Minutes of the conference on

AUTOMATIC DATA PROCESSING AND THE VARIOUS BRAILLE CODES

Massachusetts Institute of Technology

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AUTOMATIC DATA PROCESSING AND THE VARIOUS BRAILLE CODES CONFERENCE

SUMMARY OF MINUTES

FIRST DAY MARCH 17, 1961 HELD AT MIT

The chairman's introductory remarks listed the purposes for which this conference has been called. They are as follows:

1) To bring together researchers who have worked on specific projects in the areas of automation and braille.

2) To enable these researchers to meet face to face in order that they might exchange ideas, tell each other about the status of their current projects and thus participate in a common detailed informational exchange.

3) To relate certain of these developments to other developments and to the field of braille as a whole.

4) To arrive at some guide lines which will enable us to put certain emphasis on research in the future, to establish priorities among research items, and to indicate what kinds of background information are required in order that the research may go on more efficiently.

5) Where necessary to produce some plans for implementing certain research and development projects.

6) To alert the social scientists and those in charge of programs and services to the needs for certain information by technologists.

7) To establish a permanent committee which will expedite the information exchange in the future, implement certain research projects and thus in the final analysis, bring the fruits of research to the production engineering and program and service levels.

The real reason for such research and development is to bring an ever increasing variety of braille material to blind persons at lower costs more quickly and with a steady reduction in the requirements for sighted specialists.

Mr. John Haynes began by pointing out that until recently he had been operating in ignorance in terms of other research and development in the area of braille. His system is very similar to the Adelphi-Systematics system, he pointed out. Mr. Haynes' efforts began in conjunction with the Peninsula Braille Transcribers Guild in California. This organization found it was necessary to increase the amount of material they were making available to blind people. They had volunteers and braille writers, but no equipment for duplicating in sufficient quantities the copies made by volunteers. The organization does a lot of work for the California school system. Mr. Haynes stated that it seemed logical to use paper tape, record the first copy on this paper tape and then use paper tape with appropriate instrumentation to provide additional copies. Second, third, fourth, fifth copies could then be put out automatically. Mr. Haynes has been occupied with this task in his spare time for about a year. The project is not an official project of Stanford Research Institute. Mr. Haynes is doing it on his own. At the present time, the paper tape "talks" to the braille writer. That is a paper tape reader that operates a solenoid-controlled Perkins brailler. Mr. Haynes mentioned also that a student named David Milne was operating in the same sort of isolation. He /Milne/ took a typewriter and modified it in such a way that it could be connected to a solenoid-operated braille writer. Anyone who wished to produce Grade I braille, therefore, would not need to know it, but would simply need to know how to type. He has also extended the development to include what might be called Grade I½ braille with the contractions made available, but with no system for using them in accordance with rules for Grade II English Braille American Edition, 1959.

Mr. Dupress

A question was raised concerning some form of smaller scale duplication scheme which the Peninsula Braille Transcribers Guild was using. Mr. Haynes said that the organization had gone to a local plastic stamping firm which makes such things as Santa Clauses for Christmas etc. This company made them a vacuum table so that they could produce sheets of braille on plastic from a master. The braille reproduced now has very much the same feel as paper although it is plastic. The cost is about $.05 a sheet.

It was mentioned that a priest in Newark, New Jersey has a similar scheme. The priest claims that he could produce the braille material for between one and two cents a sheet.

Mr. Zickel indicated that the American Printing House has to use a somewhat different scheme because they are interested in up to 20 copies, not just one or two, from the master. The plastic costs about $.09 a sheet. It is 7½ mills, it takes two sheets to make a master for a page. A set of masters for a page costs about $.18. From these plastic masters, 20 sheets could be made very easily and as many as 200 have been made. The copies are standard braille paper.

Mr. Zickel

It might be well for this group to discuss what we are trying to attain. It seems we have several problems. If we want to make--let's say the Reader's Digest that we produce at home-- we have one problem. For the individual student who may want one copy-- this is again another problem. But in between these are several other groups where they may want one, two or let's say two, three, five or twenty copies and each of these should be approached in a different manner, or I think they can be solved in a different manner. As we go along, I'd like you to keep this in mind and see if you agree with me. If not, why let's change our approach. Nevertheless, we were trying to reach this group where we had an original made by a volunteer.

Mr. Zickel (continued)

Now from this we want to make obviously more than two copies because as I mentioned earlier, this plastic costs $.18, but from that we've made these two sheets. They are identical and stapled together, and here we have the duplicate copies from them. You can see that it's not cheap when we're talking about $.18 for the plates only, without labor. Of course the paper is very inexpensive. But this is not the two-copy answer. It is not the 100-copy answer. I think in the 100-copy range we still must think in terms of metal plates. It is essentially the vacuum form system that Mr. Haynes mentioned that is used primarily I suppose for the novelty field, although it has been used in many other places. We bought a conventional Auto-vac machine. We have simplified it, and put only a flat plate on it. We lay on the paper master, put a sheet of plastic on top of it, pull the heater over the top and after about five seconds, the plastic is soft enough so that we pull the vacuum and that's all there is to it. After making two of these plastic masters we register them by sight and staple them together. Now it does require-- this I think I would like to emphasize-- it does require a very strong press. We find that we have to buy the very heaviest--instead of a 14x22 as ordinarily used, we use a 20x30 press. The pressure required to emboss from plastic must be several times, many times the weight required for ordinary braille printing with a metal plate. But I believe you'll admit that the quality is pretty good here./samples were made available/ It seems to me it's well accepted. We have had a lot of compliments on it.

Mr. Freiberger

Those two plastic plates are needed just to get more of the same thing that you get from one. Is that right?

Mr. Zickel

We have in effect, a male and a female die.

Mr. Freiberger

The paper is between the two?

Mr. Zickel

The paper is embossed between the two, right.

Mr. Dupress

The cost per sheet is quite high for 2,3,4, copy volume. The system is not a cure-all for the situation where just a few copies are required. When 200 copies are required, or someplace before the level of 200 copies, the use of metal plates becomes cheaper and more efficient for two reasons: number 1) interpointing can be done; number 2) the cost per sheet is less along with reduced bulk. It was also pointed out that you have much better control over the quality of the material. One can never be sure that the original braille writer which produced the master made a really good master.

A question was raised concerning the Gestetner process in which ink is baked and the ink raises. The answer was given that it has not been very well accepted in some of the schools where samples have been made available. The dots are not very high and there is a sort of spatter effect instead of smooth rounded tops to the dots. The dots do not seem to be even.

Mr. Zickel had a working model of the Lavender braille writer with him which conference members were able to operate. It is very near to the production stage. Some of the advantages to the unit are that it has a very light touch, it is much smaller than conventional braille writers, it is lighter, and if produced in enough quantity will be less expensive than conventional braille writers. /Editor's note: For additional details concerning the Lavender Braille writer address Mr. Virgil Zickel, Plant Manager, American Printing House for the Blind, 1839 Frankfort Avenue, Louisville, Kentucky./

Mr. Dupress

Several comments were made concerning the layout of the keyboard. Speakers commented on the fact that it might be in a fan shape instead of straight across, that provisions might be made for the fact that the thumb is shorter than the index finger, and that many people might like to have a one-hand keyboard. One speaker said that he often wished to be able to read braille material with one-hand while he is writing it with the other.

The answer to these comments was that the Lavender Braille Writer is easier than any of the conventional ones to operate in a one-handed fashion. The Lavender writer can be adapted so that all spacing is done with the space key. As many keys may be depressed as desired. At the completion of the cell then the individual can space to the next cell.

Two methods of setting up a one-hand keyboard were given as follows:

Mr. Glaser

Well there are two ways it can be approached. The one that is probably the most familiar is where the keys are fanned in such a way that the right hand can span the entire keyboard. The middle, ring and little fingers handle dots 4,5, and 6. The thumb and index finger handle dots 1 and 3. Dot 2 is shifted next to a spacer which can be caught with the palm.

Mr. Zickel

You mean you hold one down..

Mr. Glaser

No you don't. If you use proper spacing, you can either arch your palm so you don't pick up dot 2, or by flattening the hand slightly you can pick it up. The other form, which is an adaptive keyboard, is a little bit more complex to describe. Again I'll use the example of the right hand spanning the keyboard. The three fingers--

middle, ring and small finger--pick up dots 4, 5, and 6. The thumb picks up dot 1. The index finger because of some special shaping of the keys, can pick up either dot 2, dot 3, or both simultaneously.

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Mr. Dupress

One speaker commented that the difficulty with some of these one-hand keyboards is that enough force must be exerted with one hand to produce good embossed dots. Another speaker agreed that this is a problem, and that the design must permit the relatively weak third finger to exert more effective pressure on the keys which it must operate. There should be energy storage because actually the effective force is normally exerted only near the end of the stroke. When force is accumulated during the course of the stroke, and then exerted at one time, it should make it easier for the human to use his third finger effectively to make dots. There were differences of opinion concerning the timing of the cycle and the design of the keyboard in terms of their effect on each other, on the complexity of the design and the accuracy with which the braille writer would have to be made. Furthermore, an efficient one-hand braille writer might prove more costly.

Professor Baumann mentioned that the electric braille writer currently under development in the ME Department at MIT began about a year ago with a junior design project involving three juniors. They came up with a sufficiently good design in the beginning to win a prize for their work at MIT. The work has been going slowly because in the beginning there was only limited financial support from the American Foundation for the Blind. Now there is sufficient support from the Office of Vocational Rehabilitation however to push the design ahead at an accelerated pace. The main thought behind the electric braille writer is to have a transducer which will operate faster than conventional braille writers and will operate from a variety of signal input sources. It could be coupled to a "black box." It could operate from the signals supplied by an electric typewriter. It could in short operate from keyboard inputs, computer inputs, or typewriter inputs.

The first problem encountered was the switching circuitry which would fit underneath the typewriter. The first scheme was abandoned in favor of a photoelectric signalling system. The optical switching circuitry consists in this case of opaque plastic nibs in which certain nibs are removed in order that the light may shine through and actuate the system. About 13 photocells will be actuated in various combinations. The coding system will fit underneath a standard electric portable or office typewriter. There will be two flying shuttle heads, because braille takes up twice as much space as print from left to right. One head will go over to the end while the second one is waiting and the second one will continue to the end and both will come back when the electric typewriter carriage returns. In the first design, a motor drive with the IBM key actuators will be incorporated. As many standard parts as possible will be used in order to minimize tooling up for the production later. If possible, the energy requirements will be kept down to the point where it may operate from a rechargeable battery but at the present time, it is not possible to determine whether this can really be accomplished.

Professor Baumann asked for a reaction from the conference on whether or not the braille could be presented at first in one direction and then back from right to left. This would simplify the design of the braille writer. Among the blind persons who use braille, there was a general consensus that this scheme would not be acceptable, that is, doing half the line in one direction, then returning from right to left. In conclusion, it was suggested that if you're going to write backwards for half the line, that you also reverse the cells, and that some investigation be made of how well people read, going at first in the forward direction for a line of braille, and then coming back but reversing the cells just as one does in writing braille with a slate.

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Professor Baumann

First, let me say that we'll have a regular typewriter keyboard. There will be wires leading from the typewriter (six for the regular braille cell and others).

We are planning on adding a capital sign to our braille writer. We are planning on making a seven-pointed head with seven dots on it, so that the capital sign could be included. This means that the keyboard, if we have an electric braille keyboard, can have a shift key. There will also be signals for carriage return and for line feed. The reason for this is that we would like to be able to use it on continuous fanfold paper especially if it's receiving computer output or in some other modes. Now, we would like to see this braille writer be simple and cheap enough so that an employer or a blind person could buy it and the typewriter and do his job with it. He then has access to every memo typed by the secretary in that group. We would like to see it used in a classroom. They are teaching typing in the second grade now, so if we have a device like this in the classroom, one of the students in the class can type out the day's lesson on the regular typewriter keyboard, and have available braille copies. Aside from this are all the possibilities of embossing braille from teletypesetter tape, monotape, etc. We could also provide a one-handed keyboard, with a shift key if desired and we can try various other keyboards.

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Mr. Dupress

The next topic was the IBM braille belt reader. Mr. Wheeler pointed out that there are two copies of a prototype now in existence, and that this unit has a history of quite a few years. The main reason for developing the braille belt reader was to reduce the volume of braille material by having a different storage medium for the braille. This was thought of as being punched tape. It was not thought advisable to have some new more compact kind of braille code. This would require new learning and this was pretty much out of the question. The braille would then be set us as a response to the coding stored in the punched tape. The braille would be reconstructed on a moving plastic belt. The belt is about an inch wide and about a tenth of an inch thick. The row of cell configurations (holes) is centered on the belt. Approximately the standard spacing between dots and cells obtains. The plastic memory of the belt holds small pins in the down position. The tops of these pins are the braille dots.

Each dot or pin is activated by electromagnetic means. At the end of the line, the pins are reset flush with the surface of the plastic belt. The braille cells come up at the right and disappear at the left. The individual has control over the speed with which the belt moves. There is sufficient friction in the system so that under ordinary reading conditions the dots are not pushed down. The storage medium, i.e. the punched tape, is in a fanfold for convenience of access. The space saving from braille itself to the punched tape is a factor of about three to one. In other words, the punched tape takes up about one-third as much space as the equivalent in interpoint braille material. Another comparison was made, namely that the punched tape storage volume required for the equivalent in braille was about the same as the material would take in the Talking Book medium. The first belt was made in 1946 and is still in the machine. This indicates that the belt itself has great durability. The highly ground and polished metal pins seem to have very little abrasive action; it is essentially sliding action. There seems to be a minimum of adjustment on the reader's part in reading braille that moves as opposed to moving the fingers across the braille. One participant pointed out that you learn to read the braille beginning at the right and if you miss something you could shift to the left and pick it up. One of the problems pointed out was that you cannot show centered headings, etc. Although the braille cell is slightly larger in the braille belt reader than conventional embossed braille material, Mr. Wheeler stated that it was not necessary to make it larger. At the time he tried to determine the size, no one seemed to know exactly what the size of the braille cell was. Mr. Freiberger of the Veterans Administration then pointed out that he had copies of pamphlets in which the specifications of braille were pointed out. This had become necessary because at VA reading conferences people asked questions about the specifications for the braille cell. He said that the characteristics listed were apriori judgments and that they had left room to maneuver, since some people pointed out that there was a standard slightly different from that stated in the pamphlet.

Mr. Freiberger of the Veterans Administration talked about the typesetter tape-to-braille converter. He said that the interest in this was part of Veterans Administration's taking over and continuing some of the work started by the Committee on Sensory Devices during World War II. Mr. Sidney Friedrich explored some of the problems encountered in reading machines design. He came to the conclusion that one of the ways to get around a lot of the problems was to get directly at a kind of storage other than the printed word, namely tape prepared for the publishing industry. The problems of reading this out should be much simpler than recognition of print patterns on paper. Design of the typesetter-to-braille code converter began about 1954. Many periodicals and some books were published from typesetter tape so it was thought desirable to use this medium. Mr. Freiberger showed a short film on the converter. The group who would benefit especially from this device are the deaf-blind people who do not have access to information on the radio as do blind people. The machine accepts six-hole punched tape and has as its output another six-hole punched tape, this time however, with each hole representing a dot in the braille cell. The speaker mentioned that one of the problems is that there evidently is no common agreement on what Grade I braille is.

Mr. Mulvey said that at the present time there is a commercial device which can probably convert teletype tape to Grade I braille coding with very little modification. Mr. Mulvey refers to a universal type converter which can handle five-, six-, seven-, or eight-channel tape. A plugboard permits quite a variety of conversion possibilities. A single character can be expanded up to a maximum of six characters, or any one of six characters. It is also possible to go the other way, from six or a smaller number down to one. The plugboard can be changed to accommodate different kinds of coded tapes. The machine will accept cards as well as punched tape.

The discussion returned to the typesetter-to-braille code converter, which consists of a tape read section, a logic section and a tape punch section. It was also contemplated using the IBM braille belt reader to accept the output from this machine. In its present form, the unit does not translate messages of any degree of complexity. It will handle very simple code conversion placed on the typesetter tape and read out and converted to braille. The device did not have to deal with format since it was not intended to produce braille pages.

Mr. Dirkman began the afternoon session by discussing a monotape-to-braille code converter. He said that typesetter tape and monotape have very much in common except that the monotape is wider and contains more information. It has 30 columns divided into 2 channels. Every key pressed in making up the original monotape puts a hole in each channel. The holes in these channels are used to position a matrix in a casting machine. Sensing in only one channel positions the matrix vertically and sensing only in the other channel positions it horizontally.

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Mr. Dirkman

This matrix idea suggests something like magnetic core memory which operates precisely this way. There is what is called the half-select principle, where you put a current in one column of a core matrix, saturate that particular core and then read out by a readout pulse what is on that core. The similarity between these two ideas leads to the possibility of using a magnetic core storage rather than a diode matrix. The latter is probably the most common type of decoding technique. The problem is a little simpler than teletypesetter tape in that the monotape code for capitals is different from the monotape code for small letters. In teletypesetter tape, you have a code instruction that shifts you up, then you punch the small letter. A separate code instruction shifts you back again and you continue. The monotape system on the other hand has distinct codes for capital signs and for italics. There are also mathematical signs. In fact there are 225 possible characters in the monotape code rather than 64 as in the teletypesetter code.

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Mr. Dupress

There would be a permanently wired magnetic core matrix. Many publications of a higher typographical nature use monotape. One speaker said that most books and journals which are not published on a daily basis are set in monotape. It is also easier to correct in monotape.

Mr. Mulvey then discussed the Systematics-Adelphi Multicopier, a device which is designed for the automatic production of braille copy. Mr. Mulvey brought the system up from Long Island. It was on hand in the conference room for persons to examine. There is a sensing switch under each key of the Perkins brailler writer. Depressing a given key in the braille writer causes a hole to be made in the punched tape. At the end of the system the tape-reader causes the appropriate dot of the braille cell to be embossed. Also the space bar, carriage return and line feed are activated. The advantage of the system is that a small number of copies can be made from one master copy made by one braille transcriber. The services of a braille transcriber are not required in the making of additional copies. The unit produces good standard braille. The process is not inexpensive in that braille is produced on one side of the page only. Standard braille paper is used and the quality of the braille is comparable to that produced on any Perkins brailler. Designers of the machine originally hoped that blind school children would be among the first to benefit from it. In its present form, paper must be fed manually into the output brailler a page at a time. It is hoped in further development to have an automatic feed from a fanfold or from a roll of braille paper. Mr. Mulvey stated that a reasonable reproduction rate for the system is four braille cells a second. Beyond that there seems to be some deterioration in the quality of the braille. This of course refers to the present system.

The question was raised as to why commercial companies get into development of devices in the braille area. The answer was given that Systematics is in the intercoupling business. A management consultant suggested to Systematics that they work on the Multicopier to produce braille material. The president of the corporation had blind parents, and therefore he had a special interest in this project. The factory management was then willing to acquire various parts so that the system could be put together. The Perkins brailler was donated, the reader and punch were taken out of stock. The development was turned over to Adelphi Research Center Inc. by Systematics Inc., in order that a non-profit group might be better able to seek government funding for further development.

In continued development of the Multicopier, there are several items which would be worked on. (1) The sensing system in the front end, i.e. the Perkins brailler would have to be changed so that it would not be so sensitive to the touch. In the present design it is possible just to lightly touch a key and emboss a dot unintentionally. A light dot can be made in the original braille copy from which you cannot judge whether a hole has been punched in the tape or not. (2) Some more effective way must be found to read out and correct errors in the punched tape. (3) There should be a much more efficient paper feed system. (4) The equipment should be repackaged and undergo production engineering. Mr. Mulvey said that the IBM braille belt reader might be a good verifier for what has been put into the punched tape. The punched tape generated in the Multicopier is eight-channel. Six are used for the braille cell, the seventh for line feed and the eighth for carriage return.

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Mr. Mulvey

The channels are arbitrary. It can be six. We chose eight. We use one for each key, the seventh is for line feed and the eighth is the carriage return. A blank in the tape does not cause any action in the output brailler. This is arbitrary, it can be changed.

Mr. Zickel

Talking now about what you plan for the future, do you see any problem of dependability of the system?

Mr. Mulvey

I think that can be answered. If you're asking "Will the machine last?"...

Mr. Zickel

No. My question is this. Suppose that someone writes a page of braille and a good tape. The tape may be good, but the braille may not come out as it was put in. It is a machine and is subject to failures.

Mr. Mulvey

This is always a definite possibility, but-

Mr. Zickel

Well, my reason for asking this, is, doesn't this add to the complexity of it, and if so, we should stress this. The reason I want to raise this before the group is that the system ceases to be as simple as it seemed.

Mr. Mulvey

Yes, definitely. If you want satisfactory operations, and of course we do in almost everything we build, it always turns out to be a pretty complex piece of equipment and the price is determined by its complexity.

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Mr. Dupress

Mr. Wheeler then discussed the tape-controlled braille production system at APH. He mentioned this got started at the suggestion of Mr. Zickel who was wondering about the possibility of using punched tape or punched cards in facilitating the production of braille.

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Mr. Wheeler

This automated braille production, as we call it, is actually tape-controlled zinc plate embossing equipment. Of course we had to have equipment to prepare the tape first and then we wanted to be sure that it was correct (verified), and then there is the tape-controlled zinc plate embossing machine. So essentially there are three basic units. One we call a tape perforator, then we have a tape verifier and finally a tape-controlled embosser. The tape perforator is actually an eight channel teletype tape, very much the same as we have been shown here. We selected six holes for the six dots in the cell, one channel for each dot position in the cell. The seventh channel we use as a redundancy code. In other words, the code punched in the tape is always either an even or an odd number. In this particular case, we have selected an even number of holes, so if you were punching 'a' which is dot 1, you would punch channel one and channel seven. If you punched a 'b' in it, which is two dots in the cell, you would not punch the redundant or seventh channel so you would always have an even number of holes punched in your tape. This is to be used later on in the embossing process which I'll explain when we get to that part of it. We used the Perkins brailler, added contacts to the keys, and we added a few additional contacts and keys for machine control codes. The tape has eight-channels., the eighth channel being used for machine control codes -- end of line, carriage return, things of that nature-- special codes, consisting of the combination of the eighth channel and other channels, used for the machine control but not for braille at all. The verifier consists of a tape reader, also quite similar to the reader unit they have here. An eight-channel tape punch again, the braille typewriter again, but now we've added what we call a console indicator. In verifying the tape, we take the original tape that was punched, put it in the tape reader, and then the operator attempts to punch a tape again. If the keys that he or she depresses agree with the holes that are punched in this first tape, the second tape is punched. If there is a disagreement, this console indicator has on it two braille cells in the form of lights , one set up by the first punched tape, or the tape that's being verified, the other being set up by the keyboard depressions.

The operator can then look at which lights are lit and see where the difference is, and determine which one is the correct code and by proper machine manipulation cause the correct code to be punched into the second tape. It may be the verifier's fault, or the error may be in the original tape. By going through this procedure we end up with a second tape which should be a perfect tape. Now if in verifying it you found there were no errors in the first tape you've got two correct tapes, but you generally find errors, so you discard that first tape and take the second tape as the corrected tape. For the tape-controlled embossing equipment, again we use the tape reader, and this is now coupled to a power-operated zinc plate embossing machine. This machine was built out in Louisville by the American Printing House for the Blind and we adapted certain controlling elements to it. The tape reader reads the holes punched in the tape and it sets up controlling elements on the power-actuated zinc plate embossing machine, causing the embossings to be effected onto the zinc plate. Now this is where the redundancy checking comes in. If for some reason, one of these controlling elements fails to actuate, there is a comparison made, and if the right number does not appear in this comparing circuit, the machine stops and indicates that something went wrong. It did not emboss in the zinc plate but was punched in the tape. That's where the redundancy checking comes in. So to a degree you are assured that you are embossing in the zinc plate what is punched in the tape. If a double error occurs, you can still get an error in the zinc plate, but the possibility of that is quite remote. It can happen but still the reduction in error is considerably improved by this redundancy bit in the tape code. Then of course you put the tape in the reader, insert the zinc plate in the bossing part, start it at its start position, throw the switch on, and the machine goes automatically. At the end of the line, the carriage returns, and it keeps spacing on up until you emboss the full plate. When you come to the end of the page there is an end-of-page code that causes the machine to stop and signal the operator that the side of the zinc plate is finished. You can turn it over and interpoint it on the other side. It goes through the same procedure until you come to that end-of-page. Then you take that zinc plate out, put a new one in and start over.

Mrs. Schack

What I'd like to do is to describe the overall system that IBM has designed working with the American Printing House for the Blind, an automated system for the production of braille. Our aim, here was to be concerned with the problems specifically faced by somebody who wants to mass produce braille. We wanted to design a system that would take care of any kind of copy that would come into the hands of the American Printing House. I think there are some kinds of copy that we can't handle. I think I will concentrate on what we can do. The starting point is the production of an IBM card using a standard card punch which has a straight typewriter keyboard. One of the problems we were told about by the American Printing House for the Blind is the difficulty of finding and training skilled braille transcribers to produce the number of pages per year that there is a need to publish. By substituting a typist's skill for the braille transcriber's skill we now have a much wider manpower group to choose from, because anybody who knows how to type can learn how to keypunch in a few minutes. Learning to type is not itself very difficult.

Mr. Gildea

This is a straight 026?

Mrs. Schack

Straight 026.

Mr. Glaser

No caps.

Mrs Schack

Now, the person who's producing the input does not have to know anything about braille. With some exceptions, all that's required is that the keypunch operator copy the text as it is printed. Those exceptions are that there will be in some cases special codes required to indicate format, so that the keypunch operator has to do a little bit more than just a straight copying job. For the most part, these extra codes are not difficult to handle. It's a matter of saying

to the keypunch operator, "When there's a chapter heading, punch a special code at the beginning of it and a special code at the end of it," because after that title has been translated into braille it has to be properly centered so the computer program has to know just how long it is. The cards that are produced by the keypunch operator are transcribed into magnetic tape form on an off-line piece of equipment that reads cards and produces magnetic tape. Our reason for doing this is that the computer we're using to translate braille is a 704. The most efficient use of this computer requires feeding magnetic tape in and getting magnetic tape out. The process of converting from cards to tape is simple. It's done on a relatively inexpensive machine. This tape is then fed into the 704. Time will not permit describing in detail what goes on inside the computer. We translate from standard punched card input into the Grade II braille and produce another tape which has the braille codes in it. We are trying to produce output that's verified, because we are going to produce a metal plate and the cost of correcting metal plates is something we want to avoid. Therefore we do another computer operation here and take this braille tape, put it back into the 704, this time with a different program in it. The first program I call a translation program. It goes from inkprint or keypunched copy into braille. The second one I call a retranslate program. This takes the braille codes, translates them back into inkprint form and a byproduct of this retranslation is a piece of printed copy. We get out of the retranslation program a printed copy which has on it the printed representation of braille and underneath each braille cell the equivalent inkprint characters. This paper copy is then proofread and when we are satisfied that everything is correct we take the braille tape that was produced on the first translation run and on an off-line piece of equipment produce a braille card. We were designing this system so that we could get an output that would control the stereograph equipment at the American Printing House for the Blind. At the time we started the operation we were using the eight-channel paper tape that Mr. Wheeler has described to you. Since magnetic

tape to card equipment is standard and we wanted to use standard equipment, we decided to produce our braille output in card form rather than try to go into tape. This would have required an extra or a special piece of equipment to do this. What we did do was to simulate the paper tape on the card. If you think of the rows in the card as channels in the tape, there are eight channels, the first six of which represent the braille code. The seventh is used for the even bit redundancy check and the eighth is used for special machine controlling codes such as carriage return, line feed, end-of-card and so on.

Mr. Gildea

How many characters do you store on this card?

Mrs. Schack

72 columns are used. Of these the first seven are used for identification information and the last column for an end-of-card symbol, so we get 64 characters on the card. On the 704, on-line we can only produce 72. Actually the program is set up so that we can produce an 80-column card if we want to, but at the moment we're producing a 72-column card. With respect to the status of the project, I am pleased to hear from the Printing House that we have on the presses one of the first books that we have automatically translated.

Mrs. Hooper

Next week.

Mrs. Schack

Next week? Okay. We are also in the process of proofreading several other books. Now briefly what the translation program does is as follows: The unit of translation in most cases is one inkprint word, and we define a word as all those characters which occur between spaces. I say in most cases because under certain conditions we have to scan two words to determine the correct translation. If for example, the word is 'and' and we have to look ahead to see

whether the next word might be 'for' or 'with' in order to determine whether we can eliminate a space in between. But for the most part we take one word at a time. A word is scanned and is looked up in a dictionary which is stored in the memory of the 704. The dictionary in the 704 contains sometimes whole words, more often portions of words, which might represent difficult translation problems or exceptional cases. In addition to storing the inkprint equivalent of a letter combination and the braille equivalent of that letter combination, we also store some descriptive information about that letter combination or word. This gets into some complicated programming. We use this additional descriptive information to determine whether, for example, I can use the 'ea' contraction. This descriptive information which we refer to as 'rules' bits which are stored with each entry in the table, is used to find out such things as 'Are we violating position restrictions in the word?' or 'Is this an illegal whole word?' For example, the contraction for 'sh' we can't use for 'Sh', right? So this gives us a way of searching back and forth and actually we really have to look at three bites of a word or three bites of information to determine whether it is legal. We have to look back one and forward one. As it turns out, the position restrictions in Grade II braille are the easiest ones for the transcriber to learn. The pronunciation restrictions are the hard ones. But in writing the program the position restrictions required much more programming than the pronunciation, because we just add another exception word or piece of word to the table to handle the pronunciation. The big problem, as we found out in the course of proofreading several books with the Printing House, is not so much the problem of correctly translating a word. I think we have shown pretty definitely that we can get good Grade II braille translated on a word-for-word basis. In addition to translating word for word, the program has to produce output that is the proper form for a given braille page. We have as parameters in the program a description of the kind of page we want, how many characters to a line, how many lines per page, and so on.

So for the standard books, we're doing the standard format, but if we wanted to change that we could do it with a single card. The real problem is producing special formats-- poetry, indented headings in the middle of text, making the logical decision as to whether there is sufficient room for a new heading at the bottom of a page, etc. For the most part we handle these special format problems also with the dictionary. We have made up special input codes, which the keypunch operator provides, to say 'This is the beginning of a poetry section'; and 'This is the end of a poetry section'; and the program, as soon as it encounters the special symbol that says 'Start poetry', enters a different mode. The first line of poetry will start on the first cell and the carry-over in the third cell. We've had an opportunity to test some of these format codes and I think that they are fairly successful. At the moment, we're translating the "Fanny Farmer Junior Cook-Book." It turns out that the listing of ingredients has to follow the same format as poetry.

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Mr. Nemeth

The program which I have for the 650 also starts out with a keypunch card input on the same keypunch machine and with essentially the same kind of instructions to the keypunch operator, who needs to know no braille. The keypunch operator however needs to know certain special signs for punctuation for which there is no provision on the keypunch machine, and certain combinations of strokes will accomplish this. Also I have format symbols- end of paragraph, skip a line, proceed to next page, center the following, center the proceeding, switch from Roman to Arabic numerals, and turn print page. In cases where print pages are being shown, all numbering is automatic in the program, and if the operator will just put this number at that point, the next time a print page is indicated, it will be the next one. You can follow the symbol 'turn print page' by a digit. For example, after finishing a chapter, if you turn the page and on the left side of the next page there is a picture, and the new chapter begins on the right side of the page, you don't want the next page to be where the picture is, you want it to be where the chapter begins. Consequently the keypunch operator must not only

punch the symbol for 'turn print page' but also the print page number. Without any number it will automatically be the next consecutive one; with the number it will be whatever number the keypunch operator indicates. I also have encountered the problem of whether or not a center title can be accommodated and the text continue on the same page. My code keeps track of lines, and if the center title has a number in it (either Roman or Arabic) which means it's a chapter heading, and if the line count is less than 17, then it will be embossed. If the line count is more than 17 it will just automatically put an end-of-page symbol and go to the next page. In the punched cards 80 columns are punched. The first ten columns are used for identification purposes. They contain the card number that you are currently embossing and the number of the next card coming, so that if the cards are out of order the embossing system will stop. Next I'll describe a little more about what goes on internally in the program. Instead of embossing a whole word at a time, my program stores a small dictionary of about six or seven hundred words. When I say words I don't mean whole words, I mean letter combinations- most of them are prefixes and stems. The program scans to find out whether there's a possible prefix. Let me give an example. Suppose I have the word 'proficient'. It will upon scanning find out that the combination 'pro' begins a word, and then the question is whether you should use the 'of' sign or not. It finds out later on that 'fic' is a stem and consequently it will emboss 'pro' by itself and continue on avoiding the 'of' sign. However, if the word happens to be something like 'profligate' it will find 'pro', it will then look and find that 'fligate' or any portion thereof is not a stem. Consequently the 'of' contraction will be included. Now for example with a few prefixes like 'e' and 're' and 'de' and a few stems like 'num' and 'noun', you can avoid contractions of 'en' in words like enounce and denounce and renounce and renumerate and denumerate and enumerate and things of that kind. It will also pick endings off words -- 's' and 'ing', and will emboss what's left after the endings are taken off and then add the endings back on. It is essentially a prefix-stem analysis, and also there are certain whole words which are stored. For example, among the words which are stored are the

word 'house' and the word 'store' and the word 'room' and if it finds that a word can be divided into two consecutive words, such as 'houseroom' and 'storeroom', it will not incorporate the 'er' contraction. And I've found that I have enough storage on the 650 to do this. The letter sign is implemented automatically by programming rules. The unit of scansion I use is the same as Mrs. Schack's -- a word. But I also stop at a hyphen under certain circumstances. The advent of a hyphen stops the scansion and the hyphen may be enough information for me to make a decision as to whether I can now encipher. However, if I find the hyphen, a letter and another hyphen, then I know that the first hyphen is not the end of a word and so continue to scan. For example, if you want to spell out a word like cheese, then you have c-h-e- etc. and you don't want any one of the hyphens to be regarded as the end of a unit of context and so you just let it keep scanning until it encounters the last letter followed by a space and the last space will end the unit of context. This will cause the whole word to be enciphered on one line instead of being divided between lines. By the way on my program when I can divide a word between prefix and stem, if I have a genuine prefix and a genuine stem and no room for both on the same line, the prefix will be enciphered, put on the line with a hyphen following it, and the stem on the next line. So hyphenization is taken care of when a real honest-to-goodness prefix followed by a stem is encountered and the hyphenization is correct in this case. I also have these control codes -- a cell margin, a line margin, a page margin and a volume margin. The cell margin just specifies how many cells, regardless of format. If you want a running head, when the 25th line has been embossed, the running head will automatically be put on the top of the next page with its proper page number and the embossing will continue on line two of the next page. However, if you want to do magazine work and you don't have a running head, you indicate this in a single format card and when the last line is arrived at, which is probably line 32 for magazines, it will automatically subtract the number of digits required for the page number and will allow for that many cells to be embossed, will put the page number on the bottom right-hand corner of the page and then will put the end-of-page symbol and go on to the next page.

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Mr. Dupress

Mr. Booth then discussed the Russian translation system. He spoke in place of Mr. Griffith from IBM.

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Mr. Booth

My personal interest in the braille area started out strictly from a low-cost hardware standpoint. What could be done to enable a typist to transcribe grade I braille directly? In discussing this with Mr. Dupress and Mr. Rodgers, gradually the problems began to get larger and larger, and Mr. Rodgers impressed on me the fact that the braille reader would like a true, perfect copy. The problem here was the problem of cost, really. It goes back to the question, 'What would the ideal system look like? What might it cost? And what would you be willing to sacrifice in the quality of the braille copy?' One of the things that came to my mind right away is the problem of input. As I understand it, the European system utilizes no capital letters. Since the ideal input to this system would be a teletypewriter which you can get on the commercial market -- you can actually get used machines, that, however obsolete are still good -- this would reduce the input cost problem. In other words you could locate at your outlying areas, teletypewriters which could produce a five-channel tape. This tape could then be taken and transcribed at a central location and the number of central locations would of course be a function of cost again. In considering what the ideal system might look like, there is the 704 system which Mrs. Schack has talked about, and there is also the Russian translation system which IBM is working on. The possibilities either now or in the future of having very low-cost storage made the feature of having a huge dictionary available very attractive. In other words, you would take Webster's with all of its plural forms, store it in this dictionary and your input to this would then be the five-channel teletype tape. The store would have not only the whole normal word, but also the word as it would be divided at the end of a line. The Russian translator and another form of translator -- a stenowriter translator -- utilize a huge photographic storage. It has a capacity

of 30,000,000 bits which can easily handle a Webster's dictionary in English to Russian or English to stenowriter or even English to braille. The input can be any of the conventional inputs -- in this case they're using a paper tape input -- and the access to the store is done on the longest-match basis. Normally this would be a full word. However it could be common pairs or groupings of words as long as they did not exceed the length of the input register -- salutations, headings, things like the month and the year -- high-usage groupings of words. The machine makes a reference to the store, picks the longest match and then prints out the equivalent. If the word is not in the store, it transliterates and would print out letter-for-letter -- grade I braille. The length of the input register would limit your ability to handle words which depended on sentence context -- things like the words 'pres-ent' and 'pre-sent'. The translator will have a sentence analyzer which would have the ability to handle the entire sentence. In other words, the sentence context could be absorbed. The output is then punched on tape and also printed out in a standard typewriter format. This is the present form of the machine. Where the words are transliterated, they are printed in red, e.g. proper nouns, people's names, Khruschev -- things like that. However his name is put in in English. Access time is between 10 and 30 ms. for a word match which means that the machine could be easily multiplexed to many inputs where you want to tie a lot of operators into it, for example at the printing house.

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Mr. Dupress

A translation system is under development at MIT, which looks at 32 channels simultaneously, has a large photostore similar to the IBM system, and could theoretically represent a much lower-cost translation scheme than the digital computer. Professor Baumann however addressed himself to questioning whether the rules of Grade II braille might not be modified in such a way that it would be easier to handle in any automatic transcription system. Professor Baumann stressed two points. One was that perhaps braille rules might be revised to take account of the frequency of occurrence of letters or letter groups in the English language, and that secondly, once this has been done there should be no exceptions to the rules. The translation

system which Mr. Dirkman talked about was a small photomemory scheme to fit in between the electric typewriter and the electric braille writer. It could theoretically provide all the contractions -- all 63 combinations of the dots in the cell. The person who was using it however, would have to know the rules concerning when the contractions might be used. Mr. Dirkman said he thought the scheme might make it easier for transcribers to learn braille but he wasn't sure about this.

SECOND DAY - MARCH 18, 1961

The chairman began the second day's session by listing some of the problems which must be solved by the social scientists and those who are responsible for programs and services in the area of braille. The technologists can pursue research and development more intelligently and more realistically if the following problems are solved:

1) The psychophysics of stimulus/response compatibility. The stimulus in this case is braille. The factors are the shape and height of the dot, the spacing between dots, the spacing between cells, and spacing between lines of braille. There is also the material on which the braille is embossed.

2) The minimum number of braille cells which must be presented simultaneously by any tactile transducer. To answer this question, we need to know how people actually read braille, whether they use a finger at a time on one hand only, a finger on each hand, whether they read along one line at a time, how much skipping is actually done, etc.

3) Access sources of braille other than the human transcriber. In this case we refer to monotape, typesetter tape, and the possibility of photoscan of printed material. Another part of this question also concerns the future availability of volunteer transcribers, the quality of the work done by such transcribers, the overall effectiveness of the system which involves transcribers, agencies for the blind, and the actual readers.

4) A detailed reader survey. Who actually reads braille? What is the need for specialized material? How well do existing programs really serve the braille readers? How many people would actually accept Grade I braille, or some kind of braille intermediate between Grade I and Grade II?

5) How we can make sure that research and development actually goes from the original idea to the production model and then to the actual increase in braille material for blind persons.

6) The problems of building engineering reliability into units which must be produced in small quantity. Another part of this same question would be the realistic price which we can expect to pay for engineering reliability in small quantities of production. Another part of this question involves the actual cost per unit of braille material with all cost factors considered. This would concern itself with all kinds of current braille production schemes as well as potential braille production methods.

This is a partial list which can be expanded when the permanent committee contemplated in this conference is set up.

The comment was made that at a previous session, Professor Baumann had begun to discuss modifications in the present Grade II braille, but the chair had cut him off because the end of the day had arrived. One speaker requested more information on the subject. Professor Baumann concluded his remarks by indicating that what he meant was a more suitable braille encoding which would make the data processing easier.

The chair asked if anyone would volunteer to tell the meeting how difficult Grade II braille really is in terms of its data processing by machine. The chair also asked how many words of storage were used in the 704 computer to write the program for braille transcription. The answer was given that about 5,000 out of approximately 8,000 words of storage were used. The dictionary consists of about 600 parts of words. Mr. Nemeth reports about the same size dictionary in his 650 program.

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Mr. Nemeth

The dictionary doesn't describe the rules nearly so well as the rules to implement them. It is not just the words that you store. As Mrs. Schack pointed out, and as I pointed out too, we have all of these little comments concerning the storage-- whether they may be used in the beginning of the word, middle of the word, or the end of the word.

Mr. Dupress

Would you care to comment on how much this problem would be simplified if we were very arbitrary. We just made no exceptions.

Mr. Nemeth

This would solve some problems and create new ones. If you were to allow "bb" or "cc" always to appear, you would never be able to distinguish between those contractions and the punctuation marks at the end of words. "Sea" if you were to allow "ea" contraction to appear it would look like "So," instead of "sea" and similarly with other contractions. "Egg" might be "e").

Mr. Dupress

Let us take it another step further. Let us suppose you did not permit those contractions or those usages to appear where there was ambiguity.

Mr. Nemeth

This is not the kind of rule that can be implemented by a computer.... Here is how a rule grows. Somebody thinks of a good way of writing something and then a situation arises where it turns out that it is not such a good way, so someone amends the rules, and the rules get further amended, and so finally, someone makes this comment about ambiguity. Now what Dr. Baumann had in mind yesterday was a set of rules which was almost directly translatable into computer language. The computer could then handle the rules. You cannot tell the computer to avoid ambiguity.

Mr. Glaser

I gather from yesterday's discussion that the mechanization of positionally dependent contractions would not be as difficult as some other contractions. For example, Mr. Nemeth, you mentioned the case where "of" contraction is not used in words beginning with the prefix "pro." There are many other examples like this. The question is how much meaning would be lost in these cases. I know from my own

experience that I occasionally pause in such instances, but it does not present too much difficulty. If it would be easier to eliminate such exceptions, how hard would it be to read?

Mr. Krebs

These syllabic divisions are like the traffic lights which prevent auto accidents. To use the "er" in such words as "rerun" and "prerequisite" would distort the look of the base word. These rules are not arbitrary, but are based on the language.

Mr. Glaser

You are quite right. However, they are based on notions of syllabic structure current a number of years ago. The categorizations of what particular notations mean has had quite a review in the last few years. Many rules are valid today because we are used to them, but how valid are they fundamentally? There is good reason to believe that some rules are valid only because they are accepted with usage.

Mr. Rodgers

The syllabic rules involve various factors sometimes as in the case of the word "proficient". The "of" contraction might join "o" in the first syllable to "f" in the second syllable without too much difficulty, but that does not mean that we can envision the disregarding of all the rules and using a contraction whenever it occurs. Not too long ago, we presented a page of words to some braille readers to see how much some of these things would bother them, primarily from the standpoint of pronunciation. We presented such words as "sweethe/art, ligh/th/ouse, hogsh/ead." In all of these instances, the readers were most disturbed because you have a situation here that is not comparable to inkprint. Two things can happen with the use of contractions irrespective of the syllable overlapping. One is the joining by a contraction of two letters which should be separately pronounced as in the case of the use of "the" contraction in the word

Mr. Rodgers (continued)

"sweethe/art" which is in effect two separate words, or in the case of "potholder." There again you are joining the letters by a contraction which in ordinary print presents no problems. They are pronounced separately. On the one hand there is the difficulty of separating letters that should be pronounced as one sound. An example of this is the word "tableau." I will not use the "ble" contraction because the "au" is then separated unnaturally and illogically from the rest of the word. These are things that appear only in braille. From all indications, whether you have a beginner or an experienced reader, these things have been found to be quite disturbing. However, these are extreme examples. I can envision some of the rules being simplified and I would never be opposed to simplification provided always that the simplification is the result of thorough investigation and valid scientific research on which we can base these changes knowing that they are not going to disturb the reader.

Mr. Glaser

What you are saying then is that these contractions are really looked at as representing sounds rather than groups of letters.....

Mr. Rodgers

I would say that they represent letter groups that are associated with sounds. We cannot form a contraction of letters that are pronounced separately.

Mr. Nemeth

In inkprint, the reader must decide for himself what letters go together. In braille, the reader has less free choice. He is constrained to conceive letters together but there is a limit beyond which he cannot go.

Mrs. Schack

In any case, a change in those rules arising from considerations of pronunciation would not change the 704 program significantly.

Mr. Krebs

Some sacrifices could certainly be made. For example, it is immaterial whether the contractions "and, for, of, with" are written together. However, a word should not be broken into unnatural parts.

Mr. Rodgers

Popular opinion notwithstanding, the rules of braille are no more a burden to the braille reader than the rules for the use of punctuation are to the inkprint reader.

Mr. Dupress

According to the rough guesses we can make of the blind population, between 75 and 80 percent become blind after age 21. Of the 20-25 percent of the people who are less than 21, the majority have residual vision, that is, static visual acuity, dynamic visual acuity, relative amounts of color perception etc. The percentage of people within that 20-25 percent who can be brought to functional vision is growing as ophthalmology and technology improves low vision aids. Less than 3 percent of the blind population take out a book a year in braille from a lending library. Less than 3 percent of the blind population in the U. S. is actively engaged in schools in which one or more braille books is being used by a given student during a given year. The proportions of recorded versus braille material used in education from the beginning through college are growing. The techniques for microstorage of verbal material are improving. Technology is doing a faster job on this for commercial reasons than we are doing on braille production schemes. Is there anything about the rules for Grade II Braille or the other braille codes which tends to make this an easier or more difficult situation to change?

Professor Baumann

I would like to ask one question regarding the experiment you /Rodgers/ held. You said you made brailled samples of letters and you gave it to people to read. Did any of them get the right word?

Mr. Rodgers

After considerable mental gymnastics.

Professor Baumann

How about the second time you gave them the sheets? Were they more proficient?

Mr. Rodgers

If I had given them the same words, they would have become extremely proficient after a while.

Professor Baumann

Once they got the idea that the braille was different, and they had thrown out some of their previous biases, I'm wondering if the learning process might not be fairly rapid.

Mr. Rodgers

I think if we take the experience of the English who started out by using Grade II on the basis of letter groups only and then reversed themselves, they must have done it for a reason. I'm sure people don't like to complicate matters for themselves, but they found that the reader was not reading comfortably and meaningfully from the indiscriminate use of contractions using the principal of letter groupings only.

Mr. Nemeth

What Carl Rodgers said is correct. For example, in the old English braille system it was permissible to use the "ed" contraction in words like "reduce, seduce" and the "ble" contraction in "unblemish" and so forth. Finally, they found that when these combinations cropped up in unexpected places in the course of reading, not just on a sheet of problem words, it would cause the blind person to stumble over the context for a moment until he could actually from context make out what was going on. I know blind people are very adaptable and they could do all kinds of things, but the point is, should you require it of them?

Mr. Rodgers

There is a limit to that adaptation too.

Mr. Glaser

On the sheet of words, were these individual words or were they in context?

Mr. Rodgers

These were presented as problem words, as individual words.

Mr. Booth

What if those words were presented in Grade I?

Mr. Rodgers

If those words were presented in Grade I, there would be no problem in braille as there is no problem in ordinary print, because Grade I is just a fancy word meaning spelling letter-for-letter. If you are writing out the word "launder" you would write "launder" no contractions, nothing except the braille equivalent letters of the alphabet.

Mr. Booth

Some of the things that Professor Baumann and I have been thinking of in this problem of exceptions, is that it would be relatively simple to have a low-cost store which would say store Thorndike's and/or Dewey's thousand common words with some of the roots. These words then, your high-usage words, would be contracted. The entire word would then be used. The logic necessary to implement the use of this word would be just a perfect match so that you would no longer require the computer to excercise a considerable amount of logic decision making. Your cost would be considerably reduced. In the cases where there is not a match, then we would go back and transliterate into Grade I.

Mr. Krebs

Are we trying to make the computer work or are we trying to make a readable item?

Mr. Dupress

How much faster does the reader go with Grade II Braille?

Mr. Krebs

The purpose of contractions is to shorten the distance the finger must travel to get a thought or an idea. As soon as you extend the thought--that was the trouble with Grade I, you might get only six words on a line in Grade I. When you take Grade II, you might get as many as ten to twelve words on the same line. In otherwords, the finger must travel a greater distance with Grade I to get the same information. What you are doing here is creating additional problems by trying to throw out the rules that have been established and tested just to suit a machine. You have to remember who you are serving.

Mr. Booth

Your machine would attempt to capitalize on the frequency of English words in an attempt to reduce the bulk. Instead of the six to ten increase maybe you'd go from six to nine or six to eight. There, of course, have to be studies on this type of thing.

Miss Hooper

Wouldn't you add to your problem again, because you would not get all of the derivatives because they're not common enough? You read by context and by the meaning of words. The sighted person scans. You pick up the word and the word meaning. You don't pick up the endings and all that sort of thing. If you throw that out, when you get an uncommon derivative in Grade I it doesn't look like its counterpart that's been basically contracted. You're just dividing words, separating them and their meanings. They don't look the same to you.

Mrs. Dorf

Suppose you had a secretary that divided words promiscuously and on the end of a line you came to 'U-N-D-E-R' and on the next line 'I-V-E-D.' Wouldn't you have to stop awhile to decipher what that word was? Well, that is what happens in braille, if you use the under sign in underived.

Mr. Dupress

What is the percentage, because most of us don't know and I have been asking for years and haven't found out yet, what is the percentage of cells actually saved, say, in a typical novel when you are in perfect non-changed Grade II Braille as opposed to say, pristine Grade I Braille?

Mr. Nemeth

40%

Miss Hooper

It was 33% on 1½ and Grade II saves 15% over Grade 1½.

Mr. Dupress

40%. And this has been studied carefully, right? What is the range of error in your 40%, plus or minus 2% or 5% or what?

Mr. Nemeth

If you were to take a large number of pages and count the number of cells required to emboss it in Grade II versus the number of cells required to emboss it in Grade I you would find out that the number of cells required in Grade II would be mostly about 60% of that required to make it in Grade I. However, on some pages it might be 59%, on some pages it might be 61%. The deviation, I would say, would be less than 1/2 of 1%.

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Mr. Dupress

The comment was made that this is recreational reading only and not specialized material. The chairman raised the question as to whether or not any study had actually been made of the reduction in cells used with specialized material. Although various people tried to answer the question, there was no indication that a thorough study had been made.

Mr. Haynes

One of the things we are doing is throwing around the word machine very loosely. We have been pinned down on other points, and I don't like to see this word bandied about. A machine to do the thing that I imagine Professor Baumann has in mind is the sort of thing that might cost under a thousand dollars. I can visualize this. The sort of machines we are talking about to translate into Grade II have an hourly rental or daily rental. We have got to settle this fantastic dichotomy in machines.

Mr. Glaser

There is one other question that I would like to raise that was asked before. What is it we are trying to do? Are we trying to make braille easier for the machine or are we trying to get the finger to move less distance? In reality, isn't what we are trying to do -- to get more information to the blind user of braille in a form that is usable for him? Not only in a more usable form, but even if the braille isn't perfect, it is an awful lot better than nothing. This to me is really more the question, how to get the reading material to the blind person since we have two possibilities if we want to cover the field completely. We either record all possible information in braille which means that we will have a very large library because of the inkprint library. There aren't that many blind people who could use it. The exciting thing about the machine is the fact that whether it is renting time on a large-scale computer in a center, or the use of a small machine on a local level, the blind person is approaching an era where he has a fighting chance of getting what he needs approximating that time when he needs it.

Mr. Krebs

Can we make a comparison between the Talking Book and Soundscriber discs. A Talking Book record costs two or three dollars. A Soundscriber costs $.12. What is the difference? On the Talking Book record, you have distinct reproduction. You don't have trouble with needle slide. You take a Soundscriber disc. It is an effort to listen to it; the needle jumps and you miss lines. Who will struggle with a thing like this? Only those people who are desperate for the information. The average reader will not sit down and read the Soundscriber disc. What we are trying to do with the braille system is similar to one of these two machines (Soundscriber). It is true that one is much cheaper than the other. The question is what is the end result? The end result of a good machine, even though it is more expensive, is a good braille and something that can be read. The end result of the other is a 'hodgepodge' which you would have to struggle with to get the information.

Mr. Dupress

About half the college students use tape and Soundscribers.

Mr. Krebs

Well, now they are swinging over, but I am talking about comparisons of discs.

Mr. Rodgers

There is another angle though, mainly the purpose for which the material is being presented. You are not that particular about the print of something that is going to be read and in a day or so become passe and be thrown in the waste basket as you are if you are going to produce something for more permanent value. We could have a modified form of braille and considerable violations when it is a matter of presenting material that would be of no value unless presented right away and that is to be used right away and not to be widely distributed on a more permanent basis.

Mr. Rodgers (continued)

If I could get a small reliable newspaper in braille everyday, I would be perfectly willing to read in Grade I Braille as opposed to not getting it at all. On the other hand, for things of a more permanent value such as text book material on which I am supposed to be concentrating primarily to absorb, to comprehend, to grasp, I should not want to indulge in any mental gymnastics with any braille peculiarities, but I would want to read the kind of clear logical braille which for the most part has been worked out thus far.

Mr. Glaser

I can agree with you except in one area. That is the area of textbooks. If there is a choice of getting textbooks in any kind of braille, or not getting them, I will take any kind of braille.

Mr. Krebs

I don't think you can make two braille systems-- one for specialized technical things and one for anything else. Just like a sighted person, a blind person reads by shape. He doesn't read each dot. He gets an overall picture and because he gets that overall picture, it is easy to read. Now you take a word like "then". "Then" can be written in two ways, "the" contraction followed by "n" or "th/" followed by "en/". This seems like a very unimportant point, but take the picture of the "th" followed by "en" you immediately have something that looks like "when". There is a matter of one dot difference and the reader is thrown off or hesitates when he gets that combination. When it is done incorrectly you are putting stumbling blocks in the way. Let us say that we could take a book from a publisher who uses tape and if we could reproduce this in Grade I, would you be happy? If I could get it today and people are reading it today, I would read anything. That is not the situation. If I could wait for it I would be happy to wait for it and get it in a way that I could read it clearly and fast and without difficulty.

Miss Hooper

Haven't we had an example of having two kinds of braille in the work for the blind? Take the Ziegler. After all, they don't use all the two cell contractions and the people who read the Ziegler regularly do not read Grade II braille and visa versa.

Mr. Booth

At the American Printing House you have two processes for handling braille depending on the quantity. You have the one or two shot type of thing, and then you have the zinc plates. Now certainly if you are going to be making zinc plates and many copies, you would want to have true Grade II. You would want the ultimate. Where you are only making a few copies and you are concerned about the time spent to keep the per page cost down then the possibility of backing off on Grade II would look attractive.

Miss Hooper

Even worse than that you are doubling your costs on the one or two copies because if you put it in Grade I, it is going to take three times as much space and still your production cost remains per page.

Mr. Booth

We won't put it in Grade I. We will put it in a form Grade 'C', where you take the high-usage words such as 'then'. You would have 'then', 'the', 'for', 'with', all your common words in an attempt to reduce bulk, but still trying to keep your processing time to a minimum.

Mr. Nemeth

Before I embarked on the career in which I am now engaged, I used to work for AFB, and every once in a while, I would get a request to transcribe letters in Grade 1½ braille instead of Grade II. I would just absolutely refuse to do it. I would say if you wanted Grade I½ you would get it in Grade I, or else you would get it in Grade II. First of all, it would decrease my efficiency in writing Grade II braille properly. There are different syllable rules for writing Grade I½ and Grade II, besides additional contractions. For example, 'mother' and 'father' would be written differently. In Grade I½ 'the' contraction is permitted in 'father' but not in 'mother' because of the way the hyphenization occurs.

Mr. Glaser

As far as textbooks are concerned, perhaps at the high school level there are more available now than when I was in high school. At the college level they get pretty sparse. I don't know about you Mr. Nemeth, but I haven't seen a copy of the mathematics journal in quite a while in braille. I haven't seen a single engineering journal. There are some advance texts on switching theory I would like very much to have in braille, but I'll get at them by having someone read them to me because I don't have a fast way of getting them into braille. Now admittedly putting them into a contracted form of braille is going to make me work a little harder. This returns to the same point. I'm speaking of my own personal feelings. I'd rather have them in any form than not have them at all. This at the moment is my choice, evidently.

Professor Mann

I have the advantage of not being here yesterday and therefore not knowing what the association of individual people is but there are clearly two groups of people here. One group is die-hard about protecting the status quo in braille and I respect them for this because they have, I presume, a direct responsibility for the transcription and proliferation of braille material. There is a distinct body of people who can read braille as it now is and I am certain that they have a responsibility to this group of people. On the other hand, there is a group (many of whom I know personally and have direct association with day by day) who are conversant with new technologies which are concerned with communications in various aspects. It seems to me that they are essentially saying 'let's see what we can do,' not making any promises, not making any threats to overturn the existing applecart as to what could be done in terms of increasing and making more facile the flow of information from existing documents to the blind. The thing that disconcerts me is that the purpose of this kind of a meeting ought to be to establish exploratory rapport between these two groups--the avant-garde group saying 'Look we could do these things,' the experienced people saying that it would pose certain kinds of problems.

Mr. Dupress

The only reason for this kind of research and development in the final analysis, the only reason for this kind of meeting, the only reason why the federal funds, state funds, and local funds, and volunteer time and everything else goes into the whole area of braille is to see that blind people manage to overcome the handicaps imposed by lack of visual input. Human knowledge is stored in two forms, the printed word and graphic forms on the one hand, and the spoken word on the other. Blind people without residual vision cannot use optical aids, and they have no direct access to the printed word. It has to be indirect and this handicaps them. If they need the information in a hurry, there is a time lag. In order to get the information at all, you have to put other human beings, equipment and funding between them and the printed word. When you get to the spoken word, you are involving the deaf-blind people and they in turn are limited to tactile-kinesthetic readout. What we all ought to be working towards is to reduce this dependence upon other people. If we can't do something about that, we are in pretty sad shape, collectively and singly. The fact remains that in this particular encoding form, the vast majority of blind people, whether it be for vocational purposes, or for getting at specialized material for recreation, just don't use Grade II. Is it because it is difficult to read? Is it because it isn't accessible? These things have to be explored certainly, but the question I would like to raise here is: Are we all agreed essentially that this is our goal, namely that we reduce the dependence by increasing the material and by getting nearer to direct access without human intervention? As it is now for example, the ratio of human volunteers required to see a blind child through a school system is not less than 8: 1. There are at least eight human volunteers spending hours per week, week after week, month after month, year after year, all the way from first grade on up seeing that a blind child gets through the school system.

Mr. Dupress (continued)

The ratio of permanent staff employed by organizations for the blind is not less than 25 to 30:1. In other words, for every 25-30 blind children in a given school system, there is at least one full-time staff person involved in the processing of braille material, organizing the volunteers, running the equipment, handling the funds and this is a minimum ratio. It is probably greater than that. It is a real problem and if you don't think so, just get a hold of any of the organizations which have transcribing services. There are at least 154 of these organizations (large and small) in the U. S. My guess is that there are at least 15,000 volunteers. All of these are guesses, but they are pretty safe minimum figures. This is a vast number of people, funds, equipment, man hours devoted to just letting blind children and blind people get at data. You are not beginning to cover the majority of blind people. We have to do something about this. It isn't going to go on forever. It is just going to worsen if some solutions aren't found. So let's move ahead and see if there is anything that we can agree on. The first thing is do we agree that what I just said is essentially a valid base from which to begin to do something?

Mr. Zickel

If we are to impose some of the restrictions that we have suggested here this morning, which in turn, might make braille harder to read (and please remember I am taking one side of the subject right at this moment), aren't we then limiting the number of braille readers? Why don't they read braille, simply because it is hard to learn and hard to work with and hard to use? If we found a way of going to Grade III and this is not a good terminology, isn't it conceivable that more people would want to learn it and use it? If again my information is right (through a study made at the University of Louisville), the average reading rate of about 250 braille readers that we tested was between 70 and 80 words a minute. Isn't this an indication of why we don't have more braille readers? Now could I just sum this up by saying that I would like to see a simple computer, one that we could have in Louisville. I know we can't have a 704. We have everything else in the system except the 704. So if

we can get a thousand dollar computer, or even a ten thousand dollar computer, I think our problem (my problem) would be much simpler. I think we have to remember this: Are we doing the job better or are we only meeting the needs of a fewer number of people?

Professor Mann

I came here as naive as anyone could be, but I don't presume, I don't think anyone presumes that as a result of this meeting, there will be any firm decisions made as to what should happen to any type of braille from here on out. I presume that this is a discursive meeting. The idea is to get groups of people together who have different kinds of experiences, different kinds of backgrounds, different kinds of interests all motivated towards an ultimate goal. I don't think this is a meeting which is attempting to resolve, to change, to make fiat with regard to any of the existing rules of braille. You don't make breaks with old traditions and throw everything away and say "that's all past." The new ideas coupled with the existing traditions and background knowledge, with the hope, but not the promise, the new technologies conceivably might lead towards some better approaches. I think this is the purpose of this meeting.

Mr. Nemeth

We have talked about 704 computers and 650 computers and why do you suppose we use them? Because we have them. They are available. They are computers which are used by the world in general. I'm sure that neither Mrs. Schack nor I use all the instructions that are available on the 650. We are using a machine which is essentially a numeric machine to handle alphabetic material. This is surely not efficient use of a computer. I'm sure that if a computer were built especially for handling braille, it would not cost anywhere near what a 650 or a 704 costs. It would have variable rather than fixed word length, be alphabetic rather than numeric, and I'm sure it could be speeded up and I'm sure it could be made to turn out Grade II braille according to the rules,and compromises would be kept to a minimum. No one has

actually built a machine for the purpose of translating inkprint into braille. For foreign language translations, they actually do build special machines. They build a machine just to translate Russian into English. It has no other purpose. It stores a big Russian dictionary and a couple of rules of grammar and it is programmed to do this kind of translation. Naturally, the need for Russian-English translation is probably better financed than the need for braille. The disparity in the cost of two systems is not as great as one might think.

Mrs. Schack

I might add a word to what Mr. Nemeth said about cost. We have been talking about the very expensive 704 and the much less expensive 650 and I've been doing some arithmetic and I find that Mr. Nemeth's program and my program both produce braille at a cost of approximately two-tenths of a cent per word. When you compare things, you have to talk in terms of job costs, not just rental costs per month since you are paying more money for a faster machine from which you get a higher output. I also agree with Mr. Nemeth that all we have done here is to show that braille II is programmable and if there were a machine that were designed specifically for braille transcription, we would expect to get the cost even lower. I think it is a pretty low figure as it is.

Mr. Dupress

Is a language translation system or a photostorage high-speed retrieval matching scheme more suitable to braille problems than a digital computer?

Mr. Booth

I would say that this should be left up to the committee to decide because it is a tough problem to compare costs especially in the case of the Russian translation machine or a translation machine which would handle alphabetic information. The costs are not established. The logic hardware is relatively simple and considerably reduced when it is designed to handle alphabetic information, and there is a considerable

reduction and again this goes back to the general purpose versus the special purpose machine and this sort of problem never gets settled.

Mr. Dupress

It is safe to say that if we are dealing with Grade II English braille, as now constituted, we are thinking of an extremely large photo-store or a standard 1-1.5 million computer.

Mr. Nemeth

I don't think you need such a large photo-store. You don't have to store a big dictionary. Most of the words are transcribable directly into Grade II braille. If you stored just those words which have prefix/stem or stem/suffix or word/word division, you would have only 1/10th or 1/20th of the storage required in storing a whole dictionary.

Professor Baumann

This wouldn't be the full legal Grade II braille would it?

Mr. Nemeth

Yes it would - In other words, there would be no need to store a word like 'bulk' because if it were not found in the dictionary, it would be spelled out letter-for-letter, and correctly so, in Grade II braille. You would only store such letter groups as are contracted and other letter groups where those same contractions may not be used. You would store 'the' but you might be willing to store a word like 'heart' preceded by a 't' so that you won't encipher 'fainthearted' or 'sweetheart' and 'gheart' so that you won't encipher 'stronghearted' etc. In other words, a relatively small dictionary would properly implement the transcription of Grade II braille. Even if you stored all of the words in the dictionary beginning with 'be' to take care of all the exceptions, it would still be a very short dictionary compared with an entire Webster's dictionary with all the modified words thereof.

Professor Baumann

What ratio would you estimate this to be?

Mr. Nemeth

1/20th - 5% of the Oxford dictionary. With this amount of storage, you don't need any logic.

Mr. Booth

....or a minimum amount of logic. The problem of trading logical hardware for store is of course a systems design problem.

Professor Baumann

One of the areas in which you need logic is in the rules for the use of italics.

Mr. Nemeth

Italics have to be put in by the person doing the original transcription. A machine does not read for context.

Professor Baumann

If the person doing the transcription gets it off a teletype or something like that you might be able to get at least some of the italic symbols. But in some cases you would have to store special instructions for a certain length of time.

Mr. Nemeth

In both our programs the keypunch operator has special instructions for italics: if the passage is three words or less in length, to use the single italics sign in front of each word, and if the passage is longer than three words, to use the double italic sign in front of the first word of the passage and a single italic sign in front of the last word of the passage. All the machine does is encipher each italic sign separately and nothing more.

Mr. Nemeth

With the present rules for italics, there is still a considerable amount of judgment left to the transcriber as to whether or not to include italics in a given passage. So if the keypunch operator does the wrong thing, the computer will do the wrong thing, and your high-speed storage and retrieval system will not make any worse errors than the computer would make.

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Mr. Dupress

The chairman pointed out that many of the machines which have been worked on produce Grade I braille or the equivalent in punched tape coding. The discussion then moved to the problems that arise with respect to Grade I braille

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Mr. Krebs

I don't think you could have a person who knows nothing about braille do Grade I accurately. Take the letter sign for example. If you want to write '2a' and you don't put the letter sign between the '2' and the 'a' you have '21'. There are certain things the operator has to know: how to use the italic sign, the letter sign and all the special composition signs of braille that are used to demonstrate a certain thing or make a certain thing clear.

Mr. Mulvey

May I make a comment here in regard to the technological area of English to Grade I braille. The problems are slight, the cost of the machines that could transcribe from the English word to Grade I is very low, and I think there is general agreement here about this. The means by which we could transform the English word into a new coded form are many so that the only problem that faces us is: exactly how do we get it into braille? How do we get it to people to read, as Mr. Glaser asked? He would like the engineering journals and I think if he received them in Grade I braille, this would be satisfactory to him. I think if we did it in Grade I, we would be accomplishing something worthwhile.

Mr. Dupress

Now we say it is difficult to go to Grade II. Nevertheless it has been done. We say it is easy to go to Grade I. How easy? How many exceptions does the machine have to handle which in turn is not just simply a straight one-for-one transliteration?

Mr. Krebs

First you have the italic sign, then the letter sign, the number sign, capital sign, accent sign, termination sign and all the other composition signs. These have to be programmed by somebody who knows braille and could not possibly be done automatically.

Mr. Haynes

Right now in California there is a student who has built a machine with a standard typewriter keyboard input and a Perkins brailler output that produces Grade I braille. The machine has been designed and is in operation. With a more complex design, he can give you Grade I½ braille. He would be very interested in knowing how useful this would be. But there is no question as to whether it can be done.

Mr. Nemeth

I don't think for a slight increase in complexity, he can give you proper Grade I½ braille.

Mr. Holopigian

He can give you all the 44 one-cell contractions.

Mr. Nemeth

I know, but they would be used indiscriminately. You have the same problems in Grade I½ braille as in Grade II braille.

Professor Baumann

May I ask a question of those who are acquainted with the Russian translator. Does this produce English equivalent to that produced by a human translator?

Mr. Booth

The machine as it now stands does not. Mark II which is under construction will have in it a sentence analyzer which will put out a better translation. However, it does take about ten minutes to realize what is there although the information content is there.

Mr. Dupress

How many of the human transcribers and human braille users use perfect Grade II all the time? Is it 100%, 75%, or what?

Mr. Nemeth

It is not over 2/10 of 1%.

Mr. Wheeler

I think that a lot of people are overlooking the fact that this system of braille has undergone a terrific amount of study for a number of years. These contractions are for convenience. Now we have built large computers and have started to use binary systems to make it easier for the mechanism, but we don't put the output in binary because we don't want to read it. We are sighted people, we still want to use the same method we have always used and I think this same problem exists with the blind people. We are trying to tell them that they should readjust their reading to suit a mechanism that we could provide for them.

Mr. Gildea

Your Fortran only prints capitals and it doesn't print lower case. You have only 48 characters. You get along with that and do a wonderful job.

Mr. Wheeler

But we are still trying to improve that so we can produce a readable material.

Mr. Gildea

You are accustomed to read this particular IBM form on reports that go to management, payroll clerks and everyone else. This particular form is a new coded form that everyone could learn. Even if it's an octal pair, I could read it. For the last decade I've been learning new forms of encoding.

Mr. Wheeler

We can get along with it, but we are endeavoring to improve that and make the output something that you don't have to learn anew. I still think we should be trying to direct our engineering efforts towards the ultimate results rather than arbitrarily saying, " We can't solve the problems so you have to shift over to our way."

Mr. Holopigian

That's not it at all. I don't think he is trying to say that we can't do with what we have, but that what we have is an outgrowth of about 100 years of development. Braille is built like an old house with a room added on here and a story added on here and a cellar added here. What I think Professor Baumann and Professor Mann are trying to say, and I agree, is that the system should be investigated. It is conceivable that a new system of braille would be simpler for someone who knows neither Grade I nor Grade II braille. You say it is going to be more difficult, but it might not be for someone who knows neither. If you now save 40% by using Grade II, you might conceivably save 60% by using shall we say Grade "A". Now if you can save additional space, if it is easier to use, if you use the English language and the letter combinations and words that exist today, you might be able to save space, and use a simpler computer. These are the advantages: you save space and you make it easier to read. For the new generation

that hasn't learned any kind of braille yet, I'd say you have a great many advantages. I don't know if you can do it, I don't think anyone knows at this point if you can do it. All we are saying is, give us a chance to investigate this possibility. We may make it easier both to read and to prepare. We may be able to distribute it more widely because it will go on simpler computers and therefore we will have more literature available to those who need it. The disadvantages are probably even greater, but if you don't know what you can do, how can you "knock" it? Maybe this thing will be wonderful and we should take the opportunity to look at it.

Mr. Zickel

I wonder if Mr. Nemeth and several others here who seem to have quite a knowledge of both braille and computer programming, could give us an answer to this question.. What changes in the braille system would you suggest? Is this a fair question? From my standpoint, I see we are talking about radically changing the braille system and on the other hand there is the possibility of maintaining it as it is, but I wonder if the people who have dealt with the problem could suggest what this intermediate system would be like which would permit a less expensive, less complex computer.

Mrs. Schack

One of the things I hope for as a byproduct of the 704 program is a basis for some kind of analysis of the number of exception words that are encountered because of certain contractions. I have a list of the dictionary that we are now using in the 704 program. As an identification code for each entry in the dictionary, I have written down what the contraction is that necessitated this entry. Presumably after we have published ten or twelve or fifteen books we will be able to look at the dictionary and if we see that there are fifty entries necessitated by a certain contraction, we might say that there seem to be more exceptions to the use of this contraction than there are non-exceptions, and this

then might be an important area of the braille code to look at. We would then have some statistical basis to go on.

Mr. Gildea

Do you have a frequency counter in your program?

Mrs. Schack

I don't have one now, but I could certainly put one in. I do have a counter that counts the number of times that we have to retranslate after going halfway through the word.

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Mr. Dupress

The chairman then led the discussion into the investigation of the status of various R & D projects from the previous day's agenda. A summary of the status of these follows:

1) Development has proceeded on the Lavender Braille Writer to the point where it is ready for production.

2) The development of the electric braille writer in the ME-DACL group at MIT is in the early stages. A great many engineering specifications have been drawn up. The switching circuitry that provides signals from the standard electric typewriter has been redesigned. It is now an optical instead of a mechanical system. Certain parts are now being made in the shop for assembly.

The discussion temporarily turned to the availability of Perkins Braillers. A spokesman from Perkins pointed out that it was not the intention of Perkins to become a manufacturer of braille writers. This began as a low-level production operation and has continued as such. No effort has been made to expand to a mass production system.

The question was raised as to why Perkins did not turn over its production system to a commercial manufacturer.

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Mr. Zickel

I have maintained close contact with Perkins and I'm sure most of you realize that the Perkins brailler is available to the American Printing House in limited quantities. It is available through the Printing House to schools only. I think I'm in sympathy with Perkins because we are now facing somewhat the same problem with the Lavender Writer. Everywhere we go people ask, 'Why can't we get more braille writers?' We've made close to 5000 Hall braille writers. We are still selling about 30 a month and we are keeping up production for at least another two years. Some of our braille writers have been out for 15 years. Now we have the Lavender ready to go and we made a survey of about 90% of the school people who would use a writer. The conclusion was that if we could sell the writer for less than $40.00, we could sell 2500 of them in the next five years. That isn't enough to produce it at that price. You see the tight little circle that we are in. If we could sell 10,000 we could produce it for $35.00. But even if we increase this 2500 figure to 5000 we are going to have to increase the cost of the tooling per writer and it would probably run in the neighborhood of $45.00. Now this is the situation we find ourselves in. Going back to the figure that I used a minute ago on the number of people who read braille, people who might use braille writers, we just don't seem to be able to find this kind of information. I know that Dr. Waterhouse has struggled with this and they have done it on a 2000-unit basis. I believe they have now produced about 15000of them. The figures that we now have at our command suggest that there may be less than 20,000 braille readers. Now where would another 10,000 braille writers go? This is the question and this is why he keeps producing in lots of 2000. Incidentally, Perkins spent $150,000 in the last two years expanding to meet the need. Rather than defending anyone, I feel that I'm trying to face a situation. But is the answer another 10,000?

Mr. Nemeth

Before Perkins produced their braille writer, AFB through L. C. Smith also made available a braille writer and they sometimes made 1000 at a time, sometimes 1500. There has always been a need for braille writers and no manufacturer has ever learned that he should produce 5000 at a time.

Mr. Zickel

As far as we are concerned, we have met the demand for the Hall writer. We are meeting delivery within about 30 days, but this does not satisfy everyone.

Mr. Nemeth

I know but as you say Perkins has already sold around 15,000 writers and is preparing to produce 2000 more with a backlog of a year. Now why could they not produce 5000 instead of 2000 and thereby reduce the backlog to only a month or two?

Mr. Zickel

You would have to have additional building space, tooling and could you justify this for 5000 braille writers.

Mr. Nemeth

You can sell them all.

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Mr. Dupress

The chairman terminated the discussion on the problems of the number of braille writers which are actually bought over a short period of time and the size of the lot required to reduce the price. The chair pointed out that this is a difficult question which should be studied and might be resolved by the permanent committee or a sub-committee thereof. In the area of small-scale duplication systems, Mr. Haynes from Stanford Research indicated that his work is progressing slowly because he is doing it on his own time. He is concentrating on the switching circuitry which reads out the punched tape and operates the solenoid-driven

The comment was made that it is quite a different matter to take an idea to the feasibility stage than it is to move it from there to the production engineering stage. It was pointed out that the volunteer engineering effort and the small company efforts do not take these things to product engineering. Further comment was made that it takes full time engineers to develop a reliable product capable of being mass produced.

The Systematics Corporation-Adelphi Research Center braille duplication system has been taken to the feasibility stage. The comment was made that there seems to be a desire for and a need for the system. It was pointed out however, that it is frustrating for a non-profit organization to submit a proposal that is subsequently turned down. A speaker made the suggestion that an advisory group might be set up to facilitate the solution of the problem of taking a feasible prototype to the production engineering stage with particular reference to the seeking of funds, the preparation of proposals and other items which result in successful production. The same speaker went on to outline a series of three advisory groups which the conference might consider.

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Dr. Wolfson

Perhaps some in this group might become involved in an advisory group activity. Let us break this down into three groups: First, a project advisory group whose goal would be to shorten the time between the inception of device development and the production of the device for use by the blind or by agencies. This group would probably assist in evaluating the research project unofficially. They would provide guidance in the preparation of a proposal so that by the time it does get to a funding agency that has its own evaluation group, there would be some common meeting ground. This advisory group would probably also assist in the search for funds if they really felt that the device was needed. They might also have contacts and they could also coordinate and disseminate research and development reports.

Dr. Wolfson (continued)

The second group that came to my mind was a technical advisory group -- perhaps a combination of some dollar-a-year men and some full-time people who would assure that the device was compatible with the needs of the blind. They would offer general technical guidance in the areas of mechanical design, electrical design and product design. They would assist in the establishment of specific projects and in the presentation of devices to manufacturers. When we've done the product engineering, and have something ready for production, the question becomes, 'Who is going to produce this?' This particular group would assist in this area and would offer continuing guidance to the manufacturer.

The third group would be a product engineering group. This is the home base group, the individuals who are trying to develop the device. The major function of this group would be to provide a clear concept of project guidance through involvement of volunteer industrial organizations. If for example, we set up a technical advisory group for our modified Perkins machine, they would provide specific technical guidance in the total project development. This is mechanical, electrical product design. These would be people who have experience in these areas and who are involved daily in this type of work. Many of these companies might have surplus supplies, equipment, test'scopes, etc., which they give away indiscriminately. They announce they have it and those who need it simply ask for it. This could be made available to those who are working on these specific projects. This would solve the problem of limited funding. This particular group would make reliability studies prior to a device demonstrati so that you would be assured of its being a workable device. They would also have contact with the manufacturer. They would assist the project director, the individual responsible for the device development, to meet a time schedule. If he gets bogged down for some particular reason, they will be there to assist him in dealing with the particular problem.

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Mr. Dupress

Another speaker who disagreed with this approach said that with too many advisory groups, there would be great inefficiency in their operation. He recommended instead that one group be responsible for all parts of the problem. It was further recommended that the advisory group be a small one.

The discussion returned to the status of the Adelphi-Systematics Multicopier. Further development is required to move this to a production engineering status according to Dr. Wolfson.

A small scale braille duplication system known as vacuum forming has been successfully used for a number of years. It is not a perfect system and is rather tricky to use however. Although it does not meet all the problems of small scale duplication, further development is required on the vacuum-forming system.

The teletypesetter tape-to-braille converter of Veterans Administration requires more development. A study is underway to determine the amount of development required. It is possible that a completely new design may be arrived at. A decision is pending on whether it would be better to use an adaptation of a commercially available converter rather than continuing development on the original teletypesetter-to-braille code converter begun by Mr. Friedrich.

The question was raised as to whether or not the typesetter tapes come out proof-read. The answer was given that the errors are for all practical purposes negligible and that there are errors even in the regular newspaper or magazine. It was pointed out that when there was time, the tapes might be compared to detect errors. The monotape-to-braille code converter being explored by Mr. Dirkman is in its early development stage.

The IBM braille belt reader was discussed. The two units which were previously at Peabody College are now at the American Printing House for the Blind. At Peabody, there was considerable frustration experienced in the evaluation of the unit because it broke down under normal operating conditions. The plastic belt seemed to heat up and drop out some of its pins. It was pointed out that engineering reliability is required for certain units if sufficient evaluation is to be done. Mr. Zickel was not sure when development would continue because the education research director at APH is leaving. A new director would have to be interested in the continued development or analysis of this device.

Professor Mann

The tragedy, it seems to me, is that you have a terrible impedance mismatch to the blind and the only hope of correcting this mismatch is to have a number of things which work. It isn't a matter of deciding here and now that this or that way is the way to do it. The thing to do is to have this and other ways of doing it which work and are available in adequate quantities so that clinical tests can be conducted to determine their feasibility--feasibility to the blind, not engineering feasibility. And this seems to me not an insurmountable task--not even financially. All it takes is the determination to do it.

Mr. Zickel

I disagree with you a little bit. I think the will is here. It seems to me rather a matter of money. I think this is Adelphi's problem and it seems to me this is the problem here. If there is enough money available, and I don't know where it would come from or who would have it, I think all of these could be carried on.

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Mr. Dupress

The comment was made that one of the problems is selling an idea to organizations or funding sources and that this constitutes a real block between ideas and blind people.

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Professor Mann

The approach ought not to be to sell it because this is not the time to sell the braille belt reader or any other transducer. This is the time to have several representative types of machines in such quantities that they can be tested with the blind to determine whether one or more of them is best for the job before one goes into volume production.

Mr. Zickel

We have to sell the ideas to somebody in order to have the devices built.

Mr. Nemeth

There is another aspect to consider.. Suppose you make something which is reliable and which you can put in the field to test. A person who looks further ahead realizes that this is a project very much like the Talking Book. A Talking Book machine doesn't do any good unless you have records to play on it. The belt reader involves a whole industry of producing the tapes that go with it and distributing them just like braille books and Talking Book records. This has to be taken into account when you test it. Even if you like it you have to set up a whole program for producing and distributing these tapes.

Mr. Freiberger

Perhaps the thought shouldn't be to put one of these in the home of every blind person. Perhaps it isn't to be a substitute medium. All the other media would continue, but this would be a way to get material not readily available in the other media, that is the purpose of it.

Mr. Gildea

I believe that we don't have to consider at this time, the question raised by Mr. Nemeth. As Professor Mann indicated, this is the time to develop a prototype library. At this stage of testing, we need enough information to decide whether this is a feasible system and if it holds its own against other techniques and other transducers. Once we find out that this is a practical item in a good

competetive set of media, then we can worry about the problem of making enough of them to be field tested.

Professor Mann

It seems to me it would be useful to have a transducer on which you could vary the speed or maybe even vary the braille matrix in order to get some statistical data on the various ranges of comprehension with respect to several parameters. You need various kinds of transducers, not only to fit into an ultimate system whereby every blind person would have access to whatever he likes to read, but also as research tools to find out what the problems are of tactile transmission of information to the blind.

Mr. Dupress

I will agree that the output end is the important one because this is the man-machine link and ought to have priority consideration. But there are other parts of the system which people have thought about and worked on and these have to be continued to a satisfactory prototype too, if we want universal systems. If a given transducer is tied to an input source that either exists in too small a quantity or does not fit the needs of people, you don't really have any right to spend a lot of effort on that particular transducer. In other words, you need a systems analysis as well as a components analysis. In every one of these instances you are not worrying about the production of X number of units. You are not really worrying about the question of Grade I vs. Grade II, the old blind vs. the young blind, or the motivated blind vs. the disturbed blind. You are trying to find working prototypes that will in turn be evaluated by a system which we have set up and which would include good testing psychologists. Can we agree on a hole assignment for the braille dots, the end-of-word, end-of-line etc.? Can't we all go away saying that we are always going to use the same hole in the tape for the same dot of the braille cell?

Mr. Wheeler

I think the numbering of the channels of the tapes is pretty well standardized. The eight-channel tape has five holes on one side and three on the other. Hole number one is the lowermost one on the five-hole side. The three holes on the other side are the 6th, 7th, and 8th hole. I think that is standard. Therefore, wouldn't it be reasonable to associate dot 1 with channel 1, dot 2 with channel 2, and so on? Then you have 7 and 8 which you use for your control and when we are talking about dot 1 we are talking about channel 1.

Mr. Freiberger

Some tapes I know use a nomenclature '0,1,2,3,4,5,6,7'

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Mr. Dupress

After considerable discussion, it was decided that a sub-committee would consider the hole assignment on eight-channel tape during luncheon. After luncheon, the sub-committee chairman reported back.

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Mr. Glaser

The tape channels are assigned numbers in the following order: 1,2,3, sprocket, 4,5,6,7,8. The checking for each character recorded on the tape is as follows:

> There shall be an even number of holes in each frame (no exceptions). The channel to be used to force even parity is channel number 7. With channel 8 not punched, the first six channels correspond to the six dots of the braille cell, such that channel 1 corresponds to dot 1, channel 2 to dot 2, etc. With channel 8 punched, the first six channels are redefined into control codes. A catalogue of control codes already in use will be made up and will be distributed to interested people. The space between words is defined as a control code. This one has already been assigned. Its entire coding is: No punches in channels 1 through 6, a punch in channel 7, and a punch in channel 8, yielding an even parity and defined as control code '00'. No holes in any channel, or holes in all channels are defined as equivalent codes and have the meaning of 'ignore this character, although a valid character, has no meaning in the output'; and this frame on the tape is passed by.

Mr. Dupress

It was further pointed out that the punched tape coding should be compatible with punched card coding.

The following status report concerns the 704 program and the production of books at the American Printing House for the Blind as a result thereof.

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Mrs. Schack

At the moment we are in the process of translating a number of books which were submitted by the American Printing House. IBM has committed 704 time to the extent of producing twelve books in form suitable for publication, i.e., meeting the American Printing House standards. We completed one small book. We have produced plates for another book - "The Little Navaho Bluebird" - a charming story about a little Indian girl, which I practically memorized. We are in the stage of second proofreading on a cook book which presents some format problems. This is one of the reasons it was chosen. We have the cards punched for a book for teachers and parents on new ways in sex education which also presents format problems. Mr. Haynes has been in charge of punching some cards at Louisville so that the keypunch operators there will become experienced at producing input. The first volume of another book will be run this weekend and we will be in the first proofreading stage on it. We have another book that is in the process of being keypunched but it has not been run through the first proof. I would say we have about seven books in various stages and only one of them is completed.

Mr. Rodgers

How many books will you be able to produce a year and how will that compare with the output under the present methods?

Mrs. Schack

I'm not sure that I can give an answer about how many books a year we can produce. I can give you some idea of relative speed of production. As far as the 704 translation speed is concerned, we translate a thousand words a minute. If I just let that statement stand, it looks wonderful, but we have to remember that there is also keypunching time involved. We haven't been working on keypunching long enough to make a valid statement about how many words a minute a keypuncher can do, but certainly it should in the near future, come closer to the standard of typing speed. We are also doing a retranslation phase of the program which works at faster than a thousand words a minute, but it does necessitate some off-line printer time which amounts to a couple of hours for a big book. This is the phase of the program that I hope can be gradually eliminated as we become more sure of the table in the machine's memory, but because of the rerun it cuts down our translation speed from about 1000 to let's say 600 or 650 words a minute since you really are doing it twice.

Mr. Dupress

The figure given earlier which was 2/10 of a cent per word does not include keypunch operator time nor the retranslation. It is simply the use of the computer itself.

Mr. Dirkman

Have you considered having a different kind of input designed from the paper tape, say paper tape to magnetic tape converter?

Mrs. Schack

At the moment one of our production problems is that the stereograph equipment was originally designed to be humanly operated so its speed is not very great. We are attaching to it a card reader which can operate as fast as 20 characters a second. This is something on the order of six times faster than the stereograph machine can go at present. If you consider now the magnetic tape speed, the discrepency makes it impractical.

Mr. Dirkman

Can you just slow up the magnetic tape rather than going to cards from magnetic tape?

Mr. Glaser

Operating magnetic tape that slow, the wow would prevent successful signal retrieval.

Miss Hooper

Isn't it more difficult to make corrections on magnetic tape than on punched cards? If there is an error you might waste an expensive plate. You would also lose time.

Mrs. Schack

One of the reasons we like cards is that we can make simple manual corrections--insertions and deletions. I don't say that eventually a tape-to-tape system wouldn't be ideal, but we would have to have different plate-producing equipment to make it worthwhile. Our hope here is to iron out a lot of production bugs--problems of proofreading, verification etc. Then we can start attacking the weak points of the system and substitute paper tape to magnetic tape conversion for keypunch. Then we begin to have a good automated system.

Mr. Nemeth

It would be very helpful to me if I were allowed to use the index register which we have, but I don't use it. There are other features available on the 650 that I don't use since it would then be necessary to pick and choose among the 650 installations to discover which ones could use my program. All I can assume is that the basic 650's have the ordinary instructions which come with the machine plus an alphabetic device and a special character device.

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Mr. Dupress

The question was raised as to how good the braille is that the 704 program produces.

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Mrs. Schack

It doesn't get into plate form unless Marjorie Hooper says that it is all right.

Mr. Dirkman

It has to be perfect Grade II braille.

Mrs. Schack

Yes

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Mr. Dupress

The following question was asked: Is proofreading necessary? Is it because of possible errors in the program that you are trying to check out or is it because of possible errors in the original text?

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Mrs. Schack

There are two things. There are possible errors in the original text most of which we catch because we do key-verify the cards. There are also possible errors in the program such as omissions in the dictionary. Each book that we translate brings up a new set of words and so we are continually testing and enlarging the dictionary. I don't know at what point we can begin to level off in proofreading--it may be 12 books, it may be 30. We will just have to establish that in time.

Mr. Dirkman

The newer IBM machines are much cheaper for calculation and so therefore the 2/10ths of a cent per word is quite high even compared to computers that are now available. Developments in the computer field indicate that the cost of calculation will become steadily cheaper.

Mr. Haynes

The computer time by itself is not a real cost estimate. We have thus far ignored input and output time including such factors as magnetic tape-to-card conversion, keypunching time, etc. It is not a valid comment that since the machine costs are decreasing, the entire transcription cost is decreasing proportionately.

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Mr. Dupress

The comment was made that the computer program was initiated primarily because it is difficult to train transcribers and keep them long enough to make the training worthwhile. Training time is at least two years to do straightforward copy that is not particularly difficult. The chairman raised the question as to whether the human interposed between the material and the blind person is not the major cost item. The question was raised as to whether volunteer keypunchers were considered. The answer was that at Louisville these are regular production employees. It was further pointed out however, that at other installations where braille is produced, volunteer keypunchers might be used. The question was raised as to what consideration is being given to making the 704 program compatible with the 7090. The answer was given: none at the present. The input/output routine for the 704 was written as simply as possible so that it wouldn't be too difficult to convert it for use by another computer. The question was raised as to what would happen after the dozen books to which IBM is committed, are completed. The answer was that it is up to the people at the American Printing House to evaluate the whole scheme and it is up to them to make decisions in the future. The next status report concerned the IBM 650 program.

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Mr. Nemeth

The 650 IBM program with the exception of format requirements is functional to this extent: with the keypunch operator setting the margin, it will transcribe into correct English braille, barring errors on the part of the keypunch operator. It will not handle tables; it will not handle poetry like the 704. It will take into account change of print page numbers. It will also handle the following: in the format cards, it specifies whether even numbers are to be supressed or included. If even numbered pages are to be supressed, the machine will not bother to print even numbered pages. It will just begin to emboss at the top of the even numbered page. If however, even numbered pages are to be included, it will put the even numbered pages in. This is to take into account interpointing practice vs. one-side page practice. In interpointing practice there is a running head. The running head is stored in a special location after line 25 has been embossed. If it is an even numbered page, the machine will just continue to encipher. If it is an odd numbered page it will put the running head on, put the page number on the corner of the page and continue to emboss on line two. The format symbols in the program, which have not yet been tested, are the following: change from Roman to Arabic numerals,and write right margin.

Let me explain what right margin means. Suppose you are writing a letter and the man has signed his name. If you put the right margin indicator, the word will be enciphered and after it is enciphered it will be positioned so that the last letter of the encipherment occupies the last cell of the line and the encipherment proceeds backward from there. If the line contains too many characters to allow all of the enciphered word on that line it will be printed on the next line. In other words, the machine will put the change-of-line symbol first, and position it on the next line. There is only one trouble with this. If most of the line is occupied and if that line happens to be the 25th line, the signature will appear on the first line of the next page. I have not yet tested this format symbol sufficiently in the program nor have I sufficiently tested the symbol changing from Roman to Arabic numberals. One

of the braille rules is that contents pages, preface pages and introduction pages should be numbered by means of Roman numerals, but that the text itself should be numbered by means of Arabic numerals. The program is designed so that it will ignore the instructions regarding print pages while the pages are being numbered in Roman numerals. The program generates its own Roman numerals rather than store a table of them. If the page number is xxiii, the program will generate the two "x's" and the three "i's" to write xxiii. I can get up to 3,999. Then after that it becomes too much introduction, not enough text. As far as status is concerned, I have no way of testing the output cards except manually. I would like to describe briefly the output system which I devised. The first 10 columns of each 80-column card are reserved for card identification. The first five columns contain the number of the current card and the next five columns contain the number of the succeeding card. Columns 11-80 are reserved for braille and each braille character required two columns for its representation on the 650. The odd-numbered columns represent information about the left half of cells and the even numbered columns represent information concerning right half of cells. In one half of a cell it is possible to make 8 combinations, one of which contains no dots, three of which contain one dot, three of which contain two dots and one of which contains three dots. These combinations are arbitrarily assigned numbers from 1 to 8. Number one represents the top of the cell, two represents the top two dots, three: all dots, four: the middle dot, five: the upper and lower dot, six: the bottom two dots, seven: the bottom dot, eight: no dot. For example, the letter "A" will be represented as 18--1 for the left-half of the cell, top dot, 3 meaning no dots on the right side. The "for" sign will be represented by 33, all six dots- 3 being all three dots. I get a print out of just a pair of digits. For example, if I wanted to write a word like "bulk", "b" would be 28, "u" would be 57, "l" would be 38 and "k" would be 58 and that's how it would come out in those eight digits.

The reason I designed the code is that the information on the cards can be printed out on fanfold paper. If you put it on a proper tabulator and if you change type bars, so that instead of printing number one the type bar will print the solid dot on top and two hollow dots below, and instead of printing two, the type bar will print two solid dots on top and one hollow dot below, then the listing will come out in visual braille so that it can be proofread by someone who has sight. My thesis advisor tells me that it is not incumbant on me to provide the hardware but just to show the feasibility of such a thing. I've investigated it and this kind of type is not available. So you first have to make a mold which would cost two or three thousand dollars. Therefore I am not in a position to implement making these molds. All I can do now is get a list and my wife sits by the hour reading pairs of digits on tape and I just copy them and see what kind of braille comes out. This is really a crude "cave man" method compared to what has gone on before. This is really an archaic way of doing it. If you transcribe braille, after a while you don't know where there is a mistake. It might be on the card, or my wife may have made the mistake in dictating it onto tape or I may have made the mistake in listening to her or in writing it on the braille writer. This is the only way I have had to check out the program and therefore it has not been possible for me to check out a long run like 10,000 words. Therefore it has been necessary for me to do my checking out judiciously. What I have done is go through every branch of the instructions in the program, i.e. write a word which would involve each branch of the instructions, let the machine take over and see if it would actually take the right branch. This is the only way I could check out nearly every situation which would be encountered in actual text. The cards cannot be utilized by any system that automatically produces braille at the present time.

Mr. Booth

How many cards would you need to prove out your system if there could be created a converter from your card system to the card input for the stereograph?

Mr. Dupress

Although no specific number of cards was mentioned as minimum, the answer was given that a special list of words would have to be assembled. The alternative would be to have a variety of texts such as are being transcribed by the 704 program. A sub-committee was formed consisting of Mr. Nemeth, Mrs. Schack and Mr. Booth to work out some arrangement for checking out Mr. Nemeth's program. This would not be an official IBM commitment but would be the volunteer effort of individuals.

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Professor Mann

I might make the observation that in addition to testing for those situations which you know can be handled by your program you should not overlook the need for testing with random information.

Mr. Nemeth

You are right.

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Mr. Dupress

In summary, Mr. Nemeth stated that he does not believe he has checked out every contingency since it is not possible to process such large quantities of material. The question was raised as to how good the 650 braille is and the answer given was that like the 704, it is not absolutely perfect. A small number of errors will occur and thus it produces nearly perfect braille. In both programs there are a certain number of instructions which must be given to the keypunch operator.

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Mr. Gildea

How many instructions are required for these programs and how much time is required to learn them?

Mr. Nemeth

For the keypunch operator, very little time.

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Mr. Dupress

The format must be decided by a human being with either program. The question was raised as to whether this makes it impossible to have a completely automated system. The answer given was that you have to have human intervention because of the peculiar things which occur in print for which there is in equivalent in braille. There must be special braille signs or braille indicators. The present braille rules require a certain amount of discretion.

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Mr. Nemeth

The rules of braille are such that the judgment of the human being is adequate to decide what way is correct and there is only one correct way.

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Mr. Dupress

In summary, in writing individual words in braille there is nothing permissive. It is editorial format where there are certain things which are permissive. The keypunch operator is governed by his editor and his machine. The comment was made that even in monotape there is very little editing. There is line justification however. The question was raised as to whether monotape differentiates between capital and small letters. The answer given was that it does. It also makes a distinction between large caps and small caps. In other words, those value judgments which are incorporated in the monotape are mechanizable. The question was raised as to whether what has been discussed refers to the maintenance of one or two centers for the production of braille, or at least less than half a dozen. It is more realistic to think in terms of many centers where you can get material to people faster.

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Professor Mann

Many of the things which we are talking about here are elements which have great impact to the sighted reader because of their visual input. These are irrelevant to the blind, tragic though it may be.

Mr. Rodgers

To a large extent we have to face this. Anybody looking at the code carefully would probably come to the same conclusion. These rules have been oriented for human use. Something will have to be done to revamp these rules so that they can be oriented for computer use leaving out as much as possible the judgment of humans. The code as it now stands, is designed for leisurely transcriber interpretation. When I say leisurely, I don't mean that transcribers don't work very hard. They are human beings, not machines, and they work as such. That is the difficulty we are faced with.

Mr. Nemeth

In this matter of accents the keypunch operator is instructed to write just the indication that there is an accent. The keypunch operator does not actually indicate the nature of the accent. This is not a one-to-one transcription into braille. The sighted reader has a knowledge of what the nature of the accent is, whether it is an acute accent, a grave accent, a cedilla accent or what have you. In braille, all you have except for technical purposes and foreign languages is a general accent mark and that's all the keypunch operator is instructed to put down. This is an example of what I would call a slight editorial decision. The decision to put dots to represent omitted matter rather than asterisks which inkprint sometimes uses is also a slight editorial decision. The decision to use an initial capital letter and write the rest of the word at the beginning of a paragraph in small letters is also a minor editorial decision and left to the keypunch operator. Even if you could completely automate correct braille, there is still a human error. A keypunch operator punches the wrong key: she wants to press an "x" and presses a "c"; she wants to press a "y" and presses a "u". Naturally, the computer will encipher "u" not "y". There are certain kinds of errors that you can avoid in programming.

Mr. Dupress

Suppose there is no keypunch operator but a reasonably well verified tape (Homotape, Teletypesetter tape, etc.) from industry.

Mr. Nemeth

99% of the errors have been eliminated from the verified tape. Then why is computer-transcribed braille not sufficient when braille produced under the present system (human transcriber) is sufficient even though logically it could still contain error?

Mr. Dupress

Good question why isn't it?.... What is lost in the 56/100 of 1%?

Mr. Nemeth

Nothing much.

Mr. Dupress

How does the 56/100 of 1% compare to the human being who is not an absolutely infallible transcriber?

Mr. Nemeth

I think it would probably be less. In fact I think that the braille you would get from a computer would be a more perfect braille than you would get from volunteer transcribers. A good programmer will program into his system a device for picking up a program from some intermediate point instead of having to start from the beginning. There could be component failure in the middle of the computer system. Something could incorrectly pass some validity check circuit. There are all kinds of checking devices which could be bypassed and an error generated in the electronics. After all when millions of instructions a minute are being carried out, minute after minute for an 8 hour day, statistics alone tells you that there will be some error in the system.

Mr. Glaser

Assuming no checking in the electronics system whatsoever, the probability of error is still lower than that of the human being.

Mr. Nemeth

That's true, and with checking, the error is still lower. Yet some people are not happy with computerized braille, while they are perfectly willing to tolerate the imperfect humanly transcribed braille though the number of errors is sometimes 20 times the number of errors that the computer will turn out.

Mr. Dupress

What bothers me is that if the machine won't do a perfect job then we have to have some human make it perfect. It also bothers me that when we are so close to perfection, the vast majority of braille material that people need for education, for their job, for everything is still turned out by people who are neither perfect transcribers nor the equivalent of the fallible machine.

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The next subject concerned the way people actually read braille.

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Mr. Krebs

In the so called normal process of reading, first there is the one-finger reader. The finger moves across the page and there is no verification at all. The one finger does the whole job. The other hand can be in the persons lap. The second method is to have the left hand at the margin while the right hand moves across and the left hand is used as a guide to find the next line. The third method is two-handed with the left hand being a verifier. In other words, the right hand actually does the reading and the left hand follows along for almost the entire line and then starts moving back to the beginning of the line. Actually the left hand just verifies. The fourth method is also two-handed but the reader actually uses both hands for the reading process though not simultaneously. The right hand reads to the end of the line and when it reaches

the end of the line, the left hand begins the next line. The fingers meet and then the right hand takes over once again. For half the line the left hand is doing the reading, for the remainder of the line the right hand reads.

Mr. Dupress

You don't read simultaneously with two hands, do you?

Mr. Krebs

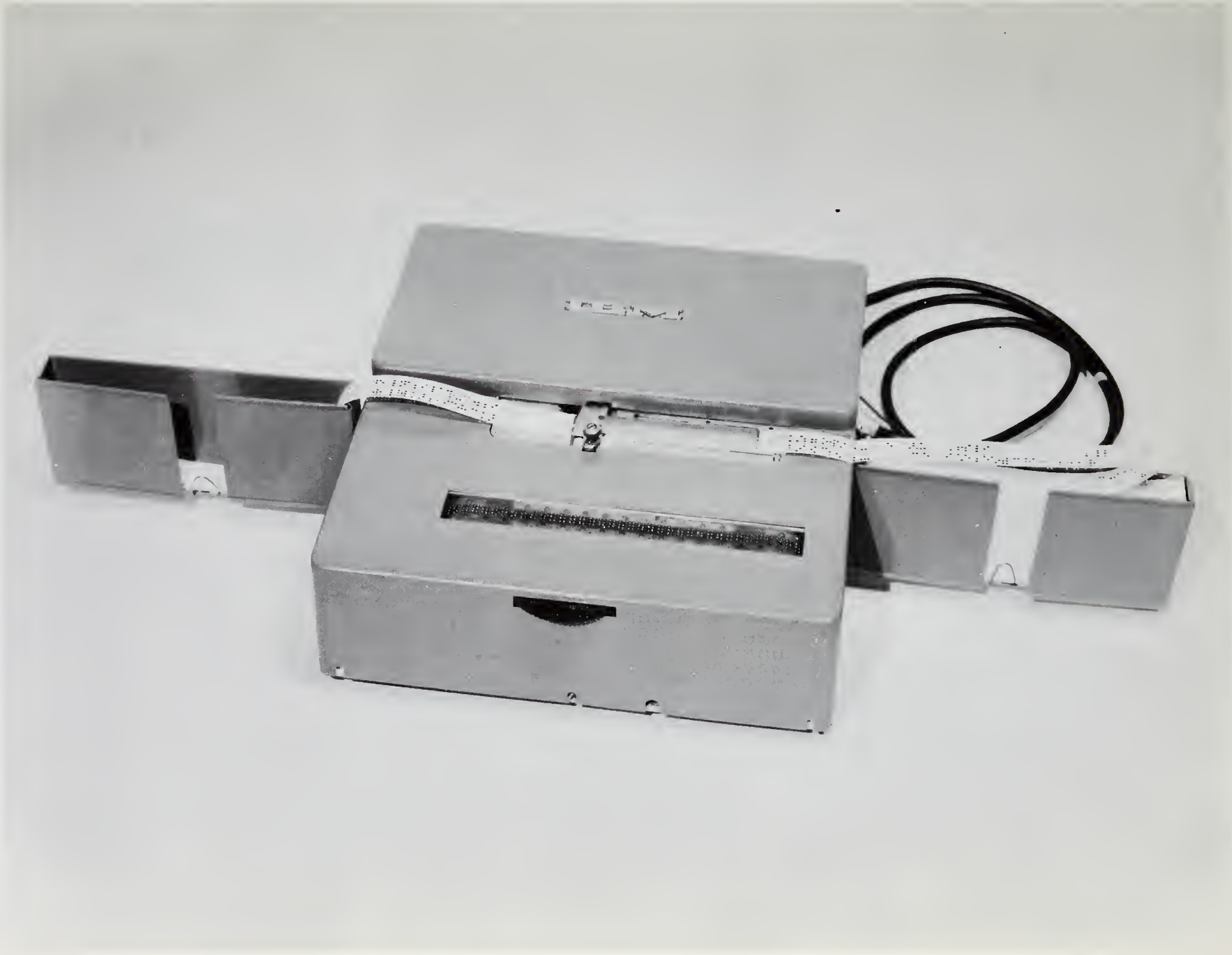
That's right. In other words, it is a back and forth motion with two hands, but only one of them is reading at a time. You can't get two different impressions at one time.

Mr. Dupress

One additional method was mentioned by another speaker who said he reads with both hands. While he is reading the first line with one hand he has begun the second line with his other hand. Then when he reaches the end of the first line, he places the words in the second line in context and continues in this way. This was not considered to be a normal reading method. In conclusion, no one was able to say flatly that a really adequate study has been made as to how blind people actually read, or if such a study has been made no one present was familiar with it.

The comment was made that there must be a sideways motion. You should not allow the dot to jump up and down underneath the finger. This was mere speculation however, and no evidence was presented.

The remainder of the second day's session was devoted to the selection of a six-member steering committee. Several sub-committee assignments were also made.



IBM-Braille Belt Reader

Adelphi-Systematics Multicopier