

STUDY I

THE COMPARATIVE EVALUATION OF SIMPLE INDEX CODES FOR THE IDENTIFICATION OF LOCATIONS IN TAPE RECORDED TEXTS

A serious problem experienced by those who use tape recorded texts is the difficulty of finding specific locations, such as chapter headings, paragraph headings, or the locations at which pages begin in the print editions. Because these locations cannot be found easily, the retrieval of desired information is an inefficient process and, as a consequence, tape recorded texts are less useful than their print analogues.

The retrieval problem is often reduced by recording, at desired locations on the same track with the recorded text, tones so low in frequency that they are nearly inaudible. Consequently, when the tape is played back at the speed used during recording, their presence does not interfere with the perception of the speech recorded on that track. However, when the tape is played back in the fast-forward mode on a tape recorder that has been modified so that the tape remains in contact with the playback head during fast-forward operation, the tones are increased in frequency by an amount proportional to the increase in tape speed. They are heard as clearly audible "beeps" displayed against a background of high pitched chatter that results from reproducing the recorded text at the fast-forward tape speed.

This system of indexing is currently employed by Recording for the Blind (RFB) in its preparation of recorded textbooks. A rudimentary code with two characters is in use. One character, a single "beep," signifies the beginning of a new page. The other character, which is composed of two "beeps" of the same type, signifies the beginning of a new chapter. An announcement at the beginning of each track indicates the pages covered on that track and, if a new chapter starts on the track, this fact is announced. With this information, the reader can interpret the code signals that are manifest during fast-forward operation to locate desired pages and chapters.

To date, no one has attempted, formally, to design more complex tonal codes for this purpose or to evaluate the usefulness of such codes empirically. The purpose of this study was to design five different codes composed of varying tones and to compare the ease with which they could be learned.

Factors To Be Considered in the Design of Index Codes

An index code of more than two characters should permit a more detailed search of tape content and provide for more efficient retrieval than the two character code described. There are many ways in which additional characters for a tonal code may be created.

The design of a tonal code should consider three factors--the time consumed by the presentation of code characters, the latency of identifications of code characters, and the ease with which the code can be learned.

The time required for the reproduction of code characters should be kept at a minimum because, at the high tape speed at which they are reproduced, long character play time can seriously restrict the amount of indexing possible. In view of the small number of characters needed for an index code, the time consumed by the reproduction of a character can be kept within the practical limits by restricting the number of elements composing it. The rule that was followed in constructing the codes tested in this project was that a code character must contain no more than two elements. The two elements in a character might be the same, as exemplified by the two identical "beeps" used by RFB to indicate chapter beginnings; might be two different values in a single dimension, as exemplified by the dot and the dash in Morse code; or might be produced by concommitant variation in two dimensions, for instance, a dot at one frequency and a dash at another.

The number of identifications of different values in a stimulus dimension that can be made by a human observer is small. Furthermore, latency of identification increases as the values requiring identification are increased in number. In an index code of the sort under discussion, characters must be identified promptly so that the reader can bring the tape to a stop in the close vicinity of the location marked by code characters.

To be useful, an index code must be easily learned since many of those who are candidates for its use may not receive formal training. Consequently, differences among elements must be highly discriminable, the set of characters composed with these elements must be readily differentiated, and the meaning of the characters must be clear.

Design of the Codes

In this study, it was decided to compare five tonal codes. Tones are desirable for index codes because their electronic generation is a simple matter, because they can be recorded satisfactorily, and because they can be varied in several dimensions in which human observers are known to demonstrate good discrimination.

The five codes compared were each composed of six characters. This number appeared a minimum for effective application of the codes. The six elements used in composing code characters were realized by varying the tone signal produced by an oscillator. These variations included tones of two durations, tones of two frequencies, and tones with two portamento effects (an increase in frequency during its course and a decrease in frequency during its course). Characters in each code were composed of one or two elements. The elements used in composing the characters in the first

code were long and short tones or dots and dashes. The elements used in composing the characters in the second code were low- and high-pitched tones which varied in duration. The two portamento effects were the elements used to compose the characters in the third code. The dimensions pitch and portamento were combined to form the elements of the characters in the fourth code. The dimensions used in the first and fourth codes were combined to form the elements of the characters in the fifth code. When only one dimension was used in composing elements, a total of six characters could be formed. However, combining dimensions to form elements increased the supply of possible characters. Therefore, the characters used in the second, fourth, and fifth codes were chosen by drawing six characters at random from those possible.

The two durations used were obtained by recording the shorter tone for 480 milliseconds and recording the longer tone for 1,440 milliseconds. When these tones were reproduced at the fast-forward speed, the shorter tone had a duration of approximately 30 milliseconds, the estimated value of a dot in Morse code sent at the rate of 30 words per minute, and the longer tone had a duration of approximately 90 milliseconds, the estimated value of a dash in Morse code sent at the same rate.

Frequency was varied to produce two tones differing in pitch by approximately one whole step in the musical scale. The lower tone was recorded at a frequency of 55 cycles per second which is the first octave A on the musical scale. The higher tone was recorded at a frequency of approximately 61.735 cycles per second which is the first octave B on the musical scale. When reproduced at the fast-forward speed, the lower tone had a frequency in the neighborhood of 880.00 cycles per second or the fifth octave A on the musical scale and the higher tone had a frequency in the neighborhood of 987.77 cycles per second or the fifth octave B on the musical scale.

One of the portamento effects was a rising tone that increased in pitch by one whole step on the musical scale during its course. The other portamento effect was a falling tone that decreased in pitch one whole step on the musical scale during its course. The two portamento effects varied between the two values of pitch selected for use in the pitch dimension and their duration matched the longer of the two durations at which tones of fixed frequency were presented.

Composition of the characters in each of the five codes is presented graphically in Table 1.

Table 1

Composition of Five Tonal Codes

	Paired Number					
Code	1	2	3	4	5	6
Duration	.	..	-	--	.-	-.
Duration & pitch	.˙	.¯	˙.	-˙	-¯	¯.
Portamento	/	\	//	\\	/\	\/
Pitch & portamento	./	.\	˙/	/.	/˙	\.
Pitch, duration, & portamento	./	-/	˙\	\-	\˙	/¯

Key: . = low pitch short tone ˙ = high pitch short tone

- = low pitch long tone ¯ = high pitch long tone

/ = rising tone \ = falling tone

Method

Subjects

One hundred students from introductory psychology classes at the University of Louisville participated in the training. These students were randomly assigned to each of the five experimental groups.

Procedure

Each experimental group learned one code using a paired-associates procedure in which numbers were used to name code characters. One training session consisting of 40 trials was prepared on tape. A learning trial consisted of one randomly permuted presentation of the six characters for a given code.

Each subject was trained individually. On the first trial, subjects heard a code character and 4 seconds later heard its name pronounced. After another 2 seconds, subjects heard the second character, and so on, until all six characters had been presented. On the second trial, the subject was instructed to guess the name of each character during the interval between its presentations and pronunciation of its name. Learning trials were administered to each subject until he met a criterion of two consecutive errorless trials or until 40 trials had been completed.

Materials

The training sequences for each code were recorded on tape so that they were identical for each student using each code. As indicated above each of the six characters in each code was paired with one of the numbers 1 through 6. Forty random sequences of these six pairs were recorded. Timing of the stimuli on the tapes followed the pattern of: code signal, 4-second pause, number name, 2-second pause, code signal, and so on through the sequence.

Results

Data on the numbers of trials required to reach a criterion of two successive errorless trials are reported in Table 2. Any subject failing to reach this criterion within the total number of 40 trials was assigned a trial score of 40. Median number of trials to reach criterion ranged from 10.75 for the duration code to 39.74 for the pitch-portamento code. All codes other than the duration code had median scores greater than 30. Differences among these medians were tested for significance using the extension of the median test (Siegal, 1956, pp. 179-184). The resulting chi-square was 38.18 (4 df) which was significant beyond the .001 level of confidence.

Table 2

Data on Numbers of Trials Required to Learn Five Tonal Codes to Criterion

	Code				
Trials	Duration	Duration & pitch	Portamento	Pitch & portamento	Pitch, duration, portamento
Medians	10.75	31.50	39.50	39.74	35.00
Ranges	7-26	10-40	12-40	24-40	11-40
N	20	20	20	20	20
Percentage failing to reach criterion	0%	30%	50%	70%	70%

Discussion

Among the criteria for selecting a usable tonal code for indexing tapes is ease of learning. This is a particularly relevant criterion in view of the fact that many users will lack opportunity for formal training in use of an index code and must, by necessity, learn its use on their own. In the comparison of the five possible codes, the duration code proved the most simple to learn as evidenced by it taking less than 1/3 the learning time of the other four codes. Had

the learning trials for these codes been carried to the point where every subject learned to criterion, learning differences would probably have been much greater.

The reasons for the differences in learning times for the codes are not clear from the data. For example, no clear trend appears that would point to increase in difficulty in six character tonal codes as complexity of codes increase from one to three dimensions. However, increasing the stimulus complexity of the elements of which simple code characters are composed seriously increases their difficulty.

In conclusion, a six character, one and two element, tonal code in which the elements are composed in a dot-dash format appears to be the most useful of those studied.

STUDY II

EVALUATION OF THE USE OF A SIX CHARACTER TONAL CODE IN FINDING PARTS IN A TEXTBOOK

Carson Y. Nolan, Emerson Foulke, Marvin J. Murr, and Kristina Davis

Abstract

Previous research evaluated five types of tonal codes for tape indexing and identified a six-character code composed of long and short tones as most easily learned. Twenty-one braille or large type readers in grades 7-12 were taught this code and trained to use it to find parts in a textbook. Simulated text materials were recorded on a two-track cassette with the tonal index signals recorded at a low frequency audible only when the APH cassette player was operated at rewind or fast forward. All students were able to learn the index code in less than 40 trials with median scores of 11 trials. Working with a history text recording of 100 minutes duration, students were able to locate exact book parts with 92% accuracy and within an average time of 2 minutes. This level of performance was judged adequate for practical use.

STUDY II

EVALUATION OF THE USE OF A SIX CHARACTER TONAL CODE IN FINDING PARTS IN A TEXTBOOK

The serious problems of finding specific locations in books recorded on tape were identified in the previous study. Solution of these problems through a development of more complex index codes was proposed. Tonal codes were selected as having most potential and factors important to development of such codes were discussed.

Five experimental codes were designed and empirically compared on number of trials necessary for learning them. Of the five, the code varying in duration of the tone of the two elements composing the characters was by far the easiest to learn. A next appropriate step appeared to be an application of this dot-dash code to the problem of finding specific locations in textbooks by the blind.

Therefore, the purposes of this project were to teach the code to blind students, train them to use the code in location of textbook parts, and then test their ability to do so.

Method

Subjects

Twenty-one legally blind students enrolled in grades 7-12 of the Western Pennsylvania School for the Blind participated. All were braille or large type readers. Seven of the students were female. Numbers from each grade were: grade 7 - 4, grade 8 - 3, grade 9 - 3, grade 10 - 4, grade 11 - 4, and grade 12 - 3.

Procedure

Students were trained for 50 minutes one day on the code, for 50-minute periods on each of the next two days on use of the code to find book parts, and were tested for proficiency in finding book parts on the fourth day.

Code training: The paired associates procedure described in Study 1 was used to teach six combinations of code characters and book parts to the students. The single training session consisted of a maximum of forty trials prepared on tape. Students were trained individually. The criterion for learning was three consecutive errorless trials.

Index use training: Training consisted of player familiarization and practice in use of the tonal code to find six parts of a book.

Player familiarization consisted of review of use of the stop, play, fast forward, rewind, variable speed, and volume controls of

the player. Insertion and removal of the cassette were also reviewed. This review continued until the students could perform all operations independently.

Index use training first required the student to use the training tape to listen for and locate index points for all six book parts in both the fast forward and rewind mode. The student was next shown the braille or large type index to be used with the tape and was given an opportunity to become familiar with it. Training in finding specific parts in the book using the index and tape recording then was initiated.

The strategy taught students first was to identify the book part (page number) occurring next on the tape, survey the braille index to determine the relation of this part to the part to be found, run the player backward or forward as required, and count until the proper index signal occurred.

During training the student was required to find examples of the six book parts searching both forward and backward, shifting from track one to track two on the tape as required. Before beginning active search for each part, the student was required to verbalize the steps he would take. If necessary, the experimenter questioned the student to assure he understood the correct procedure before making the actual attempt. Training consisted of a total of 26 indexing tasks.

Proficiency testing: Students were given two opportunities to find examples of each of the six book parts. These tasks were sequenced so that both forward and backward search was required to find examples of each part and that both tracks of the tape were used. Students were allowed a maximum time of 5 minutes to find any part. Once they had found the part on the index, they were required to play the announcement for that part on the tape. Records were kept of the time required to find each part and the accuracy of its location.

Materials

Simulated indexed textbooks were used for training and testing. Training materials were based on Units 1-3 of Global History of Man (Stavrianos, 1962). Test materials were based on Units 5-7 of this same volume.

Code training materials: For the purpose of this study the duration code, composed of dots and dashes, was modified so that some characters were made up of three elements. This was done so all characters would retain their characteristic sound when played backwards as well as forwards. For code training, the six code characters were paired with book parts as follows: page number (·), subsection (··), chapter (-), unit (--), unit activities (·-·), and reviewing the essentials (···). Signal characteristics of the code were the same as those described for the duration code in Study I. Code training materials were identical to those described in

Study I save the characters were paired with the names of book parts instead of numbers as indicated above.

Index use training materials: An indexed training tape was prepared based on Units 1-3 of a high school history text. This training material was recorded on both tracks of a C-90 tape cassette at 1 7/8 ips and was approximately 90 minutes duration. The six book parts to be indexed were coded as indicated above. A recording of this material was simulated by recording the six book parts mentioned above in outline form. This outline consisted of names of the parts, units, chapters, subsections, unit activities, and reviewing the essentials with page numbers included in order of occurrence. The announcements of the outline components were recorded on tape at 20-second intervals. The code characters that identified the announcement of the text parts were generated by an oscillator which was switched on and off by an electronic switch controlled by a battery of decade interval timers. The oscillator was set for a frequency of 50 Hz. The duration of the short tones used was .5 seconds and the duration of the long tones was 2 seconds. The interval separating elements within the two and three element characters was 2 seconds.

The book parts recorded on the source tape and the code signals generated by the oscillator were mixed and recorded on one track of a final master tape. The recording of the index signal preceded the part announcement by about 5 seconds. As described in Study I, the index signals were recorded at a low frequency that was imperceptible at the regular play rate of 1 7/8 ips, but was highly perceptible when the player was operated in the much faster speeds associated with fast forward and rewind on the APH-Modified GE M8355A Cassette Recorder.

Braille and large type tables of contents listing the book parts in order of occurrence and giving the page numbers for each part was prepared for use with the tape. Copy for these indexes can be found in Appendix A.

Instructions to be followed by the experimenters were written for code training, player familiarization, and, code use training. These instructions can be found in Appendix B.

Instructions for the proficiency test and the test outline can be found in Appendix C.

Results

The data were grouped in three levels of two grades each and means and standard deviations computed for the number of trials required to learn the code, number of parts found out of a total of 12, and the average time required for a student to find a part. These data are reported in Table 1.

Table 1

Data for Code Learning and Proficiency of Code Use

Grade Level	N	Trials required to learn code	Number of parts found	Average time to find parts (min.)
7-8 Mean	7	18.86	10.86	2.17
σ		5.96	1.46	.58
9-10 Mean	7	14.14	10.86	1.96
σ		5.40	2.61	.75
11-12 Mean	7	11.29	11.43	1.84
σ		2.06	1.13	.56

All students learned the code within the 40 trials allotted. The number of trials required ranged from 8-30 with an overall mean of 14.76 trials. As can be seen from the Table, the number of trials required to learn was associated with grade level with the lower grade requiring more trials. These grade level differences were subject to simple analysis of variance and proved to be significant at the 5% level of confidence ($F = 4.46$, df 2, 20).

Students appeared able to find parts accurately as indicated by the means in Table 1. The overall average for the groups was 11.07 parts out of 12 being correctly found. Thirteen out of 21 students found all parts correctly. A Kruskal-Wallace one-way analysis of variance applied to grade level differences for accuracy failed to demonstrate significance.

Means for times to find parts are also listed in Table 1. To calculate the means for the grade level group, the score entered for each student was his average for the 12 attempts to find parts. In computing these time averages, a time of 5 minutes was entered for any trial where the student failed to locate the part accurately within this maximum time limit. Students average times to locate 12 parts ranged from 1.20-3.43 minutes with an overall mean of 1.99 minutes. Mean time differences among grade levels were not great and failed to reach significance when tested with simple analysis of variance.

Discussion

Blind students appeared quite able to learn a tonal code based on duration of elements and to use it to find parts in a book. All students in grades 7-12 were able to learn the code in less than 40 trials. Their mean learning score of 14.76 trials compares favorable with the median learning score of 10.75 trials required for a similar code by sighted college students in Study 1 although a more stringent criterion for learning was used in the present study.

Students were able to learn to use the code proficiently to find book parts with about 100 minutes-instruction. After this

amount of instruction, they were able to locate accurately 92% of the parts required on the proficiency test. The location times required, about 2 minutes, were short enough to make use of the index practical in every day practice.

The modified duration code, consisting of six characters composed of from 1-3 elements which sounded the same whether played forward or backward, appeared to provide enough indexing capacity for most high school and college textbooks.

APPENDIXES

APPENDIX A

CONTENTS

Contents - Track One

Contents - Track One

Contents - Track Two

Index II

Contents - Track One

Contents - Track One

Contents - Track Two

APPENDIX B

TRAINING FORM

27

General Instructions

During this week you are going to learn how to use a special code to find pages and other parts of a recorded book. First, you will learn the six-character code. Next you will learn how to use the code to find the parts of the recorded book. Finally, you will be tested to see how well you have learned to use the code. Are there any questions?

Instructions for Learning Code

The code you will learn will be made of two sounds; short sounds we will call dots and longer sounds we will call dashes. The code will consist of six different characters made up of dots and dashes. These code characters will be one dot; two dots, one dash; two dashes; dot, dash, dot; and dash, dot, dash. We are going to play a tape on which each code character will be paired with the name of a part of a book such as page number. As you listen to the tape you will hear the code character, then a short silence, and then hear the name of the book part. The names of the parts of the book are unit, chapter, subsection, reviewing the essentials, unit activities, and page number. Here is a card which lists the code characters and the parts of the book paired with each. (Pause while subject inspects card.)

Now while I play the tape listen to the code characters and the parts of the book with which they are paired. (Experimenter will play trials 1 and 2.)

Now I will play the tape again. This time as you hear each code character, try to name the part of the book with which it is paired. Do this during the short silent period. At the end of this period the tape will give the correct answer so you will learn whether your answer was right. We will continue in this way until you have learned to recognize the code character paired with each part of the book. Any questions?

Note to experimenter: The criterion for learning is three consecutive errorless trials out of 40 trials. If the subject has completed one errorless trial on day one, continue on second day. If not eliminate subject.

Player Familiarization

Note: The subject should be able to locate and operate the stop, play fast forward, rewind, variable speed and volume controls. He should be able to insert and remove the cassette.

1. Allow student to inspect APH cassette recorder. If he states he is familiar with it, let him

   a. Insert demonstration cassette
   b. Activate play control
   c. Use variable speed control

(1) Speed up
(2) Slow down
(3) Set to normal

d. Operate volume control
(1) Turn up
(2) Turn down

e. Activate fast forward
f. Activate rewind
g. Activate stop
h. Remove cassette

2. If student cannot operate all controls, if he is uncertain, or if he is unfamiliar with machines, demonstrate all operations above. Have student perform until he can complete all successfully. In showing location of push buttons emphasize symbols on their faces.

Code Use Training

Materials - Outline I (braille or large type), tape I, player.

Note to experimenter: On the second day ask the student if he would like to review the code tape. If so, give trials until he reaches criterion.

1. Describe the coded tape

We are now going to listen to an indexed tape of a simulated book. When the tape recorder is in the play mode, you will hear announcements of the units, chapters, subsections, reviewing the essentials, unit activities, and page numbers as they occur in order. When the player is in the fast forward or rewind modes, you will hear the code characters against a background of noise coming from the part announcements. The speed at which the code signals are played will vary considerably and you may want to slow this down or speed it up using your variable speed control.

2. Familiarization

a. Give student cassette I right side up and request he insert it in the player.
b. Have student activate fast forward and listen to code signals for Chapter 1.

3. Initial search - Experimenter will run tape back into Chapter 1.

a. Student should successfully locate and listen to tape announcements for
(1) Unit (tell student to rewind briefly)
(2) Chapter
(3) Subsection
(4) Reviewing the essentials
(5) Unit activities
(6) Page numbers

b. Student will repeat, searching in rewind mode. Remind student to depress the stop control to stop player on rewind.
c. Continue until subject completes two successful trials, one forward, one rewind.

4. Introduction to print index

a. Let student look over first page of index.
b. Indicate length of index.
c. Show student parts on index.
   (1) Units
   (2) Chapters
   (3) Subsections
   (4) Reviewing the essentials
   (5) Unit activities
   (6) Page numbers
d. Have student find the following on print index.
   (1) Unit 1 - Read title (Man Before Civilization)
   (2) Chapter 3 - Read title (Classical Civilizations)
   (3) Third subsection under Chapter 3 - Read title (Man's First Civilization)
   (4) Reviewing the essentials, Chapter 2 (Locate with finger)
   (5) Unit activities, Chapter 1 (Locate with finger)
   (6) Page 65 - Read subsection title (Culture of the food producer)
   (7) Have student find the beginning of track 2.

5. Finding chapters forward

a. Rewind tape (side 1).
b. Require student to find chapter signal for Chapter 1, verify by listening to tape announcement. Stop tape.
c. Ask student to find Chapter 4.
   (1) Give student a chance to figure out procedure.
   (2) If he can't, ask how many chapter signals between Chapter 1 and 4 (3).
   (3) Ask him to fast forward and find the 3rd chapter signal.
   (4) Listen for chapter announcement.

6. Finding chapters rewind (Remind student that he must use stop key.)

a. Tape positioned at Chapter 4.
b. Ask student to find Chapter 2.
   (1) Give student a chance to figure out procedure.
   (2) If he can't, ask how many chapter signals between Chapters 4 and 2. (2) (Disregard Chapter 4 signal.)
   (3) Ask him to rewind to 2nd chapter signal.
   (4) Listen for chapter announcement.

7. Find chapter in track two forward

   a. Ask student to find Chapter 6.
   b. Student first should verbalize procedure.

8. Find chapter on track one rewind

   a. Ask student to find Chapter 3.
   b. Student first should verbalize procedure.

9. Find units forward

   a. Rewind tape to start of side 1.
   b. Ask student to find Unit 2.
   c. Student should verbalize procedure.
      (1) Find nearest chapter location.
      (2) Search index to find relative position (at Chapter 1 within Unit 1).
      (3) Advance forward to nearest Unit signal.
      (4) Listen for Unit announcement.

10. Find units rewind (Run tape into Chapter 2)

   a. Ask student to find Unit 1.
   b. Student should verbalize procedure.

11. Find subsection forward

   a. Ask student to find "Arab invasions and the founding moslem civilizations" in Chapter 4.
   b. Student should first verbalize procedure.
      (1) Identify nearest chapter number.
      (2) Compute chapter number difference.
      (3) Advance that number to Chapter 4.
      (4) Look in index and locate the subsection "Arab invasions."
      (5) Determine its numerical position (second).
      (6) Advance two subsection signals.
      (7) Verify with subsection announcement.

12. Find subsection rewind

   a. Ask student to find subsection "Man as a food gatherer" in Chapter 1.
   b. Ask student to verbalize procedure.
      (1) Identify nearest chapter.
      (2) Compute chapter number difference (-3).
      (3) Rewind three chapter headings.
      (4) Look in index and determine ordinal position of subsection "Man as a food gatherer" (4th).
      (5) Fast forward to 4th subsection signal.
      (6) Verify with subsection announcement.

13. Show student short way to find same subsection

    a. Return tape to Chapter 4.
    b. Verify chapter location.
    c. Compute difference between Chapter 4 and chapter coming after Chapter 1 (-2).
    d. Locate Chapter 2.
    e. Look in index and determine ordinal position of subsection "Man as food gatherer" from the bottom of list (3).
    f. Find third subsection signal.
    g. Verify with subsection announcement.

14. Find subsection in track 2

    a. Ask student to find subsection "European empires in Africa" in Chapter 6.
    b. Student should verbalize procedure.

15. Finding "Reviewing the essentials" forward

    a. Run the tape into Chapter 1 on track 1.
    b. Ask the student to find "Reviewing the essentials in Chapter 4.
    c. Student should verbalize activity.

16. Finding "Reviewing the essentials" rewind

    a. Ask the student to find "Reviewing" in Chapter 2.
    b. Student should verbalize activity.
    c. If student goes to Chapter 2 and searches forward ask him to describe another way to find it.

17. Finding "Reviewing the essentials" track 2 forward

    a. Ask student to find "Review" in Chapter 7.
    b. Student should verbalize activity.

18. Find "Unit activities" track 1 rewind

    a. Ask student to find "Unit activities" in Chapter 2.
    b. Student should verbalize procedure.

19. Find "Unit activities" forward

    a. Ask student to find "Unit activities" in Chapter 4.
    b. Student should verbalize procedure.

20. Find pages forward

    a. Ask student to find page 89.
    b. Ask student to verbalize procedure.
        (1) Locate chapter containing page (Chapter 3).
        (2) Identify near chapter number (Chapter 2).
        (3) Compute difference and find page chapter (+1).

(4) Identify part nearest page and find (Beginning ...).
(5) Compute difference between part page number and required page (+1).
(6) Advance appropriate number of page signals.
(7) Verify by tape announcement.

Note: Student can count pages in either direction from chapter or other near heading.

21. Find page numbers rewind

a. Ask student to find page 96.
b. Ask student to verbalize procedure.
(1) Locate chapter containing page (Chapter 1).
(2) Identify nearest chapter number (Chapter 2).
(3) Compute difference and find page chapter (1 or 2).
(4) Identify part nearest page and find (Culture or Review).
(5) Compute difference between part page and required page (+1 or -2).
(6) Go to appropriate page and verify number.

22. Find page forward - track 2

a. Ask student to find page 217.
b. Ask student to verbalize procedure.

23. Find page rewind

a. Ask student to find page 173.
b. Ask student to verbalize procedure.

APPENDIX C

TEST INSTRUCTIONS

Students Name: _____ Age: _____

School: _____ Grade: _____

Test Instructions - Outline II

Today we will see how well you learned to use the code to find parts of the book. You will be given two opportunities to find each book part; unit, chapter, subsection, reviewing the essentials, unit activities, and page. You will search both backward and forward. Both tracks of the tape will be used. The maximum amount of time allowed to find any part will be 5 minutes. Stop when you locate the part and play the announcement for the part on the tape.

Test - Outline II

Test starts with top reeled to beginning of Track 1. Five minute limit for each task. Subject must find tape announcement.

1. Find Chapter 5
   Time:
   Remarks:

2. Find page 237
   Time:
   Remarks:

3. Find "Unit activities" Chapter 4
   Time:
   Remarks:

4. Find subsection "Historical origins" Chapter 3
   Time:
   Remarks:

5. Find Unit 2
   Time:
   Remarks:

6. Find "Reviewing the essentials" Chapter 9
   Time:
   Remarks:

7. Find Chapter 6
   Time:
   Remarks:

8. Find subsection "A typical revolution" Chapter 10
   Time:
   Remarks:

9. Find "Reviewing the essentials" Chapter 8
   Time:
   Remarks:

10. Find page 412
    Time:
    Remarks:

11. Find Unit 3
    Time:
    Remarks:

12. Find "Unit activities" Chapter 4
    Time:
    Remarks:

STUDY III

COMPARISON OF THREE VOCAL INDEXES FOR TAPE RECORDINGS

Carson Y. Nolan, Emerson Foulke, Kristina Davis,

and Marvin J. Murr

Abstract

Three vocal index systems were compared for ease of use with cassette recordings. These included recording index information on the same track as text content, use of four-track systems to provide index information, and use of the Zimdex. Twenty-four visually impaired students in grades 7-12 served as subjects. Recordings were made of junior high social studies materials and duplicated on C-90 cassettes using each of the index systems. Separate materials were used to train and test the subjects. Subjects received 1 hour of training on each system and then were tested on their ability to find book parts exactly on a 100-minute recording. While from a statistical standpoint, the two-track system with index information recorded on the same track was superior, accuracy of use and location times for all these systems fell within the limits for practical use.

STUDY III

COMPARISON OF THREE VOCAL INDEXES FOR TAPE RECORDINGS

In Study I, five tonal index codes for tape recordings were compared for ease of learning. A simple 1-2 element, six character code composed of tones of two durations was by far the easiest to learn. In Study II, it was demonstrated that blind junior high and high school students could learn a modification of this code within a short training period and use it successfully to find parts and pages of textbook within practical time limits. However, the fact that tonal codes require special learning that may vary among specific textbooks represents a significant negative factor in their use. It would be desirable to use recorded index systems that do not require special learning.

Vocal index systems do not require such special learning. The index entry in these systems consists of a spoken announcement naming the book part or page number or a vocal announcement of a different index term, such as a number, which is paired with each book part in a table of contents. The purpose of the present study was to compare three variations of vocal index systems for time and accuracy of finding parts of a textbook. The three systems included two using spoken announcements and the Zimdex system, a number system of the type described above.

Method

Subjects

Twenty-four legally blind students enrolled in the New York State School for the Blind and Kansas School for the Blind participated. Subjects were randomly selected from the total enrollment in grades 7-12, to compose four groups of six students each, differing by reading medium and grade level. Characteristics of these groups are given in Table 1.

Table 1

Subjects Categorized by Grade, Reading Medium, and Sex

Grade	Braille		Large type	
	M	F	M	F
7-9	2	4	4	2
10-12	4	2	4	2

Design

A two factor design compared the three index types for two grade levels (types x levels). Since all students worked with all three index types, this was a within subject dimension. Order of

presentation of the indexes was randomly counterbalanced within the four groups.

Procedure

Students were scheduled for two successive class periods on each of 3 consecutive days or for approximately 105 minutes per day. On each day they were trained to use a different index system and tested in using it to find parts of a textbook.

Training took the first 50 minutes of each day's session. On the first day, students were given a brief familiarization training with the 4-track APH-Modified GE M8355A Cassette Recorder. Training for use of each index system started with an oral explanation of the system and continued with a demonstration of a tape utilizing the system during which the student manipulated the equipment. Next, use of the braille or large type index which was part of the system was explained. The student then had 10 practice experiences in finding the five indexed book parts. Each part was found through both forward and backward search. Students were required to search on all tracks of the recording. Training programs for the three systems called for location of different sets of book parts.

Following training, the student was tested for proficiency in finding book parts. The location test was the same for each of the three systems. The test consisted of 10 location tasks requiring students to find each of five book parts in both fast forward and rewind modes of search. Both sides of the cassette were employed. Students were given a maximum time of 4 minutes to locate each part. Accuracy of location was indicated by the student playing the announcement for that part on the recording. Scores recorded included accuracy and time for location. If a student failed to find the part within the 4-minute time limit, he was assigned a score of 4 minutes for that part.

Materials

Tapes. Two selections of approximately 90-minutes length each were recorded from a high school history text (Stavrianos, 1962). Training tapes utilized Unit 7, Chapters 1 and 2 from A Global History of Man while the test materials were based on Chapters 3 and 4 of this same unit. These materials were recorded by professional readers in the Talking Book Studios at the American Printing House for the Blind. These materials were reproduced at 1 7/8 ips in three index styles.

Spoken index, same track. A tape produced in this fashion contains both content and index terms recorded on the same track. To achieve this, the actual announcements of text parts to be indexed are recorded at 30 ips, reproduced at 1 7/8 ips, and imposed on the full text recording at the appropriate locations. When a tape prepared in this manner is reproduced at regular playback speed (1 7/8 ips), these index announcements barely are heard as very low-pitched

background noise. When the tape is reproduced in the fast forward mode of operation, the announcements can be heard at approximately correct pitch against a background of high-pitched chatter that results from playing the full text of the recording in the fast forward mode of operation. Pitch of the index announcements can be adjusted for intelligibility by use of the variable speed control of the APH cassette player. Book parts announced included page numbers and four part names including chapters, headings, subsections, and reviewing the essentials. Book part announcements in the index preceded the initiation of the recording of the part in the full text by an interval of 3-5 seconds. These materials were recorded on two tracks of a 4-track, C-90 cassette resulting in approximately 90 minutes of playing time.

Spoken index, separate tracks. These materials were identical to the above with one exception. Instead of recording the index information on the same track as the text content, it was recorded on a parallel track on the 4-track cassette. This eliminated all background noise when playing either the index or content.

Zimdex. This index method originally was designed by the Zimmerman Adult Learning Laboratories of the American College of Life Underwriters for use on 2-track cassettes. The method described here is a special variant designed for this project to take advantage of 4-track cassette recordings. For this variant text is recorded on one track at 1 7/8 ips and numbers are announced every 5 seconds on the parallel track at this same tape speed. There are two simultaneous announcements of every 10th number. The recorded frequency of the 2nd number announcement is such that it is reproduced legibly only when the cassette recorder is operated in the fast forward speed.

A table of contents showing the relation of the announcements of numbers to the beginnings of five text parts including chapters, headings, subsections, reviewing the essentials, and page numbers is prepared. To find a book part, the student consults this table of contents to determine the number that is opposite that part of the text he wishes to locate. Then he begins his search with the track selector set to the index track and the player in fast forward. All but every 10th number announcement are reproduced as unintelligible chirps. However, every 10th announcement is intelligible. When the user hears the number that initiates the decade containing the number sought, he returns his player to regular play and listens for that number. For example, if the student searches for number 76, he listens on the index track in the fast forward mode until he hears 70 announced. He then shifts to normal play and listens until he hears 76. He then switches the player to the parallel track and soon hears the text part he seeks.

Indexes. Braille and large type indexes for use with the two spoken index styles and with the Zimdex were developed. Copy for these can be found in Appendix A.

Training materials. Special training materials were developed for each index style to provide training as described under the procedures section. These materials appear in Appendix B.

Test tasks. Ten test tasks were defined to evaluate proficiency in use of the indexes. The test form appears in Appendix C.

Cassette recorder. The player used was the APH-Modified GE M8355A. This is a 4-track player designed so that the playing heads remain in contact with the tape while the player is operated in the fast forward and rewind modes. It is this special feature plus the availability of a variable speed control that makes vocal indexing of the type described in this report possible.

Results

Three types of results were obtained in this study. These included student location time scores for the three index styles, student accuracy of location scores for the three index styles, and student preferences for index styles.

Data comparing location times are presented in Table 2. Differences among the means for index type, reading medium, and grade level were analyzed through analyses of variance using a mixed model where index type was a within groups factor. Only one main factor, index types, was significant at the .05 level. No interactions reached significance.

Table 2

Means and Standard Deviations for Location Times for Subjects Grouped by Index Type, Reading Medium, and Grade Level

			Index type		
Reading medium	N		Spoken: 2-track	Spoken: 4-track	Zimdex
Braille					
Grades 7-9	6	M	2.09	2.37	2.10
		SD	.47	.62	.44
Grades 10-12	6	M	1.96	2.16	2.19
		SD	.46	.34	.54
Large type					
Grades 7-9	6	M	1.91	2.27	2.25
		SD	.45	.69	.48
Grades 10-12	6	M	2.21	2.29	2.40
		SD	.53	.34	.54
Total	24	M	2.04	2.27	2.24
		SD	.46	.49	.48

Data for accuracy of locations are presented in Table 3. Differences for the three index types were tested for significance using the Friedman Two-Way Analyses of Variance. No significant differences were found among location accuracy scores for the three index types.

Table 3

Means and Standard Deviations for Location Accuracy Scores for Subjects Grouped by Index Type, Reading Medium, and Grade Level

			Index type		
Reading medium	N		Spoken: 2-track	Spoken: 4-track	Zimdex
Braille					
Grades 7-9	6	M	9.67	9.17	9.50
		SD	.52	1.17	.84
Grades 10-12	6	M	9.33	9.33	9.33
		SD	1.21	.82	1.21
Large type					
Grades 7-9	6	M	9.50	9.00	9.55
		SD	1.22	2.00	.55
Grades 10-12	6	M	9.00	9.33	9.00
		SD	2.00	.82	2.00
Total	24	M	9.38	9.21	9.33
		SD	1.28	1.22	1.20

When students had worked with all three index styles, they were asked to identify the style they most preferred. Nine selected the Zimdex, nine selected the 4-track, and six selected the 2-track.

Discussion

No differences were found among the three index styles for accuracy of location of book parts. Students attained a 93% accuracy rate, which is highly acceptable considering the levels of experience present within the student groups.

Significant differences were found among the three styles for times of location of book parts. Times for the 4-track and Zimdex were 11% and 10% greater, respectively, than that for the 2-track. Mean location times for the styles ranged from 2.04-2.27 minutes. This range of difference is not great enough to be of practical significance, consequently the significant difference obtained here can be ignored. It is interesting that student preferences are slanted in the direction of the least efficient styles; however, differences among these data are also too small to carry much weight.

It would seem then that practical factors might bear the greatest weight in selection of an index style. From this standpoint the 2-track system appears most practical since twice as much can be recorded on a 4-track cassette when both index and content are recorded on the same track. Storage space required would be halved as well.

It is possible to prepare a form of the Zimdex where index and content can be recorded on the same track. However, the efficiency of this form would be considerably less than that tested in this study. Another negative factor with respect to all Zimdex forms is the significantly longer print indexes required.

APPENDIXES

APPENDIX A

INDEXES

Index One - Vocal

Contents - Side One

Contents - Side Two

Contents - Side Two | Index Numbers

APPENDIX B

TRAINING MATERIALS

General Instructions

During this week you are going to learn how to use three indexes to find pages and other parts of a recorded book. First, you will learn about the indexes. Next, you will learn how to use the indexes to find the parts of the recorded book. Finally, we will give you a chance to see how well you have learned to use the three indexes. Are there any questions?

Player Familiarization

Note: The subject should be able to locate and operate the stop, play, fast forward, rewind, variable speed, and track controls. He should be able to insert and remove the cassette.

1. Allow subject to inspect APH cassette recorder. If he states he is familiar with it, let him

   a. insert 4-track demonstration cassette
   b. activate play control
   c. use variable speed control - speed up,
      slow down,
      set to normal
   d. operate volume control - turn up,
      turn down
   e. activate fast forward
   f. activate rewind
   g. activate stop
   h. remove cassette
   i. Have subject move switch to left and listen to one track. Have subject move switch to right and listen to second track.

2. If subject cannot operate all controls, if he is uncertain, or if he is unfamiliar with machines, demonstrate all operations. Have subject perform until he can complete all successfully. In showing location of push buttons, emphasize symbols on their faces.

3. This APH cassette player has four tracks, two tracks on side one and two tracks on side two. The switch on the front left side of the cassette player controls the track being played. When the switch is to the left, you can play one track.

   DEMONSTRATE

   When the switch is to the right, you can play another track.

   DEMONSTRATE

Two Track Voice Index

Training Program

The index you will now learn will be a form of voice index. On the tape each part of a book will be paired with a voice announcement giving its name. The names of the parts of the book are chapters, headings, subsections, reviewing the essentials, and page numbers that are used in the recorded book we are going to use.

1. Describe the index tape

We are now going to listen to an indexed tape of a recorded book. For this tape you will need to leave the track switch positioned to the left since the voice index and the actual text material are recorded on the same track. The voice index is understandable when you play the recorder in the fast forward (FF) mode. In the play mode you will hear the index as a low rumble under the recorded text material. Do you have any questions?

2. Familiarization

   a. Give subject cassette 1 right side up and request that he insert it in the player.
   b. Demonstrate and then ask subject to listen to track in play mode (text material) and FF (index voice announcements).
   c. Have subject turn tape over to side 2 and listen to track in play mode and FF.
   d. Have subject play tape in rewind pointing out that index voice announcements when played in rewind are heard as garbled sounds.
   e. Tell subject that a number of voice announcements occur very close together. Listen to an example.

3. Introduction to print index

   a. Let subject look over first page of index.
   b. Indicate length of index.
   c. Show subject parts on index.
      Chapters
      Headings
      Subsections
      Reviewing the essentials
      Page numbers
   d. Have subject find the following on print index and read each title.

      (1) Chapter 2 - ("Politics: The Paradox of Authority and Instability")
      (2) 3rd reading in Chapter 1 (Historical periods")
      (3) 6th subsection in Chapter 1 ("Class systems")

(4) "Reviewing the essentials" in Chapter 1 (locate with finger)
(5) Page 382
(6) The beginning of Side 2

Remind subject that sometimes two or more book parts occur on the same page.

For example: on page 398

4. Find Page FF

a. Experimenter, put tape beginning of side 1.
Tell where tape is positioned.
b. Ask subject to find page 385.
c. Give subject a chance to figure out procedure.
(1) Find out where tape is positioned (using FF mode)
(2) Check braille or large type index to find out where page is located (e.g., on side 1 or side 2)
(3) FF to index announcement
(4) In play mode, verify page number announcement

5. Find page rewind (Remind subject he must use stop key)

a. Ask subject to find page 380.
b. Give subject chance to verbalize procedure.

Method I
(1) Find out where tape is positioned (using FF mode).
(2) Count number of announcement between position of tape and ask for page number on braille or large type index.
(3) Rewinding, count voice announcements occurring backwards until he reaches the asked for page number.
(4) In FF mode, listen for page number announcements.
(5) In play mode, verify book part announcement.

Method II
(1) Find out where tape is positioned (using FF mode).
(2) Find out on what page asked for book part is, using print index.
(3) Rewind, checking page number (using FF mode) occasionally.
(4) Continue rewinding until page number on which asked for book part is located is reached.
(5) In FF, move to asked for voice announcement.
(6) In play mode, verify book part announcement.

6. Find page rewind

a. Ask subject to find page 393.
b. Ask subject to verbalize procedure.

Method I

(1) Find out where tape is positioned (using FF mode).
(2) Count number of announcements between position of tape and asked for page number on print index.
(3) Rewinding, count voice announcements occurring backwards until he reaches the asked for page number.
(4) In FF mode, listen for page number announcements.
(5) In play mode, verify book part announcement.

Method II

(1) Find out where tape is positioned (using FF mode).
(2) Find out what page asked for book part is on, using print index.
(3) Rewind, checking number (using FF mode) occasionally.
(4) Continue rewinding until page number on which asked for book part is located is reached.
(5) In FF, move to asked for voice announcement.
(6) In play mode, verify book part announcement.

7. Find heading rewind

   a. Ask subject to find "Historical origins."
   b. Ask subject to verbalize procedure.

8. Find heading FF

   a. Ask subject to find "The United States and Latin-American politics."
   b. Ask subject to verbalize procedure.

9. Find chapter FF

   a. Ask subject to find Chapter 2 - "Politics: The Paradox of Authority and Instability."
   b. Ask subject to verbalize procedure.

10. Find chapter rewind

   a. Ask subject to find Chapter 1 - "Basic Facts: An Empire Fragmented."
   b. Ask subject to verbalize procedure.

11. Find subsection FF

   a. Ask subject to find "Pre-Hispanic Period to 15 A.D."
   b. Ask subject to verbalize procedure.

12. Find subsection rewind

   a. Ask subject to find "Ecuador, 1944."
   b. Ask subject to verbalize procedure.

13. Find subsection FF

    a. Ask subject tc find "Foreign holdings."
    b. Ask subject to verbalize procedure.

14. Find reviewing the essentials FF

    a. Ask subject to find "Reviewing the essentials" (Chapter 1).
    b. Ask subject to verbalize procedure.

15. Find reviewing the essentials rewind

    a. Experimenter, put tape to end of side 1.
    b. Find "Reviewing the essentials" (Chapter 1).
    c. Ask subject to verbalize procedure.

Four Track Voice Index

Training Program

The index you will now learn will be a voice index. On the tape, each part of a book such as page number will be paired with a voice announcement naming that part of the book. The names of the parts of the book are chapter, headings, subsections, reviewing the essentials, and page numbers that are used in the recorded book to which we are going to listen.

1. Describe the index tapes

We are now going to listen to an indexed tape of a recorded book. When the tape recorder is in the play mode and when the track switch is to the left, you will hear a man's voice read a unit on Latin America. When the track switch is moved to the right, in fast forward (FF), you will hear a voice index announce each part of the book a few seconds before it occurs in the test. The speed at which the recorded book and voice index are played may need adjusting so you may want to slow them down or speed them up using your variable speed control. Do you have any questions?

2. Familiarization

   a. Give subject cassette 1 right side up and request that he insert it in the player.
   b. Demonstrate and then ask subject to listen to tape when track switch is to the left (the text material track) and when the track switch is to the right (the index voice announcement track).
   c. Have subject turn tape over to side two and listen to tape when track switch is to the left and when the track switch is to the right.
   d. Have subject play tape in rewind with track switch to right pointing out that index voice announcements (switch is to the right) when played in rewind are heard as garbled sounds.
   e. Tell subject that a number of voice announcements occur very close together. Listen to an example.

3. Introduction to print index

   a. Let student look over first page of index.
   b. Indicate length of index.
   c. Show student parts on index.
      Chapters
      Headings
      Subsections
      Reviewing the essentials
      Page numbers
   d. Have subject find the following on print index and read each title.

(1) Chapter 1 - ("Basic Facts: An Empire Fragmented")
(2) 2nd heading in Chapter 1 - ("People")
(3) 7th subsection in Chapter 1 - ("Religion")
(4) "Reviewing the essentials" in Chapter 1 (locate with finger)
(5) Page 377
(6) The beginning of Side 2

Remind student that sometimes two or more book parts occur on the same page.

For example: on page 398

4. Find heading forward

a. Experimenter, put beginning of Side 1 - tell subject where tape is positioned.
b. Ask subject to find "Historical periods."
c. Give subject a chance to figure out procedure.
(1) Find out where tape is positioned (using FF mode).
(2) Check braille/large type index to find out where heading asked for is located in relation to position of tape.
(3) With switch to right, FF listening to voice announcements until he reaches announcement for heading asked to find.
(4) Changing switch to the left, verify book part announcement.

5. Find heading rewind. (Remind subject he must use stop key.)

a. Ask subject to find "A typical revolution."
b. Give subject a chance to figure out procedure.

Method I
(1) Find out where tape is positioned (using FF mode).
(2) Check print index to determine where heading is in relation to position of tape.
(3) Count number of announcements on print index between position of tape and asked for heading.
(4) With switch to right, rewind counting voice announcements occurring backwards until he reaches asked for heading.
(5) With switch still to right, FF listening for index announcement.
(6) Changing switch to left, in play mode, verify book part announcement.

Method II
(1) Find out where tape is positioned (switch must be to right--use fast forward mode).
(2) Find out what page asked for book part is on using print index.
(3) With switch to right, rewind checking page number (using FF mode) occasionally.

(4) Continue rewinding until page number on which book part asked for is located.
(5) In FF, switch still to right, move to asked for voice announcement.
(6) With switch to left in play mode, verify book part announcement.

6. Find subsection fast forward

a. Ask subject to find "Land reform."
b. Have subject verbalize procedure.
(1) Find out where tape is positioned.
(2) Check print index to find out where subsection asked for is located in relation to position of tape.
(3) With switch to right, FF listening to voice index announcements until he reaches announcement for subsection asked to find.
(4) Changing switch to the left, verify book announcement.

7. Find subsection rewind

a. Ask subject to find "Colonial classes."
b. Have subject verbalize procedure

Method I
(1) Find out where tape is positioned.
(2) Check print index to determine where subsection is in relation to position of tape.
(3) Count number of announcements on print index between position of tape and asked for subsection.
(4) With switch to right, rewind counting voice announcements occurring backwards until he reaches asked for subsection.
(5) With switch still to right, FF listening for index announcements.
(6) Changing switch to left, in play mode, verify book announcement.

Method II
(1) Find out where tape is positioned (switch must be to right--use fast forward mode).
(2) Find out what page asked for book part is on using print index.
(3) With switch to right, rewind checking page number (using FF mode) occasionally.
(4) Continue rewinding until page number on which book part asked for is located.
(5) In FF, switch still to right, move to voice announcement asked for.
(6) With switch to left in play mode, verify book part announcement.

8. Find subsection rewind

a. Ask subject to find "Aids to progress."

b. Ask subject to verbalize procedure.

9. Find page rewind

a. Ask subject to find page 396.
b. Ask subject to verbalize procedure.

10. Find page fast forward

a. Ask subject to find page 401.
b. Ask subject to verbalize procedure.

11. Find reviewing the essentials FF

a. Ask subject to find "Reviewing the essentials."
b. Ask subject to verbalize procedure.

12. Find reviewing the essentials rewind

a. Experimenter, put tape to end of side 1.
b. Ask subject to find "Reviewing the essentials."
c. Ask subject to verbalize procedure.

13. Find reviewing the essentials FF

a. Experimenter, put tape to beginning of side 1.
b. Ask subject to find "Reviewing the essentials."
c. Ask subject to verbalize procedure.

14. Find chapter FF

a. Ask subject to find Chapter 2 - "Politics: The Paradox of Authority and Instability."
b. Ask subject to verbalize procedure.

15. Find chapter rewind

a. Ask subject to find Chapter 1 - "Basic Facts: An Empire Fragmented."
b. Ask subject to verbalize procedure.

Number Index

Training Program

The index you will now learn will be a number index, using numbers from 1 to 1,036. On this tape a number will be paired with the name of each part of the book. The names of the parts of the book are chapters, headings, subsections, reviewing the essentials, and page numbers.

1. Describe the index tape.

We are now going to listen to an indexed tape of a recorded book. When the tape recorder is in the play mode and when the track switch is to the left, you will hear the man's voice read a unit on Latin America. When the track switch is moved to the right, still in the play mode, you will hear consecutive numbers starting at 1 read every 10 seconds. When you put the tape recorder in the fast forward (FF) mode with the track switch still to the right, you will hear multiples of 10 every 10 seconds, that is, 10, 20, 30, 40, and so on. The appropriate index number occurs just before the part of the book it indexes. The speed at which the recorded book and numbers are played may need adjusting so you may want to slow them down or speed them up using your variable speed control. Are there any questions?

2. Familiarization

   a. Give subject cassette 1 right side up and request that he insert it in the player.
   b. Demonstrate and then ask subject to listen to tape when track switch is to the left (the text material track) and when the track switch is to the right (the index announcement track) in play mode (numbers occurring consecutively), and in fast forward (numbers occurring in multiples of 10).
   c. Have subject turn tape over to side two and listen to tape when track switch is to the left and when track switch is to the right in play and fast forward mode.
   d. With switch to right, have subject play tape in rewind pointing out that the multiples of 10 announcements are heard as garbled voice sounds, and that the consecutive numbers heard are beeps.

3. Introduction to print index

   a. Let subject look over first page of index.
   b. Indicate length of index.
   c. Show subject parts on index.
      Chapters
      Headings
      Subsections
      Reviewing the essentials
      Page numbers
      Index numbers

d. Have subject find the following on print index with paired index numbers and read each title.
   (1) Chapter 1 - ("Basic Facts: An Empire Fragmented")
   (2) 1st heading in Chapter 1 - ("Geography")
   (3) 10th subsection in Chapter 1 ("Wars of independence, 1800-1825")
   (4) "Reviewing the essentials" in Chapter 1 (locate with finger)
   (5) Page 386
   (6) The beginning of side 2

Remind subject that sometimes one index number is paired with more than one book part. Indicate an example on print index.

4. Find chapter forward

   a. Experimenter, put tape positioned at end of side 2. Tell subject position of tape.
   b. Ask subject to find Chapter 1 - "Basic Facts: An Empire Fragmented."
   c. Give subject a chance to figure out procedure. (Experimenter, choose method appropriate to situation.)
      (1) Use print index to locate index number that is paired with asked for book part.
      (2) Remind subject that numbers occur in 10s with the FF mode and consecutively on play mode (switch to the right).
      (3) Switch to right, fast forward to 10th number nearest one paired with asked for book part or play to asked for number (i.e., one paired with Chapter 1).
      (4) If subject has moved to 10th number nearest one paired with asked for book part, with switch still to right, in play mode move to asked for number.
      (5) With switch to left, verify book part announcement.

5. Find chapter fast forward

   a. Ask subject to find Chapter 2 - "Politics: The Paradox of Authority and Instability."
   b. Give subject a chance to figure out procedure. (Experimenter, choose method appropriate to situation.)
      (1) Use print index to locate index number that is paired with asked for book part.
      (2) Remind student that numbers occur in 10s with the FF mode and consecutively on play mode (switch to the right).
      (3) Switch to right, fast forward to 10th number nearest one paired with asked for book part play to asked for number (i.e., one paired with Chapter 1).
      (4) If subject has moved to 10th number nearest one paired with asked for book part, with switch still to right in play mode, move to asked for number.
      (5) With switch to left, verify book part announcement.

6. Find chapter rewind (Remind subject that he must use stop key.)

   a. Ask subject to find Chapter 1 - "Basic Facts: An Empire Fragmented."
   b. Give subject a chance to figure out procedure.
      (Experimenter, choose method appropriate to situation)
      (1) Identify index number where tape is located (fast forward mode).
      (2) Use print index to locate index number that corresponds with asked for book part.
      (3) Count how many multiples of 10 occur between present position of tape and index number paired with asked for book part

      or

      count how many beeps (numbers occurring consecutively heard backwards) occur between present position of tape and index number paired with asked for book part.
      (4) Switch to right, rewind listening to backward voice announcements, counting until multiples of 10 immediately larger than index number paired with asked for book part is reached

      or

      until beep signifying index number paired with asked for book part is reached.
      (5) If tape is positioned at multiple of 10 immediately larger than index number paired with asked for book part, with switch still to right, rewind counting beeps until appropriate index number is reached.
      (6) Switch still to right, in play mode, check index number.
      (7) If index number is looked for, with switch to left, verify book part announcement.

7. Find heading forward

   a. Ask subject to find "People."
   b. Subject should verbalize procedure.

8. Find heading rewind

   a. Ask subject to find "Geography."
   b. Subject should verbalize procedure.
      (Experimenter, choose method appropriate to situation.)
      (1) Identify index number where tape is located (FF mode).
      (2) Use print index to locate index number that corresponds with asked for book part.
      (3) Count how many multiples of 10 occur between present position of tape and index number paired with asked for book part

      or

count how many beeps (numbers occurring consecutively heard backwards) occur between present position of tape and index number paired with asked for book part.

(4) Switch to right, rewind listening to backward voice announcements, counting until multiples of 10 immediately larger than index number paired with asked for book part is reached

or

until beep signifying index number paired with asked for book part is reached.

(5) If tape is positioned at multiple of 10 immediately larger than index number paired with asked for book part, with switch still to right, rewind counting beeps until appropriate index number is reached.

(6) Switch still to right, in play mode, check index number.

(7) If index number is number looked for, with switch to left, verify book part announcement.

9. Find heading - side 2 - rewind

   a. Ask subject to find "A genuine revolution."
   b. Subject should verbalize procedure.

10. Find subsection forward on side 2

   a. Ask student to find subsection "Position of the Catholic Church."
   b. Student should verbalize activity.

11. Find subsection rewind on side 2

   a. Ask student to find subsection "Militarism after independence."
   b. Student should verbalize procedure.

12. Find reviewing the essentials forward

   a. Ask student to find "Reviewing the essentials" in Chapter 2.
   b. Student should verbalize activity.

13. Find reviewing the essentials rewind on side 1

   a. Experimenter, FF tape to end of side 1.
   b. Ask subject to find "Reviewing the essentials" in Chapter 1.
   c. Subject should verbalize procedure.

14. Find pages rewind (Remind subject not to confuse page numbers with index numbers)

   a. Ask subject to find page 382.
   b. Subject should verbalize procedure.

15. Find pages fast forward side 2

a. Ask subject to find page 404.
b. Subject should verbalize procedure.

APPENDIX C

TEST MATERIALS

Training Time_____

Student's Name_____ Age_____

School_____ Grade_____

Task Instructions - Outline II

Now we will see how well you have learned to use the index to find each book part; chapter, heading, subsection, reviewing the essentials, and page number. You will search both backward and forward. Both sides of the tape will be used. The maximum amount of time allowed to find any part will be 4 minutes. Stop when you locate the index announcement and play the book part announcement.

Task

Start with tape set at beginning of side one. (4 minute limit for each task) Subject must find tape announcement.

Find Page 417

2 Track Voice	4 Track Voice	Number Index
Time:	Time:	Time:
Remarks:	Remarks:	Remarks:

Find Chapter 3

2 Track Voice	4 Track Voice	Number Index
Time:	Time:	Time:
Remarks:	Remarks:	Remarks:

Find Subsection "Revolution of Rising Expectations"

2 Track Voice	4 Track Voice	Number Index
Time:	Time:	Time:
Remarks:	Remarks:	Remarks:

Find Heading "Historical Origins" in Chapter 4

2 Track Voice	4 Track Voice	Number Index
Time:	Time:	Time:
Remarks:	Remarks:	Remarks:

Find Reviewing the Essentials in Chapter 3

2 Track Voice	4 Track Voice	Number Index
Time:	Time:	Time:
Remarks:	Remarks:	Remarks:

Find Subsection "Iberian and African Impact"

2 Track Voice	4 Track Voice	Number Index
Time:	Time:	Time:
Remarks:	Remarks:	Remarks:

Find Page 420

2 Track Voice	4 Track Voice	Number Index
Time:	Time:	Time:
Remarks:	Remarks:	Remarks:

Find Chapter 4

2 Track Voice	4 Track Voice	Number Index
Time:	Time:	Time:
Remarks:	Remarks:	Remarks:

Find Heading "Present State" in Chapter 3

2 Track Voice	4 Track Voice	Number Index
Time:	Time:	Time:
Remarks:	Remarks:	Remarks:

Find Reviewing the Essentials in Chapter 3

2 Track Voice	4 Track Voice	Number Index
Time:	Time:	Time:
Remarks:	Remarks:	Remarks:

SUMMARY AND CONCLUSIONS

Study I was an attempt to design tonal index codes in order to identify a code that required little time to display, that had easily discriminable characters, and that could be easily learned. Five codes consisting of six characters composed of 1 or 2 elements were designed and compared. The two elements in code 1 varied in duration, those in code 2 varied in duration and pitch, those in code 3 varied in portamento, those in code 4 varied in pitch and portamento, and those in code 5 varied in duration, pitch, and portamento. When compared from the standpoint of ease of learning by college students, code 1 required 1/3 or less time than any of the other four.

In Study II, legally blind junior high and high school students appeared able to learn a variant of the duration code as easily as did college students. This duration code consisted of six characters composed of from 1 to 3 elements. These characters were designed so their sound was identical when played both forward and backward. With less than 2 hours training, these students were able to learn to find indexed parts of a textbook in an average time of 2 minutes and with 92% accuracy.

In Study III, three vocal index systems were compared. These included a system with spoken index information recorded on the content track, a system with spoken index information recorded on a separate track parallel to the content track, and the Zimdex system, which was a spoken number system recorded on a separate and parallel track. A group of students learned each of these systems and was tested for time and accuracy in finding parts of books on each. Location time was significantly less for the system with indexing and content recorded on the same track. Accuracy (93% correct) was equal among the systems.

Comparisons between the systems do not lead to identification of any one system with great superiority. Tonal systems, which can be expanded easily to eight characters of from 1-3 elements sounding the same both forward and backward, appear adequate for any indexing task. Their accuracy for finding book parts (92%) was almost identical with those for the vocal systems (93%). Search time for use of all systems was near 2 minutes. Tonal systems lend themselves readily to self-indexing of tapes by blind users who possess taping equipment with tonal indexing capability such as the APH-Modified Open-Reel Sony 105 Tape Recorder or the APH-Modified GE Model 3-5192 Cassette Tape Recorder/Player. From a technical standpoint tonal index systems are quite easy to produce and do not require especially recorded index tracks as is the case with two of the vocal systems. Tonal systems do not require braille or large type indices.

The main problem with tonal systems of any degree of complexity (more than 2 or 3 characters) is that they may vary widely in design from book to book and require special learning for each. Confusion in use of tonal systems could result from such wide variation. However, limitation in character number or application in indexing volumes where content outlines are standard makes application of tonal systems practical.

Of the vocal systems, the system containing both index information and content on the same track seems superior. Twice as much material can be included on the same tape as is possible with the other two systems. It is faster in locating items because its simpler operation requires manipulation of fewer switches on the player. Its independent use requires a braille or large type index identical to the two-track spoken system, but much shorter than that required by the Zimdex. It is true that the background noise present when searching the index of the one-track system is distracting as compared to the other two vocal systems, but this is only a slight disadvantage. From a production standpoint, the first two vocal indexes require recording of a special index track for every book, while once a number index is recorded for a Zimdex it can be used repeatedly.

In conclusion, in terms of general application, the system where vocal index information is recorded on the same track as the content appears superior. For indexing of their own tapes by blind users or for indexing multiple books where common index system designs apply, tonal systems should serve equally. However, where application of tonal systems requires repeated learning, the vocal system should be applied.

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