REPORT OF PROCEEDINGS OF

CONFERENCE ON RESEARCH NEEDS IN BRAILLE

September 13-14-15, 1961

AMERICAN FOUNDATION FOR THE BLIND, INC.
15 West 16th Street
New York 11, New York

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INTRODUCTION

A conference on research needs in braille was held in the Helen Keller Room of the American Foundation for the Blind in New York City on September 13 and 14, 1961. The conference was convened at 9:30 A.M. on Wednesday, September 13, and closed at 4:30 P.M., Thursday, September 14. Co-chairmen of the conference were Miss Kathern Gruber, Director, Division of Program Development and Dr. Milton D. Graham, Director, Division of Research and Statistics.

Participants in the conference were specialists in braille, educational specialists and research personnel. The participants and the agenda were:

LIST OF CONFEREES

1. Ashcroft, Dr. Samuel C., Associate Professor
   Education for Exceptional Children
   George Peabody College for Teachers
   Nashville, Tennessee

2. Axelrod, Dr. Seymour, Assistant Professor
   Medical Psychology
   Duke University Medical Center
   Durham, North Carolina

3. Barnett, Mr. M. Robert, Executive Director
   American Foundation for the Blind

4. Bowers, Mr. Robert A., Leadership Fellow
   American Foundation for the Blind

5. Clark, Mr. Leslie L., Assistant, Technical Devices Program
   American Foundation for the Blind

6. Cox, Miss Lois, President
   American Association of Instructors of the Blind
   Overlea, Maryland

7. Dorf, Mrs. Maxine, Member
   The AAIB-AAWB Braille Authority
   Library of Congress
   Washington, D.C.

8. Dupress, Mr. John K., Director, Bureau of Technological Research
   American Foundation for the Blind

9. Foulke, Dr. Emerson
   Department of Educational Research
   American Printing House for the Blind
   Louisville, Kentucky

10. Gruber, Miss Kathern F., Director
    Division of Program Development
    American Foundation for the Blind
    Conference Co-chairman

11. Graham, Dr. Milton D., Director
Division of Research and Statistics
American Foundation for the Blind
Conference Co-chairman

12. Hooper, Miss Marjorie, Member
The AAIB-AAWB Braille Authority
American Printing House for the Blind
Louisville, Kentucky

13. Josephson, Dr. Eric, Research Associate
American Foundation for the Blind

14. Krebs, Mr. Bernard, Chairman
The AAIB-AAWB Braille Authority
The Jewish Guild for the Blind
New York City

15. Newland, Dr. T. Ernest, Professor of Education
The University of Illinois
Urbana, Illinois

16. Rodgers, Mr. Carl T., Program Specialist in Braille
American Foundation for the Blind

17. Umans, Mrs. Shelley, Instructor
Teachers College, Columbia University and
Consultant in Reading, New York Public
Schools
New York City

18. Wilcox, Dr. Everett E., Program Specialist in Education and
Educational Aids
American Foundation for the Blind

19. Peterson, Mrs. John , Secretary to Dr. Graham
Stapleton, Miss Joan M. Secretary to Miss Gruber

AGENDA

September 13 - 9:30 A.M.

Chairman	Miss Kathern F. Gruber, Director Division of Program Development American Foundation for the Blind
Welcome	Mr. M. Robert Barnett, Executive Director American Foundation for the Blind
Report	Ad Hoc Committee on Automation and Braille Mr. John K. Dupress, Director Bureau of Technological Research American Foundation for the Blind

Paper	"Research in Braille - What Has Been Done" Mr. Carl T. Rodgers, Program Specialist in Braille American Foundation for the Blind
Paper	"Errors in Oral Reading of Braille at Elementary Grade Level" Dr. Samuel C. Ashcroft, Associate Professor George Peabody College for Teachers
Paper	"Tactual Symbols for the Blind" Dr. Emerson Foulke Department of Educational Research American Printing House for the Blind
Paper	"A Tactually Presentable Learning Aptitude Test for Use with the Blind" Dr. T. Ernest Newland Professor of Education University of Illinois
Report	"Effects of Early Blindness - Performance of Blind and Sighted Children on Tactile and Auditory Tasks" Dr. Seymour Axelrod, Assistant Professor Medical Psychology Duke University Medical Center Durham, North Carolina
Report	"Some Insights Concerning Reading Problems as Reflected in AFB Leisure Activity Study" Dr. Eric Josephson, Research Associate American Foundation for the Blind

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September 14 - 9:30 A.M.

Chairman	Dr. Milton D. Graham, Director Division of Research and Statistics American Foundation for the Blind
Introductory Remarks	Dr. Milton D. Graham
Paper	"Research - What Needs to be Done as Seen by the American Foundation for the Blind" Mr. Carl T. Rodgers
Paper	"Research - What Needs to be Done as Seen by the Braille Authority and its Advisory Committees" Mr. Bernard Krebs, Chairman The Braille Authority
Discussion:	all participants
Summary of Conference	Mr. Robert Bowers, Leadership Fellow American Foundation for the Blind

This report of the proceedings of the conference follows the above agenda. Papers that were read are reproduced here verbatim. Reports given extemporaneously were tape-recorded and with minor editorial changes are reproduced here as given. Discussion was tape recorded and with minor editorial changes and considerable selection of verbal exchanges deemed valuable by the undersigned co-chairman are reproduced here. The original tapes of the entire conference are available for reference on request.

These Proceedings of the Conference will be followed up in the near future by a paper on research needs in braille as seen by the undersigned co-chairman. This paper will be programmatic in approach and will be given the same distribution as these Proceedings of the Conference.

Milton D. Graham, Ph.D.
Director, Division of Research and Statistics
American Foundation for the Blind
September 29, 1961

REPORT ON
AD HOC COMMITTEE ON AUTOMATION AND BRAILLE

John K. Dupress

It might be in order to indicate who the members of the Ad Hoc Committee are. First, I want to say that we do not feel that we have any powers at all to tell anyone what to do. We operate out of a variety of offices and although the meeting at the Massachusetts Institute of Technology was sponsored by the American Foundation for the Blind and the host facility was MIT, this Committee is made up of people from university, government, other foundations, and commercial interests. This was done on purpose in order that we might get all of these points of view represented. There are eleven members on the Committee and at any given time only six of us meet. Two of them are MIT staff members who alternate -- Professors Dwight Baumann and Robert Mann in the Mechanical Engineering Department; Mrs. Ann Schack, John Wheeler and Dick Booth of the International Business Machines Corporation alternate; Mr. Virgil Zickel, Miss Marjorie Hooper and Mr. John Haynes of the American Printing House for the Blind alternate; Mr. Leslie Clark of the American Foundation for the Blind in the International Technological Survey Project is on the Committee -- Mr. Howard Freiberger represents Veterans Administration -- and I serve as Chairman of this Committee. We feel that there ought to be some permanent group like this who not only have technological know-how, but have a present interest in technological research which can contribute something to the area of Braille. The Committee met a few weeks ago and plans to meet twice a year. Shortly after the first year we hope to put out a modest publication which will bring up-to-date research that is going on in the area including the present status of projects which are still on-going. The main purposes of this Committee are to serve as consultants to government organizations which provide funds for research in the area of Braille; to get together with individual researchers who have ideas; to consult with projects while they are still on-going; to provide specialized know-how or be able to tell the researchers where they can find it, should this be necessary, and from time to time, meet and review what is going on with a view toward specific recommendation.

In discussing the last meeting, I shall not provide details here for the following two reasons -- first, the time limitations of this agenda and secondly, because we plan to put out a report on this subject. Now to get back to the MIT Conference, we have a 77 page report which are detailed notes of that Conference. Any of you who do not have a copy may secure one during coffee break -- my secretary will bring down enough extra copies and you can take them away with you. We plan to issue a copy of the notes of our Ad Hoc Committee after I submit them to the Committee for their review. What we tried to do at the past meeting were the following things:

First, we reviewed unfinished projects. I will give you an example -- the IBM Braille Belt Reader has quite a considerable history when you come to research and development. It has had a history of testing. Now we are trying to see, as a Committee, what we can do to either have this resumed in the Engineering and Development area within IBM or at least if this is not going to be done, to know it and recommend something else. We reviewed, of course, a variety of other unfinished projects. We also have some sub-committee projects which we don't feel are the purview of existing organizations or people outside of technological areas.

A simple example, for instance, is the establishment of standardized punched-card and punched-tape coding, so that anyone who works on instrumentation for machine translation or as transducers to feed Braille into people, that these individuals can produce instrumentation which is compatible with existing systems at the American Printing House or other places. That is one type of a project that we have on a sub-committee basis. We also considered projects that might be done. That is, good ideas. An example, for instance, of a good idea is a monotape to Braille Code Converter. This gets you to Grade I Braille only, but if the output is compatible to the input of the 704, machine translation gets you to Grade II Braille. This idea did not come out of the Committee. It was mentioned during the meeting at MIT. What the Committee would try to do would be to follow through on this project which is being done on a part-time basis by an engineer of AVCO Corporation. When it is brought to the prototype stage, then probably the people at MIT will take it over from there and actually build a working model. We also feel that we should serve as liaison. We should maintain liaison with the people in the social science and program areas. Although it is perhaps out of order to say this, I am going to get it across anyway -- then people can overrule me -- that is that I feel that out of this conference, you people should set up a similar committee of social scientists and program specialists so that we will have the entire area of Braille covered completely from the technological through the social science testing in measurements into the actual implementation in programs. It does no good to develop instrumentation if it does not fit people, and it can only fit people if the social scientists find out what the people can really comprehend. Instrumentation does not get into programs unless people already in programs realistically survey the need for such instrumentation, the sources of funds, etc. The Committee also feels it should recommend to the social science and programs people things that we need to know as technologists if we are going to develop realistically instrumentation that will get into the hands of blind people. For instance, these are some of the things which we need to know:

We need to know what the market is for these devices, that is, how many blind people need what kinds of braille material? How many organizations and individuals are involved in producing this material -- all the way from the transcribing right into the production on a relatively large scale for Braille? We need to know, for instance, about how people actually learn Braille? What are the reading habits of blind people? Do they read with one hand, two hands, a single finger; how do they do this? How much of the reading is slowed down or speeded up by, for instance, changing the ratio of active to passive sensing by the human being? There are a lot of these questions that we just don't know as technologists and it is rather wasteful just to go on building instrumentation and then trying it out on people only to find that it doesn't work too well; when some of this could be done without instrumentation. Some of it could be done if those of you in the social science and program areas say to technology, "okay, we need this kind of machine as a learning device." "We need this kind of machine to measure how people really operate in the area of Braille reading." These are some of the things which the Committee deals with. We believe that such a permanent consulting-advisory -- call it what you will, Committee, is necessary. No organization including the American Foundation for the Blind, the American Printing House for the Blind, we feel, has the breadth of specialists which are not only on the Committee, but whom the Committee knows personally and this is one way that we can continue to bring to bear in this area new ideas, specialized know-how and what is more important, people who are capable and motivated.

PROPOSALS FOR RESEARCH ON PROBLEMS ENCOUNTERED BY USERS OF EMBOSSED TYPE FOR READING AND WRITING

Carl T. Rodgers

Method of Presentation

Since the beginning of the century, when the so-called "Battle of the Types" was reaching its climax, the work of developing a suitable system of reading and writing for blind persons in this country has rested in very large measure in the hands of the American Association of Workers for the Blind and the American Association of Instructors of the Blind. The committee reports which have been submitted to the annual or biannual conventions of each Association comprises a history record of the Associations' work carried on to date.

The content of Part One of this paper has been developed by taking excerpts from this history record as the focal point of presentation, and each excerpt is followed by citations from other sources relating to the content of each excerpt. Part Two is comprised of recommendations for further scientific investigations into the problems of touch reading and related subjects.

Part One

Review of Records of Investigations, Findings and Other Activities Related to the Development OF Touch Reading and Writing

Experiments Conducted by the Uniform Type Committee on Various Aspects of the Relationship of Legibility to Embossed Orthographic Characterisitics

1. Regarding the Relationship of Legibility to Number of Dots in an Embossed Character

In the 1907 AAWB convention, the Uniform Type Committee reported that it had conducted experiments to determine the relationship of legibility to the number of dots in an embossed character. Two lists of figures of 100 words each were prepared in American Braille. Each list contained 433 letters, but one contained only 795 dots, while the other contained 1,379 dots. The words were disconnected; that is, they did not comprise meaningful phrases and sentences. The list containing fewer dots was read by 39 readers in 21 percent less time, with 43 percent less errors.

At the 1909 AAWB convention, the Committee reported on an experiment designed to find out whether New York Point characters of few dots could be recognized more easily than those of many dots. Two lists were prepared, both containing the same number of letters, but one containing 44 percent less dots. The list with the fewer dots was read in 20 percent less time, with 55 percent less errors. The Committee reported that similar tests gave similar results; and at the 1911, 1913, and 1915 AAWB conventions, the Committee made similar reports on the higher degree of legibility of characters containing fewer dots.

Citations from Other Sources. In contrast to these findings, Buerklin, a German investigator, in 1917 indicated that optimal tangibility does not depend on number of dots in a character as much as on such characteristics as simplicity of geometrical form,

as in the case of the braille letters "g" or "l", and also on what he called "open characters", as in the case of the braille letters "m", "u", "x", and other characters such as the "sh" sign (dots 1-4-6), and in general, on the shape of a character. In addition, he indicated that certain symmetrical characters cause frequent confusion, as the braille letters "f", "d", "h", "j", and other characters such as that for "ch" (dots 1-6), "st" (dots 3-4), and others, which differ only in position but not in shape from one another. In all, he pointed out 37 upper-cell symbols which are symmetrically contrasting or "mirror characters".

2. Regarding the Relationship of Legibility to Characters two points high or three points high.

At the 1907 AAWB convention, the Uniform Type Committee described a test designed to find out whether characters two points high are easier to read than characters three points high. Two lists of common words were prepared in American Braille, each containing the same number of words, letters and dots, and the same number of words of any given number of letters; but in one list no letter was more than two points high, while in the other many letters three points high were included.

The Committee reported that in 55 trials the list which included the tall letters was read in one percent less time, with two percent less errors, than the one in which the short letters were used.

Citations from Other Sources. Buerklen's findings concerning the easier perceptability of "open characters" seems to have some bearing on the results of the Committee's experiment regarding easier legibility of characters three points high. All open characters are, of course, three points high.

3. Regarding the Relationship of Legibility to Horizontal Signs or Vertical Signs.

At the 1909 AAWB convention the Committee reported on an experiment designed to find out which signs are more legible - the horizontal or the vertical lines.

Two lists of 200 signs each were prepared. In one of the lists all the signs, varying from one to three dots long, were placed horizontally, while in the other list the same signs were placed vertically. Each of the 12 readers who took part in the experiment, all of whom knew New York Point and American Braille, read the two aloud, while a seeing person followed the reading with an ink copy, marking the errors and checking the time spent on each list. The signs were called not by their letter values, but by the number of dots they contained. The signs used represented more than 1/3 of the recurrence of the alphabet in New York Point and American Braille. The longest of them could be taken as the extremes of the two positions - the most horizontal and the most vertical.

The horizontal signs were read in 33 percent more time, with 321 more errors than the vertical signs; and other tests showed a similar result. In summarizing the conclusions of the tests, the Committee stated that "the vertical position offers greater advantages in legibility than the horizontal."

At the 1911 AAWB convention, the Committee's report included additional experiments with horizontal and vertical characters. In one of them, two lists of 200 characters each were used, each character being a straight row of dots from one to three. In one list all the characters were placed in a horizontal position, while in the other they were placed in the vertical. Thirteen pupils of the Batavia State School for the Blind, who were familiar with New York Point but who had at some time read American Braille, had to indicate the number of dots in each character.

The average time for reading the horizontal characters was 9.6 percent more than that taken to read vertical characters, with 163 percent more errors.

At Perkins School for the Blind, the same lists were read by three pupils who read American Braille but who had read New York Point at some time. The average reading time for the horizontal characters was 40 percent more than for the vertical, with 800 percent more errors. Additional tests produced similar results.

On the relative perceptability of vertically versus horizontally characters, the Committee's experiments were extensive indeed, and its findings would appear to be quite conclusive.

Citations from Other Sources. Wundt, another German investigator, in referring to the spacing of the dots and characters of the regular Louis Braille alphabet said that "the points stand at such distances that their spatial thresholds overlap on the ball of the index finger, while the points of a single character are found simultaneously within that space."

The simultaneous perception of single characters, if Wundt is correct, could account for the Committee's findings that vertical characters offer greater facility in reading than horizontal characters.

Ashcroft, in a recent unpublished study on Errors in Oral Reading of Braille at Elementary Grade Levels, found that, in order of difficulty from easy to hard in terms of errors produced, the words comprised of two-cell contractions ranked sixth; i.e., next to the most difficult word group tabulated in the study. It should be noted that two-cell contractions are the same type of horizontally extended characters that the Uniform Type Committee had found more difficult to read, at least from the standpoint of orthographic structure as such.

4. Regarding the Relationship of Legibility to Characters Which are the Same in Shape but which Derive their Meanings from Their Upper or Lower Position in the Cell.

These characters were designated by the Uniform Type Committee as "equivocal characters". The specific references made in the Committee's report on this particular investigation to characters which are peculiar to New York Point or American Braille would be meaningless to those not very well acquainted with either one of the system. Therefore, it seems best not to summarize the Committee's description of the tests, but simply to cite the Committee's conclusions on the problem which "equivocal characters" present:

"Experiments tend to show that time is consumed and certainty diminished by the labor of determining the position of characters which are like other characters except for their level in their line."

Citation from Other Sources. Ashcroft in the same study on errors in oral reading, found lower-cell contractions to be fourth in the order of difficulty from easy to hard, as previously mentioned, and stated that "lower-cell contractions were the most difficult of the group of single cell contractions. .....Those lower contractions having part-word and whole-word meanings were more difficult than those like "his", having only a whole-word meaning".

In addition, Ashcroft found that the double consonant contractions proved especially difficult.

It should be noted that lower-cell contractions are the orthographic type of characters which in their upper-cell positions stand respectively for the letters a,b, c,d,e,f,g,h,i,j. The difficulty, then, whether orthographic characters belong to

Grade Two braille or any other touch system of reading and writing, is one of equivocation. Ashcroft described the problem in part as one of "vertical alignment", and gave the following illustrations from his study of errors occasioned by equivocation: "was", read "just"; "enough", read "every"; "were", read "go", and so on.

5. Regarding the Relationship of Legibility to Upper-cell (unequivocal) Whole-word Contractions

In its report to the 1907 AAWB convention, the Uniform Type Committee stated:

"For the unequivocal whole-words signs, the lists were made up of the words which may be represented by such signs, several times repeated, with a few other words repeated. In one list all the words were spelled in full, while in the other, which contained the same words in a wholly different order, the whole-word signs were used wherever possible... The list containing whole-word contractions was read in 16 percent less time, with 35 percent less errors".

After further studies of unequivocal whole-word contractions, the Committee, in its report to the 1909 AAWB convention, concluded as follows:

"Unequivocal whole-word signs facilitate reading".

Citations from Other Sources. Ashcroft, in his investigation on errors in oral reading, noted that words which are represented by braille alphabet characters standing alone comprised the category which children in grades 2-6 read more easily than any other category in this study. The next more difficult category comprised words in full spelling (that is, words where no contractions at all were involved), while words in which upper-cell contractions appeared came in third place.

Ashcroft also noted that the contraction for "with", "of", "for", and "and", in addition to "the", when used as whole-words in the order given, from easy to difficult, gave a low-error index, but when they occurred as parts of words their error indices indicated much greater difficulty. Other upper-cell contractions followed different difficulty patterns.

Perhaps the succinct statement previously quoted from the Committee's 1909 report is still the only thing that can be said with some degree of certainty concerning the relationship of legibility to contractions - "unequivocal whole-word signs facilitate reading".

Effects of the findings of the Uniform Type Committee on the Further Development of a System of Reading and Writing for Blind Persons

Although the recommendations of the Uniform Type Committee for a unified system of reading and writing, made in its final report to the 1915 AAWB convention, were not adopted by the Commission on Uniform Type for the Blind which in 1916 succeeded the Uniform Type Committee, there is no doubt of the extensive investigations of the former influenced the decisions of the latter in its adoption of what became known as Revised Braille Grade One and a Half.

In this form of modified British Braille, only two of the Grade Two lower-cell contractions (equivocal characters) were retained, i.e., the part-word "en" contraction (dots 2-6) and the whole word and part-word "in" contraction (dots 3-5).

Of the upper-cell contractions (unequivocal characters), all, including the whole-words which are represented by braille alphabetic characters standing alone were retained, but with the following exceptions: The characters "ch" (dots 1-6), "st" (dots 3-4), and "ble" (dots 3-4-5-6).

The Uniform Type Committee had found that the characters standing for "ch" and "st" tended to cause confusion with the braille letter "k"; and they felt that since the character dots 3-4-5-6 played such an important role as the numberal sign, it should not be assigned a contraction value when used meadially or finally in a word.

Of the Grade Two two-cell contraction, whose horizontal alignment extends over as many as three braille cells when some of these signs are preceded by the capital sign, none were retained - apparently because of the Uniform Type Committee's repeated findings that horizontally extended characters are more difficult to read than vertical characters.

Although the Uniform Type Committee does not appear to have made too extensive a study of abbreviated words, as those prescribed by English Braille, its findings on various types of braille orthographic characteristics apparently persuaded the Commission on Uniform Type for the Blind to reject the abbreviated (short-form) words of Grade Two braille.

Citations from Other Sources. In this connection, it is interesting to note Ashcroft's findings and observations regarding words which have prescribed abbreviated forms under the code.

"The order of difficulty from easy to hard, in terms of errors produced, is..., finally most difficult, Category Six, words having abbreviated forms prescribed by the braille code... The factors which make many Category Six words the most difficult in the study are clearly difficulty of meaning and infrequency in appearance. However, there are a number of frequently used words with common meanings that also have large error indices, such words as 'also'(abbreviated 'al'),'always' (abbreviated 'alw'), 'above' (abbreviated 'abv'), 'either' (abbreviated'ei'), 'tomorrow' (abbreviated'tm'), 'such' (abbreviated 's' and the 'ch' sign), 'paid' (abbreviated 'pd') and 'him' (abbreviated 'hm')....Relatively little of the full spelling of the word is retained, minimizing the utility of word-attack techniques and putting the burden for recognition of these words on memory."

Type Scale. The Uniform Type Committee had worked out a scale of type, but the tests which it conducted were considered inconclusive. In 1920 the Commission on Uniform Type for the Blind reported that it had used the scale of the Uniform Type Committee as the basis for conducting a set of tests to investigate the relative desirability of various spacing values. The values designated as "Commission Scale" were found to be most legible after thorough testing and, therefore, were adopted as the standard spacing values.

Since that time no significant change in type scale has taken place.

Citations from Other Sources. Recently, Meyers, Ethington and Ashcroft in a study entitled Readability of Braille as a Function of Three Spacing Variables, in which the subjects of the experiments included both adult and children (the latter from grades 5-12), suggested that for adults the spacing values presently in use offer the greatest advantage in legibility. These specifications are as follows: .090" between dots within cells; .160" between cells; .220" between lines of braille; dot height,.015"; base diameter, .055".

With regard to the school children, the results of the study indicated that "the children read braille whose cell spacing was .123" at a greater rate than they read material whose cell spacing was .160".

It may be interesting to relate this finding to an observation found in Ashcroft's study on errors in oral reading.

"It should be noted that so-called 'open characters' such as 'k', 'ch' sign, and 'st' sign, are often involved in horizontal alignment problems. A word like 'know' (dots 5--k) or 'long' (1--5 6--g) leaves much space for the little fingers of young readers to lose their left-right orientation".

Perhaps this is one reason why the children read braille whose cell spacing was .123" and .140" better than they read the material whose cell spacing was .160". However, it should be noted that the "open characters" referred to by Buerklen and other investigators as easily legible characters did not comprise of two-cell contractions, as the words "know" and "long", but were simply one-cell characters as the letters "m", "u", "x", and so on.

General Statement on the Activities of the Uniform Type Committee and the Commission on Uniform Type Committee for the Blind

It would seem that the extensive investigations conducted by the Uniform Type Committee yielded significant findings on the legibility problems relating to various orthographic characteristics of embossed type. In its final report to the AAWB the Committee proposed the adoption of a system of touch reading and writing which it called "Standard Dot", which combined features of both New York Point and American Braille. Analyses of all the tests (including those not mentioned in this paper) conducted by the Committee may be found in the Proceedings of the 1915 AAWB convention, appendices A-L, pages 93, 123, 124, 142, 154, 155, 158, 161, 162, 163, 165.

At the 1916 AAIB convention, the Commission on Uniform Type for the Blind, established jointly by the AAWB and the AAIB, reported that negotiations had been initiated with the British to work out a uniform-type system for use by the blind of the English-speaking world. It was found, however, that uniformity could not be achieved on the basis of Standard Dot, because of the reluctance on the part of the British to accept any of this systems' features. Furthermore, superintendents of American schools for the blind were disinclined to adopt Standard Dot unless the British did likewise. For these reasons Standard Dot failed, without its merits or drawbacks being evaluated either through experience or experimentation. The Commission on Uniform Type finally recommended the adoption of the previously-referred-to Revised Braille Grade One and a Half. This step did not bring about a unified system for blind persons of the English-speaking world, but, as already mentioned, followed in large measure the Uniform Type Committee's findings on legibility problems.

Adoption of Grade Two Braille and Subsequent Developments

The use of Grade One and a Half braille prevailed officially in the United States from 1918 to 1932. Meanwhile, a committee known as the Special American Uniform Type Committee was appointed jointly by the AAWB and the AAIB to arrange with the British for a unified system. In 1932 this Committee recommended the adoption of Grade Two braille by this country, and the recommendation was approved by the AAWB and the AAIB, thus making the use of Grade Two braille official in the U.S.

A careful reading of the Special American Uniform Type Committee's report reveals

that the Committee evaluated Grade Two braille contractions and abbreviated words from the following standpoints:

1. Clearness of expression.
2. Degree to which they facilitate reading both by the casual as well as by the expert reader.
3. Their learnability.
4. The extent to which they save space.
5. The extent to which they facilitate writing.

How these important features of any system of touch reading and writing were actually investigated by the Committee is not clearly revealed in its report. At the London Conference the Committee accepted practically all the features of Grade Two braille orthographic types, except that the British agreed to the following changes:

1. The contractions and abbreviated words used mostly in religious literature were dropped from the system.
2. Dot 6, the capital sign of Grade One and a Half braille was accepted as the Grade Two capital sign.
3. Dots 4-6, the italic sign of Grade One and a Half braille was accepted as the Grade Two italic sign.
4. The abbreviation point (dot 3) used in Grade Two instead of the period to indicate the abbreviation of a word, was eliminated.
5. Five new abbreviated words were added to Grade Two, as follows: "across", abbreviated "acr"; "letter", abbreviated "lr"; "necessary", abbreviated "nec"; "quick", abbreviated "qk"; and "together", abbreviated "tgr".

6. Contractions were to be ommitted when they would interfere with legibility or pronunciation.
7. The Grade One and a Half braille percent sign was retained.
8. Letterpress was to be followed in the writing of Roman numerals.

From a careful reading of various committee reports, one gathers the impression that, since the adoption of Grade Two braille in the U.S., a new general method of approach superseded the methods of investigation which had been employed by both the Uniform Type Committee and the Commission on Uniform Type for the Blind as a means of attacking the problems involved in touch reading and writing. Here are a few excerpts from the various reports.

From a paper delivered at the 1933 AAWB convention, entitled Conformity in Standard English Braille, we read:

"By sequence is meant that the sign represents the letters for which it stands, no matter in what combination they may occur. Sequence is based on the principle of recognition, claiming that brevity under the finger makes the text more legible. ... Syllabication arises out of the needs of pronunciation. The two vital principles, then, of word reading are recognition and pronunciation. They are expressed in the theories of sequence and syllabication. Advocates of syllabication insists that the finger moves syllable-wise and, therefore, that syllable forms rather than words forms are essential to facilitate reading by touch".

At the 1915 AAIB convention the Braille Committee of that Association presented a paper entitled The Early Introduction of Grade Two Braille, from which we read as follows:

"Perhaps the 'backyard' research of our Grade Two braille project, as it has been so aptly named, would never be accepted by any universal measurements of research. It

certainly was not scientific, ponderous in movement and voluminous in words; it was not even set up on norms, indices, controls, or with extensive study of finger perception. Some attempt was made, however, at practical evaluation of information which would be helpful to the teacher beginning such a program. A thorough enumeration and frequency of occurrence count of the contractions which would appear in the text to be introduced was available. Some discussion centered on an attempt to determine the order of difficulty of contractions and whether a text should be especially written which would gradually introduce the contractions in the order of difficulty. This naturally brought up the question of who would or could determine the difficulty of one contraction over another and on what basis. Rather than to make any such scientific study on this question, our group chose the unorthodox approach and proceeded to go ahead on the basis that the primary books to be used should be embossed as they were written by the author, assuming that we could not ignore the previous words study and vocabulary work already done by the publisher and the author".

Ashcroft, on the other hand, in his research on errors in oral reading, containing error tabulations, error indices and error analyses, raises the following point relevant to the above citation:

"Common practice in the preparation of reading materials in braille is to transcribe print material into braille with relatively little modification. This is true from the very first reading experience of children, throughout the reading instructional program. The question is raised as to the appropriateness of this practice, especially in the beginning of reading experience. If there were a one-to-one relationship between the print and the transcribed braille materials, this practice might be more defensible. There are, however, some apparently significant ways in which contexts are changed, especially by the space-saving efforts characterizing braille. Abbreviations, contractions, and the assignment of multiple meanings may have effects on the level of difficulty of graded reading material".

It would seem that the implications of this problem alone are so far-reaching as to justify an entire research project on the subject.

At the 1955 AAWB convention, the AAWB-AAIB Joint Uniform Braille Committee, reporting on its work of revising the Standard Braille Grade Two code, stated in part as follows:

"The Committee was most pleased by the favorable comments received from many braille readers and not at all disappointed that we had not been able to satisfy all points of view. ... The Chairman wrote to the members of the three Home Teachers Associations and the chairmen of the Primary and Language Arts Workshop Sections of the AAIB to ask the committees of three from each group be appointed to report to us from the regional conventions why their comments on the proposed revisions....

It is not the intent of the Chairman to pass over this matter lightly or to give the impression that criticism of the revisions was not expressed. This, however, was to be expected. We do not earnestly feel, however, that admitting that the present code has never fully satisfied all readers and transcribers, we could do no more than our predecessors in trying to satisfy the majority of thinking, and hope that the minority will not feel ignored. ..."

In considering the value of subjective reaction and personal preference as a means of carrying out objective investigations, the following observations from the previously cited study, Readability of Braille as a Function of Three Spacing Variables, might throw some light on the matter;

"Another result not previously stated requires some interpretation - the subjective

reports by the readers concerning the kind of braille they were reading. The subjects were given no information concerning the nature of braille they were reading. At the end of the last reading period they were asked questions about the distance between the dots, cells and lines, and they were asked whether they preferred the braille they were reading to the Standard Braille. Many subjects reported that one or more of the spacing variables were closer than Standard Braille when this was not actually the case ...."

Perhaps the best approach toward effective investigation would be 1) Systematic objective testing under universally accepted norms of controls, indexing and tabulation 2) Opportunity for the expression of personal preferences properly evaluated according to the accepted methods of analyses and statistics.

The new approach in the development of touch reading and writing since the adoption of Grade Two braille in the U.S. can be finally summarized with the following citation from the Joint Uniform Committee's report to the 1958 AAIB convention:

"....There are many who have considerable misgivings about Standard English Braille Grade Two as it stands today, without any changes, alterations or improvements. So, how could we be expected to accomplish anything better than a more easily interpreted revision of the code book which incorporated a few of the more commonly accepted usages and often-voiced desires for uniformity?"

The revised code book, entitled English Braille: American Edition, 1959, officially wnet into effect on January 1, 1959.

ERRORS IN ORAL READING OF BRAILLE AT ELEMENTARY GRADE LEVELS

Samuel C. Ashcroft, Ph.D.

Purpose of the Study

The intent of the study was to analyze the type, frequency, and level of errors that occur in children's oral reading of braille. The study attempted to determine the nature of errors and their relative prevalence through the elementary grades, to provide a means for teachers to identify errors and to suggest how these errors might be remedied or avoided. It was undertaken to suggest changes in methods and materials that would facilitate more accurate and rapid reading. The study should also have implications for guiding code revision and additional needed research.

Procedures

The investigation was planned to study a large number of the blind children. The investigator's efforts were supplemented by those of cooperating investigators.

The study was concentrated on the second, fourth, and sixth grades, but data were obtained also from the third and fifth so that trends might be considered.

Each child was tested individually. After adequate rapport had been established, standardized instructions were read.

As the child read the examiner recorded above each word that was not read precisely as it should be, the exact expression of the child on an inkprint copy of the test materials.

Each child started reading paragraph one and read successive stories until he made ten or more errors in one paragraph excluding repetitions. Following each paragraph, the child was asked the reasons for any hesitancies and these were recorded.

In addition to the reading behavioral data, a number of types of descriptive information were obtained to help in the interpretation of the data. Remaining vision was described. Facts about reading history were listed. Teacher estimates were obtained of intelligence, motivation in school work, quality of previous performance in braille reading, and in other school activities.

An evaluation by teachers was obtained regarding each child's adjustment to school life in general. Additional handicapping conditions were noted and described. At the conclusion of the reading session, any unusaul factors present were noted. Adjustment to the reading session and motivation was evaluated.

Characteristics of the Subjects

More than 728 children participated in the study. Data have been analyzed for the 728 children who read at least one full paragraph, who were in the second through the sixth grades, and who did not have some additional handicapping conditions that would significantly affect their reading behavior.

The complete dissertation presents data descriptive of the chronological ages of the subjects by greades, sex, and type of educational placement in which they were. For example, there were 204 second graders ranging in age from six years seven months to fourteen years six months with a median of eight years nine months. There were 113

boys and 91 girls at this grade level. Thirty-five of the children were in day school programs and 169 were in residential schools.

More than 80% of the children were ranked by their teachers as average or above in intelligence. Day school children were rated higher and less variable as a group than were children in residential programs. Day school girls tended to be rated higher than their male counterparts, but residential program girls were rated somewhat less bright than boys.

The 728 children read 6,433 paragraphs containing 543,065 words in all, and made a total of 29,112 errors of all types. Errors, for the purposes of this study, were broadly defined. They included everything that could be defined as a slight difficulty with the content, context, and mechanics of the paragraphs. The errors may be conceptualized as comprising a continuum of difficulties ranging from slight hesitations (indicating momentary difficulties) to the grossest of breakdowns in the reading process reflected by random, meaningless responses made up of guesses showing little relationship to the reality of the embossed symbols. The point to be noted in connection with this suggested continuum of errors is that the error total, 29,112, is not a homogeneous group of errors of <u>equal import</u> for analysis of difficulty in reading in braille. Yet, all of these errors contribute to an <u>understanding</u> of the problems entailed in reading in this medium.

The Basic Premise Underlying Analyses

The analyses of the findings are made in terms of the premise that reading, no matter what the medium, fundamentally involves the same psychological processes and has as its purpose the communication of meaning. The literature on conventional reading is in rather general agreement that the minimum essential factors in reading are perception and interpretation. As Hildreth (1958) has pointed out, "Reading is a mental process involving the interpretation of signs perceived through the sense organs." Nothing about braille reading excludes it from a definition of this type. It is evident that the same factors are essential in braille and the problems encountered are therefore, similar in nature to those found in any other reading behavior. What differences there are, lie largely in the differences in modality that is, touch in contrast to vision; and in medium that is, dot symbols in contrast to print letter symbols. These differences and the characteristics related to them are reflected in the errors associated with reading in braille.

The low incidence of identified error makes many of the analyses proposed at the outset of the study seem impractical. Analysis for sex differences and differences in educational program are examples. Therefore, emphasis in the analyses has been placed largely upon orthographic features of the code and eight types of errors which appear to provide promising leads for improvement in instruction, materials for instruction, and possible braille code revision. These analyses will follow a consideration of the difficulties encountered in the orthographic categories.

Analysis of the Findings

Wide variation was apparent in the range of individual and group differences in reading ability of the children and grade groups participating in the study. For this reason, the children read different amounts of the prepared material. In order to have a common base on which to compare errors in view of the different total amounts read, error indices were computed by grade for each word in the paragraphs.

It should be remembered that the errors dealt with in these connections do not comprise a homogeneous group with respect to type. Of the total 29,112 errors, 12,108

or 41.6% of them provide data for qualitative analysis with direct relevance to the problem. It is in the analysis of substitutions for words, parts of words, and letters that the most fruitful material is found for an analysis of these difficulties. For this reason attention was focused on the substitution errors.

The words were grouped in categories according to the type of braille orthography prescribed by the braille code for their presentation. Seven categories were utilized for this purpose.

Category I words were those in full spelling.
Category II words were those in which a braille alphabetic character standing alone represents the complete word.
Category III words were those in which symbols called "upper contractions" (because they contain dots in the upper part of the cell) represent part of the word.
Category IV words were those in which lower contractions (because they contain dots in the lower part of the cell) represent part of the word.
Category V words were those whole and part word contractions made up of two cells.
Category VI words were those abbreviations as prescribed by the braille code.
Category VII words were those words made up of combinations of the other six types of orthography.

It was these seven categories into which the words were grouped for error tabulation and for later error analysis.

Average error indices for the grades by categories of words were computed to determine the order of difficulty among the categories.

Six errors indices were computed for each word. The first error indices were for all the five grades represented by the children in the study. The other five indices were specific to the five grade levels of children who participated.

The order of difficulty, from easy to hard in terms of errors produced, is Category II, alphabetically abbreviated words: Catebory I, words in full spelling; Category III, words containing upper contractions; Category IV, words containing lower contractions; Category VII, words made up of combinations of the other types of orthography; Category V, words comprised of two cell contractions; and finally, most difficult, Category VI, words having abbreviated forms.

These data indicate that Categories I, II, III, and IV contribute 74.3% of the words, but the errors associated with these words make up only 53.8% of the total errors. Categories V, VI, and VII contribute 25.7% of the total words, but the errors associated with these words make up 46.3% of the errors. That is, about one fourth of the material constituted the basis for nearly 50% of the errors.

The orders of difficulty for grades two and three were identical. The same was true for grades four and five. Grade six children differed by about 3 errors per 1,000 words read, which appeared to be a chance difference. Other minor differences in order of difficulty appeared to be chance differences of small magnitude.

Short Form Words (Category VI)

The factors which make many category VI words the most difficult in the study are clearly difficulty of meaning and infrequencey of appearance. However, there are a large number of frequently used words with common meanings that also have large error indices, such words as "also", "always", "above", "already", "neither", "either",

"tomorrow", "such", "paid", and "him". It appears that the space-saving efforts have so reduced the short form words that the abbreviations cause special difficulties. Relatively little of the full spelling of the word is retained, minimizing the utility of word attack techniques and putting the burden for recognition of these words upon memory. Reference to counts of frequency of appearance (Lockhead, 1954 and Irwin, 1929) show that the incidences of many of the more difficult short form words in general literature are so low that little space saving is actually accomplished. However, difficulty is added by them to reading in braille. The data of this study on difficulty from the standpoint of error, considered with data on frequency of appearance can provide useful guidelines for decisions with regard to words that might be more effectively used in abbreviated form.

Multiple Cell Contractions (Category V)

Multiple cell contractions were involved in words which were second in order of difficulty for the readers. Even though much of the difficulty came from several infrequently appearing words such as "character", "lord", and "spirit", many useful and frequently appearing whole words such as "these", "those", "whose", "where", "upon", "ever", and "cannot" seemed to present an inordinate amount of difficulty because of the nature of their configuration as multiple cell braille contractions.

It would seem appropriate to replace "character" with a more useful word such as "change" and to replace "spirit" with a useful word like "same". In connection with the consideration of types of errors presented later, some additional recommendations are made which are related to the problems of multiple cells.

Combinations of Orthography (Category VII)

The third most difficult category of words studied was that of combinations of orthography. Among the most difficult features of these words were lower contractions and multiple cell contractions.

As in the case of short form words, much of the difficulty can be attributed to infrequent appearance and meaning problems for elementary grade children. There were, however, special difficulties associated with the braille forms and these will be discussed in the categories which contributed orthographic features to these "combination" words.

Lower Contractions (Category IV)

Words using lower contractions fell intermediate in difficulty in the study. They were however, the most difficult of the groups of single cell contractions. The lower forms having only whole word meanings such as "his", "by", "was", "into", "were", and "to" were less difficult than the lower forms having whole and part word meanings such as "in", "en", and "be". This latter group appeared much more difficult as part words than as whole words as well as being more difficult than those having only whole word meanings. As part words, both "be" and "en" each contributed about twice as much difficulty as "in", and as whole words, "be" and "in" contributed very little difficulty by comparison with "en" standing for "enough".

A group of lower contractions representing double consonants when they appeared within words proved especially difficult. Double "b", "c", "d", and "f" all appeared among the eight most difficult words and double "g" appeared in the 19th word (of 43) in order of difficulty.

An evident problem in connection with lower signs is the number of meanings they carry in different contexts. The data of this study suggest that it would be especially useful for children's reading to drop the use of the double consonant meaning from lower signs. This recommendation has been made prior to this study and has received considerable attention, but objective data on children's reading have not been available for support.

Upper Contractions (Category III)

Category III words contributed somewhat more difficulty than words in full spelling or alphabetically abbreviated words. Some Category III contractions were used as whole words only; some, as whole words; and some, as part words only. Five of these are one cell whole words which can be used also as part words. They are of special interest because of their great usefulness. They are "with", "of", "for", "and", and "the". When used as whole words, they occured in the order named from easy to difficult with relatively low error indices. The words in which they appeared as parts have error indices indicating much greater difficulty. The order, from difficult to easy as part words, was "for", "and", "with", and "of". By contrast, signs standing for "sh", "th", "st" "ch", and "wh" were generally less difficult as part words than as the whole words for which they stood. "Wh" standing for "which" proved most difficult; "sh" for "shall", "st" for "still", "ch" for "child", "th" for "this", and "ou" for "out", followed in descending order of difficulty.

The category III contractions having only part word meanings tended to have lower error indices than did the contractions in the category having both whole and part word meanings.

Among the words of higher order of difficulty were "which", "shut", "straw", "shall", and "shirt". "Which" was often read "where". Substitution of "where" for "which" seemed to result because "which", written "wh" ⠸, was preceded by a capital sign (dot six) thus: ⠠⠸, while "where" is written ⠈⠸ ("wh" preceded by dot five). "Shut" was often read "shoot". The major problem with "straw" was hesitation, accounted for in part by context problems. "Shall" was often read "should"; "shirt" was read "short" and caused many hesitations.

It seems clear that the contractions which have several types of use, and which therefore carry multiple meanings tended to contribute special difficulties.

Full Spelling (Category I)

Category I words contributed less difficulty than any category except the alphabetic abbreviations.

Errors in connection with the words which orthography required to be in full spelling were analyzed to ascertain if some braille letters caused more difficulty than did others. The frequency of appearance of the first 100 letters in the words ranked most difficult by error indices were compared with the first 100 letters in words similarly ranked most easy.

The clearest consistency of difficulty among the grades was evident for "r", "i", and "g . Clearest consistency of ease was evident for "a", "l", "m" and "y". Burklen (1917) provided some data on this problem. His data were based on German readers, evidently adults, reading letters in isolation; "r", "i", and "g" ranked 30th, 14th and 3rd respectively (lower ranks, easier) among 39 characters ranked. He ranked "a" as 1st, "l" as 7th, "m" as 4th, and "y" as 39th.

There was a tendency for the letters appearing more freqeuntly in difficult words in this study to be represented by shapes which can be found in a greater number of

positions and therefore carrying more meaning than the letters found in easier words. Another factor which tended to differentiate the difficult letters from the easy was position in the words analyzed. The letters more freqeuntly found in difficult words appeared medially more often than the letters appearing frequently in easier words. Studies of difficulty of print letters tend to produce the same type of finding (Woodworth, 1938).

It should be noted that the words in full spelling and alphabetically abbreviated words, the two categories that use letters rather than contractions, were less difficult. Error indices for these words were lowest among the seven categories of orthography studied. The study therefore appears to suggest that braille letters do not contribute seriously to difficulty in oral reading.

Alphabetic Abbreviations (Category II)

Category II words, those represented by alphabetic signs standing alone to represent words, contributed the least difficulty of any of the categories. Aside from the words "knowledge", "quite", "rather", "every", "you'd", and "from", the alphabetic words contributed little difficulty. The discussion of error types which follows throws light on the types of problems encountered in connection with these words. However, it can be noted here that the substitution of a more frequently appearing and useful word like "kind" (which Thorndike and Lorge, 1944, shows to have much greater frequency) for "knowledge" would be helpful to children's reading. In order to improve phonetic consistency in the code, a change from having "t" standing alone to represent "that" might be made. The "t" might better stand for "too", for example. Another line of inquiry is through the types of errors that readers made.

Error Types

Eight special types of errors associated with reading in braille emerged from further analysis of the data.

These error types seem best understood in terms of the same essentials of reading which have already been named, perception and interpretation. All of the error types involved both perception and meaning problems. However, for purposes of analysis, it seemed appropriate to consider the types under three headings which help in clarification and understanding of them. The first three types of error can be considered under a general heading of problems in perception. They are missed dot errors, added dot errors, and ending errors. The second group of three error-types seem to be a special case of problems in perception involving spatial orientation and alignment problems. They are reversal errors, vertical alignment errors (or up-down alignment errors), and horizontal alignment errors (left-right alignment errors). The last two of the eight types seem best understood in terms of interpretation problems, or problems of meaning. These have been called association errors and gross substitution errors.

The criteria for classifying errors into these eight types were as follows. Missed dot errors were so classified when the word substituted for the stimulus word should have resulted only if fewer dots were present than actually existed. Added dot errors were so classified when the word substituted for the stimulus words should have resulted only if additional dots were present. In the case of orientation errors, perception appeared to be accurate, meaning was appropriate to the perception, but the spatial orientation was erroneous. In the case of errors in interpretation of meaning, perception appeared accurate, orientation appeared accurate, but the meaning given was erroneous.

In order to reduce the error totals to indices that are comparable for grade groups special error index was computed. For this purpose, the total numbers of words read by all the children and by the children at each grade level were taken as common denominators. Dividing

the total number of errors associated with an error type produced a decimal that may be read as the number of the type of errors per 1000 word encounters.

PROBLEMS RELATED TO PERCEPTION

Missed dot errors

This type of problem appeared at the rate of slightly more than four times per 1,000 words read by second graders, ranging down to less than three times per 1,000 words read by sixth graders. Though the incidence tended generally to decrease in the later grades, its relative magnitude as an error type tended to remain constant and its rank indicated an increase in its relative importance as an error type.

The missed dot type of error was most prevalent in words in which multiple cell contractions were utilized. It ranked first in this category. Missed dot errors also ranked high (second) as a problem where combinations of orthography were utilized. Missed dots were lesser problems with short form words, upper contraction, and words in full spelling, in which they ranked third, fourth, and fifth respectively. Missed dots were least contributive to difficulty in connection with words using lower cell contractions and alphabetic abbreviations.

Examination of missed dot error examples indicates some of the problems involved. Often the letters standing alone without an antecedent in the adjacent cell have different and unrelated meanings of their own. The antecedents must be utilized as cues to suspend judgment in the text until contextually appropriate closure cues are obtained. Failure to utilize these cues leads to error. The multiple cell missed dot errors reveal a tendency to give the meaning for the letter standing alone rather than the different meaning indicated by the multiple cell contraction.

The study revealed that ability to suspend judgment until "all the facts are in" is extremely important in braille reading. While this same fact is true of print reading, it is even more true of braille. All the facts that require suspended judgment for reading in print are present in braille and braille adds other factors that require suspended judgment. The elements in which judgment must be suspended in reading braille are smaller, and probably less meaningful while carrying more different meanings than the elements on which judgment must be suspended in reading print.

The "eye-voice" span, or what Hildreth (1958) has insightfully renamed the anticipation "A-span", is a measure of the suspended judgment essential to readers in print. The "finger-voice span", the braille-reading counterpart, can also better be called the A-span. The development of an optimum attention or A-span by braille readers would appear to contribute significantly to the prevention, elimination, or amelioration of all of the types of errors identified. This is especially true of missed dot errors, which seem to be related to premature closure, or failure adequately to suspend judgment until sufficient facts are "in hand".

Recommendations

In terms of teaching methodology, it seems the best recommendation that can be made in connection with missed dot errors is to work with teaching materials well suited in difficulty level to the children. One cannot suspend judgment, or maintain an appropriate A-span, unless he is reading with comprehension. Teaching must be tied closely therefore to meaningful materials. This point needs special emphasis in connection with reading by blind children because their range of experience from the standpoint of its reading materials used may be more restricted than that of seeing children.

A majority of missed dot errors occurred in connection with multiple-cell contractions. This finding has implications for possible revision in the braille code itself. It would be most helpful to assign the multiple-cell contractions to common, frequently appearing words. Assigning dot five "ch" to "change" rather than "character" is an example. It might also be wise to obtain more consistency by changing dot five "h" from "here" to "has", since "h" standing alone represents "have".

Added Dot Errors

The problem decreased with experience in reading, but its rank varied in the grade groups. Added dot problems ranked fourth for second graders, but sixth for the smaller group of third graders. It ranked third for fourth grade readers, fifth for fifth grade readers, and fourth for the sixth grade readers.

The orthographic category in which multiple cell contractions are utilized elicited the largest proportion of added dot errors. Upper cell contractions ranked second with regard to added dot errors.

The addition to a braille cell of one dot, either real or fancied, radically changes braille meaning. The space saving features that have been utilized in braille have reduced to minimums the amount of information presented for the perception of words. The fact that the added dot problems occurred most frequently in the orthographic categories where there is much contraction and abbreviation in forms indicated that more cues to meaning might be useful.

Since readers in braille utilize a word or whole method of reading, the tendency toward stimulus generalization, or inferring wholes from significant parts operates to facilitate reading. However, space saving efforts have already reduced many representations to point beyond which further "cue reduction" may result in error.

Recommendations

The necessity of reading for meaning is again emphasized by the added dot type of error. Reading for meaning requires reading material within the range of experience of children. It is, therefore, not enough to determine readability in terms of word forms and sentence length. Readability must be related to meaning as well.

The added dot type of errors shows the important influence of a predisposition or set for what is being read. Methodologically, it should be of paramount importance to teachers of reading in braille to assist children to have appropriate expectations for what they are to read. As McKee (1948) has put it, children need a "taste" of what is being said. This "taste" is especially important for the braille reader because he has the tasks of dealing with the context from the standpoint of meaning and the context of braille in which forms are used differently dependent upon their relation to the meaning context.

Ending Problems

Ending problems ranked fifth for second graders although the incidence of the problem for this group of readers was similar to that found in the other grades where it ranked higher. Ending problems ranked first for third and fourth graders, and second for fifth and sixth graders. While the problem retained a high rank through the grades, the trend in decreasing magnitude suggested its progressive elimination. This trend is further emphasized when it is recalled that readers in the later grades read considerably more material than their younger counterparts.

Ending problems were found most often in connection with abbreviated words. This problem was clearly related to the marked reduction in the stimulus and the attending relative ambiguity of the ending of the word for which the abbreviation stands.

In an analysis of 798 specific ending problems, it was found that 29% of the errors involved the omission or addition of an "s", of the remaining 71%, 21% involved "ing" problems. The "ed" ending was involved in 15% of the ending errors analyzed. Words ending in "self", in some cases abbreviated "f" in braille (as "itself" is written "xf") accounted for 10% of the errors. Problems with "er" accounted for 5% of the 798 errors and the remaining 21% were miscellaneous.

The practices in braille of using alphabetic initials standing alone for some words and of providing short forms for some words tend to condition readers to short form responses. There is a marked tendency to arrive at premature closure, and endings are missed, guessed at, or erroneously added. As reading rate is increased, there tends to be increased effort at "cue reduction", which contributes to problems with endings. To minimize these problems, judgment must be suspended and closure deferred until adequate analysis is made.

Punctuation seems to play a significant role in problems relating to endings. Braille punctuation utilizes letter forms that have punctuation meanings when in the lower part of the cell and when used at the end of a word rather than within the word. These problems seem to have a unique relation to ending and punctuation since punctuation is not read in the usual sense, but a word ending treated in the same way produces an ending error.

Recommendations

In teaching reading in braille, special attention should be given to ways to help children avoid ending error problems. Several ways in which this can be done may be suggested. First, it is of primary importance to encourage an adequate anticipation span so that maximum suspension of judgment can be developed. It appears to be the "jumping to premature conclusions" or closure which causes many ending problems. Secondly, rate of reading should be related to comprehension and efforts to step up rate should proceed only where there is evidence of adequate accuracy in the perception and interpretation of appropriate reading materials. Finally, the difficulty level of reading materials used in instruction should be carefully controlled. Since context plays such an important part in the determination of the meaning which is intended for braille characters, the reader must be able to cope with the meaning if he is to get practice in ascertaining correctly the intended braille meaning.

Some minor changes in the braille code would appreciably contribute to the reduction of ending error problems. In short form words, it would appear to be of help to eliminate the use of final consonants to stand for endings when other ending signs already exist for them. For example, it would seem better to eliminate the short form abbreviation for such words as "receiving", since "g" is used to stand for "ing" instead of the "ing" sign (⠬) when "receiving" is written "rcvg". It would seem advisable also to reduce the number of meanings attached to the lower forms which are used also as punctuation signs. For example, it would appear to be worthwhile to drop the medial double consonant meaning for the letter signs in the lower part of the cell such as "dd" when they are used also as punctuation signs. This reduction in the number of meanings among which decisions must be made might help to reduce ending problems. Very little space saving would seem to be lost by such changes.

Problems Related to Orientation

Reversal errors. Reversals are those errors related to what may be thought of as "mirror images". They are errors in orientation or the "rotation" of symbols. Examples are "i"-"e", "r"-"w", "y" and sign", and many others.

Reversal errors were the most frequent problems of second and third graders. This error type revealed the most dramatic trend among the grades. Most notable was the marked improvement that appeared at the fourth and fifth grade levels. However, reversal problems remained evident through the sixth grade.

The orthographic relationship of reversal errors contributes to an understanding of the problem. They ranked highest among alphabet words (first), upper contractions (third), lower contractions (third), and combinations (third). They did not rank higher than fifth among the full spelling, multiple cell, and abbreviated word categories.

Because braille contains many symmetrically contrasting or mirror image symbols, many opportunities for reversals are presented. Most of these opportunities occur in the alphabetic abbreviations. It is in this orthographic category in which the least number of closely adjacent surrounding orientation cues and context clues are available.

The persistence of reversal errors through the grades raises questions about their source and nature which require answers. While the literature on print reading tends to show the progressive elimination of reversals with experience, it appears that they persist longer in reading in braille. One possible explanation for this persistence is poor physical mechanics of reading. The child who uses retracings, and scrubbing finger movements to decipher braille tends to lose his orientation and to increase the possibilities for reversals. Therefore, there would seem to be crucial importance in encouraging good reading mechanics. Good mechanics, however, cannot be preserved when the reading material is too difficult. Just as eye movements must be adapted to the difficulty level of print reading material, so the reading mechanics in braille must be adapted to the difficulty of the materials. The difficulty inherent in reading materials may therefore be the cause of problems in reading mechanics which result in reversal errors. It seems, therefore, an oversimplification to attribute reversal errors solely to poor mechanics. The relationship of mechanics to the reading difficulty of materials must be considered.

Common practice in the preparation of reading materials in braille is to transcribe print materials into braille with relatively little modification. This is true from the very first reading experiences of children throughout the reading instructional program. The question is raised as to the complete appropriateness of this practice, especially in the beginning reading experience. If there were a one-to-one relationship between readability of the print and the transcribed braille materials, this practice might be more defensible. There are, however, some apparently significant ways in which contexts are changed, especially by the space saving efforts characterizing braille. Abbreviation, contraction, and the assignment of multiple meanings may have effects on the level of readability of graded reading materials.

Another possibly significant cause of the occurrence of reversal errors and their persistence, is related to the methods by which braille writing is taught and practiced.

Better practice, increasingly widely accepted as braille machine writing equipment becomes more available, is to teach writing from the beginning on a mechanical, upward writing typewriter-type device. This equipment avoids the possible confusion of mirror images and right to left orientation problems. In addition to these advantages, the braille writer method requires less fine muscular-kinesthetic coordination which is difficult for young children. The findings of this study on reversal error emphasis the value of utilizing the mechanical writing device and avoiding the necessity of slate or guide and stylus writing until reading skills are well established.

Vertical Alignment Errors

This error type most clearly showed an orderly trend toward reduction or elimination through the grades, and its magnitude was among the smallest for all the grades. Although no evidence was available for evaluation of the relation of finger size to this problem, it may well be a factor in the orderly reduction of the problem as children mature. It merits that the size of braille characters is constant for all reading materials. No larger or smaller type commonly exists for readers at different stages of development comparable to that which is common in reading in print.

Vertical alignment problems were most frequently found in the lower contraction category. A special feature of braille should be noted in this connection: the reference point for vertical alignment in reading in braille. The basic characters in braille are built in the upper part of the cell, and the alphabetic characters, from which all others are merely elaborated, have dots among the top two. Burklen (1917) provided data of interest in this connection, and cited the ratio of upper to lower dots as 129:51 or about 2.5 to one. The baseline for reading, therefore, is the top part of the cell and accounts in part for the problems which occur in connection with lower signs.

Recommendations for teaching methods in connection with this type of alignment problems are related to the encouragement of habits of good reading mechanics. The physical orientation of the material to the reader is important because a relatively constant orientation of the fingers to the material is necessary for the accurate perception of the small positional differences which are involved. Reading exercise materials, especially those in the form of flash cards must utilize phrases or short sentences so that the relationship of lower signs to meaningful materials must be evident. Even though braille orthographic rules require some lower signs to be written without intervening cell space to show their position, exercises in connection with those lower signs must be very carefully planned.

Recommendations already made regarding reducing the number of lower signs utilized and reducing the number of meanings attached to such signs would help to reduce the number of errors of vertical alignment. In addition, the following code changes might be useful. The use of low "j" for "was" and "by", which has no phonetic relationship should be dropped or changed. One suggestion has been to use the "ed" sign standing alone for these meanings. The low "h" sign standing for "his" might be changed to a short form "hs" in line with the short form for "him" - "hm". The type of change suggested here would appear to reduce the lower sign difficulties considerably.

Horizontal Alignment Errors

Left-right alignment problems appeared most frequently in connection with multiple cell contractions. In this orthographic type, left-right alignment problems ranked third. In words in full spelling, alphabetic words, and words involving combinations or orthography, left-right errors ranked fourth as a problem.

Left-right alignment problems again emphasize the importance of teaching children to read in braille with meaning. The perception of parts of adjacent characters as a more meaningful whole should not occur when the meaning context of the material is being adequately utilized. Again, an adequate anticipation span should do much to prevent the occurrence of these errors.

In a study of dot, cell, and line spacing (Meyers and others 1955) it was suggested that children would find a closer cell spacing better. The data on left-right alignment problems of this study seem to indicate why closer spacing was found better.

It should be noted that so-called open characters, such as "k", "ch", and "st", are often involved in horizontal alignment problems. A word like "know" or "long" leaves much space for the little fingers of young readers to lose their left-right orientation.

The alignment error problems again have implications for the preparation of reading materials in braille, especially with regard to difficulty. The effects of carefully graded reading materials on horizontal alignment errors should be carefully evaluated before code revisions are considered as a solution to these problems.

Problems Related to Meaning

Association Errors

The association type error is one that showed a definite trend toward increased incidence through the grades. Several factors probably account for this. As children grow older and gain more experience, they have a greater repertoire of associations on which to draw. This trend would tend to be more marked in connection with congenitally blind than with adventitiously blinded children, and more marked in both than in seeing children of comparable age.

Association errors ranked higher in alphabetically abbreviated words, in multiple cell contractions and in abbreviated words than they did in connection with other orthographic categories. These errors were thus seen more commonly in connection with that type of orthography in which minimal cues to meaning were available and where, therefore, the freest reign for associations of meanings were possible.

Problems with association errors suggest that the order of introduction of the alphabetic and abbreviated word types of orthography in reading in braille should be based on usefulness so that associations can be well established and frequently reinforced. The planned repetition in reading materials in print may not meet the needs of children reading in braille as well as some specially prepared materials for this purpose. Such an approach bears on teaching methods and materials and can be accomplished without change in the braille code. However, some changes in the code would appear to be useful.

Possible changes in the braille code might be directed toward the provision of more cues in abbreviated words so that less equivocation would exist, for example, "ac", "ag", "al", "ch", "en", which stand for "according", "again", "also", "child", and "enough", respectively. So few of the essential features of these words as wholes are available that, if they are not remembered immediately, little is available other than context to assist in attacking them.

Gross Substitutions

The extent of this type of error generally decreased with maturity and experience, but the trend was variable. Marked improvement seemed to take place at the third grade level by comparison with the second. Gross substitutions errors took a position generally intermediate among the other problems for the third through the sixth grade.

Gross substitutions ranked as the most frequent type of error in full spelling orthography. In the other orthographic categories, they did not rank higher than fourth among the error types.

Teaching methods for dealing with gross substitution errors in reading in braille would be the same as those for reading in print. The problem seems to stem from difficulties in meaning. Word attack and word analysis skills need to be built for attacking

words for which no signs, abbreviations, or contractions exist.

Readers in braille get much less practice, both intentional or guided, and incidental They are not constantly bombarded with reading materials on every hand as print readers are. The print reading child' curiosity is aroused by signs, both of instruction and advertising; he has many occasions to read things around his home and in his family and play life; television has its influence. The print reading child has a limitless potential of reading materials available to him if some attention is paid to providing them. To the contrary, the braille reading child lacks many of these opportunities. His exposure to reading materials have to be quite deliberate. Even when deliberate, the materials lack the stimulation and motivating effects of pictures, designs and colors. Furthermore, even when materials are provided, his slower reading rate allows him to accomplish much less practice per unit of time than the print reading child.

These same factors bear on the range, variety, and frequency of experience that are available to blind children, not only the vicarious experience open to him through reading materials, but also direct experiences.

These factors are related to all of the reading errors discussed, but they would seem to relate especially to the kinds of words which tend to elicit gross substitutions. As the data of this study suggest, many such words have no familiar or unique braille signs, abbreviations or contractions in them.

Reading in braille, then, like reading in print, has implications for the total development of blind children. It is not just a matter of providing opportunities for reading, but instruction in reading and growth in experiences must also be provided for optimum growth in reading.

Summary

The findings of the study have been analysed in terms of the premise that the essentials of reading in braille are, like those in print, perception and interpretation. The differences that exist between reading in print and reading in braille lie largely in the differences in modality of perception and in medium to be interpreted.

Oral reading errors in braille have been examined both in terms of orthographic features of the braille code and in terms of error types that predominate in relation to grade levels and orthographic characteristics of braille. Eight error types were subsumed under three headings. Under problems in perception, missed dot errors, added dot errors, and ending error problems were considered. Under orientation problems, reversal errors, vertical alignment errors, and horizontal alignment errors were considered. Under meaning problems, association errors and gross substitutions were considered.

The data suggest the importance of attention to the difficulty of reading material for instruction in reading in braille. Conventional readability formulae seem to overestimate the readability of materials in braille and more attention needs to be given to meaning than is provided for in conventional means.

The order of difficulty of braille orthographic categories as utilized in this study is relatively constant for the grades studied. However, they present different degrees of difficulty for the different grade groups.

Even when a broad and inclusive defintion of reading errors is utilized as it was in this study, the incidence of error, five errors per 100 words read does not appear excessively high.

The space saving efforts used in braille contributed substantially to the reading difficulty encountered. These features are (1) assignment of several meanings to the same braille symbols with context determining meaning; (2) extensive abbreviation of words; (3) the use of contractions to represent from one to five letters with from one to two symbols. Some of the difficulty with respect to these features is attributable to their assignment with little regard to frequency of appearance.

Analysis of letter difficulty indicated they did not contribute seriously to oral reading problems in braille. However, letter difficulty seemed somewhat related to the number of meanings assigned to the shape used to represent them and appeared to be in part a function of their placement within words. Those used medially more often tended to be associated with more difficulty.

Alphabetic signs contributed the least difficulty of any of the categories. What difficulty they did produce would be substantially reduced by the substitution of more common words for "k", "q", and "r", and by a more phonetically appropriate word for "t".

Errors attributable to perception problems were examined. The error types were missed dots, added dots, and ending problems. These problems seemed to result from failure to suspend judgment or to maintain an adequate anticipation span in reading. It is recommended in teaching methodology that attention be given to developing optimum attention span. The difficulty level of reading materials in braille should be controlled, not only from the standpoint of word forms and sentence length, but also with regard to meaning. Some variability in abbreviation practices, such as for word endings contributed special difficulty. These difficulties would be reduced through greater consistency of abbreviation in short form words. Short form words are often abbreviated more extensively than should be necessary or desirable. The space saving value of abbreviation would be weighed against the ambiguity created thereby. The assignment of multiple meaning to the same forms causes difficulties and appreciable improvement should result from a reduction in these meanings.

Errors attributable to problems in orientation were examined. There error types were reversals, horizontal alignment problems, and vertical alignment problems. The numerous mirror images in braille provide many opportunities for reversal errors. Reduction in the number of meanings assigned to the same shapes is recommended. While reading mechanics contributed to these difficulties, the question is raised as to whether they are cause or effect. Poor reading mechanics may result from the difficulty of material and therefore the essential cause of reversals may be the difficulty of the material. The level of difficulty of instructional materials for reading in braille should be controlled beyond the control implicit in the print materials that are transcribed. Practice in writing can also contribute to reversal problems. The use of braille writing machines is recommended. Alignment problems are related to the small differences in position in braille symbols which determine differences in meaning. This is especially true with regard to lower signs, and problems of vertical alignment. The physical mechanics of reading in braille and the reader's physical orientation to the material play significant roles in alignment errors. Instructional practices should include attention to physical orientation of the reader to the materials.

Errors attributable to problems in meaning were examined. The error types were association errors and gross substitutions. Prescribed meanings assigned by the code must be learned for successful reading. The planned repetition in print materials may be less useful for the establishment of meaning associations in braille than might specially prepared materials. Some changes in the braille code would be useful in reducing association errors. These changes would center in providing more cues to meaning in abbreviated words. Gross substitution errors may be minimized by helping braille reading children to have more practice in reading, in acquiring word attack skills, and in increasing the breadth, scope and frequency of real experiences.

Children learn to read in braille and to read quite well in view of many problems. Significant opportunities to improve their reading even more and to reduce the number of errors in reading can be found in teaching practices, in the preparation of appropriate materials, and in possible changes in the braille code.

Recommendations Regarding Teaching Methods

1. Teaching reading in braille should apparently emphasize the development of an optimum attention or anticipation span. Since both the meaning of the reading matter and the meaning assigned to braille configurations is dependent upon context, judgment must be suspended until contextually appropriate closure can be achieved. Missed dot errors, added dot errors, and ending problems seemed to be related to problems involving premature closure and should be amenable to prevention or amelioration through the development of appropriate anticipation span.

2. Reading instruction should be centered in materials of appropriate reading difficulty level to individual children. Adequate anticipation span for the utilization of context clues evidently cannot be maintained on material of a vocabulary and meaning level which is inappropriate to the reader. Short meaningful idea units may need to be utilized in beginning instruction working toward longer units as children can handle them.

3. Instruction must relate good physical reading mechanics and physical orientation to the reading materials so that perception and orientation problems may be minimized. Searching finger movements and variable orientation of the reading fingers to the material can lead to erroneous reading.

Recommendations Regarding Materials

1. Instructional materials for reading in braille should be provided at appropriate difficulty levels for the reading development level and experience of the students. Materials in which there are many multiple-cell contractions, short form words, and lower cell contractions seem to cause special difficulties for children reading in braille. Conventional print readability evaluation procedures may overestimate the readability of materials transcribed in braille.

2. Because the addition or dropping of braille dots is crucial to the meaning of a braille symbol, extreme care may need to be taken for accuracy of materials in braille. Hand transcribed materials to supplement scarce commercially published materials should be examined with care for the correctness of the braille transcription.

3. It might be useful to prepare materials in braille with repetition specially planned for the establishment of meaning in braille. Such exercises might accomplish purposes not effected by the transcription to braille of already published print materials.

Recommendations Regarding Revision in the Braille Code

1. Other short form words might be more useful providing more cues for word recognition.

2. Reduction in the number of uses and meanings assigned to contractions would apparently reduce reading errors especially in connection with lower contractions.

3. Some changes in abbreviations and contractions would make them more useful. Changes should be directed toward more freqeuntly appearing words and should consider consistency in grammatic phonetic characteristics.

4. Code revision should be directed toward decreasing the variability in the endings of words.

5. Further research should be conducted as a guide to appropriate directions for code revisions.

Suggestions for Further Research

The findings and recommendations of this descriptive study lead to many possible suggestions for further research. Experimental studies will be needed to explore the inferences that may be drawn from the data of this study. These inferences should be seen as the raw material out of which hypotheses can be developed for experimental verification.

1. The effectiveness of different approaches to teaching reading in braille should be explored experimentally. The types of errors identified in the current study suggest criteria in terms of efficiency in prevention of these error types as a basis for developing experimental hypotheses. For example, it might be hypothesized that emphasis on a method of increasing the anticipation span would reduce the frequency of missed or added dot and ending error problems.

2. It may be hypothesized that the use in teaching of materials especially prepared to provide a programmed introduction of the more difficult braille meanings would reduce the frequency of errors in braille reading.

3. Experimental study should be productive of leads to ways in which the earlier reduction of the frequency of reversal errors may be brought about.

4. Factors affecting readability of braille materials should be studied experimentally and means of describing readability in more meaningful terms should be developed.

5. The space saving features of braille should be evaluated through controlled study of their effects on reading and the comprehension of meaning. The point of diminishing returns from contraction and abbreviation should be studied.

6. Ways of developing an accelerated optimum rate of reading with regard to efficient comprehension should be studied. Such study might be developed through scientific evaluation of both braille code itself and comparison of the effectiveness of different methodological testing approaches.

THE DISCRIMINATION, ASSOCIATION AND RETENTION OF TACTUAL PATTERNS

Presented by Dr. Emerson Foulke

The amount of information that can be displayed on Braille maps, graphs and charts is sharply limited because only a few of the tactual symbols currently in use can be presented simultaneously without confusion. This paper reports results of two investigations that were conducted in an attempt to develop a more adequate tactual symbology for the display of information.

Experiment One: To present the information commonly displayed on maps, graphs and charts, symbols for areas, points, and lines are required. The purpose of the first experiment was to select tactual symbols for the presentation of areas that could be easily and reliably discriminated from each other.

Experimental Materials: Twelve tactual patterns were employed in the experiment. Some of these had been employed by Heath (1958) in previous research on the subject, and some were selected visually because of their apparent discriminability.

The patterns were reproduced by the Virkotype process. In this process, a pattern of printers ink is applied to paper by conventional methods. Then, a powdered plastic is sprinkled on the ink surface. The plastic adheres where there is ink, and the excess is shaken off. The paper is then heated which causes the plastic to melt and to thus become firmly bonded to the paper. When the plastic cools, there is a tangible pattern corresponding to the original ink pattern.

Each of the patterns that had been chosen was reproduced as a two-inch square, centered on paper two and a half by four inches. These were systematically assembled in a paired-comparison arrangement and mounted on five by eight-inch cards. The right-left positions of the patterns were varied deliberately so that each pattern would appear an equal number of times on either side. The pairs were then randomly assigned their ordinal positions and numbered accordingly. The entire set included seventy-eight stimulus cards, each pattern being compared once with itself and once with each of the other eleven patterns.

Subjects: Ninty-six legally blind children in grades four through twelve from the Missouri School for the Blind and the Illinois Braille and Sight-Saving School served as subjects. There were twelve boys and twelve girls from each of the following grade groups; four-five, six-seven, eight-nine, and ten-eleven-twelve. No children below the fourth grade were used because a previous study (Nolan, 1960) had indicated that the ability of children to make tactual discriminations does not develop fully until about the fourth grade. The subjects were all Braille readers who were doing adequate classroom work. Descriptive statistics for the four groups of subjects are shown in Table One.

Procedure: The test was administered to each subject individually. A maximum of one minute was allowed for the inspection of each card. This proved to be more than adequate. Those children who had enough residual vision to see the patterns were blindfolded. Subjects were permitted to use either or both hands in examining the stimulus cards. They were asked to judge whether the patterns on each card were alike or not alike. A practice trial proceded the test proper in which the subject was shown a card with like patterns and a card with unlike patterns.

Results: The means and standard deviations of correct discriminations for each group are presented in Table Two. The average score for the entire group was 70.7 out of a

possible 78, with a standard deviation of 5.85. Inspection of the standard deviations for the four groups indicates greatest variability in performance for the six-seven grade group and the least variability for the ten-eleven-twelve grade group.

Results of an analysis of variance due to grade and sex are shown in Table Three. It will be seen that neither of the main effects of the grade by sex was significant at the five per cent level of confidence.

The Pearson product moment coefficient of correlation between chronological age and test score was .15, which is not significantly different from zero at the five per cent level of confidence. There was a correlation of .26 between IQ and test score which is significant at the one per cent level of confidence.

It had been stipulated that those patterns would be rejected which were involved in error ten per cent of the time or more. Five patterns were retained using this criterion.

Errors made on the "alike" responses were compared with those on the "not alike" responses to determine whether or not the subject had acquired a set for judgments of "not alike", since "not alike" was the correct response eleven out of twelve times. The percentage of error for both responses was the same, 9.3 per cent. In view of this finding, it is not believed that a "not alike" response set was operative.

Experiment Two: If such patterns are to serve as symbols in the tactual display of graphic information, it is necessary to determine the facility with which associations between them and the objects and events for which they stand can be formed. Also, it is necessary to know how well such associations are retained. The experiment by Foulke and Morris was performed to answer these questions.

Procedure: The six best discriminated patterns in the experiment by Morris and Nolan were used in a paired-associates learning task. The patterns were presented, one at a time, for tactual inspection. Ten seconds elapsed between the presentation of successive patterns. Words to be associated with these patterns were chosen from the New International Phonetic Alphabet. The word to be associated with a given pattern was heard seven seconds after the presentation of that pattern. Upon hearing a word, the subject removed his hand from the pattern before him, and it was replaced by the next one. The signal to start feeling the next pattern was a buzzer. Starting with the third trial, the subject pronounced the word to be associated with each pattern before he heard that word. The sequence of patterns was varied from trial to trial. Inter-trial and intra-trial intervals were the same. The word to be associated and the buzzer that served as signals were recorded on magnetic tape, as were the instructions. Each subject received ten trials a day until he achieved a criterion of two successive errorless trials during one day's session.

The retention interval was 28 days. Retention was measured by the savings method.

Subjects: Twenty Braille readers, of both sexes, with light perception or less, from the Kentucky School for the Blind served as subjects during the learning phase of the experiment. One of these subjects was unavailable during the retention phase.

Table Four gives mean trials to criterion for the learning and the relearning phases of the experiment, and the mean for the individual savings scores. Examination of the data in this table suggests that learning occurred readily and that relearning after an interval of 28 days resulted in substantial savings.

An estimate of the rate at which learning took place can be gained by examining the following figures: 5.3, 6.4, 8.4, 9.3, and 11.2. These values are correct numbers of responses for successive Vincent Fifths of the course of learning as determined by Hunter's method. This procedure has not been repeated for the relearning phase of the experiment because subjects relearned so rapidly that division into Vincent Fifths was not feasible.

The stimulus items used in this experiment were not of equal difficulty. Evidence for this point is presented in Table Five. The entries in this table are the means of ratios of errors to total number of guesses for each subject on every stimulus-response pair.

Discussion: The results of the preceeding two experiments indicate that tactual symbols can be found that are discriminated, associated and retained with sufficient ease to recommend their use in the tactual display of graphic information. An attempt to use these symbols in this way has not yet been made. Morris and Nolan have repeated their experiment using the six best discriminated patterns and six additional patterns. Eight of these patterns met the criterion of being involved in error less than ten per cent of the time. A similar search for symbols to represent points and lines is underway at the present time.

Summary: Two experiments were performed in order to find patterns that could be used for the tactual display of information. In the first experiment the discriminability of a group of tactual patterns was determined by the paired-associates techniques. Five patterns that met the criterion of being involved in error less than ten per cent of the time were isolated, and the feasibility of this approach for future research was demonstrated. In the second experiment the ease with which these patterns could be associated with words and the durability of such associations was demonstrated.

References

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Table 1

Distribution by Grade, Sex, Mean Age, and IQ of the

Four Groups Comprising the Total Sample

Grades	4 and 5	6 and 7	8 and 9	10, 11, and 12	Total
Number of subjects	24	24	24	24	96
Girls	12	12	12	12	48
Boys	12	12	12	12	48
Average Age (Months)	140.5	171.5	191.0	221.1	181.0
Average IQ	101.0	96.0	104.0	107.0	102.0

Table 2

Mean Correct Responses and Their Standard Deviations for the Total Group and for Each of the Four Subgroups in the Study

Grades	Sex					
	Girls		Boys		Totals	
	Means	S.D.	Means	S.D.	Means	S.D.
4 and 5	70.6	3.90	68.6	6.69	69.6	5.57
6 and 7	67.0	8.88	70.2	5.39	68.6	7.52
8 and 9	71.4	4.96	73.2	3.98	72.3	4.58
10, 11, and 12	73.4	3.71	71.3	4.37	72.4	4.18
Totals	70.6	6.20	70.8	5.47	70.7	5.85

Table 3

Results of Analysis of Variance of Differences among Groups by Grade and Sex

Component	df	SS	MS	F
Grade	3	261	87	2.64
Sex	1	1	1	.03
G x S	3	131	44	1.33
Error	88	2892	33	
Total	95	3285		

Table 4

Means and Standard Deviations of Trials during

Learning and Relearning and Savings

	Mean	Standard Deviation
Learning	16.35	6.09
Relearning	7.58	4.89
Savings	52.88%	

Table 5

Mean Per Cent of Errors for the Six Tactual Patterns

(Patterns are indicated by the words with which they were associated)

Tactual Patterns	Learning	Relearning
Bravo	33%	10%
Coca	20%	7%
Delts	15%	10%
Kilo	57%	40%
Lima	29%	14%
Zulu	30%	12%

THE BLIND LEARNING APTITUDE TEST*

T. Ernest Newland, Ph.D.

The Background

Useful as the Hayes Adaptation of the Revised Stanford Binet and the Wechsler individual psychological tests have been with the blind, there has appeared to be a need for a test of learning aptitude developed specifically for and standardized upon the blind. The presence of two conditions was regarded as warranting the development of the Blind Learning Aptitude Test, or BLAT. Since it is quite possible that the "intake" of any individual--how he benefits from the stimulation of his environment--can be affected by his sensory adequacy, the sampling of the behavior of the blind might well be accomplished through the sensory modality of touch by means of which much of his environment has impinged upon him and by means of which he will continue to be affected. The Hayes and Wechsler tests already being used to sample experience and behavior essentially verbal in nature, the possibility of behavior sampling through cutaneous-kinesthetic channels seemed to warrant consideration. If the individual's cutaneous and kinesthetic sensory modalities figured largely in what the individual learned and in the way in which the individual learned, it seemed plausible that a measure of his general capacity to learn might justifiably be influenced by his reacting to stimuli involving that complex of sensory modalities.

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*The effort reported here has been nurtured in many ways. The sensed need and the basic hunch underlying the work dates from the late 30's when, as Chief of Special Education in Pennsylvania, my efforts to understand the learning potentials of blind children were far from satisfacotry. Shortly after my coming to the University of Illinois, the Bureau of Educational Research, of the College of Education, provided some funds in 1952 for the first steps. Shortly thereafter, the University Research Board provided major financial support, largely for graduate research assistants. This was augmented by contributions, largely in the form of services and materials, by the American Printing House for the Blind. For the past two years, a research grant by the American Foundation for the Blind has made possible bringing the work up to this point. A reduced teaching schedule has been the University's not insignificant contribution.

The work could not have progressed without the help of the graduate assistants who took a deep personal interest in the undertaking, and the many school people--both residential and day--who helped, often in manners much more than making subjects available.

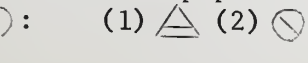
I am deeply appreciative, in particular, of the quick understanding and the unhesitatingly supplied encouragement of both Dr. Hayes himself and Dr. Lowenfeld.

A second consideration contributing to a need for a conceptualization of learning potential such as this is the possibility that the acculturation of blind children is discernibly more diverse than among children with no such sensory impairment. While the effects of the auditory stimulation of blind children may not differ markedly from those of non-blind children, the adequacy of their tactual stimulation has been a source of continuing concern to those interested in the blind. As a part of this, overprotective attitudes on the parts of the responsible adults in the environments of blind children are believed to be such as to contribute to a significant diversity in the experiental backgrounds of blind children. This complex of acculturation diversity, or wide range of experiental background, appeared to make particularly necessary the development of behavior sampling which placed a minimum of emphasis upon what the child already had learned. Instead of presuming, for instance, that most children's experiences would enable them to identify some object reasonably common in our culture, a less culturally contaminated sample of behavior might be made, for instance, by having him identify which one of a group of tactually perceived figures (probably new to him) was different from the others.

In order to involve the subject in a kind of behavior which will figure largely in his learning of braille, the test items are presented in base relief form. However, total figure discriminations are grosser than those called for with respect to the braille cells used in written material for the blind. With the exception of those item elements where textural contrast is involved, the items are constructed of embossed dots.

Generally, the attempt to measure learning aptitude ("intelligence") has been made in the straightforward manner of measuring achievement--vocabulary, general information, arithmetic computation, and the identification of relationships among elements which have been learned--and then, in effect, inferring an attending capacity to achieve. Behavior sampling in the areas of problem solving (other than arithmetic computation), following directions, memory, and similarities and differences, has in large part involved some kind of achievement, but has involved also certain psychological processes by means of which that which has been achieved has been interrelated. Fundamental to such an approach has been the assumption of comparability of acculturation. Particularly in the more difficult of clinic cases, this assumption has not been reasonably satisfied. Such a variation tends quite often to be present in blind children--due both to the fact of experiential curtailment resulting from the nature of the sensory impairment itself and to the often protectively motivated curtailment of the child's experiences by the responsible adults in his environment.

In contrast with the approach involving the measurement of achievement, and from this inferring capacity to achieve, is the possibility of attempting to measure the operation of learning capacity more directly--without placing any major premium upon the effectiveness with which that capacity has operated. Such approaches, usually designated as "culture-free" or as "culture-fair", are by no means new. They merit such designation to the extent that the quantified depiction of the subject's performance reflects his psychological processes which are important in his learning rather than the results, or products, of those processes.

Illustrative of behavior sampling in terms of achievement (product of learning) more than in terms of psychological process (from which achievement results) would be an item such as this: mortorboard:commencement:bikini: (1) dancing (2) swimming (3) preaching (4) drawing. Here the discrimination power of the item rests more upon the subject's knowing the meanings of the words involved than upon his knowing the is-to-as-is-to relationship per se. On the other hand, performance on items such as  need not be so much a function of

the subject's ability to verbalize "square", "circle", "diagonal", etc., or even to know those words, as it is of his ability to identify the relationship which makes possible the establishment of a valid proportion. Verbalization may be facilitative to a solution, but it by no means is essential to a proper response. In like fashion, with the stimulus, "Which one is different, or does not belong with the others?", the correct solution of the item "sergeant, general, corporal, commander, colonel" depends primarily upon the subject's knowledge (achievement, product) of the meanings of the words constituting the item, whereas the subject's identifying the "different" element in the item "V O V V V" is a function primarily of his ability to identify properly the relationship involved rather than his ability to verbalize the letters or the figures making up the item. Here, again, though, verbalization of the elements may be facilitative to arriving at the correct solution.

The discriminative power of most "intelligence" tests has tended more to be a function of the subjects having acquired familiarity with the elements which constitute them than upon his ability to use psychological processes on elements which are culturally neutral, or largely so. The former may be regarded as involving primarily the products of the capacity to learn; the latter may be regarded as involving primarily the processes essential to learning.

The assumption is made that the BLAT involves sampling of behavior primarily with respect to certain psychological processes important in the act of learning. The processes sampled include (1) the discovering of differences, (2) the identification of identities, and, in several patterns of its manifestation, (3) the discovery of relationships with view to extrapolation in terms of them. These relationships consist of three patternings: (a) a progression of the order A, B, C, D, What-comes-next? type: (b) a major figure or pattern with an identifiable part missing; and (c) four-figure and nine-figure matrices. The four-figure matrix is, in effect, the proportion pattern of A:B::C:?, although, in presenting the item to the subject, no words denoting proportion as such are used. In a sense, the behavior sampling is confined to Spearman's education of relationships and his education of correlates. Memory per se is not sampled. Perception is not tested apart from other psychological processes. Verbal adequacy as such is minimally involved; verbal instructions are employed, but vocabulary demands in communication are minimized. For checking purposes, the subject's verbalization of his behavior on the training items is invited, and can be aided by the examiner, but is not demanded.

Related Endeavors

Early efforts to develop intelligence tests for the blind consisted essentially of attempting to adapt for use with the blind certain tests which had been standardized on non-handicapped populations. In 1914, R.B. Irwin worked with Goddard in adapting his Vineland Binet for use with the blind. W.B. Drummond, in a January, 1915 issue of the British journal, The Teacher of the Blind, suggested adapting the Binet-Simon tests for use with the blind, although it was not until 1920 that he actively explored the possibility of the use of an adaptation of the Goddard-Irwin tests which T.H. Haines had made in Ohio. In 1916, Haines published results on the blind which he had obtained also by means of an adaptation of the Yerkes Point Scale of the Binet. The testing done by means of such adaptations, largely by S.P. Hayes and Miss K. Roese at Perkins, Overbrook, and Batavia, provided a rich background out of which subsequent testing adaptation efforts were to come.

The stimulus of the group testing needs of World War I contributed to Hayes' 1919 adaptation of the Pressey Group Point Scale for use with the blind. In Europe, Drummond reported in 1920 on his use of the Haines adaptation, and Burkler reported

in 1918 and 1921 on his use of Bobertag's adaptation of the Binet. Hayes' 1923 "scissors and paste" adaptation of the 1917 Binet was heavily contributive both statistically and experientially to his 1930 revision. This, in turn, was succeeded by his 1943 adaptation of the 1937 Revised Stanford Binet. Other adaptations were being made: Results on the use of the Otis Group Test of Mental Ability with a group of blind subjects was reported by Ruth Sargent in 1931, and this may have been the same test by means of which B.F. Holland obtained some of the data he reported in 1936. Some three years later, E.N. Fortner reported on results obtained by means of the Kuhlmann-Anderson, and Brown and Davidson reported results obtained by means of the Institute for Juvenile Research Test for visually handicapped children. In 1942, Hayes published an adaptation of the Wechsler-Bellevue, and Pintner reported on attempts to adapt the 1937 Binet by means of photostatically enlarging the visual materials.

In 1945, I. Winifred Mangan made an English adaptation of the 1937 Binet. Mangan's 1949 doctoral dissertation reports her attempt to create a non-verbal group test of intelligence for the blind. Presuming some braille reading ability on the part of the subjects, the test elements reported in the dissertation involved (1) recognition of likenesses; (2) progression in number and/or position of the dots within the braille cell; (3) the completion of paired patterns of braille cells; (4) a "common factors" function which required the identification of the braille cell common to the first two elements of a test item followed by the addition of that common factor to the next following element; (5) a pattern completion activity involving the identification of a four-cell pattern followed by the completion of a three-cell nucleus in such a way as to make a corresponding type of pattern; and (6) a nine-figure matrix test which involved the use of geometric figures, but with the possible answers designated by braille numbers. Little use of this test appears to have been reported.

One other type of test development goes on, although relevant published information appears lacking, probably because the work has not yet reached a reportable stage. These endeavors apparently are primarily of the nature of adapting existing test materials, and appear to be intended for use with adults.

With the exception of Mangan's efforts, prior attempts at measuring the learning capacity of blind children appear to have consisted predominantly of the adaptation of scales or tests originally developed for and standardized upon the non-blind. (In the literature on these attempts, the term "blind" was by no means restricted to subjects with complete lack of sight.) Those test items which could be used in their original form were used; those which could be slightly adapted for use either were adapted (the visually-perceived Binet line length item became a tactually-perceived stick length item, for instance); or attempts were made to create a few items which could take the place of apparently unadaptable ones. Understandably, attempts were made to obtain results on such adapted tests which would be analogous to those obtained on the originals. On the adaptations most widely used, the behavior sampled was heavily verbal in nature.

These factors are pointed out <u>not</u> in the sense that they represented psychologically unwarranted approaches to the problem of obtaining meaningful evidence about learning potential, but rather to sharpen the contrast in some respects with the attempt here reported. Generally, prior behavior samplings of the blind have been in areas highly susceptible to acculturation--both verbal and otherwise. They have tended to "play down", or minimize, the part played by one of the blind's major channels of learning--the tactual medium. Important and psychologically legitimate as these are, the

possible merits of an essentially non-verbal tactual approach to psychological processes, rather than to the products of "intelligence", seemed to hold psychological promise. In contrast with Mangan's attempt, the BLAT approach in no way used the braille cell, although materials embossed in dots and lines were employed.

No assumption was made either as to whether BLAT data would provide a better single basis to predict the learning behavior of the blind than any of the existing adaptations or as to whether some combination of BLAT results with those of some other existing related device would be better than the results of any single device. Logically, it would seem highly likely that BLAT results, when combined with the results of the Hayes Interim device, or with results of the verbal part of a Wechsler, might be found to constitute the best predictive basis for the learning performance of the blind.

Data Collection

A battery of potential test items was collected. Those which appeared useable with the blind were selected, plates made, and printed first on braille paper and later on plastic. Ninety-six items were presented individually by specially trained testers to 193 blind subjects. A blind subject was defined as one who was reported as having no functional vision after his third birthday and who did not use sight in reacting to the items. On the basis of the responses thus obtained, the 49 items which best discriminated across chronological age levels were administered to 325 additional subjects. The ages of those reacting to the items ranged from 5 to 21 years. The statistical findings reported here involve only those S's from 6 to 17 years old inclusive. Both residential and day school S's were used. Where age populations available exceeded the size of the sample desired for any given setting, a random selection was made from an alphabetized list of children at the particular age levels. Responses were obtained also from 113 adventitiously blind and from 273 partially sighted S's but the data on them are not included in the present analysis. TABLE 1 shows the nature of the total population which reacted to the items.

No attempt was made to control the nature of the sample in terms of sex or socio-economic status. TABLE 2 shows the breakdown of the population which reacted to at least the 49 more discriminating items in terms of these factors.

The data were obtained from children in five midwestern states (Illinois, Michigan, Ohio, Pennsylvania, and Wisconsin), from two west coast states (California, and Oregon), and from two east coast states (Massachusetts and New York). Represented were nine residential schools (only the one at Pittsburgh, for Pennsylvania) and 59 different day schools in 18 different cities.

Six groups of items were employed in the analysis here reported. (One, involving the identification of similarity between a stimulus element and five response elements within which the stimulus element had been rotated on plane surface, was dropped after being tried on the first 193 subjects because of the difficulty in presenting the problem to the S.) Included were the following series of behavior samplings:

1. Discovery of differences. Given six stimulus elements in a test item, to identify the one which was different from the other five. (Series B and D, 8 items)

2. Discovery of identities. Given a stimulus element, to locate one just like it among five response elements in each test item. (Series A, 7 items)

3. Proportion completion. Given stimulus elements A and B associated in some manner, to find which of six response elements would be similarly associated wtih stimulus element C. (Series E and H, 16 items) This was, in effect, a four-figure matrix.

4. Progression completion. Given three stimulus elements associated in some progressive manner (size, completeness, position, composition), to discover which of six response elements would come next in the stimulus progression. (Series F, 6 items)

5. Gross figure or pattern completion. Given a partially complete stimulus figure or pattern (a broken circle or square, or a pattern of lines or dots), to identify which of six response elements properly completes the figure or pattern. (Series G, 5 items)

6. Nine-figure matrix completion. Given a matrix with eight of the nine interrelated component elements present, to identify which of six response elements properly completes the matrix. (Series J, 7 items)

Each of the different presentations was preceded by two practice items. On each such item, S was asked, after he indicated his response to the item, how or why he chose the response element. Special care was exercised to avoid threatening or appearing to challenge S regarding the nature of his choice. When necessary, S was helped to verbalize his behavior. At no time were words like "circle", "square", or "triangle", or the like employed unless S indicated that such words already were in his working vocabulary. Not infrequently, "this" and "that" (instead of the names of the figures) sufficed when properly coordinated with S's looking and describing behavior. In some instances, the looking behavior of S's hands was taken as adequate evidence of S's thinking, and the correct verbal accompaniment was supplied by E.

Gross Results

Data analysis is incomplete. Thus far, there is only a collection of items on which S's responses have been grossly studied. The data are such, however, that each child's performances on each series and on all 49 items can be thought of crudely as "test scores". The results presented here are only in terms of such "scores" as earned by the born blind subjects, as defined. Shown in Figure 1 are the average "scores" earned by different gross age groupings for the different kinds of behavior samplings and for all 49 items combined.

Among varied personal information sought in the different school's files (and all too often not found), were the results of the Hayes Binet and/or Wechsler Verbal testings. The most recent results of such testings were converted into Binet mental ages or Wechsler test ages, and these measures were then correlated with the total "scores" on the 49 items. For 256 subjects, ranging in chronological age from 5 to 17, the Binet-BLAT product moment correlation coefficient was .537. For 146 subjects, ranging in chronological age from 5 to 16, the Wechsler-BLAT correlation was .455. These results are high enough to suggest the possibility of a reasonable psychological commonality, but also low enough to suggest the sampling of something somewhat different from the nature of the total behavior sampled by the Hayes and Wechsler approaches.

Some Emergent Problems

It must be remembered that BLAT is an attempt to obtain a reflection of certain important aspects of the fundamental learning potential of blind children. Only in so far as the basic psychological processes sampled are necessary to the acquisition

of the skills of braille writing and reading can it properly be perceived as throwing predictive light upon the learning of braille. Sensory and motor factors undoubtedly play roles much larger, proportionately, in acquiring braille skills than are represented in BLAT scores. As will be indicated later, the role of a perceptual factor may need to be explored considerably more explicitly and systematically. There probably is a need to explore more fully the role of a space factor which may be operating in the learning of braille, and also in certain other learnings of the blind. Whether a factor such as this is operating in the reading of slate-written braille, in orientations in the study of geography and geometry, and in space orientation in independent travel by blind persons is yet to be ascertained systematically.

Observing the responses of children to the BLAT materials has aroused certain other curiosities which are relevant to our thinking about research on and about braille. I shall mention them only briefly, relying upon our ensuing discussion to provide for any fuller exploration of those which may appear to you to merit such further consideration.

1. The first curiosity I invite you to share has to do with the nature of the relationship between braille writing behavior, by means of the slate, and braille reading behavior. Granted that braille writers are coming increasingly into use, we shall have with us for some time yet a large number of situations in which slate writing will be employed. I prefer to leave the matter with you in question form, all of them presuming the use of slate writing: What is the nature of the relationship between the habits formed in connection with slate writing and the habits formed which we call reading braille? Do these two sets of habits, those constituting writing and those constituting reading, facilitate or interfere with each other? Are they formed so separately as to have no psychological relationship? What kind of relationship should they have, psychologically and educationally, so as to be most facilitative to each other? We have some opinions on this general problem, but I believe we have little, if any, relevant research evidence.

2. The fact that certain parts of our test items were missed by the younger subjects much more often than by the older subjects raised a question about the operation of physical components on the perception span of the blind. The number of square centimeters of space on the reading fingers of a young blind child limits his sensory intake for any given tactual perception. For him to be able to perceive a given pattern which occupies a specified space, he must, by exploration, obtain more perceptions in order to see the whole pattern than would an older blind child with greater space per perception. Both younger and older readers have a three-fold reading problem: the number of perception units reacted to; the order in which these units are reacted to; and the synthesis problem of putting these elements together so as to arrive at some meaning. But the younger child, by virtue of the size of his fingers, must necessarily encounter and integrate more perceptual units. Perhaps this is a compound problem, necessitating a recognition of this fact of more perceptual units and a possibly equally important matter of helping him to learn the most productive order or manner in which these elements should be sought out. In the light of such thinking, the use of a larger braille cell for younger children may need more intensive psychological exploration.

3. Exercising great restraint as to the extent to which brain injury is perceived as being present among the blind and recognizing the highly heterogeneous nature of the neuropathological conditions which constitute this diagnostic category, we might profitably address ourselves to a study of braille reading anomalies and different kinds

of brain injury. Using rigorous neurological and psychological criteria in terms of which to identify the different kinds of neuropathology, we should explore, almost as if de novo, the extent to which braille response deviations occur among the blind in terms of the rotation, figure-ground, and other response aberrations reported for sighted brain-injured subjects. Illustrative of a very gross "tinkering" along this line, I had some concern that responses to BLAT might be affected by brain injury. Enlarged embossed reproductions of the Graham-Kendall Memory for Designs items were made and presented to two born blind adolescent subjects who were clearly identifiable as brain-injured from birth. They were asked to reproduce the stimuli after tactual exploration of them. Contrary to expectations, no rotation was evidenced in the reproductions. The possibility of problems associated with cerebral dominance also should be explored in connection with those of brain injury.

4. Early in the exploratory thinking leading to the work on BLAT, Dr. Cronbach suggested that the nature of the proposed item structuring was primarily that involved in the important psychological processes of generalization, synthesis, and/or the identification of relationships. He suggested that there might be a need to sample simple perception, since this might well be an important factor in learning by the blind. The impact of the results thus far analyzed makes more clear the merit of this suggestion. This still needs to be done, probably with view to the results of such a measurement being used along with the results on BLAT. Whether such results would be used as a separate score which could make a BLAT score more meaningful, or whether it should become a part of a total BLAT score would have to be determined in subsequent study. The chances are that a separate score approach would be more meaningful psychologically and educationally.

5. The results reported here begin to take on psychometric significance only at the six to seven year level. There remains a need to develop a variety of approaches and materials which can be used effectively to throw light on the learning potential of still younger children. A large number of adaptable materials suggest themselves: those developed at the Printing House for use in evaluating reading readiness; a variety of cubes, spheres, cylinders, and the like, of varying sizes; adaptation of the Wallin Peg Board, the Witmer Cylinder, the Sequin tests, and the like; and adaptations of a number of toys which have found their way to the marketplace from the psychometric laboratory.

6. Lastly, there may be merit in developing a set of embossed (or other) stimuli which can be presented to the blind in such ways as to evoke responses which may be conceptualized in terms of a developmental continuum. The blind subject can be invited to respond to each stimulus, and his response then evaluated as to whether it constituted a response only to the total form (a mass response), or whether it consisted of responding to elements within the total figure, such as circles within a square (an individuated response), or whether it consisted of responding to patterns of elements within the total figure (an integrated response). Such responses might be capable of being translated into gross mental levels, but could throw light of their own on the child's psychological developmental status. The acculturation factor of the vocabulary involved in communication to and by the subject would merit most careful attention in such an approach.

Research is inescapably a chastening experience. That which looks so simple and straightforward at the outset becomes increasingly complex and elusive with further critical study. That which was once simple learning capacity and so easily measured now has become so frighteningly complex that only the uninformed proceed to measure it without qualms. The study of the elements which seem to constitute the learning aptitude of the blind is easily 25 years behind the identification of those elements

in the sighted. More than ever before, attention should be given to the assessment of psychological processes which serve as the basis for learning rather than basing our thinking on measurements of product and inferring process from that.

TABLE 1

Total Number of Children Taking at Least the Residual 49 Items, by Age and Type of School

	Born Blind (I)		Adventitiously Blind (II)		Partially Seeing (III)*		
C.A.	Res.	Day	Res.	Day	Res.	Day	
5	0	2	0	3	0	1	
6	28	15	1	1	7	6	
7	31	27	0	0	5	15	
8	28	29	4	1	7	11	
9	32	26	3	2	6 (1)	20 (1)	
10	25	19	4	2	9	28 (2)	
11	35	13	3	1	10	20	
12	26	8	9	6	14 (2)	10 (1)	
13	30	10	3	2	15 (3)	9	
14	27	11	6	0	9 (4)	10 (1)	
15	21	13	12	2	14 (2)	5	
16	28	10	7	7	13 (3)	6	
17	22	4	13	3	9 (2)	4	
18	18	2	11	0	8 (1)	2	
Over 18	11	0	5	2	0	0	
Total	362	189	81	32	126 (18)	147 (5)	937

*The N's in these columns include both categories of the partially seeing--those born that way and those believed to have acquired the condition. Of the 126 residential school subjects, for instance, in this category (III), 18 were reported as having become partially sighted since their third birthday.

TABLE 2

(1) (2)
Occupational Level, Sex, and Race of "Born Blind" Subjects
(3)
by Type of School Setting, Chronological Ages 6 through 18

	D.O.T. No.	Sex				Race				Totals					
		Male		Female		White		Other		Res		Day		Tot.	
		Res	Day	Res	Day	Res	Day	Res	Day	N	%	N	%	N	%
Professional and managerial	0	28	11	27	25	55	35	0	1	55	16	36	19	91	17
Clerical and Sales	1	16	16	14	6	29	21	1	1	30	9	22	12	52	10
Service Occupations	2	10	11	13	11	22	17	1	5	23	7	22	12	45	8
Agricultural and Related	3	15	1	13	1	28	1	0	1	28	8	2	1	30	6
Skilled Occupations	4,5	32	22	39	17	69	39	2	0	71	20	39	21	110	20
Semi-skilled Occupations	6,7	26	11	20	10	44	20	3	0	46	13	21	11	67	12
Unskilled occupations	8,9	26	7	35	16	56	18	5	5	61	17	23	12	84	16
Unknown		17	11	18	13	35	15	0	9	35	10	24	13	59	11
Totals		170	90	179	99	338	166	12	22	350		188		538	
Percentages		48		52		95		5		65		35			

(1) Based upon reported principal bread-winner, and classified on the basis of job classification in the 1949 Dictionary of Occupational Titles (Vol. I, Second Edition).

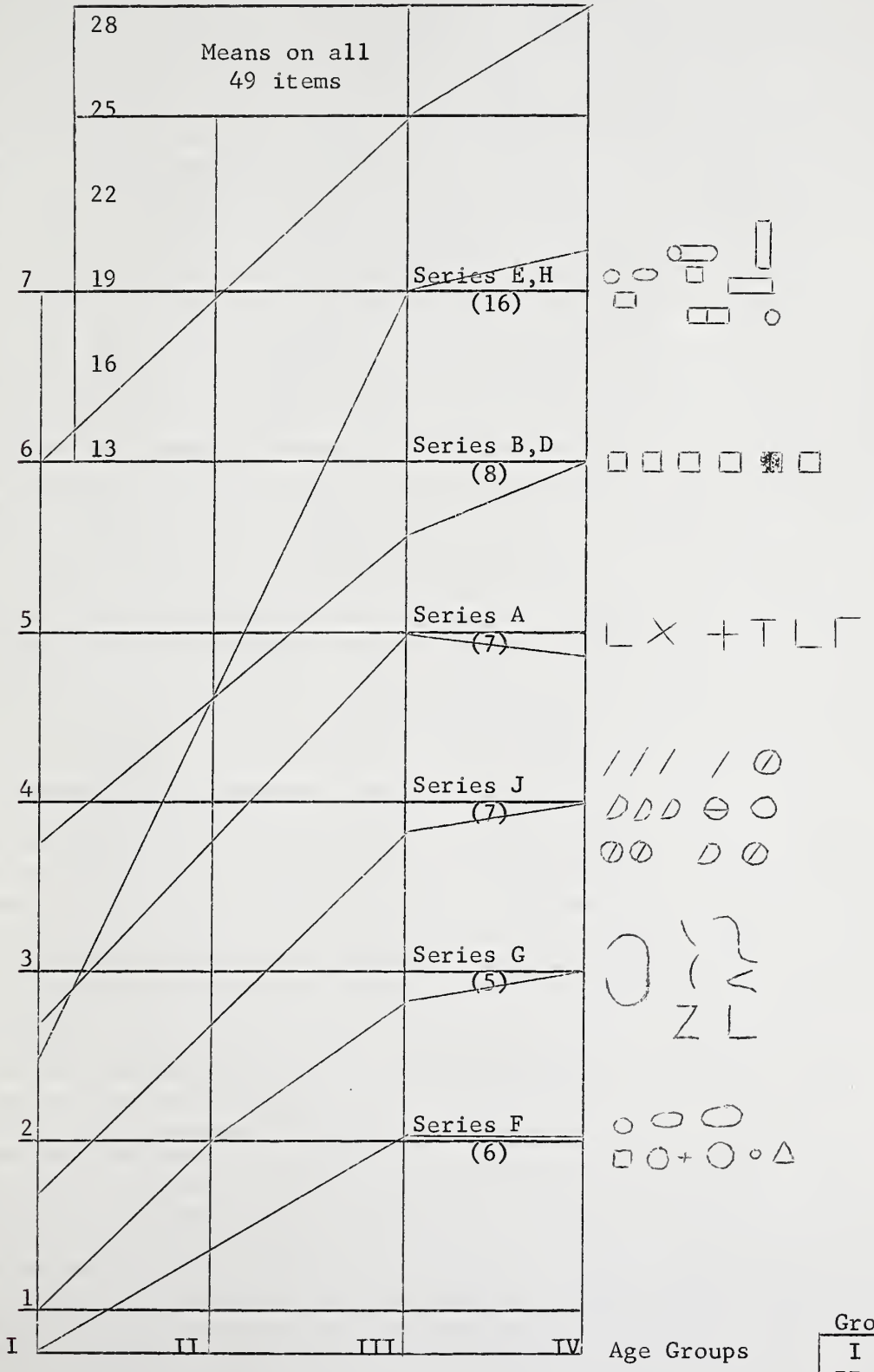
(2) "Other" includes two subjects other than Negro--one at the professional-managerial level and one unknown.

(3) School setting was determined on the basis of where the children lived while obtaining their schooling.

FIGURE I

Mean Scores Earned by 516 Born-Blind Subjects,

Ages 6-17 Inclusive, on the 49 Most Discriminating Items



Group	C.A.
I	6-8
II	9-11
III	12-14
IV	15-17

Report on the Effects of Early Blindness on the Performance of Blind and Sighted Children

Seymour Axelrod, Ph.D.

My study was a traditional, comparative study, that is, I compared blind and sighted children. This was, at one time, a classic kind of approach and to some extent has died out, but I thought it was of interest. I compared blind and sighted children in performance on two levels. One, a threshold level--here what I did was to determine the smallest amount of pressure that could be felt on the fingertips. I did this in the classical manner of Van Fry--he used horsehairs actually, I used nylon, graded series of nylon monofilaments. I brought these down one at a time on the fingertip and simply asked the subject whether or not he could feel it. This was the light touch threshold. I got two point thresholds--another classic technique also developed by Van Fry, among others. Here the question is, by how much distance must two points be separated before they can be senses or perceived as two rather than one? As you probably know, if I were to hold my fingers about that far apart--say one-half an inch apart--and press them into the small of your back, you would probably report that you only feel one rather than two stimuli. Well this is the same thing only more refined on the fingertips. There is another aspect to the study having to do with more complex functions--a problem solving kind of thing, something different in detail but similar to some extent to what Dr. Newland did--that I won't talk about at all here because it has no relevence at all to Braille. Let me just read that part of the summary of my paper, of my dissertation, which has to do with these tactile thresholds. Since it won't take very long, I can read the entire summary. Any of you interested in more detail than I can give you in response to questions after I am finished, or more detail than you can get tomorrow in discussion if you want to bring anything up here, can get the complete publication from Miss Helga Lenda, AFB publication director. Let me be very brief then, because this is available in print and there is no sense, I think, in my spending too much time on it. The title is the "Effects of Early Blindness on the Performance of Blind and Sighted Children on Tactile and Auditory Tasks". 82 school age children with blindness at early on-set, that is on on-set at 18 months of age or earlier and 82 sighted children matched for chronological age with that group served as subjects for (1) light touch and two point thresholds on the right and left index fingers and the ring finger on the left hand and (2) performance on two complex tactile tasks and one complex auditory task involving the ability to derive relationships among objects or stimuli presented. (3) the ability to transfer solution from the problem presented in one sense modality to its analogue presented in another and (4) the relationship between tactile thresholds in complex tactile test performance. 20 late blind subjects, age of on-set two years or later, were compared with the other two groups on the ability to perform the complex tactile tasks and to transfer the solution of one of these to an auditory analogue. When I get the results with reference to these complex tasks, I will describe them in some detail. So far as tactile thresholds are concerned, the data corroborated neither the old theory of compensation nor the belief that blindness causes a generalized rise in thresholds. Both of these, as you probably know, are in the literature. The compensation idea whose foremost antagonist was Hayes is still around. In spite of Hayes, in spite of Axelrod, you hear it from people who ought to know better. There are a number of things you hear from people who ought to know better. My favorite example is of a psychologist of a school for the blind (residential school) which shall be nameless, who gives zero I.Q.'s when she can't communicate with a child and in reporting average I.Q.'s of the children she tests, throws in zero as a score and throws this into the average and uses arithmetic means. This is the kind of thing one finds in supposedly expert authoratative circles or at least positions of power, let's put it that way. Back to my experiments. The differences between sighted and blind subjects depended upon sex and finger tested and I used to refer to this as a finger by sex interaction, but people objected to this. This is jargon of analysis and variance.

What this means essentially is whether the sighted group or blind group had lower, that is better thresholds, depended on whether you were talking about boys or girls and on which of the three fingers that I worked that you were talking about--and this goes I think, a long way in explaining some of the variations in early published reports having to do with compensation--at least having to do with tactile thresholds. It is one of these 6-5 "pick-them" situations. If you want to think that blindness leads to compensation in touch or addition or kinesthesis or smell then you can find data to support this. If you want to believe that blindness leads to a general lowered sensitivity, that is higher thresholds, it takes more energy to excite, then you can find this in literature and if you want to believe that blindness makes no difference, then you can find that as well. Almost certainly a good deal of this confusion arises because of the absence in adequate samples of enough representatives of both sexes, of enough body surfaces, and of enough measurements. However, here is the one compensation, "early blind subjects did have lowered two point thresholds than sighted subjects on the right index finger". Now remember, I tested the right index finger, left index finger and ring finger of the preferred hand. This is almost always the right hand, but not always. Confirmation is not obtained for proposals that Braille reading either raises or lowers the two point threshold of the reading index finger more than that of the non-reading index finger. There have been suggestions in literature that a great deal of the type of experience that is gained by an individual in reading, say if he is a right handed reader or a right index finger reader, that this experience would somehow lower the two point threshold, that is make him more acute; that is, again, reduce the distance between two points which is necessary in order for the individual to report that he is being stimulated by two points rather than one. The differences among the three fingers tested did not seem to depend upon which finger or fingers were used in reading Braille. At the beginning of the testing session I gave the subjects a book and said I want to see how fast you can read and they sat down and started reading very quickly; all I was actually interested in was finding out which finger or fingers were making contact with the Braille cells. I always said "very good" and took the book back after having observed which surfaces were in contact with Braille cells. The differences among the three fingers tested did not seem to depend upon which finger or fingers were used in reading Braille. However, this is an interesting point conceivably relating to sensory dominance here. Subjects who read primarily with their right index fingers had lower two point thresholds. That is, were more acute, on all three fingers tested, than subjects who read either with their left fingers primarily or with both index fingers. An individual who read primarily with his right hand, with his right index finger,used his left hand essentially to mark his place or to follow along for a bit but not more than 1/4 of the page. This subject was more likely to have lower two point thresholds on all three fingers tested than subjects who read either essentially with there left index finger or with both hands. (This means normal compensatory adjustments, I think). The question here would be what is the mechanism? Here the problem arises, what is the mechanism for the transfer to non-reading digits? That is an individual who does essentially this, reads across with his right index finger and uses his left index finger just to mark the beginning of the next line has better acuity not only on that immediate finger, but on the other index finger and on the ring finger of the preferred hand. (The subjects were in months from 108 to 236). The person who read with his right index finger is a person who is highly-sensitive touch-wise, and he only needs to use his right index finger. Unfortunately, we are bilateral and anything you can say for the right you can say for the left--if you can't say it you are in trouble. Maybe there is a dominance problem we ought to get into. Orton, who as many of you know, I suppose, has been interested in reading disabilities in children for many years, especially as related to cerebral dominance suggests that people who are pure rightees or pure leftees, are much more adequate perceptually than people who are integrated, that is sometimes right, sometimes left. Reading techniques appeared to have no effect on light-touch sensitivity.

There is an analogue to this--a tactile kinesthetic analogue to this--which is a tactile generalized expansion. In both of these, the early blind subjects performed less well than other sighted controls. Finally, early blind subjects performed less adequately than sighted controls on a learning set task involving the transfer of a principal solution from the matching problem presented tactually, kinesthetically to an analagous one presented orally, by audition or the other way around. That is, transfer from the task presented in one modality to a task presented in the other modality was poor among the early blind subjects. The results on complex task performance are consonant with theory stressing the importance of early visual learning for later problem solving and experiments based on these theories. Nevertheless brain damage associated with or consequent through blindness at early on-set cannot be ruled out as a factor. A group of children blind due to retrolental fibroplasia which has often been singled out as especially likely to be associated with brain damage, did not show larger deficits than other early blind children. This comparison was not considered crucial, however, since it is impossible to say with certainty that early blindness from other causes is uncomplicated by more general central nervous system involvements. The most important sentence in this whole business, I think as far as we are concerned here, is this. The differences between early blind and sighted groups under complex tasks were though statistically significant, nonetheless small. They should not be regarded as evidence of gross impairment of intellect and processes. The point here, and this is a point with almost every well-controlled comparative study (that is, studies comparing sighted and blind children or adults) is that regardless of what differences may appear--what differences may occur, regardless of how exciting, how interesting these differences may be, say to psychologists or educators who are interested in basic processes, the differences are, in almost every case, very small, small enough so that we need not be concerned with the ability to learn of a blind child because he is blind. This was the reason that I asked Dr. Newland and Dr. Foulke in earlier discussion about use of sighted subjects. It appears to me that much of the word that is done with tactile presentation of materials--even if it is work that is being done specifically as preliminary to developing a test or a technique for blind individuals--much of the leg work, that is, much of the spade work, can be done with sighted individuals with almost complete transfer of results and can be done much more economically.

SOME INSIGHTS CONCERNING READING PROBLEMS AS REFLECTED IN AFB LEISURE ACTIVITY STUDY

Eric Josephson, Ph.D.

In view of the great care that was given to the papers presented yesterday, it is just as well that these informal remarks are being made today. When this agenda was prepared many weeks ago, we had hoped that more of the results of our research would be available now than is the case. But those of you who are doing research know, the catch word among so many researchers is manana, which means what we hoped would be ready today will be ready tomorrow, or maybe next week sometime.

Although we have been engaged for several years in research on the reading interests and leisure activities of blind people, we only entered the field to interview a sample of almost 700 blind adults this summer. As a result, data from these interviews are still being tabulated and analyzed right now. Therefore I have only some very preliminary statistics; and while they may be of some interest to you, I don't think they will answer all the questions that John Dupress raised yesterday when he said that technological research is not really reliable without a certain amount of social science research to back it up. You are undoubtedly interested in the kinds of populations that you are trying to serve. Perhaps what we have will be of some use to you. At the present time, however, you may be able to help us, in trying to formulate further questions that our research may provide answers to.

The survey I am talking about is not only a survey of reading. Some of you may remember that the Foundation for the Blind did a survey on Library Services for the Blind five years ago (directed by Mr. St. John of the Brooklyn Public Library) and focusing largely on the public or Library of Congress system of regional libraries. At that time, the Foundation announced that it would follow this with a survey of the reading needs and interests of blind readers themselves. So the next logical step seemed to be a survey of readers; and several years ago we pre-tested this survey in New Jersey, with almost 200 adults. However, we broadened this to include non-readers as well, since it occurred to us that in many ways the problems of non-readers are equally important, if not more important, than the problems of readers. Those of you who know the St. John Report may recall some of its conclusions and recommendations. One of the major questions it raised was how much the reading public among the blind can be enlarged. This is why we have always been interested in the problems of non-readers as well as readers. When we finally went into the field this year, the study had been broadened even further so as not just to be restricted to the interests of readers, or the question of how many non-readers could be converted into readers, but to include other areas of leisure activities. You will notice that by assumption we are identifying reading here as a leisure activity, but remember that we have been restricting ourselves largely to adults. This is because we have always felt that the reading interests and problems of children should be studied separately. As a matter of fact, in view of many of the remarks that were made yesterday, I feel that

even more strongly. I sense that in the field of Braille, a great deal of research has to do with educational or pedagogical problems that concern children in schools. But our interest has been more in the leisure reading of adults. In the surveys we have been doing, we have been limiting ourselves largely to persons twenty (20) years of age or older. In measuring the leisure activities of blind people, we are interested in reading, in their social life, in the organizational life that they have in their community, in their employment, in their family associations, in their cultural interests and tastes, and in many other things too. Our aim here is not just to collect statistics, although today all I can show are some very crude statistics; our aim is to collect material that will be of some use to action organizations like this that are interested in increasing the opportunities for leisure pursuits among blind adults. Very roughly, this is the aim of our project.

Now, as I said, our sample in this particular survey consisted of nearly 700, actually 684, blind adults who were interviewed in four states. The states were North Carolina, Massachusetts, Minnesota and Oregon. In North Carolina we studied two areas--one the metropolitan Charlotte area and the other a rural county near Raleigh--Johnston County. In Massachusetts we limited ourselves to the Boston metropolitan area, in Minnesota to the Minneapolis metropolitan area and in Oregon to the Portland metropolitan area. In all cases, we obtained names from State Commissions for the Blind and sampled from their registers. We had varying success in the different states in terms of response, in terms of refusal, in terms of the difficulty in finding people at home and in actually completing interviews with them--but I won't go into that now. As a matter of fact, we contacted altogether over 1500 blind adults in order to obtain fewer than 700 interviews. I should say, then, that this may not be a representative sample although we don't know how un-representative it is. But even assuming that the best register can give you a representative sample of the blind in that state, the losses that you encounter in trying to make contacts with blind persons from these registers are so great that it is very unlikely that you wind up with a representative grouping. One bit of evidence that it is not representative lies in the very fact that we came up with so many readers. As a matter of fact, in our sample of nearly 700, almost 50% were identified as book readers. This suggests to us that we have a disproportionately large number of book readers in our sample. This assumption is based in turn on the estimate of the Library of Congress that there are approximately 55,000 or 65,000 persons who are using Talking Book Records and Braille books out of a total estimated blind population of approximately 350,000 or 360,000. In any case, approximately 1 out of 6 or 7 have been estimated to be readers in the total blind population. However, in our sample, the number of readers was much higher. That's not too unfortunate, as a matter of fact, since we are also interested in comparing readers according to the amount of reading they do. But, I think it should be made clear that this is not necessarily a representative grouping.

Now, as I said before, I must apologize because our analysis is underway at this very minute and we have only by special effort been able to get some figures in time for this particular meeting. I do have some gross statistics that I thought you might be interested in seeing and which will give some of the trends in Braille reading--both in the national picture and in our particular sample. Table I, which shows trends in Braille reading, is based on Library of Congress statistics; and I should urge caution on your part in using these figures, since in all cases these are estimates except for the number of Braille readers reported by the Library of Congress. This table shows trends in Braille

reading, as reported by the Library of Congress between 1940 and 1960. As you will see, looking at the four columns in the table, the absolute number of Braille readers has decreased somewhat from almost 14,000 in 1940 to a little more than 9,000 in 1960. Now let me explain that these are Braille readers identified by the Library of Congress, that is, persons who are using the many regional libraries associated with the Library of Congress program. As a result, any Braille readers who obtain their books exclusively from private sources are not included. However, although some of you may correct me, my guess is that this includes probably the largest proportion of Braille readers in the U.S.A. As for the estimated total blind population, these estimates are derived from Dr. Hurlin's figures showing, in 1940, 230,000 blind persons and in 1960, 350,000. The final column shows the relative decrease in the amount of Braille reading; and for those of you who cannot see this table, we find that in 1940, the number of Braille readers identified by the Library of Congress represented about 6% of the total estimated blind population and that this declined gradually--in 1947 it was down to 4.3%, in 1951 to 3.2%, in 1960 to 2.7%. The 1960 figure for the total estimated blind population is a projection of earlier Hurlin figures that the Foundation has issued. Now, again, this suggests, as far as the general population is concerned, a relative decrease in the importance of Braille reading. Unfortunately our study throws no light on this problem because it is not historical. That is, it does not show trends. It just shows the amount or proportion of reading, for example, Braille reading, in a given sample at this particular time--1961.

Table II shows reading in general. I thought you would be interested to see how the amount of reading in general (which includes not just the use of Braille but also records, sighted readers, tapes and even ordinary ink print) varies from region to region. As I said, in our sample, nearly half of all the respondents were identified as readers. Here we identified readers as those who had read a book within a month prior to the interview. We don't mean comic books or magazines--we mean a book equivalent to a hard covered book. As you will see, actually 48.9% of the total sample had read a book within the past month and breaking this down for the five areas in which we conducted interviews, you will see that there was a high of 61.8% of our sample in Portland, Oregon who read a book within the past month and a low of 35.2% in the metropolitan Charlotte area. We have not yet analyzed the reasons for these differences. Some of them we could probably guess at, but I don't know that they concern us at this particular meeting. Undoubtedly there are differences in the efficiency and in the productivity of the various regional libraries. Differences in the proportion of readers undoubtedly reflect differences in library management as well as differences in the cultural tastes and interests of the populations concerned.

Table III, I think, may be of more interest to you since it shows the relative importance of Braille reading in our sample population. First of all, we asked persons whether they were <u>able</u> to read Braille, regardless of whether they were <u>presently</u> reading Braille. Among our 684 respondents in all five areas, you will see that over one quarter of them, or 26.6% said that they were able to read Braille. Again, you will see that there is considerable variation from region to region, so that in Minneapolis 42% of our sample, I would say a rather surprisingly high number, said that they were able to read Braille; whereas in Johnston County, North Carolina, a rural county, only 16% said that they were able to read Braille. Remember again, that this is an adult population--20 years of age and older. But if you look at present Braille readers not

just as a proportion of those able to read Braille, but as a proportion of all readers in our sample, or finally, as a proportion of all respondents, you will get a different prospective on the importance of Braille reading for the adult population. I won't read all the figures, but again taking our sample as a whole, present Braille readers represent only 28% of all those able to read Braille. That is, only a little more than one quarter of all those that have the ability to read Braille are reading Braille books. This figure is further refined when you measure Braille readers as a proportion of all book readers. And here the figure falls to a little bit more than 15%. And, finally, in the last column, when we measure Braille readers as a proportion of all respondents, only 7.5% of our adult sample are presently reading Braille. Again, there is regional variation. In Minneapolis 10% of all our respondents were reading Braille, but in Johnston County, North Carolina, only 5% were reading Braille. This may include reading the Reader's Digest. Here, we are not interested in whether they are book readers or magazine readers or both, but merely whether they are presently reading Braille.

Table IV gives us further perspective in showing how important Braille reading is among the various modes of reading. We asked respondents, "How do you do most of your reading--in ordinary print, in Braille, with records or with the help of a sighted reader?" Fifty-four per cent said that they relied chiefly on records, 22.6% said that they relied chiefly on sighted readers--and here is an interesting phenomonon, I think--a larger proportion siad that they relied chiefly on ordinary print than relied on Braille. Presumably, they had enough vision to read ordinary print. Only 7.9% of our book readers--this is not now the total sample, but just book readers--said that they relied chiefly on Braille. This means that only about 4% of all our respondents are heavy Braille readers, a figure which is pretty close to what we showed in Table I, where the number of braille readers was estimated at less than 3% of the total blind population. I think that this gives you perhaps a more realistic measure of the importance of Braille reading than some of the other tables. Here, it is not just a question of who has the ability to read Braille, but who really depends on Braille. Now, again, I say that this does not really throw any light on national or historical trends of Braille reading. It does show, however, that Braille reading is a minority behavior--at least among the adult blind population. I would suggest to you, at least for discussion purposes, that this raises interesting questions about the future of Braille as an adult exercise or activity.

In time to come we will analyze these statistics much more carefully and show what the correlations are between reading and socio-economic characteristics, intelligence, personality, employment, family life, social life, social isolation and so on. For example, we now know that only 2.6% of our book readers who had read either Braille or records within the past six months expressed general dissatisfaction with the library services available to them and relatively few said they had any difficulty receiving or returning books or records through the mail--only about 13%. A much larger proportion said that there were books that they would like to read that are not now available to them in records or Braille. As a matter of fact, 28% of the book readers said that there were such books not available that they would like to have available; and we will be able to find out what some of those books are. Almost one quarter of them said there were ways in which library services in their areas could be improved. So that what you find, and this is what we found in earlier studies, is that there is no general dissatisfaction with the library services that are available--and this means chiefly the regular library system. On the contrary, I think most users of that system are pretty generally satisfied with the selection of books that are available and with the services

provided. They do express complaints sometimes about the condition of the Braille books, reporting that some of them are dog-eared, some of them torn, some of them battered; or about the problem of lugging containers around and mailing and receiving them and so on. I think they are more likely, however, especially in the case of a small vocal minority, to complain about the lack of certain types of books that may be of particular interest to them. Again, these are just clues that we are beginning to get and that we will have to explore more fully as the analysis continues.

In the next few weeks we will be analyzing more carefully the interests, the tastes and the characteristics of readers. I think those of you who specialize in the study of reading behavior will certainly appreciate that it is not enough just to distinguish between readers and non-readers. We must also distinguish the intensity of reading, so that we can identify light readers, moderate readers, heavy readers and note differences among them. As far as the readers are concerned, I think we are primarily interested in finding out whether they are getting enough to read and whether they are getting what they want. If not, why not? And if not, what would they like to read?

But I think we are even more interested in the interests and problems of non-readers--who in this case may represent only one-half of our sample but as we know, are far more important numerically in the total blind population. Here, the question is how many of them can conceivably be converted into readers. I don't think anybody in the Foundation is naive enough to expect that all of them can be. Let us assume that 6 out of 7 blind adults are not reading books, whether Braille or records or anything else. I think what we would like to do would be to make some fairly careful estimate about the proportion that can reasonably be expected to be added to the reading population. It may only be 5%, but I think whatever the figure is, it would probably not be too large. I think it is important to have some kind of an idea of how much larger a population the various reading programs, both public and private, should aim to serve.

Now, when it comes to those who are non-readers and have no interest in reading and pretty clearly cannot be identified as potential readers, I think another whole area of exploration is opened up for us. This is one of the reasons why we supplemented this study of reading by adding various other questions on leisure behavior: to find out whether other (non-reading) interests are being satisfied and if not, why not. Again, as I say, the whole purpose here is to help action programs in the entire field of recreational interests for blind adults. I think that many of these problems are by no means exclusively the problems of blind adults, but rather, problems of an increasingly aged population. Looking at it with this perspective, I think you will agree that reading is just one of many interests that have to be analyzed and studied if we are to come to grips with the growing problem of leisure for this aging population. I think, as a result, the kinds of data that we will come up with will probably fall in line with the growing volume of studies on the leisure interests of the middle-aged and the aged.

Now, coming back to the problem of Braille, I think that the question I raised before about the importance of Braille perhaps can be raised again for further discussion. Our evidence would seem to indicate, and again, we will know whether this is borne out in the next few weeks, that Braille use declines with age. Thus, while many blind children may learn Braille in school, relatively few of them continue to use it after they leave school, at least for reading.

Whether they use it for other purposes of communication--for example writing--is unfortunately something we don't have any information on. Our data certainly suggest that not many continue to read in adult life. As a result, I would suggest that the future of Braille, aside from its educational functions and purposes, looks rather uncertain. What we need is precisely the kind of thing that John Dupress was talking about yesterday, careful market studies, if you don't mind my using that phrase--although I don't like it myself--which will indicate just what the demands are and will be. That is, what kinds of populations can be expected to need or use this means of communication in the future? To answer this question we must bear in mind not just that we are dealing with an increasingly aging population (for whom Braille may be hard to learn), but also with a society that will be developing entirely new means of communication. Can Braille survive?

Table I

Trends in Braille Reading

Year	Number of Braille Books Circulated	Number of Braille Readers (Lib. of Congress)	Estimated Total Blind Population	Percent of Total
1940	---	13,558	230,000	5.9
1947	301,977	10,732	250,000	4.3
1951	201,805	9,467	300,000	3.2
1960	267,033	9,391	350,000	2.7

Note: Figures for the number of braille books in circulation come from annual reports of the Library of Congress, which sometimes gives them for calendar years and at other times for fiscal years. Hence circulation figures are not strictly comparable. The number of braille readers is also derived from reports of the Library of Congress and represents only those persons being served by the regional libraries for the blind. Braille readers who obtain their books and other publications exclusively from private sources are not included. Estimates of the total blind population have been derived from Hurlin, Estimated Prevalence of Blindness, the 1960 figure being a projection based on the increase of the general population.

Table II

AFB--Leisure Activities Study

How Readers Vary by Area

Area	Proportion of Readers in AFB Sample
Portland, Ore. (178)	61.8%
Minneapolis (157)	57.9
Johnston County, N.C. (75)	45.3
Boston (152)	37.5
Charlotte (122)	35.2
All five areas (684)	48.9

Note: The figures in parentheses after the area represent the total number of blind adults interviewed in our survey. Readers are here defined as those who read a book--in braille, on records, or with the help of a sighted person--within the month prior to the interview.

Table III

AFB--Leisure Activities Study

The Importance of Braille Reading

Area	Able to Read Braille	Present Braille Readers as Proportion of...		
		Those Able to Read Braille	All Readers	All Respondents
Minneapolis (157)	42.0%	24.2%	17.6%	10.2%
Boston (152)	23.7	30.6	19.3	7.2
Portland, Ore. (178)	23.0	34.1	12.7	7.9
Charlotte (122)	22.1	22.2	14.0	4.9
Johnston County, N.C. (75)	16.0	33.3	11.8	5.3
All five areas (684)	26.6	28.0	15.2	7.5

Table IV

AFB--Leisure Activities Study

Primary Mode of Reading

Mode	Number	Percent
Records	206	54.2
Sighted Reader	86	22.6
Ordinary Print	33	8.7
Braille	30	7.9
Other	4	1.1
Don't know	21	5.5

Note: The 380 respondents who had read a book during the past six months were asked, "How do you do most of your reading--in ordinary print, in braille, with records, or with the help of a sighted reader?"

Part Two

Recommendations for Scientific Investigations into the Problems of Touch Reading and Related Subjects

Carl T. Rodgers

Although the foregoing review of what has taken place to date regarding data-gathering on the problems of touch reading is far from complete, the following inferences may be drawn from what has been presented:

(1) A considerable amount of literature on the problems of touch reading already exists; (2) Some of this literature, if wisely utilized, can form the basis for a continuing chain of data-gathering on the many unknowns which still remain unsolved in the area of touch reading and related subjects. The recommendations which follow are intended only as a mere starting point in the gathering and organizing of basic information.

1. Finger Movements and Touch Perception Problems

Buerklen, Grassemann, the Uniform Type Committee and other investigators have conducted studies on the touch movements of the reading fingers, the finger or fingers most involved in reading, the differences in movements and finger pressure of the good and the poor reader, and so on. Some of the questions that remained unanswered are:

a) Can reading ability be accurately predicted by means of stereognostic speed tests or by some other means?

b) Can all beginners be taught to read equally well with both hands so as to learn to employ the two-hand method of reading?

(Note: The term "two-hand" method is here used to mean as follows: The left hand begins a line of braille. At about the middle of the line the right hand takes over the reading of the line and, at the same time, i.e., while the right hand is still reading, the left hand moves to the beginning of the next line and begins to read, the reading being continuous and without a pause, the hands always meeting at about the middle of each new line. In this connection Maxfield, in her book entitled THE BLIND CHILD AND HIS READING, states as follows:

"To most seeing people and even to many blind people it is incomprehensible that anyone can read ahead on a lower line with the left hand before the right has finished the preceding line. .... One girl who read with unusual high degree of accuracy, speed and comprehension vowed that she could not possibly read ahead with one finger because her mind could not carry two sets of ideas at the same time. A little later, when this girl was asked to read some very difficult material, she was reading so far ahead on the next line with her left hand that her two fore fingers met in the middle of each line.")

c) Part of the reading process consists of a series of consecutive stimuli on the fingertips as they moved over the line of braille from left to right. How is this process, if at all, affected when the consecutive stimuli are provided for the fingertips by a continuous moving line of braille, as in the case of the IBM Braille Belt Reader?)

d) Is there a significant relationship between finger legibility and comfort on the one hand and the surface quality of the various substances used for braille embossing purposes on the other hand? For example, the type of ink used in the solid-dot process, the Thermofilm sheets, etc.

e) Buerklen's experiments on the relationship of fatigue to touch sensitivity seemed to indicate that sensitivity is not diminished by fatigue. Investigations along this line should be continued, especially with reference to the learning of braille by newly blinded older children and adults, in whose case fatigue appears to interfere with their reading efforts.

Recommendation 2. The Degree of Difference Between Eye and Finger Simultaneous Apprehension of Orthographic Character Groups should be Investigated.

Javal stated that the eye can apprehend as many as ten letters simultaneously, whereas the finger can apprehend only one character at a time. Is this statement true where the finger is concerned? Individual variations in simultaneous finger apprehension may account for wide differences in reading speed among blind persons of all age levels. Possibly, too, the ability of some persons to compensate for the limitations of simultaneous finger apprehension through some better use of consecutive-stimulation touch movements may account for these wide differences in reading speed.

In his study on BRAILLE AND TALKING BOOK READING: A COMPARATIVE STUDY Lowenfeld noted that "a comparison of rates of braille reading from school to school reveals that there are great differences in the median rates....At each grade level the highest median found is about twice the lowest." Information on this whole problem would be useful in evaluating the relative effectiveness of the various methods advocated in the teaching of reading to beginners, such as the word method, the letter method, the word-letter method, and so on.

Recommendation 3. Investigation Should Continue on the Relationship of Legibility to Spacing Values, Dot Diameter, Dot Height, and Perhaps even Dot Shape.

The authors of the study on Readability of Braille as a Function of Three Spacing Variables stated:

"It must be remembered that other values of the three spacing variables could have been selected. The fact that the two middle values were superior for two of the variables for both children and adults would suggest that greater extremes would not have been read at a greater rate. Slight deviations from these middle variables could very well be read as fast or faster than the values employed in this study.

"....An unpublished study by Meyers and Ashcroft demonstrated clearly that differences in dot height as low as .001" can be discriminated by blind readers".

I, myself, once came upon a brailled page with dots so exceptionally clear that I wondered whether the braillewriter or writing frame on which they had been made was set in accord with standard dot specifications. It turned out that the page in question had been written on a writing frame that produced triangularly shaped dots.

Further investigation into this whole area may very well lead to greater reading facility, increased reader comfort, and improvement of braille as a more effective educational tool.

Recommendation 4. Investigation of the Problems Created By the Space-Saving Efforts Characterizing Braille Should be Continued.

From a book by Madeline Seymour Loomis entitled WHICH GRADE OF BRAILLE SHOULD BE TAUGHT FIRST?, we read the following concerning the relationship of legibility to space-saving through the use of Grade Two braille contractions:

"....Grade Two braille is definitely a word method; it expresses a word in as few signs as possible in order that it may be recognized more quickly".

From the much more recent work on errors in oral reading by Ashcroft we read:

"....The space-saving efforts used in braille contributed substantially to the reading difficulty encountered. These features are:

"1. Assignments of several meanings to the same braille symbols with context determining meanings.

"2. Extensive abbreviation of words.

"3. The use of contractions to represent from two to five letters with from with from one to two symbols".

Thus it is clear that much remains to be learned about the effects - beneficial and undesirable - of the various space-saving features of braille on legibility. An accurate and complete tabulation, in order of difficulty from easy to hard, of all the space-saving techniques prescribed by the braille code could be the first step towards a satisfactory solution of the problem. The tests to be conducted as part of the study should include representative segments of all the braille-using population.

Once all the pertinent facts are gathered, they can be used as the basis for the preparation of pre-primers and other texts for the teaching of braille reading which will meet the real needs of all the various groups of touch readers; in other words, the development of proper teaching procedures will then become an actual possibility.

A parallel study should be conducted for the purpose of ascertaining the extent to which Grade Two braille is or is not a word-method-type system. The following examples should illustrate what is meant concerning word-form variations in Grade Two braille.

The word "go" is in braille represented by the letter "g" standing alone. When reading the word "go" in braille, however,the reader encounters the letter "o" ("ago"), which of course did not appear in the representation of the word "go"; and instead of representing "go", the letters "ag" have the prescribed meaning "again" under the braille code.

The word "like" is in braille represented by the letter "l" standing alone. However, when reading the word "alike" in braille, the reader encounters the full spelling of the word ("alike"); and instead of representing the word "alike", the letters "al" have the prescribed meaning "also".

The word "in" is represented by the "in" sign (dots 3-5) standing alone. However, when reading the compound hyphenated word "mother-in-law", the readers encounter the full spelling "in" instead of the "in" sign.

The present practice of introducing Grade Two braille at the elementary grade levels, from the children's first reading experience and without regard to the presentation of the contractions and abbreviated words in terms of order of difficulty

is based at least in part on the assumption that Grade Two braille is in effect a word-method system of learning, because the fullest use of the contractions and abbreviated words from the outset of reading experience avoids the need of the children's encountering words in different orthographic forms. An analyses of frequency of occurrence of word-form deviations in Grade Two braille similar to the above will be useful in an objective evaluation of the soundness or inappropriateness of the practice and assumption just mentioned. The suggested analyses, plus other related findings, could reveal that the introduction of contractions and abbreviated words on a graduated basis and in terms of order of difficulty may be a much more effective teaching procedure than present practice.

Many more data-gathering recommendations could be suggested. For example, it does not seem that, to date, any systematic tests have been conducted for the purpose of determining the relationship of the early introduction of Grade Two braille to the learning of spelling, not only with regard to accurate word spelling when writing in braille, but more particularly when writing on the typewriter, where every word has to be spelled in full and spaced from other words in accord with literary practice.

Likewise, it does not appear that experiments, conducted under standard, scientific controls, have been made to determine the extent to which it is actually possible for children at elementary grade levels to write accurate braille in light of the present practice of introducing contractions and abbreviated words with no regard to order of difficulty. It should be noted that accurate braille means adherence to the rules of English Braille and that, therefore, studies designed to measure the accuracy of braille writing must include ratings on the accurate application of braille rules governing the contractions involved in any test content, in addition to ratings on the accurate formation of the braille orthographic characters as such.

The problem of whether the sense of touch can be trained to recognize three-dimensional objects when they are represented in embossed flat form also awaits further investigation, as do many other problems in the entire area of touch perception, discrimination, recognition and interpretation. It is hoped that these few recommendations for further research will serve to stimulate both thinking and action on the subject.

BRAILLE AUTHORITY

RESEARCH AND DEVELOPMENT REPORT

Bernard M. Krebs

In contemplating a program of research and development in braille and its pertinent off-shoots, the Braille Authority proposes to review established practices, to reexamine current techniques, and to reach out for sound procedures which will assure the maximum utility of braille in the social, cultural, and economic fulfillment of blind people. In questioning what at present exists, the intent is not to upset or to negate the valuable work that has gone before, but rather, to reaffirm those principles which can withstand the test of scrutiny, and to establish them firmly, through documentary proof, as the base from which to move forward. It is possible herein to present only a sampling of the areas of investigation which are envisioned for placing braille in its proper prospective as a vitally important resource for the rehabilitation and social advancement of blind people.

The Value of Braille

Braille, as an enabling tool, offers the uniquely effective resource through which blind people can actively participate in the recreational, vocational, and educational opportunities of the community at large. It has become quite routine to speak of the housewife using braille recipes, of the bridge player using braille cards, of the professor using braille text books, of the scientist using braille notes and equipment, of the salesman using braille files and catalogues, and so forth, and so on. In the general picture, the use of braille has been making significant gains. Braille libraries report a steady increase in both circulation and borrowers over the past several years, climaxed by a ten percent advance in 1960. In view of these facts, it is difficult to understand why only about 30,000 of the approximately 300,000 blind people in the United States engage in reading braille books and magazines.

Teaching Techniques and Manuals

Great strides have been made in developing specifications, procedures, and techniques for the use of the cane in foot travel. Those who were provided with the rigid course of training have gained in independence of action and in expanded employment opportunities. Little good would have been accomplished if the canes were distributed without a course of training in their use.

It is equally evident that the mere knowledge of the braille system without the development of reading skill is inadequate for the full utilization of braille as an enabling tool. There is a real need for the preparation of an instruction manual for the teaching of braille which will prescribe the techniques required for the attainment of reading facility.

The braille instruction manuals which are presently available to home teachers and braille instructors are so replete with nonsense practice material that the student can easily become discouraged through sheer boredom. An interesting and stimulating braille lesson manual can and should be developed.

Unfortunately, braille and blindness have become synonymous in the public mind. As a result, some newly blinded adults have rejected the study of braille as an escape from the acceptance of blindness. To cope with the psychological factors involved, the instructor of braille must be fortified with detailed information on the methods and procedures to be followed in overcoming this type of resistance to adjustment.

Technological Aspects

A study has already been made on the space and height factors of the dots of the braille cell by the American Ptinting House for the Blind and by the University of Kentucky. Despite the results of the findings of the research project, braille publishers and equipment suppliers are still producing materials which do not conform to the specifications established by the study. The braille slates and machines of the two major manufacturers show a differential of two braille cells for each line of writing. It is also interesting to note that Japanese braille is geared to even a somewhat smaller cell specification. The value of setting a specific standard for the braille cell can readily be demonstrated in terms of a decrease in bulk and of a reduction in costs. Both these significant advantages could be achieved if the small cell specification is proven to be the correct standard.

It would also be helpful if specifications were provided for paper used in braille magazines, books and hand-transcribed matter. There is strong indication that the texture factor of braille paper and materials does affect reading ease and speed. For example, certain textures of plastic employed in the vacuum forming, duplicating process were disturbing to the touch because of their slickness. A reduction in expense and bulk might also be achieved through the study of the grade and texture of materials for braille production.

A shortage of high standard stereotype machines and braille writers has seriously affected the preparation and supply of educational materials for the student in residential and integrated school programs. Because of the serious lack of this equipment, administrators of educational programs have been compelled to resort to expensive and barely satisfactory production methods, and volunteer transcribers have been retarded in the service of supplying required text books. Serious thought must be given to insuring an adequate source for the production and supply of this essential equipment.

It is encouraging to note that technical genius has been hard at work on the development of devices which, hopefully, will reduce the high cost of braille publishing. Thus far, the IBM braille system has not demonstrated that it can lessen expense or meet reduced production schedules and there is serious doubt as to whether it can achieve either of these goals. However, a partial answer toward these ends may be found in the electrified braille-writer-tape-punch equipment which was originated by Systematics, Inc., and which is now being experimented with at Adelphi College. With this device, a volunteer transcriber produces a punched tape which is used to activate a braille machine for the production of good quality copies on braille paper. The perfection of this valuable equipment is being delayed through lack of development funds.

Braille Codes

The Braille Authority and its advisory committees of experts and specialists are expending much time and effort in developing and establishing literary and technical codes which will present literature, music, and the natural sciences in an efficient and legible braille form. In recognition of the importance and value of the projects, all persons involved render service without monetary compensation and give time from leisure and official duties.

The major effort of all concerned is devoted to a detailed analysis of principles and procedures and in seeking practical solutions to the problems involved, based on knowledge, experience, and ingenuity. It is unrealistic to expect that volunteers of this calibre can expend the time and effort required for the testing of the findings or for the formulation

of a word for word final draft of a major code development or revision. The committee which worked out the changes in the literary code attempted to be all things to all people, and this, in all likelihood, was a contributing factor in causing the study to extend over eight long years.

The Advisory Committee on Mathematical and Scientific Notation has made significant progress in developing a logically designed, expandable, all-level mathematics braille code. The Advisory Committee on Text Book Techniques and Format is to establish realistic procedures for the presentation of maps, diagrams, pictures, etc., in a form which will have real meaning to the touch. The Advisory Committee on Music Notation expects to expand the International Braille Music Code to include additional instruments and music scores. Virtually no work has as yet been done in developing the chemistry and physics braille codes. All of these functional tools are needed yesterday for programs in education and rehabilitation.

The Braille Authority proposes to obtain a grant for research and development which will assure that the important projects under way can be brought into service expeditiously. Full time paid personnel can then be engaged to conduct field tests, to unearth problems requiring solution, and to prepare drafts based upon findings of the several study groups.

Research Responsibility

Although it is the responsibility of the Braille Authority to initiate the research necessary for the development of techniques for all tactual reading media, to designate the areas of further study into the psychological and physiological aspects of finger reading, and to encourage the development of educational materials and tools toward the simplification of the teaching and the learning of braille codes, many of the spheres of research and development mentioned herein are, and should continue to be the responsibility of the Research Departments of the American Printing House for the Blind and the American Foundation for the Blind. It is imperative that the lines of particular interest be drawn so that duplication of effort will not occur. The need is for all to work shoulder to shoulder in the common cause of providing the basic tools and techniques essential to the education and rehabilitation of blind people.

DISCUSSION

Chairman: Shall we get started. This is the second phase of the program as we planned it. The first part of the program has been presentations of what has been done and what is going on. This is deliberate. I know that in many cases you have wanted to discuss some of the questions that were brought up. We deliberately have put forth, first of all, the things we know because we don't assume that all of us have the same level of information. Now I think we have a fairly equal amount of the same information. A second phase as I saw the program is what we are now going into, that is, some thinking about an organized basis of what we might do, of what we need to do, and then the third phase will be open discussion. At that time I think I can add a few remarks about where we in this meeting might go. The first presentation of the second phase is by Dr. Josephson on some of the interesting statistics that have come up in connection with our AFB leisure time activities study. After this I am going to ask Mr. Bowers to give a summary that was prepared by Mrs. Florence Henderson for the U.S. Office of Education of the existing research projects on braille reading that she knew of when she made this summary three or four months ago. Then we go into the next phase which is what we can do. Dr. Josephson...

(Dr. Josephson's Report)

Chairman: Now to move on. I would like to ask Dr. Foulke to give a short informal presentation on some of the word that is going on at the Printing House that he didn't report on yesterday. In our attempt to get at areas covered that we know are going on in the way of research and that have already been completed I have asked him to give a little more information.

Dr. Foulke: First I will mention some research that has already been completed on listening comprehension and then mention some research that is planned in studying braille reading. The Printing House in cooperation with the

University of Louisville just finished a research project paid for by the Office of Education to study the ability of blind school children to comprehend speech made rapid by the speech compression technique. In case any of you are not familiar with this it is a technique that permits us to increase the word rate of previously recorded material without altering the speech in any other way. That is, the pitch of the speaker's voice remains the same, the timbre remains the same. The only thing that there is changed is the word rate and by means of this technique we are able to achieve any word rate we might desire. Now we have just conducted a study in which we asked children to listen to selections at word rate up through 375 w.p.m. in increments of 50 w.p.m. starting with 175 w.p.m. which is a typical reading rate. We also had another group which read the same material in braille. Also because we thought that the kind of material listened to would make a difference we asked the children to listen to two different selections. We have found that at 275 w.p.m. or a 100 w.p.m. faster than the typical reading rate for professional readers the children were comprehending the material they heard as well as a 175 w.p.m. and practically as well as children who read material in braille. It's difficult to get any accurate information about how fast children do read braille Grade 2 but there are a couple of studies. In the particular group we used we found that they are reading braille at about 65 w.p.m. so this means that when they listened at 275 w.p.m. they were covering the same amount of material in less than a quarter of the time. And comprehending it practically as well. Also the interaction that we expected was there. There was a significant interaction between word rate and the kind of material listened to. I would like to point out that these children that we used in the experiment had never had speech presented in this fashion before. Of course, since they were young children they did not have the elaborate background of association which exists in adults in the interpretation of the material. We planned for the next two years to be studying this problem further and what we hope to do now is to try to give some notion as to what the upper limit is in comprehension and then to develop and evaluate

several training programs for teaching people to comprehend rapid speech.

Dr. Newland: Does this involve the Fairbanks Comprehension Technique?

Dr. Foulke: It involves the technique. However, it does not involve the machine that is being manufactured by the University of Illinois because unfortunately the machines aren't good.

Dr. Axelrod: How is compression accomplished?

Dr. Newland: Can I help? If you imagine a recording on a tape 10 feet long and then imagine that you have a interrupter which cuts out say one inch of every foot. Then these ends are pulled together so it is now 10 inches shorter than 10 feet. This tape is played through. Fairbanks has gotten this down to 30%, and still not affecting comprehension.

Mr. Barnett: Does it cut out consonants?

Dr. Newland: It is not that selective. It is merely a periodic cut out of X-% of the material recorded.

Dr. Foulke: It discards at regular intervals a specific amount of the speech. The discard interval is kept so small that the ear cannot detect its loss and the amount of depression then is decreased by the frequency with which intervals are discarded. The only thing you have to be careful about is that you keep your discard interval small enough so you never lose an entire speech element and so the ear cannot detect the absence of what you have cut out.

Dr. Newland: May I add a little to that? Fairbanks has taken out 30-40% and still gotten comprehension.

Dr. Foulke: We have comprehension at 50% and I might add in fooling around with this I can now listen to speech at 375 w.p.m. which is more that 50% compression. The message time has been shortened by more than one-half and I can comprehend it quite well.

Miss Gruber: How much depends on professional reading at the beginning?

Dr. Foulke: I am sure the reader would make a difference and this is one of the things we intend to investigate. We did use professional readers in our study.

Mrs. Umans: Can you vary the reading rate depending on the persons background.

Dr. Foulke: We can produce a tape at any desired rate, but you cannot vary the rate during the course of the presentation.

Chairman: Could we go along to your next project, Dr. Foulke?

Dr. Axelrod: How much is chopped out at a time?

Dr. Foulke: 15-25 miliseconds

Dr. Foulke: Dr. Nolan is going to be undertaking some research starting this fall on the reading of braille. What he hopes to do is to learn more about the perceptual cues that are used in reading braille and in order to do this kind of research he has found it necessary to gain some control over the presentation of the braille stimulus. Consequently the Printing House is having made at the present time a instrument, a brailled Tachistoscope which will enable us to present braille up to about, I think, 30 characters for controlled timed intervals. This will permit us to study thresholds of recognition for individual timed intervals. This will permit us to study thresholds of recognition for individual letters, for words, for phrases. It will permit us to gain some knowledge of the extent to which shaped cues are utilized; it will give us an opportunity to learn a good deal more about many of the perceptual cues that are actually used in the recognition of brailled characters singly and collectively and furthermore in addition to that it may prove useful in developing training techniques and in arriving at statements for teachers to tell children which would be useful in improving the rate by which braille is read and comprehended.

Dr. Newland: Do you plan to provide for sub-groups by different mental levels?

Dr. Foulke: I am quite sure that this will be done. What we intend to do initially in order to get some greater familiarity with the material we are working with is to try to find out what the recognition threshold is for various letters, common syllables and words. Unless we gain a little more knowledge about the

stimulus we are working with we will try to find something more about those who are responding to the stimuli.

Dr. Newland: Wouldn't you start the other way giving a variety of mental levels, how do they respond, what speed?

Chairman: What is the length of the project?

Dr. Foulke: This is being supported by NIH and it is so far going for two years.

Mr. Rodgers: Is there a limit on the range of previous braille reading experience that the subject will have?

Dr. Foulke: I am sure that when we get to the point of designing specific experiments involving subjects we will consider factors such as this.

Chairman: Thank you very much Dr. Foulke. This gives a little more information as to what is going on.

I have asked Mr. Bowers to read a compilation by Mrs. Florence Henderson. Some are old projects, some are repeated from accounts we have already heard, but I think we can afford to repeat. (This compilation can be found in the appendix).

Now I think we will move into the second presentation that we have on the forward look which will proceed our discussion. Mr. Rodgers will begin and Mr. Krebs will follow.

Mr. Rodgers...

Chairman: Questions?

Dr. Axelrod: How much space is saved in using Grade 2 against Grade 1?

Mr. Rodgers: I have come across no accurate estimate. I have,however, come across an estimate between the use of Grade 1½ and Grade 2. The specific American Uniform Type Committee estimated that 10% space was saved between Grade 1½ and Grade 2 when the capital signs are used.

Miss Hooper: We figure 15% from 1½ to 2.

Dr. Axelrod: What about letter for letter.

Miss Hooper: I think it is around 40-45% between 1 and 2. It depends on the vocabulary being used.

Mr. Rodgers: What type of vocabulary does that 15% represent?

Miss Hooper: This just a over the years estimate.

Dr. Axelrod: In view of what Mr. Rodgers has said and in view of what Dr. Ashcroft has said obviously one basic question is whether it is worth using these space saving devices.

Chairman: Duly noted and deferred

Dr. Newland: To go back to the reference to Lavelle; the visual span of sighted readers is 20 or 30 units in one fixation. What you see is 10-15 times more than a blind person can.

Chairman: Would you like to come up here to read your paper Mr. Krebs.

(Mr. Krebs Paper)

Chairman: Any questions?

Mr. Barnett: With reference to your sentence that the Braille Authority proposed to seek a grant; is this something that is reflecting all of our discussions about this?

Mr. Krebs: yes

Mr. Barnett: In other words this isn't a different approach than the one we have been discussing.

Mr. Krebs: No

Dr. Newland: This is a matter of information. Is this grant a Federal grant that you are talking about?

Mr. Barnett: What he is talking about we have been discussing off and on now for two years and that is if we can get a base to assist the Braille Authority with the sort of things that are going on now, the U.S. Office of Vocational Rehabilitation might accept for consideration a research proposal. As you know in almost all such cases there is to be some nongovernmental agency matching say 10 or 15% and so the question then would be if the Foundation would consider this. We have said that if something like that could emerge the AFB would try to get the matching funds. It has not yet been formalized.

Dr. Newland: I was thinking we have as matter of record specific Federal appropriations made for research on and in the interest of the mentally retarded. We have seen an appropriation made for training of workers in the area of the deaf and speech handicapped. I think with precedents like these there might be merit in thinking in terms of seeking legislation which would provide a Federal fund independent of the budget of vocational rehabilitation, but paralleling the approaches which have made for handicapped groups.

Mr. Barnett: I think if you examine your idea you will find new legislation is not really necessary. It may be that funds are available in OVR or the National Institute of Neurological Diseases and Blindness. Also possible even in the American Printing House's new bill which allows more flexibility I hope, giving them more funds in future for research. I think there are lots of resources available now.

Dr. Newland: But we are still competing.

Chairman: Any more questions? Thank you very much, Mr. Krebs. I would like to call on a few people for their thinking before we go into general discussion. Mrs. Umans, have you any comments or questions?

Mrs. Umans: Is there a sizable number of people who have difficulty in learning how to read braille? What type of motivation can be used for people who have difficulty in learning braille?

Miss Gruber: What is the situation as far as methodology with sighted children at the present time?

Mrs. Umans: There is at present a committee supported by the Carnegie Corporation to study this particular problem.

Dr. Newland: I think we make a mistake in assuming that there is a method; methodology may differ with the level of the child and that this should be the primary take-off. We also need to take populations of blind readers, poor readers, good readers, etc. and make intensive clinical studies of them.

Mrs. Umans: The teachers too should be considered as far as effective teachers and ineffective teachers. What makes an effective teacher? How have they been successful?

Dr. Wilcox: What about the adult blind? There is a far larger population of them

Miss Cox: We have been making a study of our school on the length of time it takes children to learn braille. Does the child have enough time to learn braille and does this depend on the ability of the child to learn braille? The bright child moves along at a good pace, but we do definitely have problems in learning braille as you do with sighted readers. We definitely have need for the kind of study Dr. Newland was talking about.

Miss Gruber: How scientifically sound is it for a teacher that is teaching sighted children to use the same method with a child that is trying to learn braille?

Miss Hooper: You can't use the same material in teaching a blind child as you do in teaching a sighted child.

Dr. Josephson: We should consider the problem of motivation. Blind and sighted children would be similar in this respect. If a child is not motivated what comes after doesn't have much effect.

Chairman: We have some questions and ideas to chew on during lunch. We are adjourned. The discussion will be resumed after lunch.

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Chairman: We are now interested in expression of needs for existing research.

Dr. Ashcroft: We have to separate code problems and reading problems. Children's problems are those of learning how to read. People who have become blind and have learned how to read are concerned with learning a code. These two issues must be kept discrete; however, I imagine there are some places where they do overlap.

Chairman: Shall we start on code. Mr. Dupress.

Mr. Dupress: If there is only one code, do you decide if this is to be the code purely from the children's standpoint and forget about the adults? Or do you decide it is alright for both? Technological workers don't know which is better therefore they can't do there instrumentation. Are we asking the right questions in the social science field?

Dr. Newland: Did I hear you say there are simpler codes?

Mr. Dupress: There might be simpler codes, I don't say there are.

Dr. Ashcroft: Pelple have learned to read everything - sticks, plastics, moon type etc.

Mr. Dupress: Yes, except they are in the minority if they know more than one.

Dr. Axelrod: Aren't there strong implications for code change? I would like to propose this question. What would be the changes? Obviously space saving can be carried to extrememes. According to Ashcroft there would be 15% of reading errors. Would the space be worth the additional ambiguity introduced?

Mr. Rodgers: I think the topic of codes can get extremely complicated if we do not take into consideration certain factors: (1) If we wanted any changes in the code what changes would we make? (2) Before we can talk about any changes we have to get at the fundamentals. In my paper I pointed out certain difficulties that have been found out so far. I think some of the members in the group will bear me out that they do not make any pretext in saying that their findings are absolutely conclusive therefore we need a continuation in the chain of research that has been initiated by Ashcroft and European researchers. Then we can decide whether any changes need to be

made in the code or whether it is simply a matter of presentation to begin with. In the case of both children and adults we need more data gathering. Then we can determine from there whether we need change in code or if it is just a problem of presentation. I think there is considerable variation between adults and children. This matter of code therefore has to be studied. The literary code is a good basis for the continuation of further investigation, but from there we might use those findings as a means of improving other codes particularly mathematics, chemistry and physics. I pose this question if it is found out that two cell autographic characters are relatively difficult to read in literary braille the same might be difficult to read in any code (i.e. math, music).

Chairman: Mr. Rodgers, in your opinion is there anything in the existing code where research is not needed?

Mr. Rodgers: It is known that whole word upper cell contractions facilitate reading. From there on we have many questions brought out in the Uniform Type Committee. Alphabetic word signs are the easiest to read.

Chairman: Other opinions?

Dr. Newland: We can recall the fact that the total of errors represented only 5% of reading errors. (from Ashcroft). When considering the change of the code we need to conceive a teaching method which provides a reduction of errors (also Ashcroft). I think we should avoid getting into a discussion of methods of changing the code because there are so many more fruitful areas to discuss.

Dr. Ashcroft: I agree

Mr. Barnett: Then I assume that no one wants to change the braille alphabet as set up by Louis Braille. In other words no one wants to change the braille alphabet as universally recognized. It is what has been done to it since that causes the problems.

Mr. Rodgers: The problem is a matter of a 6 dot cell 3 dots high and 2 wide limited as it is. You could research till doomsday, but you could not go much further

unless the touch area of the fingers could be made to feel a area more than that of the 6 dots. Six points is about the best that the human body can do in simultaneously sensing of the stimuli.

Chairman: Any differences of opinions? Other points then?

Dr. Foulke: It is true if you use more contractive signs you increase the risk of misinterpreting a particular character or combination of characters. You also save space and save reading time which may make available cues to interpretation. I would also like to mention one more thing with regard to Ashcroft"s findings. I wouldn't be surprised if the study were carried up through the high school level that we might find a interesting interaction and that some errors are misinterpretations of contracted forms stemming from errors in the lower grades.

Mr. Rodgers: It is a question of presentation of the contractions in the order of difficulty from easy to hard. We have to then present them in this order and decide which are easier and which are harder. We must not forget the adults.

Miss Gruber: Is there any scientific evidence to indicate if a child under the 6th grade reads contractive braille more rapidly than he reads straight braille?

Dr. Axelrod: No evidence.

Mr. Rodgers: We do not know enough about what constitutes ambiguity and what does not, therefore, we can not contemplate changes at this time in the braille code.

Dr. Newland: Aren't we saying then that we need an extension of Ashcroft's study which would (1) be a study that would follow through with those children who have learned braille from early blindness and (2) with adults who have undertaken braille in later years, say after 20. We might find that the errors would wash out as Dr. Foulke said.

Dr. Foulke: I agree, because then we would be able to find out the problems children encounter at various ages and we could see interactions.

Chairman: Dr. Axelrod you have been wanting to speak.

Dr. Axelrod: Ambiguities are ambiguities whether you are a child or an adult.

Mr. Rodgers: You are speaking of different things: (1) equivocations on one hand in terms of a position of the character on the upper or lower cell (2) meaning assigned to that cell and (3) dot height.

Dr. Axelrod: The question is whether it is worthwhile spending this additional time if you can in other ways straighten out the code so you wouldn't have to worry about ambiguities.

Dr. Ashcroft: You could do this but you would pay the price.

Mr. Krebs: I have serious doubts about the effectiveness of the research done on ambiguities. Dr. Ashcroft is quoted in Mr. Rodgers paper as illustrating certain points, one of which was an extension of the cell from left to right from 6 dots. Actually that is not a fact. Grade 2 does not do that at all. You have 2 completely different units when you have a 2 cell contraction and when you have a short form word and one is not relevant to the other because one is a whole character which is supposed to be observed by the finger whereas the other is a cube plus another character so that I don't think it is relevant to difficulty. The second point I was interested to learn was that short form words are the most difficult to learn because we have found short form words are the simplest to learn. The experience and all information that we have received in all the years shows short form words have been the simplest to learn. Now I believe that the fallacy in Dr. Ashcroft's research is the fact that he tested children up to a certain age.

Dr. Newland: That is no fallacy.

Mr. Krebs: I mean in the overall picture for generalizations. Now by stopping at a certain level he did not take into account the familiarity of certain words. We have found through testing that certain words will occur once in 30 pages, once in 40 pages, once in 50 pages, etc. The fact that the child does not become familiar with these words is part of the reason he cannot understand and readily except them. Unless a child has the experience with these words you cannot say that the test that has been done really fulfills the principle that is set down.

Chairman: Other topics?

Mr. Barnett: Is the problem of presenting charts, maps, diagrams, etc. the same as presenting codes? There seems to be some need with regard to presenting pictorial material. (General agreement)

Mr. Krebs: I was very much interested in Dr. Foulke's exhibits. He showed circles just the size of the ball of the finger. One of them was a circle with nothing in it. The other was a circle with a sort of a fill-in and I had to look at that twice to find out what was different between these two circles. Anything that makes you look twice is a very bad form of education.

Dr. Newland: I do not interpret Mr. Barnett's question on codes. It deals with the problem of space orientation of the blind. Not space just on paper but space perhaps in the larger sense.

Miss Cox: You talked about the literary code and we have left mathematics and science out. There seems to me to be a need expressed for changes in mathematics. I would like to hear if there really is a need for changes in order to go on with the advanced math.

Mr. Krebs: There is a definite need for changes based on problems in clarity. These problems need taking care of.

Chairman: Does this mean that you have a need for research on this problem?

Mr. Krebs: We have no need for research here; we need testing at the moment.

Dr. Wilcox: Can we ever again make changes without data?

Mr. Rodgers: With regard to Mr. Krebs' statement, the short form words and other word characters are based a good deal on meaningful reading. The less experience the reader has the less he can capitalize on meaningful reading and braille is to a great extent meaningful reading much more than inkprint because of these other characters. Therefore, what Mr. Krebs has said emphasizes the reasons why we should systematically tabulate all these things and find the order of difficulty on the basis of experience and other factors

including the relationship of finger size of young people to old people. All these things are a matter of concern to research. With regard to maps, illustrations and circles very often in scientific braille we have to resort to representing inkprint symbols by means of coded symbols (i.e. a arrow right, arrow left). This makes us wonder if it would help students to get some concept as to how these things actually look in inkprint so that it will enable him to interpret the coded symbols entailed.

Chairman: Let's move on to problems other than code problems.

Dr. Ashcroft, would you like to restate your second major topic for discussion.

Dr. Ashcroft: The second point is the matter of reading for blind persons, especially children. I think we can teach children to read most anything you give them. The problem is to do a better job of teaching them to read. I don't think the code should be changed solely in the interest of first grade readers. There is a point beyond which code changes can't be made and then we will have to adapt to do the best we can. Mr. Rodgers referred to the introduction of contractions. I don't know how much this should concern us because we don't introduce contractions, we introduce a reading vocabulary.

Mr. Rodgers: By that I meant - I did not mean vocabulary should be selected to suit the blind beginner. I meant we should leave the vocabulary as it is used for sighted children. But if some contractions and abbreviated words are found to be relatively more difficult for inexperienced readers leave these contractions out (I mean speaking strictly of Grade 2 Braille), and use them later as the child acquires more experience. If you analyze the braille system and the way it works out with regard to form variations you will, I think, find words that are sometimes written with the use of contractions, sometimes written in full spelling because the rule of code requires that the contractions be not used. Now I am not criticizing the braille, but I am simply saying that there are variations. You also find that often words in Grade 2 braille that are written in full spelling. Since there is no 1-to-1 relationship between

inkprint and braille I think this whole matter can be studied and contractions introduced on a graduated basis with reference to difficulties which you found out.

Dr. Ashcroft: When I got involved in this problem my purpose was to find a way of diagnosing reading problems for children and finding out how these problems can be prevented and remedied. I was amazed at the findings: there was a low incidence of errors. My object was to identify reading problems and to suggest remedies and I don't like to see these data taken too far beyond that objective. I don't think there is enough data here or in any research that has been done thus far to direct code changes.

Mr. Krebs: I would like to know at what level the incidence of error is significant for what ages. I myself make errors in judgment. Where do you draw lines?

Chairman: I think research scientists are quite capable of drawing norms as a result of their research. That is entirely within their competence.

Miss Hooper: With reference to Mr. Rodger's statement, if you are going to to introduce contractions more or less gradually at different age levels you also need to study the difference between the ultimate and "will he ever be able to read that sign".

Chairman: Could we now begin to summarize research needs as they have been expressed these last two days.

Dr. Newland: I have listed some problems which we have talked about. Here are researchable areas: (1) research needed on social functional role of braille. (2) research on what I am calling known group approaches where we take a group of children on some level or different levels who are identified as superior braille readers and another group identified as inferior readers and study them intensively to find out in what ways they differ; I know there have been some analysis made but they have stopped short of significance. (3) I would be interested to know the extent to which teachers of the blind use psychological data in adjusting educational expectations and methods to the

children. Many of the data used aren't good; are they using the existing data is a question. (4) I would like to see a study of intensive efforts to speed up the reading by the blind, with emphasis on increasing their motivation to do so. (5) We need intensive clinical studies made of braille reading aberrations that may be thought to be associated with brain injury. That is my list.

Chairman: Dr. Foulke:

Dr. Foulke: Research is needed on teaching programs: learning and reading braille, the perceptual span of blind and sighted readers, and retention of reading should be pursued. We should know how I.B.M. reading machines vary rate to which braille material can be transmitted and the increase of reading speed that is the result.

Mrs. Umans: You speak about the rate of reading or increase of reading speed. There have been very few studies that have shown we can do this with sighted people. On a few retention studies that were done it was found that by two years most of them were back where they started from.

Dr. Foulke: In the case of sighted readers his problem is not his perceptual span.

Mrs. Umans: There are methods that we use with our sighted readers that can increase the rate of reading and I wonder if this is something we can share without the use of a machine.

Dr. Newland: When I taught remedial reading, we used simple motivational procedures where the individual himself plotted his own curve. I think with a machine that acceleration can happen. Then I think we can go into the classroom and relieve the teachers' load, particularly those who have been operating under the assumption that it is not possible to read better.

Miss Gruber: Dr. Ashcroft's work on this subject is with adults. Do the researchers have any results on speeding up reading with children using a machine?

Dr. Ashcroft: No.

Mr. Rodgers: Considerable work has been done on central span and central touch by the Uniform Type Committee in the U.S. and Buerklen, Grassemann and Wundt from Germany and Javal from France. I would suggest that all the literature be carefully looked over and evaluated before proceeding.

Chairman: A competent researcher would automatically do that. Miss Cox.

Miss Cox: I would like to propose that we do some research on the work in developmental reading. I feel if we investigate the work done with sighted children and find out if they would be applicable to readers of braille that it would be quite worthwhile in improving the reading of students who have gotten by the stage of just beginning to read.

Dr. Newland: I suggest we think big. I can perceive a 3 year project where people go into the classrooms, into the schools and work with the teachers with a plan on what they will look for and how they will measure the end results.

Mrs. Umans: The use of the basal reader in teaching reading to sighted and blind should be considered. This is a problem with sighted youngsters. A number of people are questioning the use of it. If you transcribe it into braille it seems to me that you are compounding the difficulties that are inherent in the basal reader to begin with. It seems to me that you are presenting concepts that they do not understand. I would suspect that if you take this reader that is not good to begin with and you translate it to braille you would have problems.

Miss Cox: This is something we have been aware of. Two people have attempted to write books on this at Perkins. There are people in the field of education of sighted children who are studying problems of multiplicity of books. Dr. Fraser from Ohio State University has done work on this.

Miss Hooper: If you take basal readers away as a possibility, what are we going to do for these children?

Miss Cox: This is something beginning teachers have tried to overcome by creating materials.

Miss Gruber: Miss Cox has tried to establish the validity of transfering systems of speeding up reading for the sighted and speeding up reading for the blind individuals who are good braille readers. Are methods used for teaching beginning reading to sighted also valid for teaching beginning reading to blind children? Has there been research on this topic?

General Comment: no research

Dr. Foulke: I don't think we should disregard that as a source for formulating research. The problems are not identical.

Mr. Dupress: We need a variety of studies of how people actually read braille. We don't know what happens to comprehension.

Dr. Axelrod: Mr. Dupress, what has been done to the braille reader? Have people been taught to use the braille reader?

Mr. Dupress: It has not been possible to field test it to any extent because of engineering problems which are being worked on. Also M.I.T. is building a simplified version. If this group here feels the machine is useful I.B.M. will continue its research and development of it. Then it is up to us to use this as a research tool. I.B.M. is interested in the possible market for the machine which we should be able to tell them.

Mr. Rodgers: We can't express our viewpoints until we have a reliable machine and have field-tested it.

Dr. Axelrod: The machine is useful, I would think

Dr. Newland: If you can get someone to take on the field testing as a project in a university and apply for a grant from the U.S. Office of Education you can include in your grant sought, funds for development or refinement of the machine.

Dr. Foulke: We have some such ideas at the Printing House. We plan to do some research with it.

Mr. Krebs: That is an objective that is not workable. We have been using a technique which could provide the validity of the development of this machine. Our

technique is to gear the speed of reading of the individual being tested. By that I mean you have one individual reading ahead of the other. The student follows along the line and the tester increases his rate of reading speed in accordance to the ability of the person. As the speed increases the reading speed of the instructor also increases. One of the techniques we use is to make certain errors to test whether the person is actually following the content or whether he is just excepting words the instructor is saying. We have found this technique shows very good results.

Miss Gruber: What is your data on that? How many people have worked with it?

Mr. Krebs: As far as I know I am the only one.

Mr. Dupress: Perceptually speaking a moving tactual display is not the same thing.

Miss Gruber: I wouldn't even have to have braille copy to follow you.

Mr. Krebs: The thing that impressed me was that the person was trying to chase my finger.

Chairman: Could we move the discussion on to new topics. Miss Gruber

Miss Gruber: We have been talking about midget braille and giant braille. Would the technologists be able to produce midget braille, giant braille and triangular shaped dots on a machine?

Mr. Dupress: M.I.T. personnel are working on producing simple braille at the present time, but later on they propose to get into a study of other tactual instrumentation.. One topic which should investigated is what needs to be done for people of different ages, for people with diabetes and so on, people who cannot read ordinary braille.

Miss Gruber: We cannot go on with research until we have technical apparatus that will produce material for us to test.

Mr. Dupress: On that point, social science and technological researchers should get together to decide what instrumentation is wanted and it can be supplied. Then we could divide this subject up into two areas: that technology which can be done with existing instruments and that which needs instruments.

Chairman: Other new topics, please. Miss Cox.

Miss Cox: I suggest program instruction and individualized instruction for children as a topic.

Chairman: Mrs. Umans, you have some comments?

Mrs. Umans: I have been heading up a team of program instructors. We are in the throes of experimentation and some of these findings are significant. Others are also interesting.

Chairman: Dr. Ashcroft. Then Dr. Foulke.

Dr. Ashcroft: We have been working on a text giving instruction in braille. Our efforts in this have grown out of our experience with instructing teachers in basic code in a 5 week summer session. They are under a great deal of pressure with a normal summer load and the learning of braille, which means they must acquire the skills in this short period of time. Emotional behavior sometimes results. In order to solve some of these problems we have programmed the introduction of braille into a textbook form and we have used it for two years. We have evidence of what we think is remarkable improvement as a result.

Dr. Foulke: We have considered the possibility of motivational instructional devices with the possibility of drawing up a research proposal, but we don't know yet what we will do with this.

Mrs. Umans: We have developed some material which is being used throughout the country. Would you be interested in looking at this material? If you feel you might use it you may do this.

Dr. Foulke: I would certainly be interested.

Chairman: I suggest that you make arrangements between you for sharing it. Miss Gruber.

Miss Gruber: Dr. Ashcroft, your material is for teaching sighted adults the code?

Dr. Ashcroft: Yes, adults.

Miss Cox: I would like to see some material developed to find out what its value would be in work with children in learning to read braille.

Dr. Newland: I think Dr. Ashcroft's material is valuable. It is a difficult subject and his material can give a running start to anyone trying to develop a methodology.

Chairman: Are there publication plans for your material, Dr. Ashcroft?

Dr. Ashcroft: I expect to have a publication contract on my desk when I return home, and it will be very available.

Miss Gruber: Would the Library of Congress accept this as a medium of interest for transcribers?

Mrs. Dorf: I have looked at it but not extensively. I can't say.

Chairman: Other new topics for research, please, Dr. Newland.

Dr. Newland: I would like to see a project done on space orientation.

Chairman: Mr. Dupress.

Mr. Dupress: Active vs. passive means of learning braille should be looked into.

Chairman: Dr. Ashcroft.

Dr. Ashcroft: We need to know the amount and type of material available so that we can increase the amount and type of material and the speed with which it is produced. Also we should consider small quantity reproductions. We still don't have this problem solved.

Dr. Newland: On the topic Mr. Dupress raised, has it been explored? Let's imagine a moving braille tape with the subject holding his finger on the spot where he is successively stimulated electrically.

Dr. Foulke: The problem in electrical stimulation of the skin is that when the skin is stimulated in two places. The effect is confusing.

Chairman: Are there other suitable topics for research that you can mention briefly.

Dr. Ashcroft: Braille writing equipment.

Mrs. Cox: Diagnostic tests.

Dr. Ashcroft: Introduction of writing, especially the appropriate time of introduction.

Miss Hooper: Introduction of spelling.

Miss Cox: Spelling in relation to reading.

Dr. Axelrod: Dr. Geldard at the University of Virginia is working on vibrations on the chest. You need a very simple code. Subjects can read 40 wpm. He showed

communication could take place. He developed a whole skin area as a means of communication. There is no reason why such stimulus could not be mounted on the fingertips. There ought to be more work because this might be easier than braille.

Dr. Newland: I have been concerned with the talk of use of the dictionary by blind children. It seems to me that our mechanical geniuses might develop a memory drum which would have a dictionary recorded on the drum.

Dr. Ashcroft: We need also to improve communication among researchers with meetings of this type.

Miss Gruber: With the number of projects that have been going on is it within the purview of the Braille Authority to keep an inventory of braille projects in this area?

Mr. Krebs: We are a small group. We need a full time person to do this. We couldn't keep all these records otherwise.

Dr. Ashcroft: Is there any possibility for expansion of the Braille Authority with different types of specialists involved?

Chairman: What do you want from this meeting? Do you want an ad hoc committee from this group? Or are there other possibilities for committees to follow through?

Mr. Krebs: I don't see ad hoc committees. They are "in hoc" committees. I don't see its status. I don't see what effect it can have on the whole picture. I think you need established committees.

Chairman: Do you have a research committee in the Braille Authority?

Mr. Krebs: That is our next step.

Chairman: Do you want what material this group develops for your committee.

Mr. Krebs: We would definitely appreciate it.

Dr. Newland: Would this possible ad hoc committee function as the AFB research advisory committee which was in existence 8-10 years ago involving rehabilitation and a number of agencies?

Chairman: No

Dr. Newland: I would support the general idea of a permanent committee provided it is given a broad base.

Mr. Krebs: As we formed our committees in the Braille Authority we attempted to get people in all areas on a particular subject. The base of each sub-committee is as broad as possible. The Braille Authority does not know everything and admits it. All committees are formed this way except the literary code which we feel confident to handle ourselves. All other committees we wish to get as broad representation and on the research it is extremely important to have good research people who not only know research but know the implications of the sociological, psychological and physiological. In addition they must know the employment possibilities that research might foster.

Miss Cox: Would this ad hoc committee be the group that would carry suggestions from this meeting to foundations for finances, etc.? Would the committee work with the Braille Authority?

Dr. Axelrod: Would it be limited to braille and related topics?

Chairman: In answer to your questions, as I see it what we proceed to do is strictly on a voluntary basis. I don't know that anyone can constitute anything at this meeting. It is a matter of personal interest as to whether anyone would want to help carry through on this effort on a voluntary basis. It is up to us to try, from the research point of view. You all have been very kind in giving us researchers lots of things to consider. It is now up to us to try to set forth those topics for people in the field and for people who have funds. This means a document that we have to formulate among ourselves, including research people and content people, to make sure we have full coverage. I have asked and gotten content problems. We haven't exhausted discussion of the methodology by which we should work on some of these problems. I would like some people to work with this with me. I will prepare a first draft. Then I would like to ask Dr. Newland, Dr. Foulke, Dr. Axelrod and Dr. Ashcroft to react to the document I put in their hands. After we research people are happy enough with

it we will send it to content people for them to look at it still as a draft. After their responses I could see this as a document to be used for whatever use they want, such as an appeal for research funds for a specific project, or other use. I am proposing an open document for anyone to use.

Dr. Newland: I think it should appear in some professional periodicals or journals which goes to all the people working in this field.

Dr. Axelrod: For the psychologists I would like to send an announcement, say, in the American Psychologist and something in the bulletin of Division 22 of APA.

Chairman: These are good suggestions. For further action, this would leave to the Braille Authority any of those people that they would like to invite to their research committee as it is set up and it would leave them with the document to do with as they wanted to use it. If we in AFB or any other member of this group are needed on a consultation basis I suggest we take that step next, but at the moment we immediately need to digest what we have said here the last two days.

Dr. Axelrod: On another line of action, how do you get a graduate student interested in doing something in this field?

Chairman: I would hope our document could be used as preliminary guide to interest them and to give them guidance.

Dr. Foulke: I have gotten some of the students at the University of Louisville interested in this area.

Chairman: On my suggestion of preparing a research program paper, is there any objection to my asking these gentlemen and Dr. Wilcox and Mr. Rodgers?

Mr. Krebs: You should define various kinds of research. Whose responsibility would be these things? The Foundation, Printing House? We in the Braille Authority do not wish to interfere with this.

Chairman: This is an open document I am proposing. After we release it, I think we should know who is doing what with it. We need some follow-up.

Dr. Axelrod: I feel this will be written up, gone over, sent out and forgotten.

Dr. Newland: I can see value in the planned distribution of the document in addition to the American Psychologist, American Education Research Association and Division#13 The Educational Psychologist should receive copies. I think personally addressed documents to members of something or other is more effective.

Dr. Axelrod: Would there be any way to indicate that the Foundation would support applications to granting agencies like NIH?

Chairman: We will consider supporting any application that goes to NIH for what that is worth. We have done this in the past. I think action ultimately depends not only on a lot of people or artificial promotion by an organization but on the researchers around the country who have facilities and the personnel to do the job that we suggest.

Dr. Newland: The only way this would be implemented would be to raise the ante on any fellowship in connection with any of these projects.

Chairman: The Foundation is not giving research fellowships anymore, but the subject should be pursued with the Federal government, particularly the U.S. Office of Education.

Dr. Newland: I mean some kind of assistance to any student who becomes involved in any of these projects.

Chairman: Yes, on a fellowship basis or a project basis. I don't know if there is any way at all of institutionalizing this whole approach to research funds on braille by getting a block grant or a large program grant. It is customary for some kinds of research. I think they should be approached. We should set forth the needs and show we can go about these needs in certain stated ways by project support or large program support. We should ask the two offices most concerned (Office of Education and OVR) whether they are interested enough to call a group together about implementing our recommendations for a block grant or whether they want to do it on a piece-by-piece project basis.

Miss Hooper: Is there any way we can set it up by instituting the order of need?

Chairman: We will try to designate priorities. Let's leave it then that we will do what we can as soon as we can; those of us on the research side will give our thoughts to those of you in the content side through a document that reflects as much as possible our thinking here together with a few recommendations on how we will go about implementing this. I will make it a point to approach the Office of Education and O.V.R. about whether they would be interested in having us as a small delegation or as a newly constituted group to try to implement our recommendations through research support.

Now it is late. I want to thank you all for your whole-hearted cooperation. It has been a provocative and fruitful meeting. I hope good research programs will come from it.

Thank you very much. The conference is adjourned.

SUMMARY OF NOTES FROM

CONFERENCE ON RESEARCH NEEDS IN BRAILLE

Robert A. Bowers

Greetings from Mr. Barnett

Braille, possibly followed by orientation and mobility, has a top priority when considering the needs of blind individuals. The Foundation's great concern is that braille become a more useful tool while remaining uniform internationally. There is need for more basic research, not only into the physical nature of braille, but in establishing some permanency for the several codes. There is need to examine and evaluate new proposals and practices in braille without prejudice. It is obvious that if research is to be carried on successfully, it will require full-time staffing, sound planning, and adequate financing. Research cannot go on through use of donated time.

Discussion

It was suggested that we need to separate the issues of the code from the issues of teaching reading; Children are learning to read-adults are learning a code. The braille codes must either be based on children's needs, adult needs, or compromise unless separate codes are to be taught to children and adults.

Should clarity or spacing be the main concern? If the basic concern is for uniformity and usability, Dr. Ashcroft's study carries strong implications for code changes. Ambiguities in existing codes need to be diminished.

Mr. Rodgers stated that any change contemplated would involve the following:

a. A continuation of basic research already completed and under way.
b. An examination of methodology and format for both children and adults.
c. Moving out from a base of what we know through research.

Dr. Newland suggested that the difficulties may not all be with the codes but that= better teaching methods should be explored.

Mr. Rodgers suggested that studies be done on a more logical presentation of braille from easier to more difficult signs for both children and adults.

It was suggested that control groups using uncontracted braille be compared to groups using contracted braille to compare comprehensive and speed of reading.

It was suggested that methods of presentation be looked at before changes in braille are tried. Mr. Krebs indicated that testing should be done only after children have had a great deal of experience with reading.

Mr. Barnett suggested that much more research was needed in the whole area of tactile impressions: charts, maps, braille, "raised pictures", etc. The codes other than literaty braille also need to be studied more in terms of special problems they raise.

Mr. Rodgers stated that short form words are based on meaningful reading and require experienced readers. The order of difficulty of words needs to be determined on the basis of maturity and development of readers. Better equivalents are needed for inkprint symbols.

Research was indicated on the possible confusion of word forms when words are presented in uncontracted and also in contracted form.

Dr. Newland suggested the following as areas to be researched:

a. Socio-functional braille usage.
b. Known group approaches to instruction (ability, individualized reading, etc.)
c. Individualization of instruction by teachers based on psychological and other data.
d. Varied cell size and spacing
e. Studies in rate of reading increase
f. Intensive study of braille reading aberrations thought to be associated with brain damage.

Dr. Foulke suggested more research on comparing perceptual and interpretive spans of blind and sighted readers. There was some indication from the IBM Braille Belt Readers that increasing reading speed increased reading span.

Mrs. Umans cautioned that acceleration and remediation studies with sighted students indicated that speed increments may not be retained over a long period of time and that this should be considered in terms of increasing rate of braille reading.

Dr. Newland proposed that a three year study of braille skills be planned for schools.

It was suggested by Mrs. Umans that the reading materials themselves may cause difficulties. Teachers of reading are becoming more critical of textbooks now available, and the additional problems of their braille adaptations may only compound the difficulties.

Miss Gruber suggested that research be done on the applicability of teaching methods for the sighted to the teaching of the blind.

Research was indicated into the kinds of reading skills needed, the use of reading, types of codes, format, etc. Also, it is necessary to consider whether braille is the best reading and writing system that can be devised. Good machines are needed for valid testing of these skills. Research is needed in the size, shape and spacing of braille dots. Research is needed in the contributions which might be made by programmed materials.

Research is also needed on the following:

a. The differences between active and passive reading (particularly in light of increasing use of audio instruction).
b. Increasing the amount and types of materials.
c. Small quantity reproduction of tactual materials.
d. Writing equipment
e. Diagnostic testing for reading skills.
f. Introduction of braille writing in terms of time and methods
g. Spelling and its relationship to reading.
h. New reading devices and aids, electirical stimuli, vibrators, sound stimuli
i. Use of a memory drum for dictionary and other reference materials.
j. Music and other braille codes
k. Format in terms of duplicating print format

It was suggested that an inventory of braille projects under way be kept by the Braille Authority or some other responsible agency.

It was recommended that the research people present at this meeting be asked to react to and act upon the suggestions and recommendations made during this conference. It is further recommended that research needs be disseminated through various journals and that support from agencies and services be secured.

APPENDIX

Some Recent and Current Research Projects Related to

Educational Procedures

Used with Visually Handicapped Children and Youth

Prepared by
Mrs. Florence Henderson
Former Associate Professor of Education
San Francisco State College
May 1961

Area	Title	Investigator	Date
READING			
1. Readiness and Reading	"Tactual Perception in Young Blind Children	Alexander and Nolan	1958
2. Readiness and Reading	"Tactual Perception of the Blind"	Conlin, Jan Eliz.	1957
3. Readiness and Reading	"Cues Used by Blind Children in Categorizing Objects"	Nolan	Planned for 1961
4. Reading	"Field Trial of I.B.M. Braille Reading Machine for A.F.B."	Ashcroft	1959-60
5. Reading Appraisal	"Errors in Oral Reading of Braille in Elementary Grades"	Ashcroft	1955-60
6. Language Development	"An Investigation and Analysis of Verbalism among Blind Children"	Harley	1961
7. Concept Development	"Variability Among Young Blind Children in Object Recognition"	Nolan Morris	1960
8. Prediction Reading Readiness	"Roughness Discrimination Among Blind Children in the Primary Grades"	Nolan	1960

Area	Title	Investigator		Date
Reading Con't.				
9. Prediction Reading Readiness	"Further Results in the Development of a test of Roughness Discrimination"	Nolan	Morris	1961
10. Reading Test	"A Comparison of the Oral and Written Methods of Administering Achievement Tests"	Nolan	Davis	1960
SPEECH				
	"Speech Problems of Blind Children (A Survey of the North California Area)"	Rowe		1958
ORIENTATION				
	"An Experiment in Teaching Topographical Orientation and Spatial Organization"	Garry	Ascarelli	1959
2. Large Type Pictures	"Teacher Evaluation of Large Type Pictures"	Nolan		1960
3. Paper and Ink Combinations Large Type	"Legibility of Ink and Paper Combinations"	Nolan		1960
PREDICTIVE				
	"Effects of Early Blindness-Performance of Blind and Sighted Children on Tactile and Auditory Tasks"	Axelrod		1958