Braille Production Handbook

Establishing Braille Production Facilities

in

Developing Countries

A HANDBOOK

by

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Preface

During the past few years, the Swedish Federation of the Visually Handicapped (SRF) has become more and more involved with projects in developing countries. These activities have bought us in closer contact with many organisations of and for the blind and, as a result, we have become increasingly aware of the need for braille production facilities in these developing countries. In a world where access to information is becoming increasingly essential to everyday life, so access to information in braille is an increasingly acute problem for blind people.

With this handbook, we, with the financial aid from the Swedish International Development Authority (SIDA), hope to make some contribution to the development of braille production facilities in those countries which do not yet possess such facilities and, therefore, make some steps towards alleviating the problems blind people have in obtaining the education and information which is so readily available to the sighted.

Bengt Lindqvist
Chairman, SRF.

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SECTION I: INTRODUCTION

Chapter 1: The Importance of Braille

Braille has been the primary medium of communication for the severely visually handicapped for over a century. During the last two or three decades, its use has been declining in some countries as a result of both social and technological developments. A number of factors, however, have, and are likely to, keep braille as the most important medium of communication for the severely visually handicapped:

1. The most significant factor is perhaps that braille is both a reading and writing medium. This, together with the process of tactile reading, makes its use and its user active. Contrasted to the passivity of listening to pre-recorded tapes and their strictly sequential ordering of presentation, the braille reader has much more control over the interpretation and/or ordering of the material to be read.

2. The format of a book is, in fact, a very important aid to the reading process, whether it be visual or tactual. It is very much easier to find a specific place in a conventional book than it is in a Talking Book. Furthermore, even with braille books it is possible to skim over a number of pages which are not essential - then continue normal reading again when necessary. It is also quite

likely that the spatial structure of a conventional book aids the mental structuring of the content. This in turn probably aids memory, understanding and recall of the books' contents.

3. Braille books allow the presentation of tables and diagrams in tactile form, if they are not too complex. The information contained in such illustrations often loses its value and/or effectiveness if presented in a sequential form. It should be noted, however, that tactile diagrams are difficult to interpret - the tactile reading process is less well adapted to interpreting spatial patterns than the eye. It is of the utmost importance, therefore, that much thought is put into the design of such tactile material.

4. The use of braille maintains communication skills. To be able to write and to read is an ability which is becoming more and more important, and these skills also contribute to other language skills such as conversation and expressing one's ideas verbally.

5. Braille can also have an important function at work. In many jobs notes must be taken and information written down for future reference. For such work, braille is often a superior medium to cassettes, even when these are available.

6. The structural features of braille are especially important for reference and study material, i.e. material which has the purpose of presenting information. General reading matter is perhaps not so critically dependent on the format advantages of braille but on the other hand many readers will have the opportunity to interpret the contents directly themselves and not be influenced by the inevitable interpretation imparted by readers' of Talking Books.

Despite these advantageous features of braille, its use in a number of countries has been declining. This decline is dependent on a complex of factors which will be discussed in the next section. It has been maintained by one commentator*, however, that the primary cause for this decline has been 'benign neglect'. That is to say, the use of braille is not something which happens 'automatically' when someone loses their sight. It is a difficult medium to learn, especially for an adult who has been used to reading print, and often there is insufficient and/or inappropriate material available in braille in order to motivate the necessary interest to learn it.

In other words, there is a good deal more involved in braille provision than just being able to print it. Selection of material to match needs, adequate facilities for learning and standards for teaching, and an appropriate

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* Clark, L.L. The Future of Braille. Braille Research Newsletter, No. 9. 1979. pp. 5-45.

braille code, are all equally important as the ability to be able to print the braille material. If braille is to function as the medium of communication of which it is capable, it must be actively and vigourously supported by all organisations and institutions which are concerned or involved with the welfare of the visually handicapped.

SECTION II: GENERAL ASPECTS RELEVANT TO THE DEVELOPMENT OF BRAILLE PROVISION FACILITIES

Chapter 2: The Use of Braille

There are many factors affecting the use of braille in any particular country. In this chapter these will be discussed under the following three headings:

(a) External factors, such as the availability of braille material, the use of alternative media and the facilities for learning braille.

(b) Factors directly relating to braille, such as its bulk, the difficulties caused by some code systems and the difficulties of teaching it.

(c) Factors relating to the readers, such as age, residual vision and their general ability

(a) External Factors

(i) The availability of braille

To learn braille. even to someone of above average ability, represents a considerable commitment, in terms of time and effort, on the part of the learner. This is especially true if braille is learnt during adulthood, and consequently, there should be sufficient material <u>of the right kind</u> available so as to justify this commitment.

Availability involves two aspects. Firstly, that there is sufficient range and quality of material in braille, and secondly, that the material produced is of the kind required by the user population.

The first factor is primarily a straightforward matter of having sufficient production capacity. However, other factors as relevant. For example, much more literature exists in the English language than in any of the minor languages such as Dutch, Swedish, Finnish, etc. and, as English is the primary language for a number of countries around the world, English braille is far more available than braille in many other languages. Another factor relates to the number of schools where blind children can be educated and how long such educational facilities have been in existence. The main bulk of braille readers will be made up of those who have been taught braille during their school years.

The second factor is, however, rather more complex as it demands a knowledge of the needs for braille. This is very difficult to assess, even in countries where braille has been available for decades, as it is difficult to know what the effect of increased provision would have on demand. In other words, to what extent has the relatively poor availablility of braille caused a situation where many braille readers are not aware of what types of material are available in inkprint and, therefore, are not in a position to demand it in braille?

Creating awareness of what is available generally is therefore an important aspect of braille provision, in addition to providing the known requirements.

(ii) Alternatives to braille

Although few people would maintain that developments made by modern technology will ever replace braille entirely, it is of great importance to use all available communication aids to the fullest extent of their effectiveness. In planning any new braille production facility full consideration should therefore be given to the total problem of information and literature provision for the visually handicapped.

In many cases the more recently developed equipment, e.g. cassette copying equipment, Optacons (optical to tactile converters) closed circuit T.V, etc., may be either too expensive or too sophisticated to be appropriate for some countries. Nevertheless, it is important that the people responsible for planning provision for the visually handicapped to have a long-term view, at least at the back of their minds, so that an appropriate long-term development plan can be outlined and maximum utilisation of resources ensured.

Large Print: The use of large print for reading by the visually handicapped has been increasingly encouraged by ophthalmogists and educators who now agree that any residual vision should be utilised as much as possible.

Facilities for producing large print have lagged behind demand somewhat, perhaps because the section of the visually handicapped population who have most need of this medium - the partially sighted - have only recently been recognised as a grouping requiring special aid.

The use of large print is closely associated with the nature and prognosis of the residual vision each person has. General vision assessments may not necessarily provide accurate indications of whether the most suitable medium for a person is braille or large print. A detailed vision assessment should, therefore, be made where possible before any decision is made with regard to the most appropriate medium to be used. This is an important aspect to consider as the number of severely visually handicapped who can make use of print by some means is probably considerably greater than the number who will become braille readers.

Tape and cassette recorders: The introduction of recorded books either on open-reel or cassette , has had a major impact on the use of braille in many countries. With the introduction of portable cassette players/ recorders, the effects have become more widespread as these can be used for note-taking in lectures, memoranda, personal letters, etc. as well as for pre-recorded material. However, cassettes can be used simply because the material is unavailable in braille and it is quicker and cheaper to produce a cassette rather than transcribe the material into braille. This can happen despite the fact that braille would be the better medium in principle.

In countries not already having recorded material available or where provision of recorded material is still at a low level, then the future development of this medium and its potential impact on the use of braille ought to be studied in connection with any developments of braille provision.

Direct-Access reading machines: The principle of direct-access reading machines for the blind is that they 'read' material which is printed or typewritten (the quality of the type must be at least reasonable), and then convert this input into a form which, when displayed, can be perceived by a blind person. Such machines, therefore, allow, in principle, a blind person to have access to any typed or printed material which is normally available to a sighted person.

All direct-access reading machines currently available, with the exception of the Kurzweil Machine, are of the character-conversion type, with either audible or tactile outputs. That is, these machines only convert the black-white image under their optical probe to either an audible or tactile symbol. In contrast, the Kurzweil Reading Machine recognises letters and words in English and is, therefore, able to read the material aloud, by means of a speech synthesiser. This machine can only be used for English at the present time and is rather expensive, although the price is decreasing. Further discussion of this particular machine is outside the present context.

In the case of the character-conversion machines, a learning process is required in order to be able to read from them and, furthermore, the output is necessarily presented sequentially. Both these features have so far ensured that reading speeds are kept down at a fairly low rate in most individuals. This has meant that these machines - the best known example is the Optacon - have a fairly limited, although none the less significant, use for visually handicapped people. Such uses mainly involve scanning through print material, such as the day's mail, indexes, bibliographies, articles, etc., to determine whether they, or which of them, require more detailed consideration. Reading machine users with reading speeds of less than about 40-50 words per minute (i.e. the majority) are not likely to use their machines for reading lengthy articles or books; these types of material are usually either read to the visually handicapped person or they are transcribed onto tape or into braille.

(iii) Facilities for learning braille

As stated earlier, those people who lose their sight after school age, usually find braille a difficult medium to master. It is not a natural process to acquire braille reading skills simply as a result of loss of sight and, therefore, braille reading must be an important part of any rehabilitation programme for the visually handicapped. Furthermore, full recognition must be given to the fact that learning to read braille is a difficult and complex task for the majority of learners and therefore specialist teachers and techniques are required which draw upon the fairly extensive research* which has been carried out in this area.

Inadequately trained teachers and insufficient, and often inappropriate, material for learning are probably a significant cause of the low proportion of severely visually handicapped who can really use braille effectively. Greater attention on both the quality and availability of braille would have significant effects on the numbers of braille users and their level of competence.

(b) Factors Relating Directly to Braille

(i) Physical characteristics

Braille is based on a cell composed of six dots - three high by two wide. There is no real

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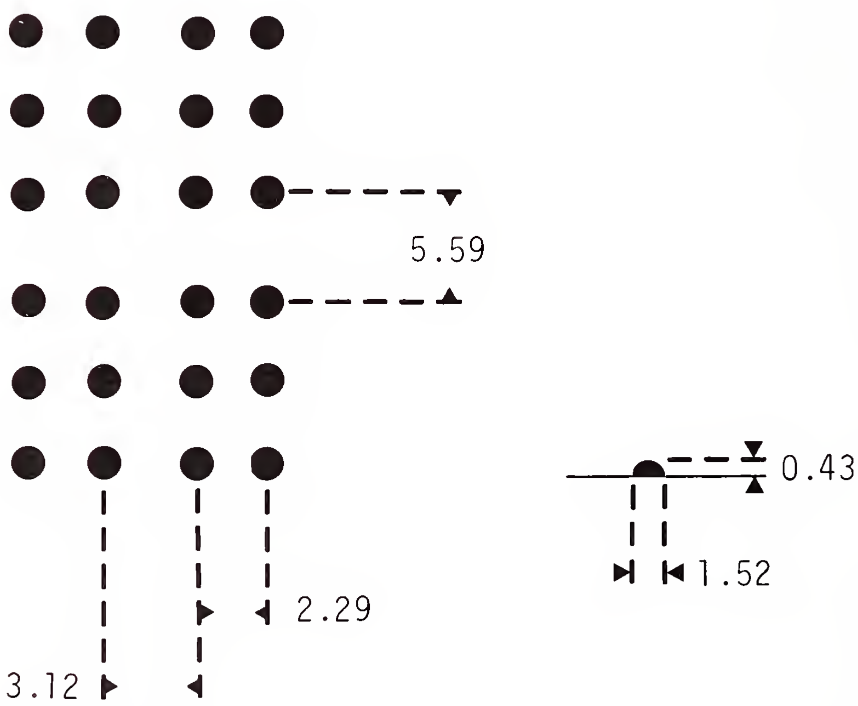
*see overview in: Hampshire, B.E. Braille: A Medium of Communication for the Severely Visually Handicapped. UNESCO: Paris. 1980 (In press).

standardisation of the dimension of the braille cell between different countries. However, an experimental study carried out by Meyers, Ethington and Ashcroft*, found that the following dimensions were superior for reading.

Figure 2.1: Dimensions of the braille cell



Thus, for a person newly introduced to braille, to distinguish the individual braille characters can be very difficult. Just how difficult this initial process of learning to perceive the braille characters is will depend on age and circumstances during the onset of the handicap. Most people, who have reasonable vision, rarely use their tactile sense for detailed

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* Meyers, E., Ethington, D. and Ashcroft, S. Readability of braille as a function of three spacing variables. J. Applied Psychology, 42, 163-165. June, 1958.

discrimination. Thus, it takes some time to adjust to being dependent on this 'unfamiliar' sense. However, it should be emphasised that the perception of braille characters is well within the capabilities of normal tactile sensitivity.

Although braille characters may appear small when trying to read them tactually, they take up considerably more space than inkprint characters. A sheet of braille (297 x 210 mm) can contain 29 lines of 30 characters each, i.e. 870 characters on each side. A similar sized sheet of standard typewritten characters contains typically about 2,500 characters, i.e. about three times as many. This means that transcribing material into braille involves a considerable increase in number of pages and, therefore, storage space. This again can be a particular hindrance for having reference books in braille as these are often bulky enough in print.

(ii) <u>Braille code systems</u>

The basic braille code system consists of a braille character for each of the alphabetic characters and the common punctuation marks. In addition, however, many countries also have a system where the braille characters are assigned meanings which correspond to whole words and/or certain letter combinations within words. Also, certain words are always written in an abbreviated form. In some highly contracted braille systems some braille characters can have several totally different meanings depending on their context. The use of these contractions is defined for each system by a set of rules.

The idea behind having these contractions is to reduce the bulk of braille books and to increase the speed of reading. The contraction systems in use in many countries have been criticised with regard to both these claims. Careful study should therefore be given to the level of contraction used in braille materials. A simple whole-word contraction system probably saves nearly as much space as the highly contracted, complex systems, and has the significant advantage of potentially making braille more accessible to a greater number of people.

(iii) Teaching braille reading

Up until recently the teaching of braille has borrowed from conventional techniques and materials used for the teaching of print reading. There is now becoming, however, an increasing awareness that teaching braille, especially where a contracted braille system exists, requires material and an approach which takes account of the special complexities and difficulties imposed by the braille system.

These difficulties are associated mainly with three aspects of braille. Firstly, braille creates its own problems by using contractions and no special 'method' developed for the teaching of print reading can substitute for a thorough knowledge of the effects these contractions have on reading and learning to read. Secondly, the range of ability and experience of the people wanting to learn to read at any given age varies enormously. This suggests an individualised approach to teaching as far as possible, as being the most appropriate although this is more demanding on skills and qualifications of the teacher. And thirdly, there is the problems of providing braille material for learners. Again, it is not always advisable to transcribe beginning-reading materials for print reading to braille. Contracted braille can create complexities where such complexities do not exist in print. A number of research and development projects have studied this problem of designing beginning-reading materials for braille*. It should be borne in mind that in these days of increasing levels of illiteracy among sighted children, that the learner of braille faces the same problems as the sighted learner of reading and in addition has all the extra obstacles imposed as a result of his handicap.

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* e.g. the project carried out by the American Printing House called "Development of a Beginning Braille Reading Series". The project was completed in 1978.

(c) Factors Relating to the Readers

(i) Age

In industrialised countries, the visually handicapped population is heavily dominated by the elderly - typical figures are that 65 per cent of the visually handicapped are 65-years-old or over, and only 4 per cent are under 25 years. This situation is probably different for many developing countries where children form a much larger proportion of the general population - despite higher infant mortality rates - and life spans are shorter.

There is some evidence to show that age of onset of visual handicap is a significant factor in learning braille. Thus, a very much higher proportion of congenitally blind people learn and use braille compared to those people who lose their sight later in life. The reason for this situation is not, however, simply due to age. Factors such as the type of material produced, its availability, the braille code system, quality and availability of braille instruction, etc. are all influential.

(ii) Residual vision

Perhaps the most fundamental characteristic of the visually handicapped population is that only a minority are totally without sight. The proportion of totally blind is only around 3 per cent in industrialised countries, although this number may be higher for some developing countries. Consequently, some definition of sight must be employed in order to separate those people who require special aids and material because of their lack of sight from those whose bad eyesight can be compensated by the use of spectacles.

Deciding on criteria to use in order to draw a dividing line between these two groups is an arbitrary and often difficult process, and widely differing estimates can be obtained for the visually handicapped population depending on which approach to assessment is taken. Two different approaches have been taken.

On the one hand, an objective test of visual acuity can be used, e.g. the Snellen chart, which gives the familiar 'numerical' definition of visual impairment. On the other hand, approaches have been taken which attempt to classify the visually handicapped population in terms of what they can do with any residual vision which they may have - so-called 'functional' definitions of visual impairment.

The approach and criteria used to define visual handicap can have drastic effects on user estimates for any special materials or aids, such as braille. Thus, if 'blind' and 'partially sighted' children are differentiated on the basis of a general visual acuity measurement and they are educated as two quite distinct groups, this could result in some children learning braille when their residual vision could be used to read large print. And, conversely, some children may be taught print when, because of the particular characteristics of their visual defect, braille might have been a more suitable medium. The problems would not be solved, however, simply by changing to a 'functional' approach. These involve a very large amount of administration to carry out, and are also difficult to standardise on a large scale.

(iii) Ability structure

It is generally agreed that intelligence is an even more important factor influencing braille reading performance than it is for print reading. The reasons for this have been discussed in some of the earlier sections of this chapter.

Another factor which is significantly related to braille reading performance is language ability. A number of studies have shown that contextual cues in texts, for example, grammatical structures, certain word endings, familiar letter sequences, etc. considerably aid the reading process. Ability to utilise these linguistic cues depends on the level of language development of the reader.

Patterns of Braille Usage

The above discussion illustrates the many factors influencing the use of braille. Many of these factors can be influenced by policy decisions made by the organisations concerned with the provision of material for the visually handicapped. Obviously, economic factors will provide the major limitation on the level of provision. However, it is important to be aware of the patterns of braille usage and on what these are dependent. Only then can any provision system, whether small or large, function to its full effect.

The final section of this chapter will consider braille usage in terms of the major groups of users. These can be usefully classified as follows:

- school children
- students
- employed
- casual readers.

School Children

This group should take high priority among the groups of users. For children learning braille, it represents their first contact with written language and, therefore, their chance to achieve literacy and education.

In the case of text books, requirements can be reasonably accessible as these are often decided upon by some central authority, such as the Ministry of Education. In these cases, the number of copies required will be maximised which is an advantage and, in the majority of developing countries, the books used in all schools are determined centrally. Although provision of text books is very important, material for school children goes beyond these. It includes, for example, handouts, notes, examination papers and supplementary material of many kinds. Mainly, these will be fairly short in length and produced originally by the individual teachers or other school staff. Provision of such material is particularly important in integrated education of the blind child is not to be put at a considerable disadvantage compared to his/her sighted peers.

School children's requirements for material are, in general, very wide ranging and a very broad, 'multi-media' approach should be taken towards their provision. A variety of materials should ideally be available - braille, raised diagrams, maps and illustrations, models and, if available, recorded material. This range of material is likely to be greatest in countries having integrated education, as the blind pupils' texts and materials will need to reflect as accurately and as comprehensively as possible the material of his sighted peers. However, the different nature of tactile and visual perception must be kept in mind so that the visually handicapped pupil does not just receive simple-minded, 'tactile analogues' of the print material.

Students

This group will inevitably represent a numerically small number of people. However, their needs will be disproportionately high in relation to their numbers. Further, the material required may often be of a complex nature requiring specialist transcribing skills.

One of the largest problems associated with providing this group with material is obtaining the material to be transcribed in sufficient time to be able to produce it for when it is needed. To some extent, however, books at university level are used internationally so contact should be made with all the major braille libraries which lend books to find out whether a certain book has already been transcribed.

Again, as with school children, a 'multi-media' approach is really necessary to meet needs in full as illustrations and diagrams of various kinds are often required to supplement braille and/or recorded material.

<u>Employed</u>

In all countries the visually handicapped tend to be concentrated into only a few occupations compared to the sighted. Furthermore, these tend to be manual occupations not demanding literary skills to any great extent. Evidence exists, however, which suggests that the range of occupations a visually handicapped person has to choose from is not primarily governed by the limits of his/her handicap places on their capacity, but by traditions and role-expectations for visually handicapped people in that country. It should be the role of all organisations of and for the blind to try and diversify the range of occupations available to the visually handicapped and this implies the possibility for them to gain access to and to be able to keep up with the published information available to the sighted as far as possible.

A large proportion of the material required by this sector will be for such material as instruction manuals, directories, information leaflets and so on. This material often has the characteristics of being bulky, even in print, and of needing to be up-dated or revised at fairly regular intervals. These two features make it a particularly difficult area of provision to be catered for by conventional braille production facilities.

Casual Readers

This is rather a broad category as it involves to a large extent all those people who can read braille. The material used by this group of readers can, therefore, be usefully sub-divided into the following types:

- full-length books
- magazines, periodicals, etc.
- short-length, 'information' material.

Full-length books

Since most ordinary braille books tend to be at least 200-300 pages long, a reasonable reading speed is required if these books are to be read as a leisure activity. It is probably true that in most countries the heavily restricted range of titles and the time taken to produce those books which are transcribed, deters many potential readers from reading more and thereby attaining a reasonable reading speed.

The requirements for braille books is rather difficult to estimate. Although the interest and desire to read more probably exists in more people than who currently borrow braille books, their low reading speed and lack of titles prevents them from being more active readers. To try and stimulate this 'hidden demand' should be a long-term goal of a braille printing house.

Magazines, periodicals, etc.

For many sighted people this type of material forms by far the greatest part of their reading matter. Literacy does not automatically imply an interest in 'the classics' or similar material; it allows people to inform, amuse, or distract themselves as they wish. But, more importantly, it helps maintain skills learnt at schools such as proficient reading speed, spelling and perhaps additional languages. Thus, such popular publications as Readers Digest, womens', sports', special interest magazines, radio/TV programme guides, etc. are equally popular among visually handicapped readers where they are available. This kind of material probably has the largest potential for reaching braille readers in any quantity.

Short-length material

This type of material is taken for granted by the sighted but is frequently unavailable to the blind. It includes such material as timetables, circulars, information leaflets, memos, etc., etc. Like magazines, short documents of various kinds are required by virtually all braille readers, whatever their occupation or interests.

Chapter 3: Overview of Braille Production Equipment

The purpose of this chapter is to present a general classification of braille production equipment together with their associated characteristics. All the equipment considered will not necessarily be appropriate for small-scale production or for developing countries. However, a general discussion of braille production equipment in a wide context will provide a better basis for considering small-scale systems in more detail in the next section.

Figure 3.1 illustrates the various braille production techniques for which the technology exists at the present time.

Braille production, as far as producing unbound embossed sheets, can be considered as consisting of three stages:

(a) inputs
(b) intermediate storage/coding, and
(c) outputs/copying.

(a) Inputs

These can be divided into two main types - those where braille is encoded manually, either on a mechanical or on a electrical keyboard, and those where print is encoded or, by some means, read into the system. This print input must then be translated to braille with the help of a computer.

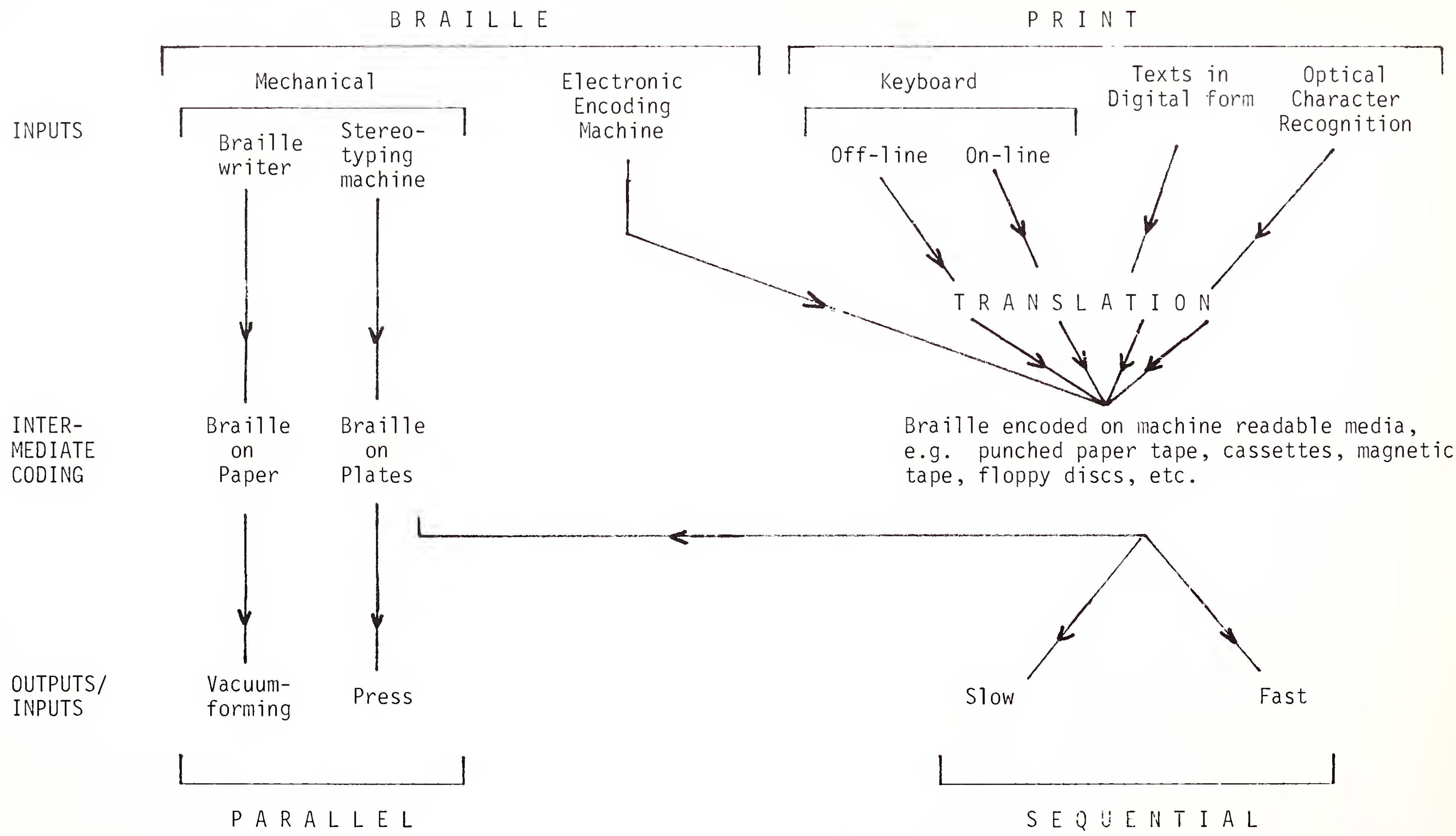
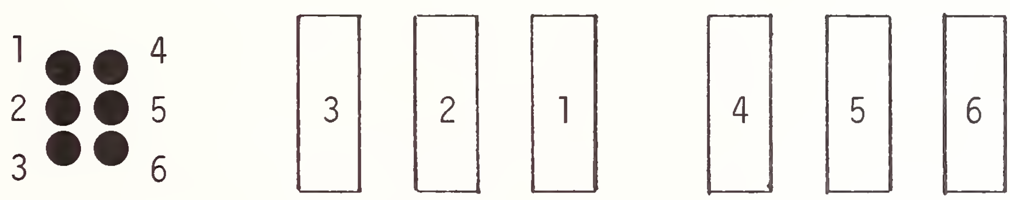


Figure 3.1: Braille Production Techniques

(i) Braille inputs

These require a skilled braille transcriber to operate the keyboard. The most common type of keyboard used for braille transcription consists of six character keys - one key corresponding to each of the six dots composing the braille cell. Although the arrangement of these keys can vary between machines, the most common is as follows;

Figure 3.2: The most common convention for numbering of braille cell and layout for braille keyboard



The range of equipment using braille keyboards is wide; ranging from the simple mechanical braillewriters which write braille directly onto paper, to electronic braille encoding units which code the braille onto some machine readable medium.

The advantage of mechanical keyboards is that they are relatively simple and are tolerant of a fairly wide range of environmental conditions. Braillewriters are also relatively cheap. Stereotyping machines, on the other hand, are expensive, ranging from about

$8,250 (Howe, USA) to $13,000 (Marburg, West Germany). The main disadvantage with mechanical equipment is that corrections are difficult and time consuming to make as these have to be made directly on the paper or the metal plates. If the error involves more than just rewriting a few incorrect letters, this can mean that the whole page, or even several pages, must be completely re-written.

In the case of electronic keyboards, some coding medium is used, e.g. punched paper tape, magnetic tape or cassettes, etc., which normally allow some correcting facilities. The level of sophistication of these correcting facilities can, however, vary enormously. At the lowest level, simply a back-spacing facilitiy exists so that errors realised at the time of being keyed in can be easily corrected. However, corrections to be made after proofreading involve similar amounts of re-writing as would be necessary with a mechanical input device. At the opposite extreme, braille encoding equipment is available which allows insertion or deletion of text, which, together with the original, can be re-formatted to the desired line length.

In general, the writing of braille can be considered as consisting of two stages - a transcribing stage and a correcting stage. The degree of separation of these two processes is fundamental to the design of an input system.

With the mechanical transcribing equipment, transcribing and correcting are carried out as two, quite distinct procedures. Firstly the material is transcribed, then it is passed on to the proof reader, errors are located and marked after which the material is then handed back to the transcriber for the errors to be corrected.

The more sophisticated braille encoding equipment allows, in principle, these two processes - transcribing and correcting - to be done at the same time as one another. The transcriber first writes a line, page, or several pages which are displayed either tactually or visually. The amount written will depend on the internal memory of the equipment or the size of the display in less sophisticated equipment. This text can then be read, checked and corrected, if necessary. Then, when the text is considered as being error free, it can be transmitted to some machine readable medium, such as paper tape or cassette.

Both these 'extremes' have disadvantages. The former, by not allowing the transcriber to immediately correct mistakes (and some research suggests that about 70 per cent of keyboard errors are 'slips' which are immediately noticed by the operator), puts an unnecessary burden on the proof reader and can be frustrating for the transcriber. On the other hand, it is generally recognised as not being a good idea for someone to check the text they have written - one often misses one's own mistakes. Thus, a separate proof reading stage will still be necessary, so little is gained and a considerable amount of time is lost because of the longer time it takes to transcribe the material if it also has to be checked before being recorded on the machine readable medium.

There is a need, therefore, to strike a balance between speed of operation of keyboard (which implies relatively long runs between stoppages) and facilities for the transcriber to correct any errors that he is aware of making, without continual checking of what has been written. Ideally, writing units having only basic correcting facilities together with a sophisticated correcting/editing unit, used mainly, if not exclusively, for correcting after proof reading, is an optimum braille input equipment configuration.

(ii) Print inputs

If print is provided at the input stage of a braille production process, this obviously implies the existence of a braille translation program at a later stage. For many countries, the level of expense and the amount of development work required for the introduction and running of these systems, make them inappropriate for detailed consideration in the present context. However, the cost of such equipment is reducing and they are also becoming less complex to operate. Thus, awareness of such production systems is important as many developing countries are, or will be, in a position to consider such production methods.

There are two approaches to the manual input of print for braille translation. The first is 'off-line', that is to say the text is written using encoding equipment which forms an independent unit in the system. Standard equipment can be used for this, the main feature of which should be good possibilities for correction so that a minimum of errors are in the text before translation begins and that the medium and code system used for encoding the text allow conversion to other media and code systems. The other approach is to have the encoding equipment 'on-line' to the main computer, i.e. directly connected to it. This assumes a fairly large scale, centralised, and expensive system.

The other print inputs involve the conversion of existing material directly to a form where it can be translated to braille, thereby eliminating the necessity for someone to write out the material again specially for braille production. This can be done either by obtaining the tapes used for setting the original inkprint book or magazine - so-called compositors' tapes - where available, or by reading the print text by means of optical character recognition equipment. Both these latter production techniques involve expensive and sophisticated equipment and a high level of technology in use generally in the country concerned.

(b) Intermediate storage/coding media

After the braille has been written it must, in the majority of cases, be duplicated. Duplication implies the existence of a 'master' and these can be one of three different types:

- braille on paper
- braille on metal plates
- machine readable media.

(i) Braille on paper

If braille is embossed on one side of the paper, this can be duplicated using vacuum-forming equipment. The paper masters can be kept in case further copies will be required at a later date.

(ii) Braille on metal plates

Braille can be embossed on folded metal sheets by means of a stereotyping machine. These plates can then be set into a press and used to press out braille copies on paper. These plates are heavy and, if bought ready cut, very expensive, thus they are not particularly appropriate for long-term storage. However, before the introduction of electronic equipment, nearly all printing houses had large cellars and/or rooms full of stereotype plates and many still have such archives today.

These obviously represent a great deal of money and space which could be better utilised if more efficient storage means were available.

(iii) Machine readable media

There are a number of different such media which can be used.

Paper tape: This is cheap to buy but cannot be reused which means it can be as expensive in the long run as a medium which is initially expensive but can be reused many times, e.g. cassettes. Paper tape can be rather awkward to handle and, if not handled carefully, can be easily damaged. Paper tape punches and readers are, however, relatively inexpensive.

Punched cards: Also cheap, although card punch and reading equipment is expensive. Relatively small amounts of text on each card (one or two lines) so correcting and editing is relatively straightforward as cards can be replaced.

Magnetic cassettes: These are probably the most common form of machine readable medium used in braille production. However, despite certain standards existing, e.g. ECMA 34, hardly any system is directly compatible with another. Cassettes are a very convenient media for handling. Their main disadvantage is that the text is recorded sequentially so that it can take a significant length of time to search for a particular point in the text. This, however, is not a particularly large disadvantage for normal text correction as it is usually carried out sequentially from beginning to end.

<u>Floppy discs</u>: These are a more recently developed medium which are becoming cheaper, although at the present time their cost is roughly the same as that for cassettes. Their main advantage is the fast search facilities possible. The main disadvantage with these is that they can be rather sensitive to rough handling. Floppy discs are most appropriate for systems wanting to store large amounts of text then selecting certain parts from the total stored.

(c) Outputs

As with input equipment, output equipment can also be classified into two main types as follows:

(i) Parallel devices

These outputs produce one page or one double page in as many copies as are needed, followed by all the copies of the next page, and so on until the edition is complete. The conventional methods for braille production, i.e. press braille and vacuum-formed braille, are of this type.

(ii) Sequential devices

In contrast to parallel outputs, sequential devices produce one complete copy of a book, magazine, etc. at a time. If several copies are required then the machine readable medium is run through the printer as many times as the number of copies required. All such output devices are controlled from some form of machine readable medium, or are connected directly to a computer.

Assuming that the material to be produced in braille has already been transcribed, the time taken by these two different types of output device to produce multiple copies of this transcribed material depends on two factors. These are the time taken in actually embossing and the time taken in resetting the equipment. The former factor is a simple function of embossing speed in both types of machine. The latter factor, however, depends on a different variable according to whether the embosser works in parallel or sequentially.

In the case of a parallel embosser the machine must be 'reset', e.g. the stereotype plates must be changed in the press, or the master changed in a vacuum-forming machine, as many times as there are number of pages in a single copy of the material to be produced. In contrast, a sequential embosser must be reset, e.g. the paper tape or cassette must be rewound to the beginning of the text, as many times as there are number of copies of the material to be produced.

These 'reset' times are a significant factor in the total production time, especially in the case of press production where stereotyped plates must be taken out of, and new ones set into, the press for each new page. This means that production systems using parallel outputs are less effective the fewer the numbers of copies to be produced, and that systems incorporating sequential braille embossers are most effective for producing single, or just a few copies, of material. Exactly where the changeover point comes for these two types of output depends, naturally, on the individual equipment. In general, however, it is possible to say that press production of braille is the most appropriate for material required in 20 or more copies upwards.

Characteristics of Braille Production Systems

The above classification of braille production equipment allows a simple, but nonetheless useful, classification of braille production systems to be made.

It can be seen from Figure 3.3 that four types of braille production system can be identified. An 'X' in a square indicates where a particular input can be coupled with an output in order to form a method for producing braille. Where squares are left blank, this indicates that the particular input and output corresponding to this position cannot be used together.

Each of these four different types of production system (A, B, C and D) have particular characteristics associated with them which help to determine which type of system is most suitable for a particular situation and production need. These characteristics are given below.

Type 'A' system (Braille input - Parallel output)

1. Skilled braillists are required for transcribing the texts to be produced.

2. Systems in this category are of a fairly simple type, although in the case of electronic braille encoding units being used, rather more complex routines can be involved, especially with regard to correcting the machine-readable medium after proofreading. However, where the

		BRAILLE			PRINT		
		Mechanical Braillewriter	Stereo-typer	Braille encoding	Print encoding On-line	Print encoding Off-line	Compositor Tapes
PARALLEL	Vacuum-forming	X	A			B	
PARALLEL	Press		X	X	X	X	X
SEQUENTIAL	Slow		C	X	X	X D	X
SEQUENTIAL	Fast			X	X	X	X

Figure 3.3: A simplified classification of braille production systems

situation allows it, such encoding equipment gives significant improvements over exclusively mechanical transcribing equipment.

3. Demands on the technical infrastructure within the country using the equipment are not particularly high for most of the systems in this category. Braillewriters, stereotyping machines and presses are fairly straightforward mechanical devices, although some are electrically-assisted, which are basically reliable and can be serviced by engineers with no special knowledge of braille equipment. In the case of braille encoding units being used, maintenance and service can be somewhat more of a problem.

4. Costs vary considerably within this category. Stereotyping equipment and presses are expensive if bought new. Such equipment can, however, be obtained second-hand, especially as more braille printing houses are going over to computerised systems. Vacuum-forming equipment is relatively inexpensive. Running costs of both these methods are high due to the high cost of plates and plastic. The cost of plates can, however, be considerably reduced by obtaining unwanted surplus sheet metal from canning factories, for example. This can then be cut, folded and punched on the premises of the printing house for a relatively low cost.

With respect to electronic equipment, there is a wide range of equipment and an equally wide range in prices. Such equipment can, however, be obtained for considerably less than the cost of a single stereotyping machine, so this input alternative should not be taken automatically as an expensive technique.

5. This category of production system should be regarded mainly as one for middle to large scale production, i.e. 20 or so copies upwards.

<u>Type 'B' system (Print input - Parallel output</u>)

1. All systems in this category involve electronic equipment and require computerised translation of print text to braille. They are, therefore, fairly complex systems to implement at the present time.

2. Skilled braille transcribers are not required for the input of text. This can be carried out manually by any keyboard operator or, in the case of more sophisticated systems, taken directly from digitally encoding media. Skilled braillists will, of course, be necessary in the development of such systems and probably in checking output also.

3. A high level of technical infrastructure should exist in the country using the system. It cannot be expected to buy a complete system which will function completely satisfactorily from the first time it is switched on. Qualified personnel will, therefore, almost certainly be required and this can be very expensive if they have to be brought in from other countries.

4. Development costs involved with this type of system can be relatively high, although costs are currently decreasing, especially with the development of microprocessor-based systems.

5. These systems are for relatively large-scale production, that is, for material required in 100 or more copies.

Type 'C' (Braille input - Sequential output)

1. These require electronic braille encoding equipment as sequential printers can only be controlled from some form of machine-readable medium.

2. These systems are only effective for small-scale production, i.e. less than about 20-30 copies. They are specially effective for production of single copies and short-length material in just a few copies such as information sheets for local needs, short articles, etc.

3. The technical infrastructure required in the country should be at a reasonably high level. That is to say, electronic equipment should be in common use, with facilities for buying spare parts (even from abroad) for the maintenance and servicing of fairly sophisticated electronic equipment, i.e. equipment incorporating integrated circuit technology.

Type 'D' systems (Print input - Sequential output)

1. These systems have mainly the same characteristics as Type 'B' systems.

2. The main difference between this category and Type 'B' is that Type 'D' systems are most effective for smaller production runs, i.e. 20-30 copies or less.

Chapter 4: Some General Principles in the Design of Braille Production Systems

In Chapter 2 the characteristics associated with the types of material typically used by the different groups of braille users were discussed. In Chapter 3 braille production systems were classified into four basic groups. In this chapter the classifications developed in the previous two chapters will be brought together so as to be able to specify the characteristics of production systems most appropriate for providing the different types of material needed by the groups of users.

Summary of the characteristics of the material used by the different groups of braille readers

School Children

1. Large range of types of material required - from complete books to short-length material such as supplementary classroom notes.

2. Specialised code systems and/or formats, e.g. mathematics, science, music, can often be required.

3. Size of production will depend on the level of development of the education system. If this has been in existence for several years, then it is likely that a good proportion of

the blind children in the country attend either local or special schools. In many developing countries, however, education of blind children is in its earliest stages with perhaps only a single school in existence. In many countries more extensive education for blind children will only be possible with the development of integrated educational facilities.

4. There is likely to be a demand for short-length, supplementary material, such as classroom notes, internal examination papers, information leaflets, etc.

5. Braille should be considered as one media among several, e.g. recorded material, raised diagrams, maps, etc., models and so on, if a fully adequate provision is to be achieved.

Students

1. Material will almost always be required in single or a small number of copies.

2. For certain subjects, demand for complex and/or specialised code systems and formats will be required.

3. Demand for material will probably be irregular, e.g. it will probably be much higher before, and at the beginning of, term when reading lists become available.

4. Some transcriptions may be of lasting value, i.e. copies may be requested at a later date or new editions of books may contain large selections from the previous edition. The appropriate sections from the original transcriptions can, therefore, be used in the new braille edition.

5. Students require access to considerable amounts of journal articles, abstracts, etc. Their ability to carry out their studies effectively may, therefore, be greatly facilitated by a 'transcribing service'.

Employed

1. Material required by braille readers for their jobs will, to a large extent, be specific to themselves, and therefore required in single copies.

2, Some reference material such as dictionaries, instruction manuals, directories, information leaflets, etc. may have relevance to a number of work areas and, therefore, be required in several copies.

3. Ability to handle incoming, and internal, information is an inceasingly common requirement for employment. This can, in part, be dealt with by 'transcribing services'.

4. Reference material used will require up-dating at certain intervals, which is not possible if the whole work must be re-written as a result.

Casual Readers

1. Books produced should, as far as possible, try to reflect the current output of print books, but the needs of known braille readers should also be catered for.

2. Magazines, periodicals, etc, which provide news, information, and general reading matter, intended for a wide audience.

3. Periodical material intended for special interest groups, e.g. sport, hobbies, the home, etc.

4. Short-length material such as timetables, information leaflets, local events calendars, etc., etc.

Some Design Criteria for Braille Production Systems

By comparing the characteristics of material typically needed by the main groups of users with the production characteristics of the various system types illustrated in Figure 4.1, some general guidelines can be drawn up regarding the design of braille production facilities.

The most important factor is that systems incorporating 'braille input' can be used for all types of braille material. This means that a system of this type should be chosen initially for the establishment of braille production. Consideration of the needs of school children, students and the employed show need for complex material of different kinds which, at the present time, computer translation systems cannot deal with effectively.

Braille input systems in Figure 4.1 are divided into two types - those which are mechanically based and those which incorporate electronic encoding equipment. Mechanical systems were used until recently by all the world's braille printing houses, thus quite a high level of provision can be achieved by the use of stereotype machines and presses (for medium and large scale production) and vacuum-forming equipment (for small scale production). These pieces of equipment have particular advantages in the present context as they are fairly straightforward to operate and maintain, are basically reliable, and can often be obtained second-hand, thus making the initial investment required relatively cheap. New, stereotype machines and presses are rather expensive.

This equipment has its disadvantages, however. Because the braille is embossed directly onto paper or metal sheets, corrections, or any revisions to the transcribed text are tedious and time consuming to carry out. Just how critical a factor this is will depend on the type of material being produced and the level of provision being aimed at. Another disadvantage can be the great amount of space taken up if master plates and paper sheets are to be kept in an archive.

	BRAILLE		PRINT
	Mechanical	Electronic	
PARALLEL	All types of material.	All types of material.	Non-complex braille codes and formats.
PARALLEL	With stereotype and press: Medium and large scale production. With braillewriter and vacuum-form equipment: Small scale production.	With remote controlled stereotype machine: Medium to large scale production.	Medium to large scale production.
PARALLEL	Difficult to correct, up-date and revise material.	Relatively straightforward to correct, up-date and revise material.	Convenient to correct, up-date and revise material.
PARALLEL	Rather slow production speeds.	Somewhat faster production speed due to time saved in correcting.	Fast production speeds possible, especially if text already in digital form and can be read directly into the system.
PARALLEL	Inconvenient long-term storage.	Convenient long-term storage.	Convenient long-term storage.
SEQUENTIAL		All types of material	Non-complex braille codes and formats
SEQUENTIAL		Small-scale production	Small-scale production
SEQUENTIAL		Relatively straight-forward to correct, up-date and revise material.	Convenient to correct, up-date and revise material.
SEQUENTIAL		Somewhat faster production speed compared to vacuum-form production due to time saved in correcting.	Fast production speeds possible. (See above)

Figure 4.1: Summary of production characteristics of the four basic types of system for braille production

Braille encoding systems also allow the production of all types of material. And, by using remote controlled stereotyping machines and sequential printers, both large and small scale production requirements can be catered for from the same input equipment. Use of machine-readable media can facilitate correcting and revising transcribed material and also provides a more convenient form of long-term storage than metal plates.

Equipment incorporating the use of electronic encoding equipment and equipment under remote control implies, however, greater complexity in not only the equipment itself but also in the organisation of production. One can say that the nature of production becomes more abstract and complications can arise out of this. This, however, will be taken up in more detail in the next section.

Systems incorporating 'print input' imply an even greater increase in complexity and, at the present time, cost. Costs of electronic equipment are decreasing yearly, however. The rationale for the development of computerised systems was partly to remove the dependence of braille production on a few skilled people, i.e. braille transcribers, and partly to rationalise production by automating processes where possible and to avoid the re-writing of texts which already have been written once onto machine readable medium. This latter aspect also allows a much faster distribution of braille material than could ever be possible with manual transcription.

In the present context, such systems (i.e. Type 'B' and 'D') can be disregarded as such systems demand a level of technical infrastructure in the country using the system which would imply that it would not be correctly classified as a 'developing country'.

Thus, in the succeeding chapters, systems of Type 'A' will be concentrated upon, especially those incorporating mechanically-based equipment. One of the main reasons for this is the fact that, in most countries to which this book is aimed, there is a technical infrastructure of a mainly "mechanical" type, as opposed to an essentially "electronic" technical infrastructure which exists in most European and North American countries. Even in countries where sufficient money might exist, introduction of sophisticated electronic equipment is likely to come up against considerable problems if local experience and local facilities for service and maintenance are not in existence.

However, a brief discussion of electronic braille encoding systems will be given in the next chapter as it is clear that many developing countries are approaching "electronic" sophistication and, therefore, some insight into the application of electronics to braille production may be useful.

SECTION III: Establishing Braille Production Facilities

This section deals with the more practical aspects involved in establishing braille printing facilities.

In Chapter 5 the introduction of mechanically-based braille production equipment is considered. This will cover:

- specifications and costs of braille production equipment
- the premises and/or floor area where the equipment is to be situated, and
- the personnel required to operate the various pieces of equipment.

Also, an overview of equipment and raw material costs for a small braille printing house is given in order to provide a guide to the initial costs involved in running a small braille production facility.

In Chapter 6, electronic-based systems for braille production are critically discussed. It is doubtful that, at the present time (January 1980) such systems are appropriate for the initial venture into braille production for a developing country. However, such systems are becoming more common and such equipment is increasing in capacity and sophistication but decreasing in price every year. Therefore, such approaches are worthwhile for all to know about and possibly appropriate for some developing countries which have experience of braille production already.

Chapter 5: Introduction of Mechanically-based Braille Production Facilities

Two separate systems will be considered in this chapter. Firstly, stereotype/press production and secondly, vacuum-forming production. These two production techniques are still the most common methods employed by braille printing houses around the world, and ideally both methods are necessary if comprehensive provision of braille material is to be given in the major areas of need.

Stereotype/Press Production

The major stages in this production process can be listed as follows:

(i) Stereotyping: This involves the writing of the manuscript on a special machine which embosses the braille characters into a folded metal plate.

(ii) Proofreading: A single copy of the braille is produced from the embossed plates. This is read and the errors are marked.

(iii) Correction: The incorrectly written braille characters are flattened and the correct characters are written in their place.

(iv) Printing: The corrected metal plates are put into a printing press and braille is embossed on paper.

(v) Gathering: The braille sheets are placed in their correct order.

(vi) (a) Stapling: The sheets are fastened by means of staples, or

(b) Binding: The sheets are bound in a way similar to ordinary inkprint books.

(i) Stereotyping

If visually handicapped stereotype operators are to be employed, then the manuscript to be transcribed must be read to the stereotype operator by a sighted person.

This can either be done directly, i.e. a sighted person sits with the stereotype operator and reads the text to him/her, or the material must be recorded onto tape first, then the operator transcribes from this tape. In the present context the use of a sighted person reading directly to the stereotype operator is probably the most appropriate, as use of a tape recorder involves an extra investment in equipment. However, some discussion of suitable tape recorders is given below.

Equipment

For the sighted reader any cassette recorder can be used for recording the manuscript. A more specialised cassette recorder is, however, preferable for the stereotype operator. This cassette recorder should have a foot control, and there should also be a facility whereby the tape rewinds the equivalent of two or three words when this foot control is released so that when the tape is started again, the last two or three words written should be heard first. The amount of tape automatically rewound can, on many machines, be adjusted.

These cassette machines are standard office equipment. Some typical machines are:

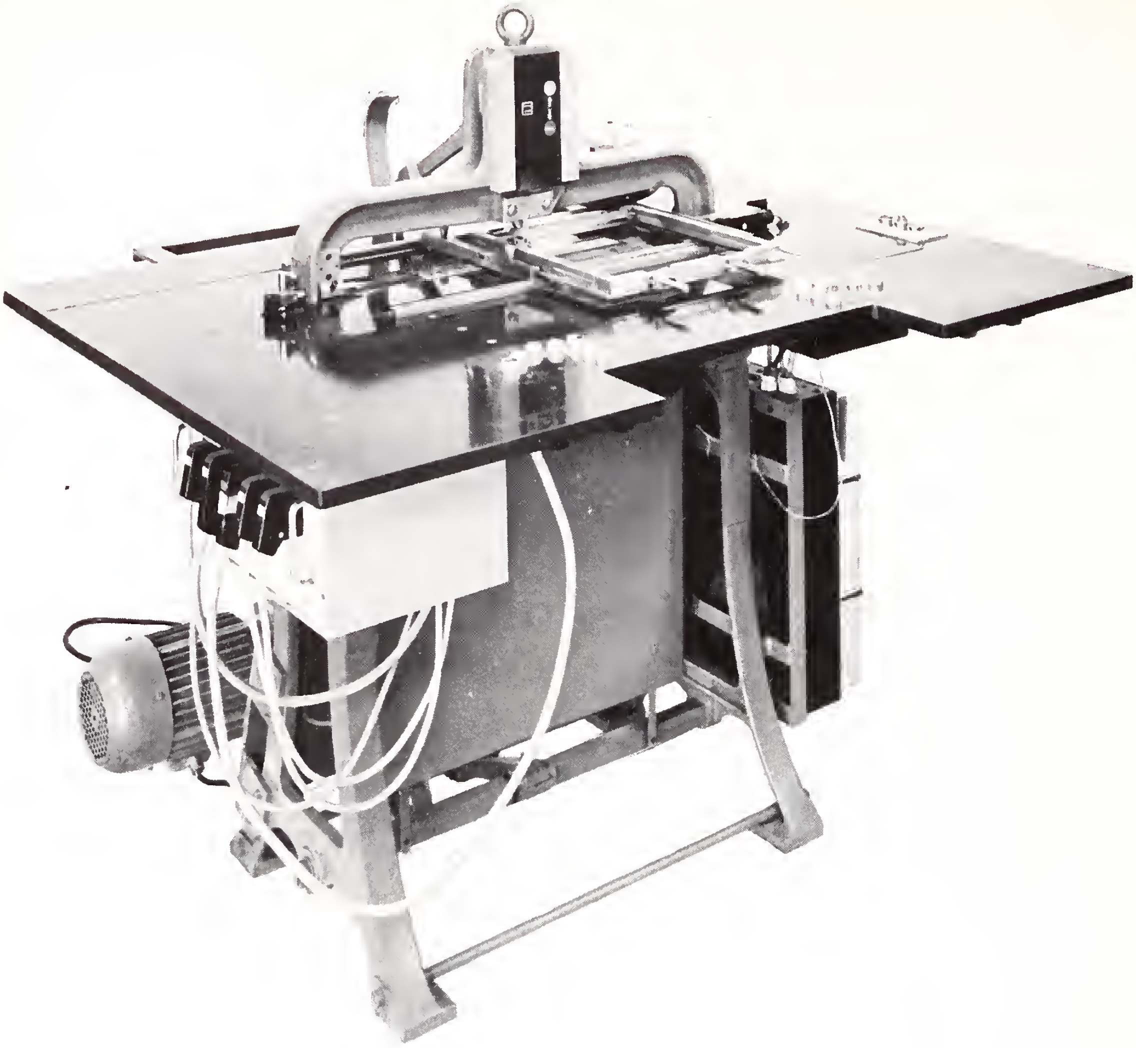
- Sony BM-25 or BM-30
- Sanyo TRC 8600.

There is considerable variation in prices between the different models. A machine with automatic repetition can, however, be expected to cost around $100 - $200.

Stereotyping machines emboss braille characters into double metal sheets (in actual fact a single sheet folded in half). These sheets are embossed on both sides, thus allowing interpoint braille, i.e. the braille embossed on the second side of the page is embossed between the characters on the first side. The position of the plate when turned is automatically off-set so that the dots embossed on the second side automatically come between those on the first side.

Stereotyping machines are heavy-duty machines built for dependability and long-life. They can, however, be noisy and heavy to operate compared with braille writers. Details in which the various machines can differ include whether the metal plate fits into the machine vertically or horizontally, plate size which the machine can take, and whether the keyboard is for one-handed or two-handed operation.

Details of the machines currently available are given on pages 64 - 67

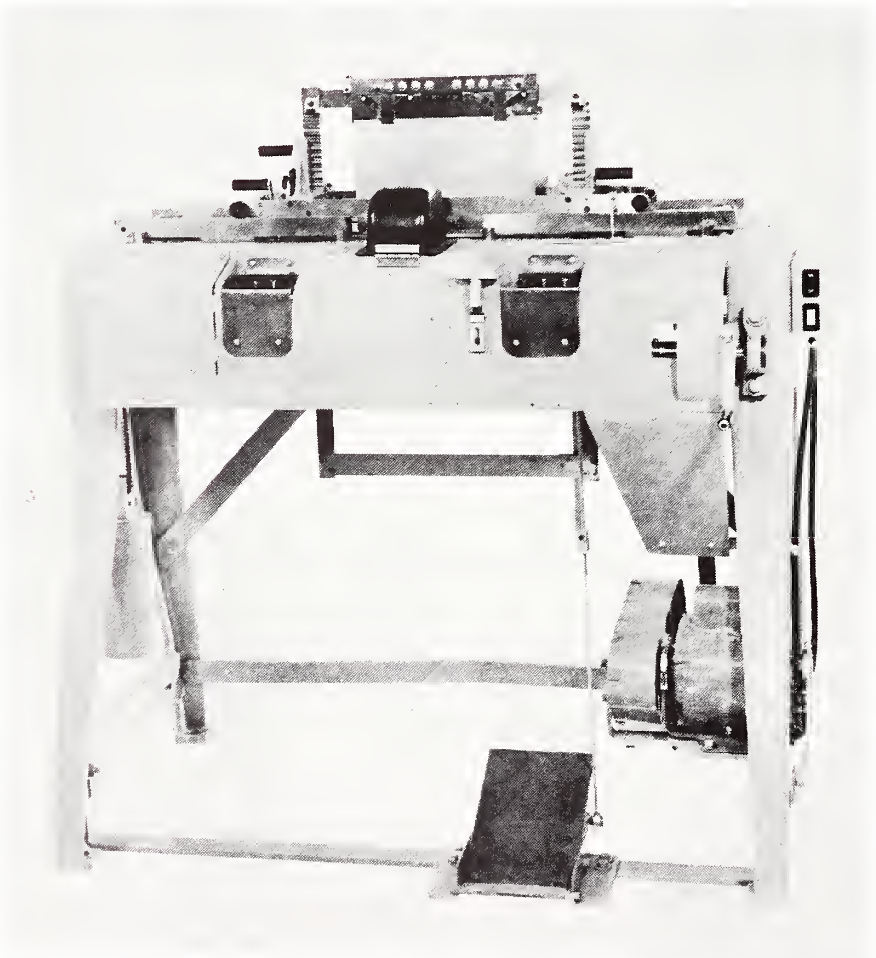


Marburg Braille Stereotyping Machine

Manufacturer:	Deutsche Blindenstudienanstalt Am Schlag 8 3550 Marburg/Lahn 1 German Federal Republic
Print Format:	270mm x 340mm (special format on request. This format allows 28 lines with 36 characters with large cell or 31 lines with 40 characters with medium cell size.
Power requirements:	Standard supply - 220/380 volts, 3-phase, 50 Hz. Different supplies possible.
Space requirement:	Approximately 1.9 m^2
Weight (net)	Approximately 350 kg
Weight (gross) overseas packing:	Approximately 450 kg
Volume requirement for overseas packing:	Approximately 2.6 m^3
Price:	Approximately $13,000 including correcting equipment and accessories and special packing case. (1979)

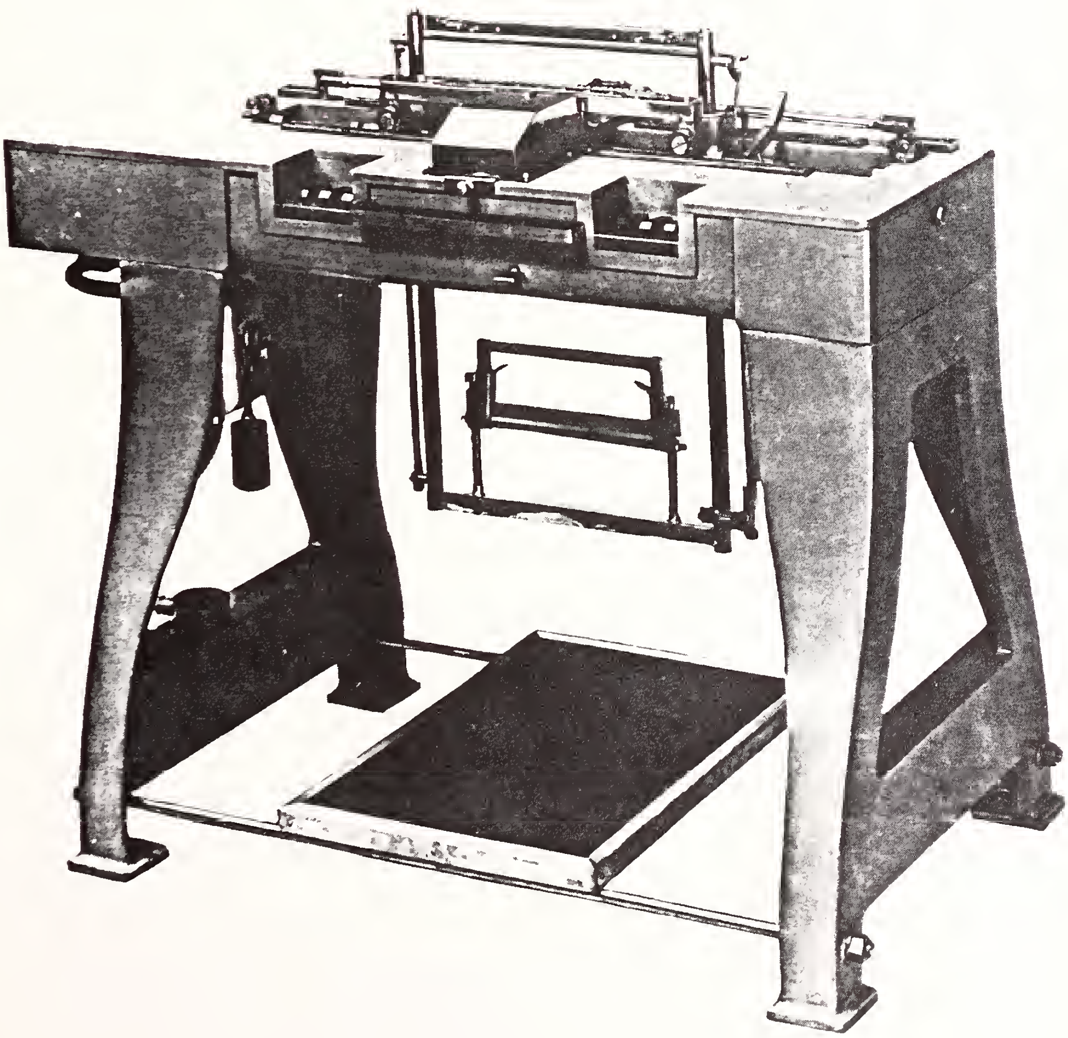
Howe Press Stereograph Machine

Manufacturer:	Howe Press of Perkins School for the Blind 175 North Beacon Street Watertown MA 02172 USA
Plate size:	254mm x 356mm (0.2mm thick)
Power requirements:	110/220 volts
Size:	914mm x 610mm x 914mm
Weight:	Approximately 261 kg
Price:	Approximately $8,250 (1979) FOB Watertown



Moy Stereotype Machine

Manufacturer:	Ernest F. Moy Limited 116-134 Bayham Street Camden Town London NW1 0BB England
Plate size:	393mm x 241mm
Power requirements:	AC electric motor wound to customer's requirements.
Size:	1120mm x 610mm x 910mm
Weight:	240 kg
Price:	Approximately $33,700 (1979)



Premises

Each stereotype machine should be located in a separate room which should be well isolated against noise. The dimensions of the room should be approximately 10 m^2 with, in the case of a sighted person reading to the operator, a place for him to sit. In the case of a sighted person recording the manuscript, a separate room will be required, which should be situated away from the stereotype and press equipment, where the recordings can be carried out. An appropriate power supply (see 'Equipment' above) must be available in the room. There should also be available in the room a table or working surface where corrections can be carried out.

Personnel

The person carrying out the reading or recording of the manuscrift should naturally have a good, clear voice and be a fluent reader.

A stereotype operator must obviously have full command of the braille code system(s) in use in the country. Blind, as well as sighted, people can be stereotype operators, and a reasonable degree of proficiency should be achieved within about one month. A stereotype operator should be able to produce approximately two corrected pages (i.e. one stereotype plate) per hour.

Plates for Braille Embossing

An additional aspect must be considered in connection with the use of stereotype machines. This is the metal plates used in them. Traditionally, a metal alloy consisting mainly of zinc is used for stereotype plates. Zinc, however, has become very expensive and in many countries alternatives have been looked for. One cheap source of metal plate which can sometimes be arranged is to use the wasteage from canning factories, or similar bulk users of metal sheeting. In these cases the metal usually has a high content of aluminium and is, therefore, somewhat harder than the traditional zinc plates. Such metals can cause a higher rate of wear on the stereotype machine but nevertheless a number of countries use such metal plates quite successfully. Such metal plates should be approximately 0.2mm thick.

If such metal plate is bought from bulk users it will almost certainly be in relatively large sheets (e.g. 1 m^2). This means that they must be cut down to the size required for use in the stereotype machine. This can be done quite easily with a manually-operated plate cutter. This, however, involves an extra investment in equipment and an extra stage in the production process. Thus, the cost of buying finished, zinc stereotype plates should be compared to the total costs of buying surplus sheet metal, cutting it to size, folding the cut sheets and punching the holes in them necessary for fixing them in the stereotype machine.

With regard to obtaining standard zinc stereotype plates, which are already folded and punched, it is best, in the first instance, to contact one of the major braille printing houses. The large braille printing houses can sometimes supply such sheets from their own stock, if only relatively few plates are required. If larger quantities are needed, then they can arrange contact directly with their own suppliers. The cost of such plates can be expected to be around $1.50 - $2.00, excluding transport, per plate. Each plate weighs approximately 0.3 kg. Among the large braille printing houses are the following:

EUROPE:

Deutsche Blindenstudieanstalt
Am Schlag 8
3550 Marburg/Lahn 1
German Federal Republic

Royal National Institute for the Blind
Braille House
338-346 Goswell Road
London EC1V 7JE
England

Organisation Nacional de Ciegos de Espana
Jose Ortega y Gassett 18
Madrid 6
Spain

Association Valentin Haüy
5-9 rue Daroc
75007 Paris
France

AMERICA:

American Printing House for the Blind
1839 Frankfort Avenue
Louisville
Kentucky 40206
USA

Clovernook Printing House for the Blind
7000 Hamilton Avenue
Cincinnati
Ohio 45231
USA

ASIA:

Nippon Lighthouse Welfare Centre for the Blind
4-37 Naka 2-chome
Imazu
Tsurumi-ku
Osaka City 538
Japan

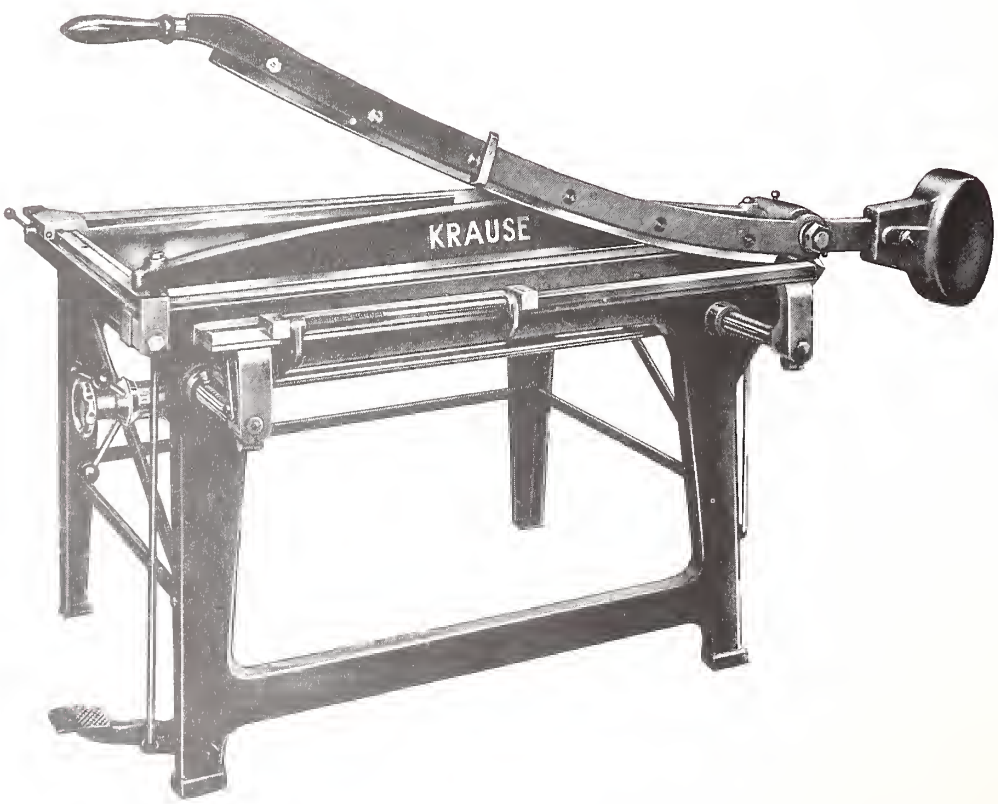
If a local supplier can be found for suitable metal sheet, then this will need to be cut to size, folded and punched.

For the first cutting a large metal cutter will be required capable of taking the size in which the sheet is bought. Simple, manual equipment is manufactured, although second-hand cutters may be possible to obtain from local printing shops or printers' suppliers. For new equipment, if it cannot be bought locally, the following company may be contacted:

Krause-Biagosch GmbH
Postfach 14 05 60
4800 Bielefeld 14
German Federal Republic

Plate Cutter

Model:	Light Duty Cardboard Shear Model D 106 U	
Cutting Length	1060 mm	
Floor space reqd.:	Width	950 mm
	Depth	1850 mm
	Height	920 mm
Net Weight:	Approximately 170 kg	
Gross Weight:	Approximately 280 kg (sea transport)	
Volume of sea case:	Approximately 0.81 m^3	
Price:	Approximately $2,700 FOB German port (1979)	



Krause Light Duty Cardboard Shear
(This can be used for cutting thin metal sheets)

Such large cutters are not very accurate and, therefore, a small cutter will be required for trimming the plates to the exact size required. Such a cutter is required even if ready cut stereotype plates are bought in order to cut off the fold at the top of the stereotype plate so as to allow it to be set into the press (see page

When the metal is cut to its approximate size, it must be folded so that it forms a double sheet corresponding to the eventual braille paper sheet size. The folding operation can be achieved with the help of the clamp which exists on the metal cutter. After making a fold in the plate, this fold can be pressed flat by putting just the folded edge under the clamp which normally holds the metal sheet in place when being cut and then forcing this clamp down onto the fold.

When folded, the plate must then be trimmed to its exact size. A small cutter is used for this which will allow accurate measurement of the plate. This folded plate must then be punched with the required holes so as to allow it be be set into the stereotype machine. Such a punching machine may possibly be obtained from the stereotype manufacturers. If this is not possible, one must be specifically made so that the holes will match the requirements of the stereotype machine exactly. Local workshops should be contacted in the first hand and if such a punch cannot be made locally, then the following firm can be contacted who will make one according to specification.

Alfred Sandersson Maskinfabrik AB
Djurgårdsgatan 19
Fack
580 02 Linköping
Sweden

Price: Approximately $1,000

(ii) Proofreading

This is an important stage in the production process if good quality material is to be produced.

Equipment

No special equipment is required.

Premises

A quiet office room will be required for the proofreader. It should be big enough to allow two people to work in it comfortably. This will be necessary when a sighted person must visually check the original text (see below). There should also be sufficient shelf space to allow the proofreader to keep all necessary reference books near to hand. Proofreading can also be carried out at home.

Personnel

The qualities required of a good proofreader are not easy to define nor are they easy to come by. Obviously very good command of braille is required but also thoroughness and ability to concentrate on details is necessary. The person should also have the ability to pick out logical inconsistencies in the text even though no obvious error can be defined without reference to the original book. A good educational background is clearly required by such a person, although not necessarily of the highest. Proofreading skills probably relate more to 'personality type' rather than simply to 'intelligence'.

(iii) Correction

Equipment

Correcting equipment can be bought together with the stereotyping machine. It consists of a stylus and hammer which can be used to knock down the individual dots of the incorrect braille cell or cells. These can then be rewritten either by setting the plate back in the machine (Note: This must be the same machine it was written on originally) and rewritten or, if only a few dots need to be rewritten, by means of a hand punch. (Note: Corrections must be complete before the plates are separated.)

Premises

There should be a strong table in the same room where the stereotyping is carried out.

Personnel

It is good policy for each stereotyper to correct his/her own mistakes.

(iv) Printing

Equipment

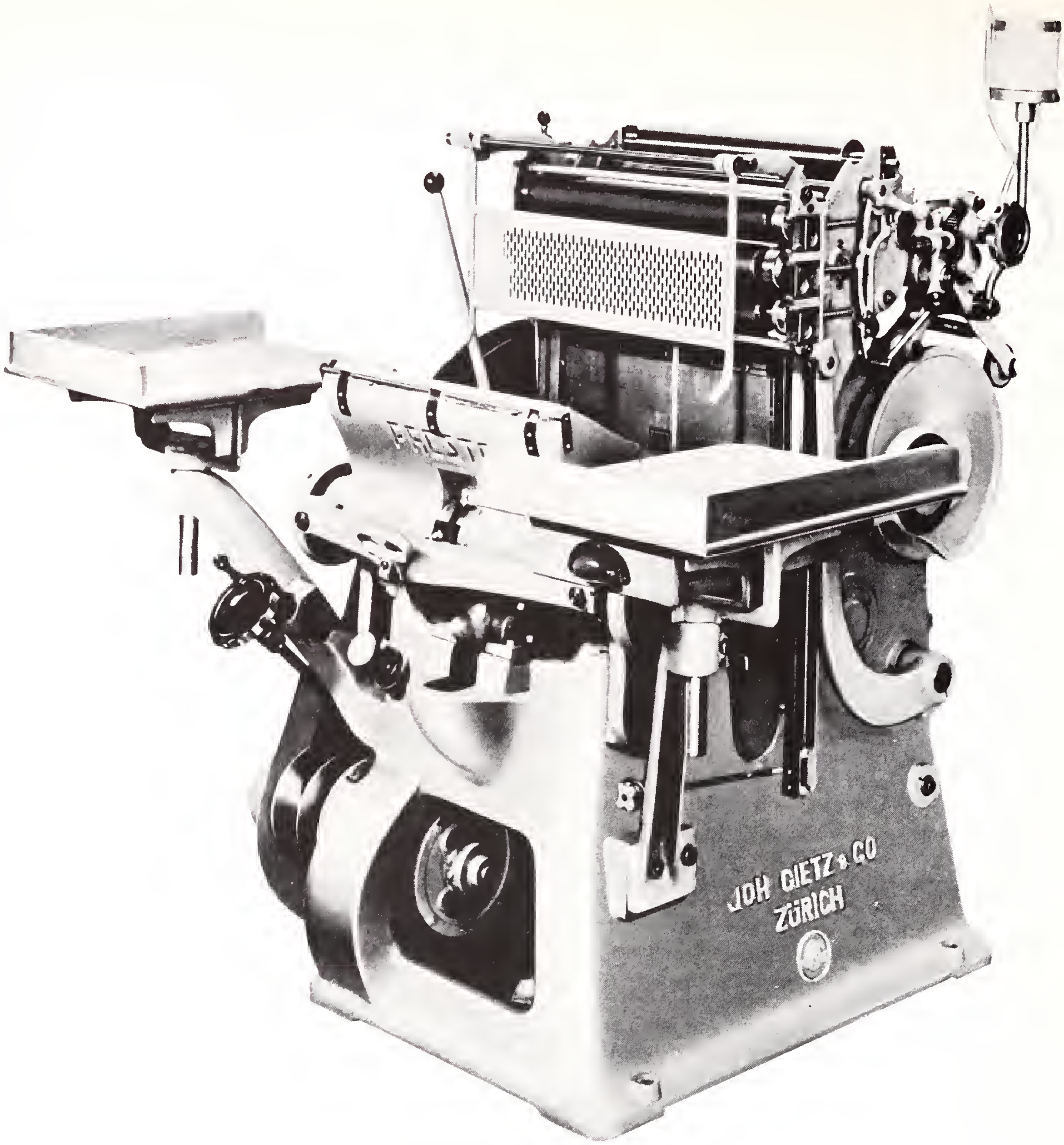
'Braille' presses are, by and large, standard machines which have been modified to take account of the fact that two embossed metal plates must be set into the press rather than a print master. Also, because the paper must be embossed, the high pressures of an embossing, rather than a printing, press should be used.

There is a considerable range of presses in use for braille production with speeds ranging from a few hundred pages to 40,000 pages per hour. There are also both hand-fed and automatic, rotary and flat-bed presses in use.

The majority of presses in use are of the flat-bed type and it is generally considered that this type of press gives a better quality braille than a rotary press. The main advantage of rotary presses lies in the high speed of operation possible. However, this is not an important aspect in the present context.

New presses are expensive pieces of equipment so it is recommended that a thorough survey of large braille printing houses and local printers should be made in order to find out whether a suitable letterpress printing press can be obtained second-hand. In general, presses are reliable, long-lasting machines so that quite old machines, in good condition, can be bought quite safely.

If a second-hand press cannot be obtained, then new hand-fed flat-bed presses are still manufactured.



Gietz Flat Bed Press

Hand-fed, Flat-bed Presses

1. Gietz Hand-fed Platen Press

Manufacturer:	Joh. Gietz & Co. CH-8305 Dietlikon ZH Brüttisellerstrasse 8 Switzerland
Model:	DHT
Maximum sheet size:	330 mm x 480 mm
Impressions/hour:	1800
Power Consumption:	1.1 kw
Floor space:	1350 mm x 1450 mm
Net Weight:	1150 kg
Gross Weight:	1400 kg
Price:	N/A

2. Titan Cutting and Creasing Platen Press

Manufacturer:	Wekama Kartonagenmaschinen Gräbner u. Co. 4800 Bielefeld 14 Postfach 14 05 60 German Federal Republic
Models:	Titan 0, Titan EM 0
Platen size:	810 mm x 610 mm
Impressions/hour:	900-1800
Power requirements:	220/380 volts, 50 Hz, 3-phase AC supply. (Other voltages and/or 60 Hz available at extra cost - approx. $140.)
Floor space:	Titan 0: approx. 1540 mm x 1520 mm Tital EM 0: approx. 1580 mm x 152 mm
Net Weight:	Titan 0: 2,800 kg Titan EM 0: 2,900 kg
Gross Weight:	Titan 0: 3,100 kg Titan EM 0: 3,200 kg
Cubic box measurement:	Approx. 6.2 m^3
Features:	Titan 0: Pedal operation for starting machine. Titan EM 0: Push button operation, timer for variable dwell time in open position for feeding.
Price:	Titan 0: Approx. $27,000) Titan EM 0: Approx. $30,400) June 1979

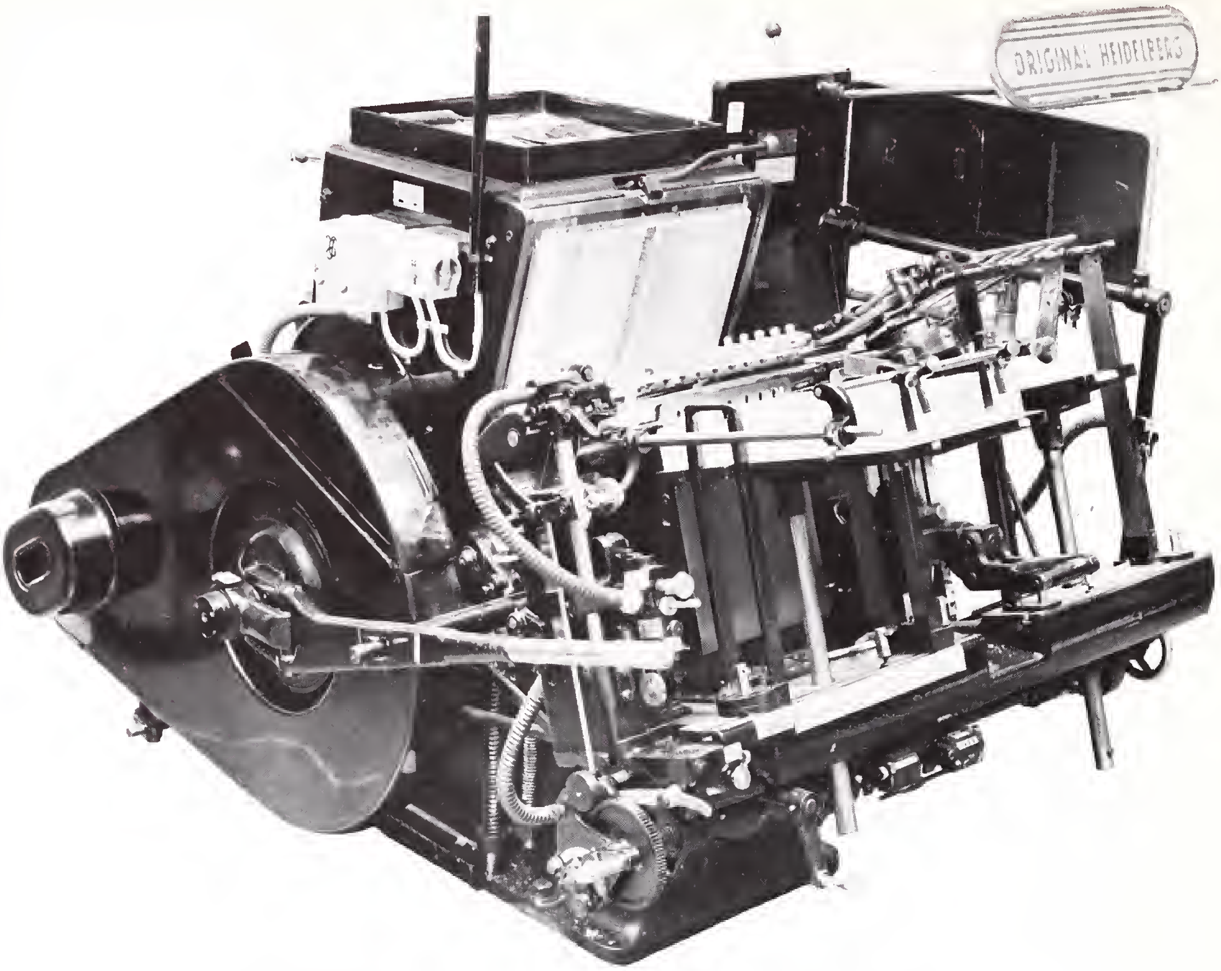
3. Simon Hand-fed Platen Press

Manufacturer:	Simon Container Machinery Limited P.O. Box 31 Stockport Cheshire SL3 ORT England
Model:	TXA
Maximum sheet size:	800 mm x 1079 mm
Impressions/hour:	900-1200
Power Requirements:	380/440 volts, 3-phase, 50 Hz. Special voltages charged extra.
Floor space:	3251 mm x 1930 mm
Net Weight:	4902 kg
Gross Weight:	5310 kg
Price:	Approx. $47,000

Presses with automatic feed can also be used for braille production and two such machines are available ready converted for braille production. A press with automatic feed is obviously considerably faster than one with manual feed. However, a manual press of some type should be available in addition to an automatic so as to allow a single copy for proofreading to be taken from the embossed stereotyped plates.

The two automatic presses which have modifications for braille available as given on the following pages.

Correcting an error in a braille stereotype plate



Heidelberg GTS Automatic Feed Press

Heidelberg Cutter and Creaser

Manufacturer:	Heidelberger Druckmaschinen AG Postfach 10 29 40 D-6900 Heidelberg German Federal Republic
Model:	Model GTS 34 x 46 cm. Special design for braille embossing.
Maximum sheet size:	340 mm x 460 mm
Impressions/hour:	4,000 sheets per hour
Power requirements:	380 volts, 3-phase, 50/60 Hz
Dimensions:	2080 mm x 1480 mm x 1470 mm
Floor space for press alone:	2080 x 1700 mm = 3.5 m^2
Foundation for press:	1080 x 540 mm = 0.6 m^2
Net Weight:	2220 kg
Gross Weight:	2450 kg
Total floor load:	2350 kg
Normal working space:	3500 x 2700 mm = 9.5 m^2
Price:	$21,000-$22,100 FOB German port, including sea worthy packing, electrical driving equipment, standard accessories. (September 1979)

Krause Automatic Braille Embossing Press

Manufacturer:	Krause-Biagosch GmbH Postfach 14 05 60 4800 Bielefeld 14 German Federal Republic
Model:	Automatic Braille Embossing Press, Model C 64-50 Qb.
Maximum sheet size:	640 mm x 500 mm
Impressions/hour:	Approx. 1320 to approx. 2400
Power requirements:	380 volts, 3-phase, 50 Hz
Cubic box dimensions:	Approx. 11 m^2
Net Weight:	Approx. 3200 kg
Gross Weight:	Approx. 4050 kg (2 cases total)
Price:	Approx. $56,500 (with vacuum system for paper feed). FOB German port. (January 1979)

Rotary presses can also be used for braille production. The main feature of these presses is that they are capable of high speed operation which, in the present context, is not so important. A disadvantage with rotary presses is that the plates must be bent before they can be set into the press so this involves an extra operation in the production process. There is a rotary press specially made for braille production available from:

Deutsche Blindenstudienanstalt
D-3550 Marburg
Postfach 1150
German Federal Republic

This machine is capable of around 10,000 sheets per hour and costs approximately $18,000 (1977). Further details can be obtained from Marburg.

Marburg Rotary Braille Press

Plate and Paper Preparation

There are two aspects which are closely related to the printing of braille. These are the preparation of plates for the printing press and the preparation of paper. Whether both, or either, of these will be necessary will depend on how the paper and plates are bought and the kind of press used. For these reasons they will be considered separately.

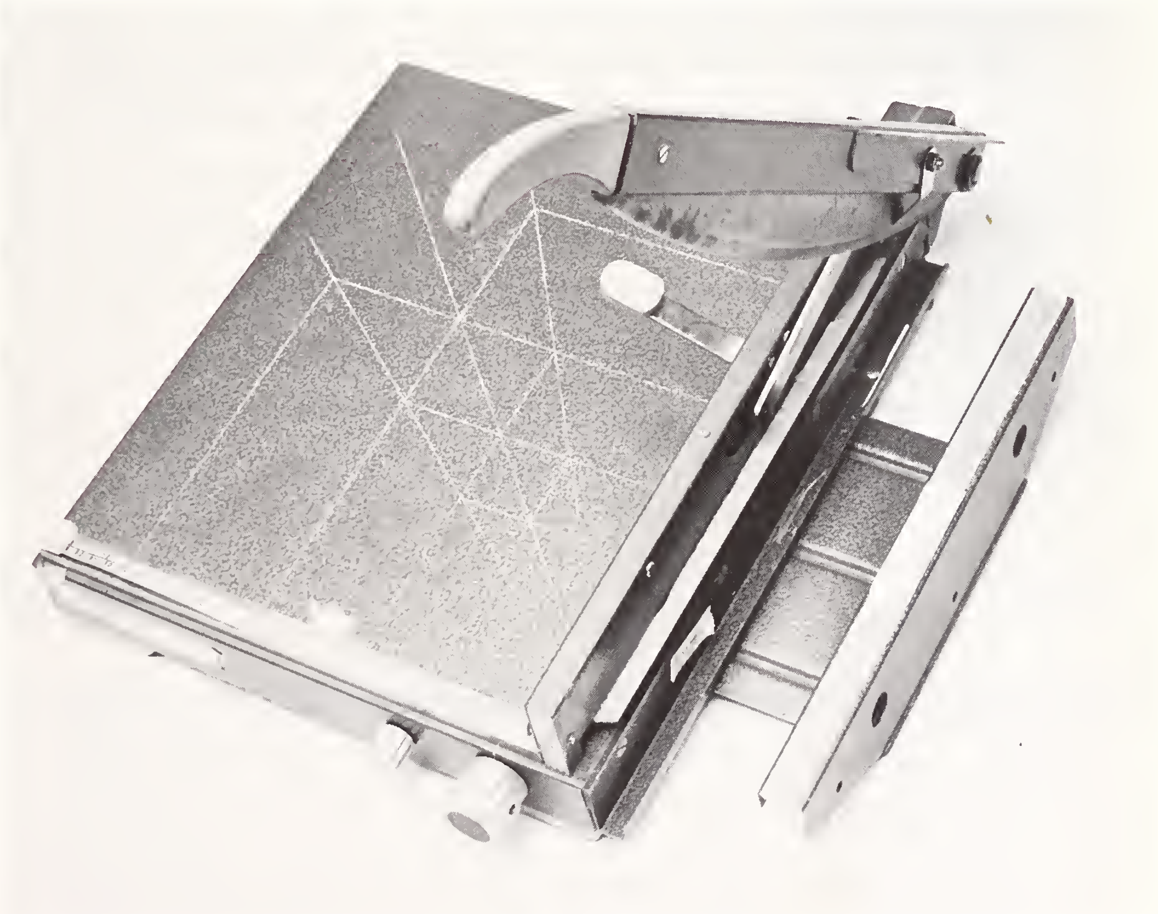
1. Plate Preparation

After the stereotype plates have been corrected they must be separated before they can be placed in the press. There are, however, certain manually-fed presses where this is not necessary. A small plate cutter can be used for cutting of the folded edge of the stereotype plate. Local print workshops or suppliers should be able to supply such equipment but if not, the following company can supply them.

The plates, after having been separated, should always be kept together by means of two small pieces of masking tape.

Small Plate Cutter

Manufacturer:	EBA Maschinenfabrik Adolf Ehinger KG D-7460 Balingen 1 Goethestrasse 10 Postfach 12 40 German Federal Republic
Model:	EBA Express 420
Cutting length:	420 mm
Dimensions:	640 x 340 x 120 mm
Price:	Approx. $165



Small Plate Cutter

2. Paper Preparation

If only one size of paper is to be used then the paper can be bought already cut to this size. For this reason, it is of advantage to choose a standard size, such as A3 (420 mm x 297 mm). If two or more sizes are to be used, e.g. one for books and one for magazines, then it is best to buy the paper in the larger size and then cut this to the smaller size on the premises. The smaller size should, therefore, be, as near as possible, an exact division of the larger size, e.g. A4 (210 mm x 297 mm is half A3 (420 mm x 297 mm)) so as to avoid wastage.

Manually operated paper cutters (guillotines) can be used, although these can only cut a few sheets at a time. Such equipment can be obtained from most printers' or office suppliers. If large quantities of paper must be cut then an electric machine would be needed. These are standard pieces of equipment in print workshops so one may be obtained second-hand or print shops may be prepared to loan of hire out the use of their machine.

Premises

The press room should be about 60-100 m^2 and its floor should be strong enough to carry a load of 1,500 kg/m^2. There should be a power supply capable of providing 380 volts, 3-phase at between 2.5 to 5.5 kw. The room ideally should be large enough to store the paper stock or at least a considerable proportion of it. This can be important if differences in temperature and humidity exist in the same building; paper is sensitive to changes in these factors and exposing paper to such changes should be minimised as much as possible. Sufficient strong shelves should also be provided for short-term storage of plates.

Personnel

Partially-sighted persons are capable of operating printing presses, providing they have suitable guards and safety devices, which most new machines have. No special requirements are needed in order to be a press operator, although a basic interest and 'common sense' with regard to machinery would be advantageous.

(v) Gathering

The braille from the press will be in the form of double sheets, which will require gathering together in their correct order before binding.

Equipment

Although automated equipment exists for this operation, it is very expensive. Most braille printing houses gather, therefore, by hand. In the present context, this is also the method recommended.

Personnel

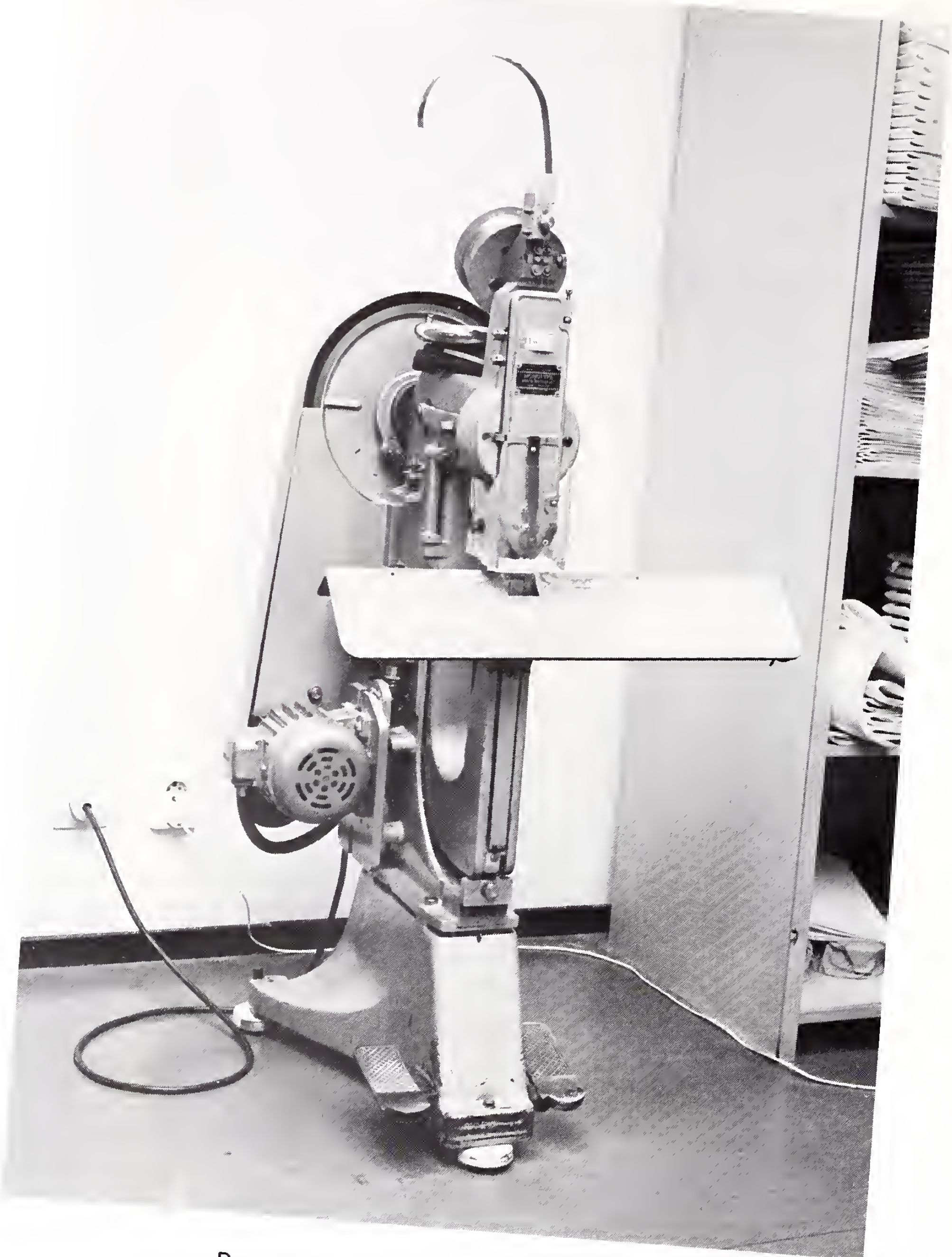
Gathering of braille sheets provides good opportunity for the employment of visually handicapped persons. Some ability to read braille is advantageous although not essential.

(vi) Stapling and Binding

(a) Stapling

Stapling in the present context refers to setting in one or two staples in the centre-fold of double braille sheets, i.e. one sheet has four sides of braille. A number of standard machines can be obtained which can carry out such stapling. These may be possible to obtain second-hand either locally or from large braille printing houses abroad. Manufacturers of new equipment are given on the following pages.

The Braille Printing House in Dar-es-Salaam, Tanzania



Boston No. 7 Stitcher

Stapling machines

Manufacturer:	Bostitch Division of Textron Inc. East Greenwich Rhode Island 02818 USA
Model:	Bostitch No. 7 Wire Stitcher
Speed:	Up to 125 stitches per minute
Power requirements:	Selection of motors dependent on power supply (voltage and frequency).
Floor space:	584 x 660 mm
Weight:	128 kg - approx. 182 kg when crated
Price:	Approx. $4,000 (September 1979)

Gerd Winterling KM 17 Stitcher

Manufacturer:	Gerd Winterling Grafischer Maschinenhandel und Zubehör Gustav-Werner Strasse 6 7443 Frickenhausen 3 German Federal Republic
Model:	Model KM 17
Power Requirements:	380 volt, 50 Hz
Machine Dimensions:	620 x 1160 x 700 mm
Saddle length:	620 mm
Weight:	Approx. 100 kg
Price:	Approx. $2,400 incl. packing FOB German port

Premises

An area of no more than 10 m^2 is required for a simple stapling machine. Suitable tables or benches should be placed on each side of the machine for stacking unstapled and stapled material.

Personnel

This equipment is very straightforward to use. Visually handicapped persons can operate this equipment quite easily.

(b) Binding

For books which will be used over a period of time, a secure and strong binding will be required.

Hand Sewing

Braille books can be hand-sewn in a similar fashion to traditional book binding methods. One special aspect involved with the binding of braille books is to set thin strips of braille paper between the embossed sheets such that they lie along the left hand margin of the sheets. This extra thickness in the bound part of the book is to compensate for the extra thickness of the paper where it has been embossed with braille. Failure to do this causes the braille pages to bow upwards when bound so that the covers do not lie flat when the book is closed.

Equipment

Little is required in the way of equipment in order to sew books by hand. Suitable needles, thread, etc. should be possible to purchase locally.

Premises

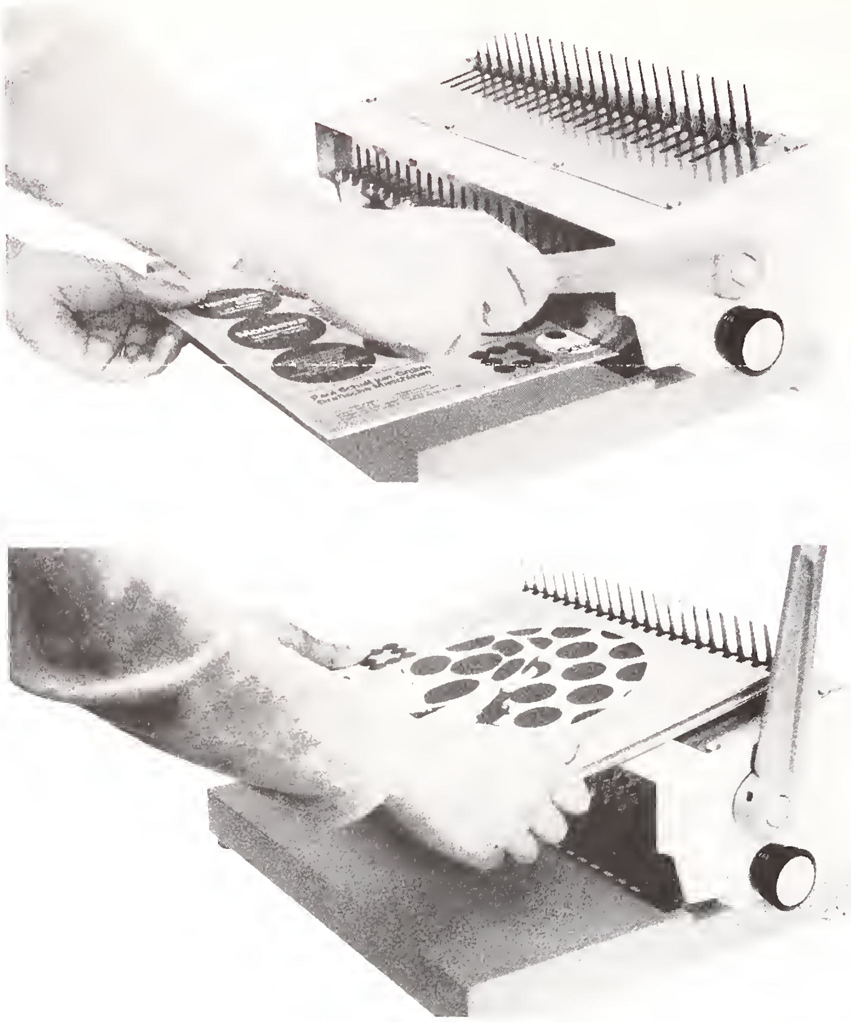
A working space of approximately 10 m^2 should be sufficient for the binding department. Good storage space and working surfaces should be provided.

Personnel

This is a relatively specialised and skilled job, thus a person trained in book-binding should be available for training others if a skilled binder cannot be employed. Another possibility is to send the books out to be bound, although this involves a significant extra cost.

Simple Binding Equipment

A number of relatively new and inexpensive techniques are being introduced in a number of braille printing houses which are considerably quicker and easier to carry out than the traditional binding techniques. These involve punching a row of holes down the left hand side of the sheets to be bound, then inserting some type of 'ring' or 'spiral' binding element into these holes and fixing it.



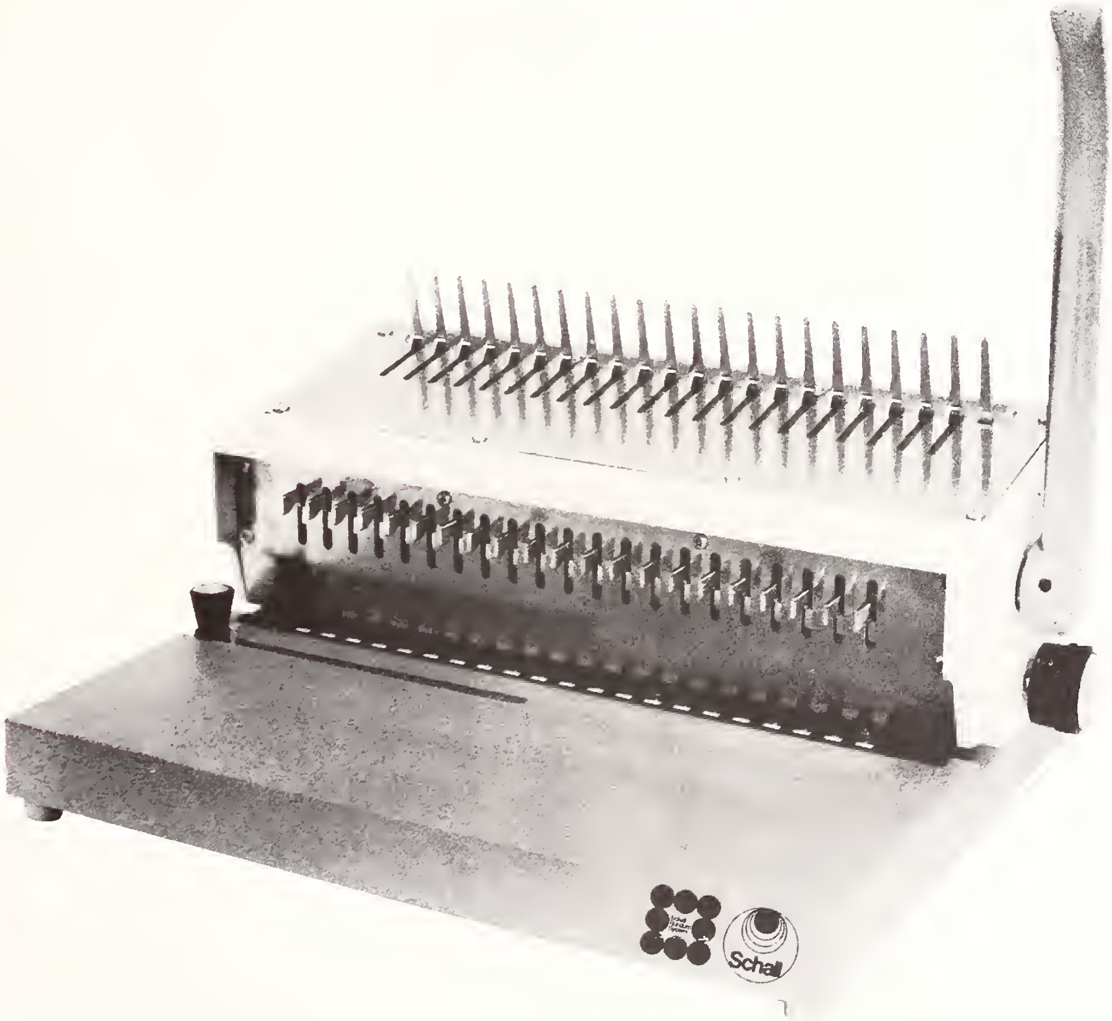
The two operations involved in comb binding are illustrated above. First, holes are punched along the edge to be bound (top). Then, the plastic comb is inserted and closed with the aid of the upper part of the machine (bottom).

Comb Binding

Manufacturer: Chr. Renz Maschinenbau GmbH
Postfach 1120
Rechbergstrasse 44
D-7072 Heubach
German Federal Republic

Model: Combi-S, Types 33 and 34
Combined Handpunch and Binding Machine

Price: Approx. $525



Schall Plastic Binding Machine
(This machine is sold by Renz)

Gestetner Velo-Bind

Manunfacturer:	Gestetner Duplicators Limited P.O. Box 23 Gestetner House 210 Euston Road London NW1 2DA England
Model:	Velo-Bind Machine, Model 100
Power Requirements:	220 volt, 50 Hz
Machine Dimensions:	178 x 552 - 406 mm
Weight:	12.5 kg
Price:	Approx. $1,200

Ring Wire Binding

Manufacturer:	Chr. Renz Maschinenbau GmbH Postfach 1120 Rechbergstrasse 44 D-7072 Huebach German Federal Republic
Model:	Combi - SRW - Combined Handpunch and Closer
Price	Approx. $485

Ring Wire Coms (per 1000 ex works, excl. pack.)

For A4 size (297 mm)

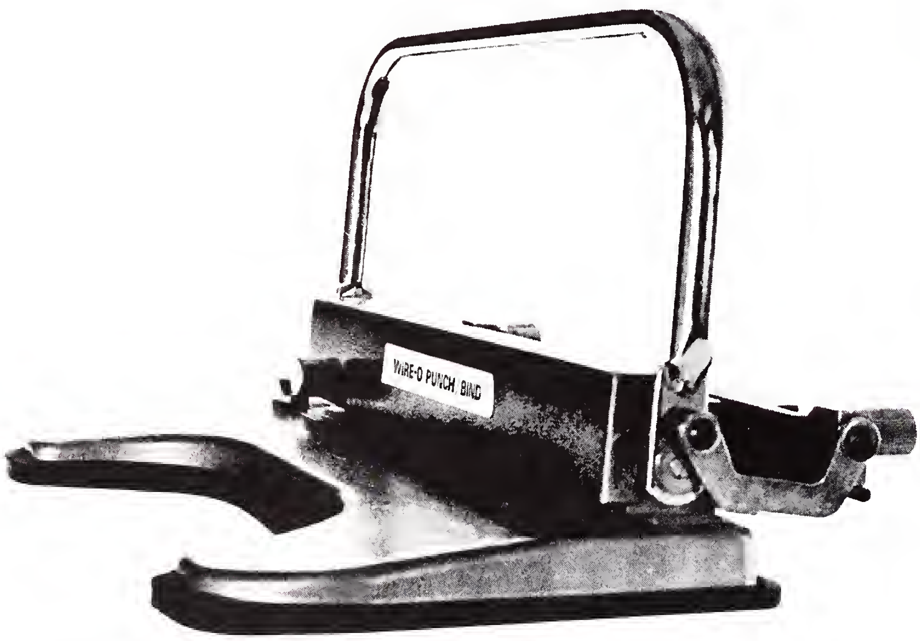
Diameter	Price
4.7 mm	$125
6.3	$134
8.0	$163
9.5	$177
11.0	$204
12.7	$215

Spiral Binding

Manufacturer:	Chr. Renz Maschinenbau GmbH Postfach 1120 Rechbergstrasse 44 D-7072 Heubach German Federal Republic
Model:	HDWA - Universal spiral winding machine HST 78 - Hand Punch
Price:	HDWA - $2,000 incl. one winding mandrel HST 78 - $440 Winding Mandrel - $94

The illustrations show how the Wire-O Punch/Bind Unit is used.

Manufacturer:	James Burns Bindings Limited Douglas Road Esher Surrey KT10 8BD England
Model:	Wire-O Punch/Bind Unit PB 34
Machine dimensions:	400 x 263.5 x 89 mm
Weight:	8.7 kg
Price:	Approximately $700 (1980)



The Wire-O Punch/Bind Unit

Premises

An area of about 10 m^2 is required for a small binding department. The room should be well provided with flat working surfaces, shelves and cupboards. The binding can be carried out in the same room as the gathering if there is sufficient space.

Personnel

No special requirements are necessary in order to be able to use these binding techniques. They can also be carried out by visually handicapped people.

Braillewriter/Vacuum-Forming Production

The major stages in this production process can be listed as follows:

(i) Transcribing

The braille is written directly onto braille paper.

(ii) Proofreading

(iii) Correction

(iv) Vacuum-forming

This is a special method for making copies of the braille sheets in plastic.

(v) Binding

(i) Transcribing

Equipment

The Perkins braillewriter is now in very widespread use throughout the world and is recommended for all transcribing work. One of its main advantages is that paper can be replaced in the machine and corrections written in after the incorrect dots have been flattened down.

Perkins Braillewriter

Manufacturer:	Howe Press of Perkins School for the Blind 175 North Beacon Street Watertown MA 02172 USA
Paper size:	290 x 355 mm
Machine dimensions:	394 x 299 x 246 mm
Weight:	4.5 kg
Price:	Approx. $235

The Perkins Braillewriter

Premises

A standard office room will be required for this work. If sighted people are to carry out the work, a 10 m^2 area can be shared by two people. A visually handicapped transcriber will, however, require a room to himself as he will need to listen to a tape recorder. A desk, chair and suitable shelves and/or cupboards will be required for reference books, paper, etc.

Personnel

See "Personnel" for stereotyping equipment above.

(ii) Proofreading

As for stereotyping above.

(iii) Correction

Corrections must be made directly on the written braille copy. This is done by pressing the individual dots down with a blunt stylus then rewriting the correct braille symbol. As with stereotyping mistakes involving several letters or words, this can mean that the whole page or several pages must be entirely re-written.

Equipment

Any narrow, blunt-edged object can be used to press down the dots. The correct dots can be written in either by putting paper back into the braillewriter or by means of a slate and stylus. A 4-line 40 cell slate designed to enable corrections to be made on a sheet of braille produced on a Perkins brailler is available from:

Howe Press of Perkins School for the Blind
175 North Beacon Street
Watertown
MA 02172
USA

Price: $3.75 (1977)

Premises

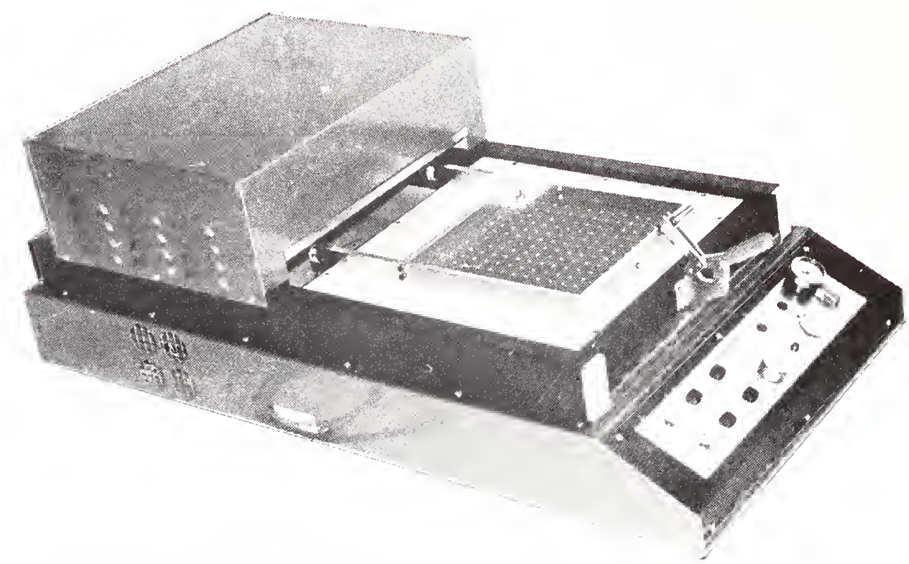
The transcriber can carry out the correction work in the same room in which he wrote the material.

Personnel

The corrections should be carried out by the person who carried out the original transcribing. In this way errors which occur systematically can be eliminated by the transcriber.

(iv) Vacuum-Forming

Equipment



Clarke Model 375 Vacuum forming machine

1. Clarke Model 375

Manufacturer:	C.R. Clarke & Co Carragamman Lane Ammanford Dyfed SA18 3EL Wales
Max. sheet size:	375 x 375 mm
Max. sheet thickness:	2 mm
Power requirements:	240 volts, 8.5 amps (max), 50Hz
Max. heating cycle time:	15 seconds
Price:	Approx. $1,700 (1980) Special size clamps, approx $45 extra Std. clamp sizes supplied with each machine, i.e. 280 x 290 mm and 280 x 216 mm.

2. Thermoform

Manufacturer:	American Thermoform Corporation P.O. Box 125 8640 East Slauson Avenue Pico Rivera California 90660 USA
Max. forming area of machine:	254 x 267 mm
Max. height of master:	Less than 6 mm
Power requirements:	115 volt/60 Hz (110 volt/50 Hz and 230-240 volt/50 and 60 Hz available at additional charge of $45)
Warm-up time:	Under 10 minutes
Capacity:	150-200 copies per hour
Price:	$1,070 (1979) includes one clamp frame and platen.

Additional clamp frames and platens:

Large:	11" x 11.1/2"	$98
Small:	9.3/4" x 11.1/2"	$98
Letter:	8.1/2" x 11"	$98

Premises

It is most important that the room where vacuum-forming is carried out has good ventilation as fumes are given off in the process of warming up the plastic sheets.

Personnel

No special qualifications are required by the person who operates a vacuum-forming machine. It can also be carried out quite safely by a visually handicapped person.

(v) Binding

The techniques described under 'Binding' in the previous section on stereotype-press production can also be used for binding plastic sheets.

Overview of Equipment and Raw Material Costs for a Small Braille Printing House

This book is primarily aimed at countries with relatively few braille readers and without any access to braille production facilities suitable for multiple copy production. Thus, this section considers in more detail the basic costs involved in equipping and running a braille printing press appropriate for such countries.

Equipment

The minimum equipment required will be the following:

1	stereotype machine	Approx.	$10,000
1	press	"	$22,000
1	small plate cutter	"	$1,700
		TOTAL	$33,700

The prices given are the approximate prices of equipment purchased new. They are 'FOB' prices, i.e. transport, custom taxes, etc. must be added. It should be emphasised, however, that each of these pieces of equipment may be possible to obtain second-hand. Thus, some large braille printing houses should be contacted and local print shops and printers' suppliers should also be contacted as the

With this equipment, ready cut and punched plates must be bought and a single size of paper must always be used so that this can also be bought ready cut to the required size. If only relatively small amounts of paper are required (less than 1,000 kg) then braille printing houses should be contacted to see if they can supply the paper from their own stocks.

The printed braille sheets can be gathered by hand and sewn together by hand. This method of binding produces good quality books and is cheap, It is, however, slow.

Cost of Raw Materials

The probable production needs to take priority in such a small braille printing house are school books and magazines of general interest. These two types of production will be considered separately.

(a) School Book Production

One reasonable stereotype operator should be able to produce an average of 2 braille pages (i.e. one stereotype plate) per hour. This includes time spent correcting the plate, but not proofreading time.

Thus:

2 pages/hour = approx. 12 pages/day
= approx. 2,500 pages/year.

If the books produced have an average of 150 braille pages, then:

approx. 16 books can be produced per year.

If these books are produced, on average, in 75 copies, then:

approx. 187,500 pages will be printed which corresponds to:

approx. 47,000 double sheets (e.g. A3 size (420 x 297mm).

The paper can be bought in A3 size and

1,000 kg A3 paper contains approx. 55,500 sheets, and costs approx. $2,000 (FOB manufacturing country).

This quantity of paper can, therefore, be taken as roughly corresponding to one years production requirement for paper.

Approximately 1,250 plates will be needed for one years production and each plate (ready cut and punched costs approx. $1.50 (FOB). Thus:

1 year supply of plates will cost approx. $1,875.

<u>Total cost of raw material can, therefore, be estimated as being</u>:

<u>$3,875</u>

(b) Magazine Production

A reasonable magazine production level for a small braille printing house would be a monthly publication of approximately 20 braille pages, and with a circulation of approximately 250 copies/month.

This means that:

Yearly production = 20 x 12 = 240 pages
= 120 stereotype plates

Cost of stereotype plates at $1.50 each = $180

If 250 copies are made of each magazine, then:

Yearly need for braille paper (A3 size or equivalent) = 1,500 sheets.

Approx. 300 kg of paper will be required to cover this requirement (including some wastage) which will cost approx. $700.

Total cost of raw material can, therfore, be estimated as being:

$880

There are numerous factors to be added to the above costs in order to arrive at the actual cost of production. These include depreciation of machinery, salaries, cost of premises, cost of binding, distribution costs, administration, etc. Costs of braille production are discussed in more detail in Chapter 11.

Chapter 6: Electronic Braille Production Systems

General Considerations

Since the first computerised braille production system was developed at the end of the 1950's, considerable development has taken place in the area of electronics generally, and computerisation in particular. Although this development has caused significant and continuing decreases in costs of electronic equipment, the successful application and use of such equipment depends on many more factors than just being able to afford to buy such equipment. These factors are discussed below when considering advantages and disadvantages of such systems.

In order to keep within the context of this handbook, only systems where dependence on a computer is not essential will be considered. Systems dependent on a computer program for the conversion of ordinary text to braille are most rational in countries where labour cost is high, equipment is relatively cheap, and expert technical back-up is easily available. In developing countries this is not usually the case; here labour is usually readily available but equipment, spare-parts and often expert technical back-up, would have to be imported and would therefore be expensive especially as foreign currency if often scarce.

Nonetheless, electronic systems can be considered as having two particular applications in the present context. These are as follows:

1. Countries where there already exists modern stereotype machines and a braille press, and where a need to expand production exists.

In this case, the use of electronic braille input devices offer a cheaper alternative for expanding transcribing capacity, and better flexibility in production.

2. Countries wanting braille production facilities to serve a particular, and relatively small need.

An example here is a resource centre catering for school books and other educational material. These are often required in a few copies - less than 20 - and an electronic system can provide a better, although not a cheaper, alternative to Perkins and vacuum-forming production.

Advantages/Disadvantages of Electronic Systems

Advantages

1. In braille printing houses serving the needs of the whole blind population, there will be a need for production in both large and small numbers of copies - from several hundreds or even thousands down to single copies. With conventional technology, this implies two completely separate, mutually

exclusive, production methods. For medium to large numbers of copies, stereotype and press production is used; for small numbers of copies, a Perkins and vacuum-form copier is used.

If electronic braille encoding units are used, then both large numbers of copies (via an automated stereotype machine) and small numbers of copies (via a braille printer) can be produced from the same encoding operation.

2. Braille printing houses having a number of stereotype machines can only expand their transcribing capacity by buying more stereotyping machines. These, if purchased new, are rather expensive items, costing around $10,000. An alternative is to modify an existing stereotype machine, if it is quite modern, so that it can be operated from punched paper tape or cassette, or similary digitally coded media. Thus, electronic braille encoding units can be used for transcribing the braille. These are relatively cheap - costing perhaps half or a third as much as a stereotype machine.

3. With a reasonably sophisticated editing system, considerable time and effort can be saved in the correction of material compared to that needed by mechanical methods. Simple electronic correcting facilities, such as 'delete' and 'over-write' do not offer significant improvements over correcting facilities with mechanical methods, however.

4. The most significant advantage with electronic systems are the possibilities for converting text, already in digital form, to braille without having to rewrite it. It is in such situations that electronic production techniques really begin to cut down production time and can also be economically advantageous as well. The successful application of this production approach is, obviously, very dependent on the general level of technical development of the country as a whole.

Disadvantages

1. The most important aspect to investigate when considering electronic equipment is their maintenance and availability of spare parts. To begin with, electronic equipment is much more sensitive to temperatures and humidity (typical ranges are 15° - 30°C; 40 - 95% non-condensing. For many countries this makes reliable air conditioning essential if such equipment is to be used.

   Servicing of the most modern electronic equipment nowadays involves merely the replacement of an "electronic card". When an error occurs, it is located to a specific card. This card is then simply taken out and replaced with a new one and the faulty card, in most cases, is returned to the manufacturer for repair. Although this type of maintenance does not require a highly skilled electronics technician on site, it does require a store of spare electronic cards which can amount of a very large proportion of the machines' total costs. Furthermore, if repairs must be carried out abroad, this can present a very big problem, politically and/or economically by making the continued functioning of the equipment dependent on foreign companies and foreign exchange.

2. The running of a braille production system based on electronic equipment demands a much tighter organisation as such systems involved a great number of "production stages" and production also becomes more abstract. With conventional mechanical methods, the braille is written directly onto paper or metal plates, both of which can be seen or felt directly. With electronic equipment, the braille is encoded onto paper tape, cassette or other electronic media, none of which can be seen or felt directly.

   The complexity of the concept of encoding characters digitally, removing, inserting and rearranging text electronically, should not be underestimated. Although all the operations involved with using such equipment are logical and apparently straightforward, it will take most operators, used to operating mechanical equipment, many months, if not years, to achieve a real understanding of how to use electronic equipment effectively. This will mean that in the initial months of operation, the new system may be much less effective than the old. Electronic systems are not straightforward to introduce or to change to. Problems with organisation and personnel must be expected and much attention must be given to these aspects if the system is to be successful.

3. The rationale behind the introduction of an electronic production system usually lies in the desire to increase size and efficiency of production. Such systems can promote this in two different ways:

- It allows the printing house to employ personnel, untrained in braille to write into a computer which then converts it to braille. A medium size computer allows many such "keyboard" operators to work simultaneously. However, this approach usually has involved increase in cost as it is expensive to employ people to key text into a computer system, which is itself expensive. One way round this is to utilise volunteers although they would have to work consistently in order to make the system pay which can be difficult to maintain with volunteer workers.

- Electronic systems allow, in principle, a braille printing house to "tap" directly material already written in digital form. In developing countries very little, if any, of written text produced locally has been produced with the aid of a computer. Thus, this potential advantage of electronic systems does not, as yet, exist for developing countries.

Obtaining Further Information about Electronic Braille Production Systems

Development is still proceeding at a fast rate in the area of electronic braille production systems - a process resulting in simpler systems to operate, greater reliability and decreasing costs. This, together with many present-day developing countries' own development, implies that more and more countries will be becoming interested in the application of electronics to the production of braille.

There are a number of sources for obtaining more detailed information regarding the "state of the art" in electronic braille production systems. Within the Committee on Cultural Affairs of the World Council for the Welfare of the Blind, there is a "Sub-Committee on Comperatised Braille Production and Other Media". This sub-committee consists of:

Mr D.W. Croisdale (Chairman)	Civil Service College 11 Belgrave Road London SW1 V1RB England
Mr A.A.J. Gildea	SIGCAPH The Mitre Corporation Box 208 Bedford MA 01730 USA
Professor Dr H. Werner	Rechenzentrum der Universität Munster 4400 Munster Roxeler Strasse 60 German Federal Republic

This sub-committee has defined for itself a number of specific objectives. These are:

> "to create and maintain an international directory of people and organisations involved or interested in computerised braille production;
>
> to collect and disseminate information of a statistical nature about current production systems and future plans;
>
> to hold international meetings to help achieve these aims"

Another source of information is the:

Warwick Research Unit	University of Warwick
for the Blind	Coventry CV4 7AL
	England.

This research unit produces an 'International Register of Research on Blindness and Visual Impairment' which includes an up-to-date register of people working on computerised braille production. In addition the Warwick Research Unit, in conjunction with the American Foundation for the Blind, publishes an occasional journal entitled 'Braille Research Newsletter' which frequently contains artcles dealing with new developemnts in computerised braille production.

SECTION IV: RUNNING A BRAILLE PROVISION FACILITY

There are a number of aspects which are important to the efficient running of a braille printing shop but are quite separate from the actual "mechanical" production process. These aspects include the following:

- selection of material
- editing material for braille
- distribution
- economics of braille production

No real hard and fast rules can be set out with regard to how these aspects should be dealt with. A number of points, however, are worth discussing and these will be illustrated by some experiences obtained from a number of braille printing facilities in developing countries.

Chapter 8: Selection of Material

The resources available for braille publishing, even in the most technologically advanced countries, are such that only a small proportion of the literature available to sighted readers can be available to braille readers. This situation makes the process of selecting books or other material to be produced in braille a very important one.

In the majority of countries wanting to establish braille production facilities, the highest priorities for production are text books and other educational material for children and adults. The latter involves mainly books for adult literacy programmes. As an illustration, the Braille Foundation of Uruguay in Montevideo, has the following policy regarding selection:

> "A program for blind children, taking into account the principle of offering blind children the same chances as sighted children, is what we aim for.
>
> Thus, in braille script, are produced the most up-to-date and accepted books, adapted also to the young blind reader's particular needs: his age, schooling level, social and cultural background. When working out each program, an equilibrium is pursued between the instructive texts and the entertaining reading material provided because it is important to contribute to the blind child's amusement, recreation and enjoyment of literature. In the case of 'Martin Pescador', we select articles, tales, poems, etcl which have appeared in magazines for sighted children, as well as writing articles especially destined to the young blind reader."

It is fairly usual that the books used in schools are decided in advance by the Ministry of Education and they are, therefore, standardised throughout the country. These books should provide the printing house with its first titles to produce in braille.

Although educational needs should take the first priority, as soon as the most essential needs are catered for, attention should be given to the needs of the people who have completed their education. In some countries where braille printing houses have been established for some years, resources have been concentrated exclusively into producing school text books.

Although an undoubted need exists for such books, one of the purposes of being educated is lost if those skills learnt, for example, braille reading, are forgotten because of the absence of appropriate reading matter with which to maintain a competent level of reading.

Probably the best way to provide such material is by producing a general interest magazine as they do, for example, at the Braille Foundation of Uruguay.

> "On choosing material to be published in the magazines for adults, we aim to turn braille publication into a bridge between the blind reader and the world, a connecting gear of communication and information in order to foster the social integration. Therefore, we select articles, reports, essays, etc. from local and foreign publications, completed by our own specially written articles.
>
> While selecting this material, we assume that the blind have the same interests and needs as the sighted people in the field of reading. Therefore, we include sections for literature, science, arts, humour, fashion, sport and so on. We likewise try to make the braille system as functional and efficient a way of communication as normal script is for the sighted."

Another aspect with relation to the selection of material is that of providing material in local languages. This is particularly important for material to be used for adults, especially in adult literacy programmes and for young children at school. In India, for example, the need for material in local languages is particularly acute.

"...India is a country where there are about 15 languages spoken and most of the many states in the country have regional languages of their own. The policy of the Project[1] is to make a nation-wide approach while trying to meet the need of the blind in the literary field. Therefore, through the various organisations working for the cause of the blind, we are organising honorary editorial groups to make specific recommendations of material to be printed by the project, to assess the need by conducting a survey in their respective regions, to organise transcribing work to prepare braille master copies and to distribute the printed material to the needy ones."

In such situations, an effective way of developing a braille production facility can be to establish stereotype plate production on a local level so that material in the dominant language of the area can be transcribed. These plates can then be sent to a regional press, serving a number of different areas, for printing.

A related aspect is also the production of material which is relevant to the environment and culture of the reader. Most European and American books reflect the culture and environment of wealthy, technological, sophisticated societies which is not at all the situation in developing countries.

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[1] Braille Press Project, Christian Foundation for the Blind, Madras, India.

Chapter 9: Editing

In this Chapter, "editing" will be used in a very wide sense. It will include discussion of thos aspects which must be modified because of the differences between braille and braille reading on the one hand, and print and visual reading on the other. These will be discussed under the following headings:

- Layout
- Contraction system
- Illustrations.

Layout

Braille does not have anywhere near the same flexibility as inkprint with regards to setting out of the text in order to make reading easier or the text more easily understood. This reflects the different nature of braille and print reading. In the latter, it is possible to have an overview of a relatively large amount of text so that use of different type styles, different line spacing and so on, can help the reader to structure the text he is reading. Braille does not allow the same possibilities. Use of the fingers means that the text must be read in a more or less sequential way and the number of braille characters is fixed at 63, unlike the virtually unlimited number of inkprint characters which are possible.

In order to compensate for the difficulty in obtaining a quick overview of a braille page, its layout should be standardised as far as possible. For example, page numbers should always be placed in the same position on the page; tables of contents, indexes, reference lists, etc. should be set out in a standard way, and so on. In short, a braille book should be edited so as to limit, as far as possible, the need to search and/or cross-associate different parts of the text.

Aspects relating to format which a braille editor should give special consideration to are the following:

- tables
- prefaces, forewords, introductions, appendices, glossaries, bibliographies, references
- page numbering
- foreign words.

In general, however, it is usually recommended that, as far as possible, the original print book should be followed.

Contraction Systems

The size and spacing of braille characters are such that transcription from print to braille means a considerable increase in the bulk of braille books over the print original. In order to try and minimise this increase in bulk, the braille codes for many languages, e.g. English, German, French, etc. use a "contracted" braille code. This means that many frequently occurring words are abbreviated to one or two letters in braille and also frequent letter combinations are also abbreviated to a single braille character within words. In this way the bulk is reduced and also, since the number of characters has also been reduced, the speed of reading should be increased. However, since there are only 63 characters possible in the braille code, contracted braille systems usually assign a number of different meanings to the same braille character. This, in turn, means that a set of rules must be developed so that the different meanings of a braille character can be determined through its context and that their use does not interfere with the reading process generally.

The use of contraction systems has come under some criticism during the last few years. The main reasons have been that a large proportion of the contractions used do not save a significant amount of space and that the rule system controlling the use of contractions is too complicated. This makes the process of learning braille even more difficult than it would be if uncontracted braille were used and that in many cases the complexity of the system hinders any increase in reading speed that might result from a reduction in the number of characters.

A particularly important aspect in the present context is that it is widely accepted that contracted braille is more difficult to learn than uncontracted. An implication of this is, of course, that fewer people, especially those learning as adults, will succeed in learning braille. This would go against one of the principle aims of the printing house - that of bringing literacy and literature to as many blind people as possible. The question of whether contracted or uncontracted braille codes are to be used should be discussed carefully before any general policy is decided.

Illustrations

The use of illustrative material, e.g. diagrams, photos, flow-charts, drawings, etc. in print books, particularly text books, has increased considerably during recent years. Often much of this illustrative material is to make the book "look" more interesting and the information they convey is not essential to the understanding of the content of the book. An important aspect in the editing of books which are to be transcribed is, then, to decide which illustrations are "useful" and, therefore, should be reproduced in some form in the braille edition and which illustrations can be left out without any significant loss in the book's content.

Reproducing illustrative material in braille books is not an easy task. There are two basic approaches. One is to try and describe the figures verbally. The other is to try and produce a relief illustration corresponding to the original in the printed book.

One of the reasons why illustrations are used in print books is that they can contain a great deal of information in a relatively small space. For this reason they are often included as "summaries" of what has been described in the text and can usually, in these cases, be left out. In cases where the illustration provides new and important information, the editor must first decide how much space a written description would take. A general rule might be to limit any such description to two pages. If such a description would take more than this some other form of reproducing it should be found.

Another aspect of illustrations is that they can easily show the relationship between a large number of "aspects" or "processes". A diagram can present an immediate overview of a process showing its different components and their relationships effectively "simultaneously". Such information is impossible to present effectively with the essentially "sequential" nature of written description.

The alternative to written description is to produce diagrams, maps, etc. with raised areas, lines, symbols, etc. so that their outlines and surface can be determined through the reader's fingers. An important aspect in the production of such relief material is their design. A diagram in a print book can rarely be copied directly into a relief form as it would be too complex for the fingers to be able to distinguish the various lines and shapes. The ability of the eye to distinguish shapes and patterns is vastly superior to the fingers' ability to distinguish shapes and patterns produced in relief form.

A diagram or illustration to be produced in relief form must, therefore, be edited. That is, its most important features extracted and simplified; all unnecessary detail, e.g. shading should be removed, details which need to be labelled should be reduced to a minimum and these are best done by marking them with letters and numbers and then having a key on a separate page so as to avoid mixing text and illustrations together. Symbols used should be standardised as far as possible, at least nationally, but preferably internationally.

Even with careful design, it should not be assumed that just because a person can read braille he/she can also read a tactile map or diagram. Wherever possible, the use of raised illustrations should be introduced at an early stage in the education of blind children. This allows them to start at a very simple level and slowly develop skills so that when more complext maps and diagrams become a more important part of their school work, they will have had some experience of this medium.

Production of Relief Figures

With regard to methods of production, there are a number of simple and relatively cheap approaches.

Spur Wheel: This is simply a small wheel with points around its circumference. This wheel can be moved over the reverse side of the paper thereby causing a row of dots to be embossed on the other side. By using different shapes of "spurs" on the wheel, a variety of distinguishable lines can be produced. The technique is, however, limited to rather simple linear diagrams.

Some different types of spur wheel

Upward Relief Drawers: There are a number of kits available for drawing raised lines directly onto special plastic sheets. The action of the "pen" when drawn over the plastic sheet is such that an upward raised line is produced in the plastic following the pen's movement. This technique has similar limitations to the spur wheel.

Upward Relief Drawing. The set illustrated can be obtained from: Dutch Association for the Blind, Kipstraat 54, Rotterdam, the Netherlands.
Price: Hfl.125 (1979).

Master allowing vacuum-form copying: This method is probably the one in most widespread use. It involves the building up of a "master" on a paper base using cardboard, wire, sandpaper, pieces of wood, cloth, etc. which can then be vacuum-formed (see Chapter 5). The materials making up the master are chosen to gives shapes and textures in the vacuum-formed plastic.

Examples of the types of material that can be used for making a master map for vacuum form copying. The materials illustrated are from the Nottingham Kit for Making Raised Maps. These can be obtained from: Mobility Research Unit, Department of Psychology, University of Nottingham, University Park, Nottingham, NG7 2RD, England.

One final point is that often provision of models or even actual examples of an object can be better approaches to "illustration", especially in an educational context, rather than trying to produce raised diagrams.

Chapter 10: Distribution

For most newly established braille printing houses, the initial production will involve books for schools. In countries where the visually handicapped are taught in special schools, distribution will amount to no more than transport of the books from the printing house to the school or schools. In countries where an integrated education system is in operation, distribution can probably best be organised in co-operation with the Ministry of Education. Books and other material for sighted children must be distributed out to schools fairly regularly so that braille books can be sent out in combination with these deliveries.

The next "level" of provision creates greater problems for distribution. At this stage, provision of braille can be classified into two main types:

1. providing for individual needs, and
2. providing general interest reading material.

Thus, the braille printing house must maintain close touch with both the specific needs of individual braille readers and of material which is of general interest and value.

Initially, it is probably best to produce a general interest magazine. This can contain articles of general interest selected from articles already published in print magazines, important news items and any articles or information which might have special relevance to the blind. Such magazines could be sent initially to institutions or other organisations where blind people may go to meet or work, and to individuals known to the organisations of and for the blind. With such a publication, reading material can be provided to blind adults who have either left school and, as often happens, no longer have access to any suitable braille material or who have become blind as adults and have learnt to use braille. Also, such a publication can provide a means for establishing contact with braille readers and of getting to know their needs. In this way an individual mailing list can be created.

Braille Libraries

There are two main ways in which braille books can be distributed via loaning from a library.

Most commonly, one or two centralised braille libraries exist which loan out books to individuals. These are usually sent out using the normal postal deliveries since, in the majority of countries, articles for the blind do not require postage. An alternative system is for a central producer of braille books to send out copies of books to all regional, and even some local, libraries in the country where the braille readers can then borrow them from.

Although the latter system is better for the braille readers, the problem of space often makes this difficult to carry out in practice. Few regional libraries have such an excess of shelf space to be able to stock more than a few braille books. Also, books must be produced in quantities of perhaps 20 and upwards, and the cost of this production may not always be justified by the number of borrowers. For these practical reasons, a centralised library system for braille books is more common. The books are usually produced in single copies, and these are then loaned out. Obviously such a system can mean waiting a long time for certain books. However, by using home transcribers, a relatively large and cheap production can be maintained.

It is very important, with both de-centralised and centralised loaning systems, that the readers know what books are available. This information can be given out in a braille magazine such as that described at the beginning of this chapter. Short descriptions of each book should also be given (such short summaries sometimes appear on the cover of inkprint books) so that the reader can be fairly certain to receive a book which will be of interest.

Selling Braille Books

A few countries produce braille books for selling. Obviously, actual production costs can never be recovered by the sales alone no matter how popular the book might be. The usual custom is to sell the braille book for the same price as the inkprint version and the difference is then covered by the printing house, or by external funds granted to the printing house. In the case of most developing countries this type of distribution is inappropriate and funding for braille production should be granted to the producer in full.

Chapter 11: The Economics of Braille Production

It is very important for a braille printing house, as with any other production unit, to know how much it costs to produce its products. There are many ways of calculating production costs and it is not the purpose here to recommend any one particular approach over another. However, it can happen that people taking over the responsibility of running a braille printing house have had no previous experience of running a production unit. Therefore, outlined below is one approach to calculating the cost of proudcing braille which can serve as a guide for those who might require it.

One procedure for calculating the cost of braille production involves the following steps:

1. List all equipment used in the process of producing braille and their cost. The cost of this equipment should be written off over a period of years - usually 10, although in the case of electronic equipment this should be 5 years, or even less - by taking 10 per cent of the machine cost each year into the cost of production. It should be noted, however, that in this way only the original cost of the machine is recovered. Thus, if a machine was bought in 1980 for $10,000 then only $10,000 will be recovered by 1990 when a new machine may be needed. In 1990, however,

this same machine will cost considerably more - perhaps $20,000. Thus, in actual fact more than 10 per cent (assuming a writing-off period of 10 years) of the machine's original cost should be taken out each year to allow for probable cost increases occuring during the writing-off period. Exactly what this percentage should be set at will depend, in large part, on general economic conditions in the country concerned.

2. List all those employed at the printing house, even those who are not directly involved in production, e.g. manager, secretary, caretaker, etc. and their respective salaries.

3. List all other costs involved in running the printing house, e.g. rent for the building, telephones, electricity, etc.

4. Construct tables showing how these various costs listed in 1-3 above are divided between the various production processes used in the printing house. Such tables are illustrated on the following pages.

5. Estimate/calculate the number of braille pages passing through each production unit yearly. To illustrate this an estimate of the capacity of a printing house with equipment and personal listed in Table 11.1 and 11.2 can be made.

EQUIPMENT

COST ITEMS	Stereo-typing	Perkins	Printing	Vacuum-forming	Gathering	Stitching/ Binding
2 stereotype machines at $2,000/year each	$4,000					
3 Perkins braille-writers at $55/ year each		$165				
1 Vacuum-form machine at $200/year				$200		
1 press at $4,500/year			$4,500			
1 small plate cutter at $30/ year	$30					
2 stitchers at $800/year each						$1,600
1 ring-wire binding machine at $100/year						$100
TOTAL	$4,030	$165	$4,500	$200	-	$1,700

Table 11.1: Equipment costs per year divided across printing house production units

PERSONNEL

COST ITEMS	Stereo-typing	Perkins	Printing	Vacuum-forming	Gathering	Stitching/ Binding
2 stereotype operators at $1,000/year each	$2,00					
2 proofreaders at $1,500/year each	$1,500	$1,500				
3 Perkins operators at $750/year each		$2,250				
1 press operator (75%) + 25% gathering at $1,500/year			$1,125		$375	
1 Vacuum-form operator at $650/year				$650		
3 gatherers/ binders at $750/ year each					$1,125	$1,125
1 manager at $3,000/year	$500	$500	$500	$500	$500	$500
1 secretary at $1,500/year	$250	$250	$250	$250	$250	$250
1 caretaker at $600/year	$100	$100	$100	$100	$100	$100
TOTAL	$4,350	$4,600	$1,975	$1,500	$2,350	$1,975

Table 11.2: Yearly salary costs divided across printing house production units

OTHER RUNNING COSTS

COST ITEMS	Stereo-typing	Perkins	Printing	Vacuum-forming	Gathering	Stitching/ Binding
Rent for premises at $15,000/year	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500
Telephone at $300/year	$50	$50	$50	$50	$50	$50
*Electricity at $400	$100		$100	$100		$100
Miscellaneous materials and expenses at $600	$100	$100	$100	$100	$100	$100
TOTAL	$2,750	$2,650	$2,750	$2,750	$2,650	$2,750

*Perkins braillewriters and gathering operations do not use any electricity. Therefore, electricity costs are not taken up in the costs of these operations.

Table 11.3: Remaining costs of printing house divided across production unit

Stereotyping

An average stereotype operator should be able to produce one plate per hour, including the time taken for correction.

1 plate/ hour x 5 hours/day (actual working time) x 23 days/month x 11 months/year = 1,285 plates/year.

Therefore, 2 operators should produce <u>2,530 plates/year</u>

Printing

On average, 200 copies are made of braille publications written on stereotype machines.

Thus, 2,530 plates/year = 5,060 written pages/year = 5,060 x 200 = 1,012,000 printed pages/year.

If braille is printed on A3 paper (i.e. 420 x 297 mm) then each A3 sheet will be equivalent to 4 braille pages.

Thus, 1,012,000 braille pages = <u>253,000 A3 sheets</u>

Perkins braillewriters

One Perkins operator should be able to produce 3 pages/hour, including time taken for correcting.

3 pages/hour x 5 hours/day (actual working time) x 23 days/month x 11 months/year = 3,795 pages/year.

Thus, 3 operators should be able to produce 11,385 pages/year.

Vacuum-forming

On average, 4 copies are made of braille publications written on Perkins machines.

Thus, 11,385 written pages/year = 45,540 vacuum-formed pages/year.

Gathering

Only the braille sheets from the press need to be gathered.

Thus, 253,000 A3 sheets are gathered/year.

Binding/Stitching

The plastic sheets are bound using the ring wire binding machine. The average number of pages in books (i.e. volumes) bound with ring binding is 50.

Thus, 45,540 ÷ 50 = 911 books are bound/year.

The A3 sheets from the press are centre stitched. The average number of pages in books (i.e. volumes) stitched is also 50.

Thus, 253,000 ÷ 50 = 5,060 books are stitched/year.

6. The cost of the raw materials must now be calculated. In the example given here, these are:

<u>Plates</u> - bought ready cut to size and hole-punched.
Cost: $2.00/plate

<u>Plastic</u> - bought in large sheets, cut to size by an ordinary printing house nearby.
Cost: $0.07/page

<u>Paper</u> - bought in A3 sheets (420 x 297)
Cost: $0.03/page

A4 sheets (297 x 210) cut from A3 sheets by printing house nearby.
Cost: $0.02/page

(Cutting costs included in "Miscellaneous expenses")

<u>Ringwire element</u> - Cost: $0.15/element

Wire for stitching machine is marginal and can be included in "Miscellaneous expenses".

7. The costs associated with each production unit can now be calculated by totalling their costs and dividing this by the number of "items" (i.e. plates, pages, etc.) produced or handled by each unit. Thus, from the above example:

Stereotyping

Costs	=	Equipment	-	$4,030
		Personnel	-	$4,350
		Other	-	$2,750
		TOTAL	-	$11,130

Production:	plates/year	-	1,265
Unit cost:	11,130 / 1.265	=	$ 8.80/plate
Raw material:	plates	-	$ 2.00 each
	TOTAL UNIT COST	-	$10.80/plate

Printing

Costs	=	Equipment	-	$4,500
		Personnel	-	$1,975
		Other	-	$2,750
				$11,225

Production:	A3 sheets/year	-	253,000
Unit cost:	11,225 / 253,00	=	$ 0.04/A3 sheet

Raw material:	paper	-	$ 0.03/A3 sheet
*TOTAL UNIT COST		-	$ 0.07/A3 sheet

Perkins braillewriters

Costs =	Equipment	-	$ 165
	Personnel	-	$4,600
	Other	-	$2,650
	TOTOAL	-	$7,415

Production:	pages/year	-	11,385
Unit cost:	7,415 / 11,385	=	$ 0.65/page
Raw material:	Paper	-	$ 0.02/page
TOTAL UNIT COST		-	$ 0.67/page

---

*An additional cost which should be added to the printing cost is the time taken for setting the plates in the press and taking them out again. This cost should correspond approximately to the salary cost of the press operator during the time taken to carry out these operations. For this example, $0.50 will be taken for the "setting" time.

Vacuum-forming

Costs =	Equipment	-	$ 200
	Personnel	-	$1,500
	Other	-	$2,750
	TOTAL	-	$4,450

Production:	pages/year	-	45,540
Unit cost:	4,450 / 45,540	=	$ 0.10/page
Raw material: plastic		-	$ 0.07/page
TOTAL UNIT COST		-	$ 0.17/page

Gathering

Cost:	Equipment	-	-
	Personnel	-	$2,350
	Other	-	$2,650
	TOTAL	-	$5,000

Production:	A3 sheets/year	-	253,000
Unit cost:	5,000 / 253,000	=	$ 0.02/A3 sheets
Raw material:			-
TOTAL UNIT COST		-	$ 0.02/A3 sheet

Stitching/Binding

Cost:	Equipment	-	$1,700
	Personnel	-	$1,975
	Other	-	$2,750
	TOTAL	-	$6,425

Production: Volumes/year

= 911 + 5,060 - 5,71

Unit cost: $\frac{6,425}{5,971}$ = $ 1.08/volume

Raw material:	stitching wire,	$ - /volume
	binding elements	$ 1,15 /volume

TOTAL UNIT COST:	STITCHING -	$ 1.08/volume
	BINDING -	$ 2,23/volume

N.B. This method of costing stitching and binding assumes a fairly constant size of production in terms of number of pages/volume and number of copies.

Having obtained a unit cost of each production unit, total production cost of any publication can now easily be worked out. In order to illustrate this, a comparison can be made between the costs of stereotype/press production and braillewriters/vacuum-forming production for varying numbers of copies produced.

Stereotype/press production

10-page pamphlet

Stereotyping/proofreading 5 x 10.80			=	$54
"Setting" time 3* x 0.50			=	$1.50
Printing:	10 copies:	3 x 10 x 0.07	=	$2.10
	100 copies:	3 x 100 x 0.07	=	$21.00
Stitching:	10 copies:	10 x 1.08	=	$10.80
	100 copies:	100 x 1.08	=	$108.00
Total cost:	10 copies		=	$68.40
	100 copies		=	$184.50

Braillewriter/Vacuum-forming

10-page pamphlet

Braillewriter/proofreading 10 x 0.67			=	$ 6.70
Vacuum-forming:	10 copies:	100 x 0.17	=	$17,00
	100 copies:	1000 x 0.17	=	$170.00
Binding:	10 copies:	10 x 1.23	=	$12.30
	100 copies:	100 x 1.23	=	$123.00
Total cost:	10 copies		=	$36.00
	100 copies		=	$299.70

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*This figure is the number of pages divided by 4 and rounded up to the nearest whole number. Thus; in this example 10/4 = 3. Therefore, plates must be put in and taken out of the press three times.

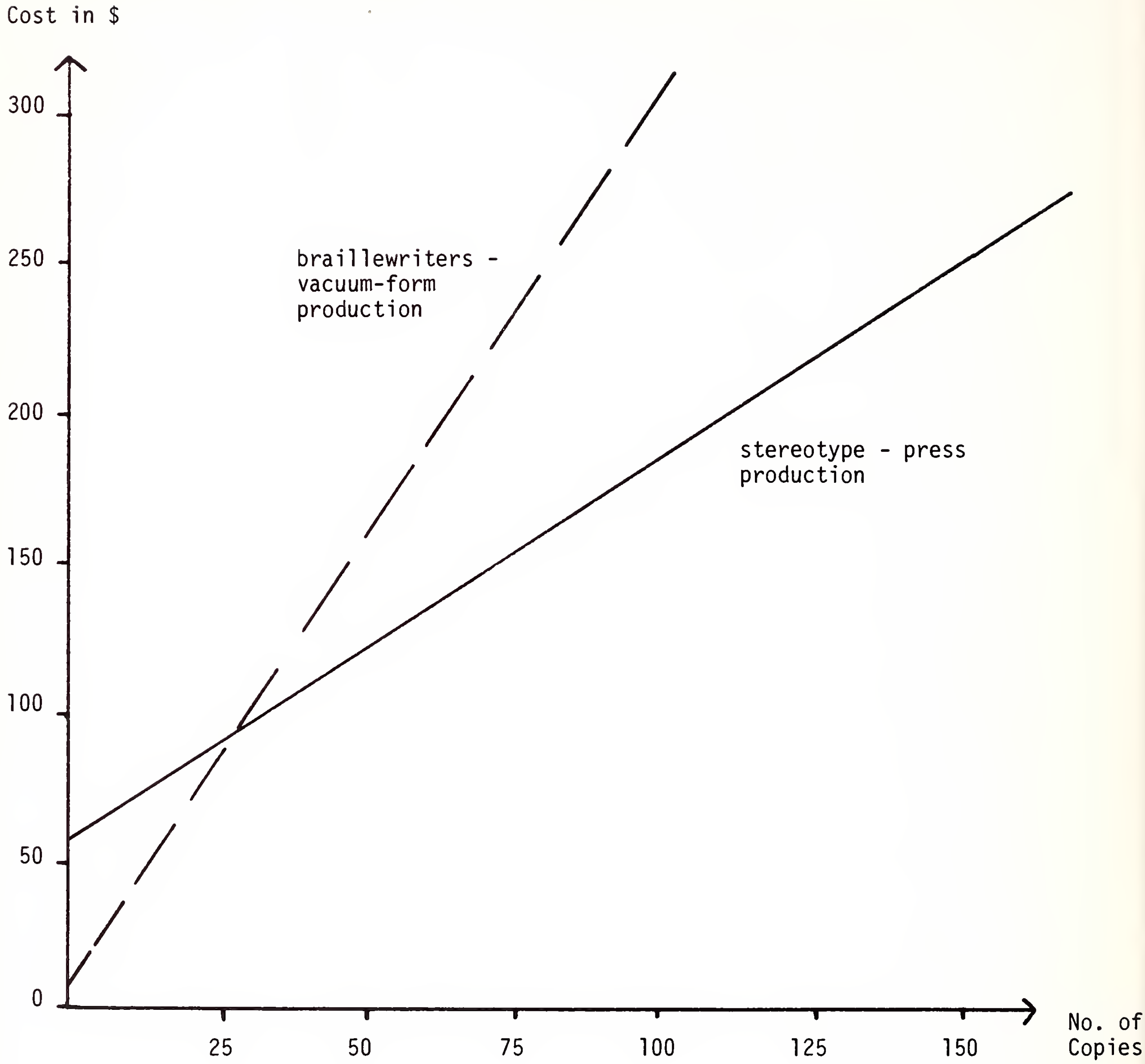

Figure 11.4: Comparison of costs between vacuum-form and press production for a 10-page pamphlet

Stereotype/press production

100-page book - 2 volumes

Stereotyping/proofreading 50 x 10.80			=	$540
"Setting" time 25 x 0.50			=	$12.50
Printing:	10 copies:	25 x 10 x 0.07	=	$17.50
	100 copies:	25 x 100 x 0.07	=	$175.00
Stitching:	10 copies:	2 x 10 x 1.08	=	$21.60
	100 copies:	2 x 100 x 1.08	=	$216.00
Total cost:	10 copies		=	$590.60
	100 copies		=	$943.50

Braillewriters/Vacuum-forming

100-page book - 2 volumes

Braillewriting/proofreading 100 x 0.67			=	$67.00
Vacuum-forming:	10 copies:	1000 x 0.17	=	$170.00
	100 copies:	10,000 x 0.17	=	$1700.00
Binding:	10 copies:	2 x 10 x 1.23	=	$24.60
	100 copies:	2 x 100 x 1.23	=	$246.00
Total cost:	10 copies		=	$261.60
	100 copies		=	$2013.00

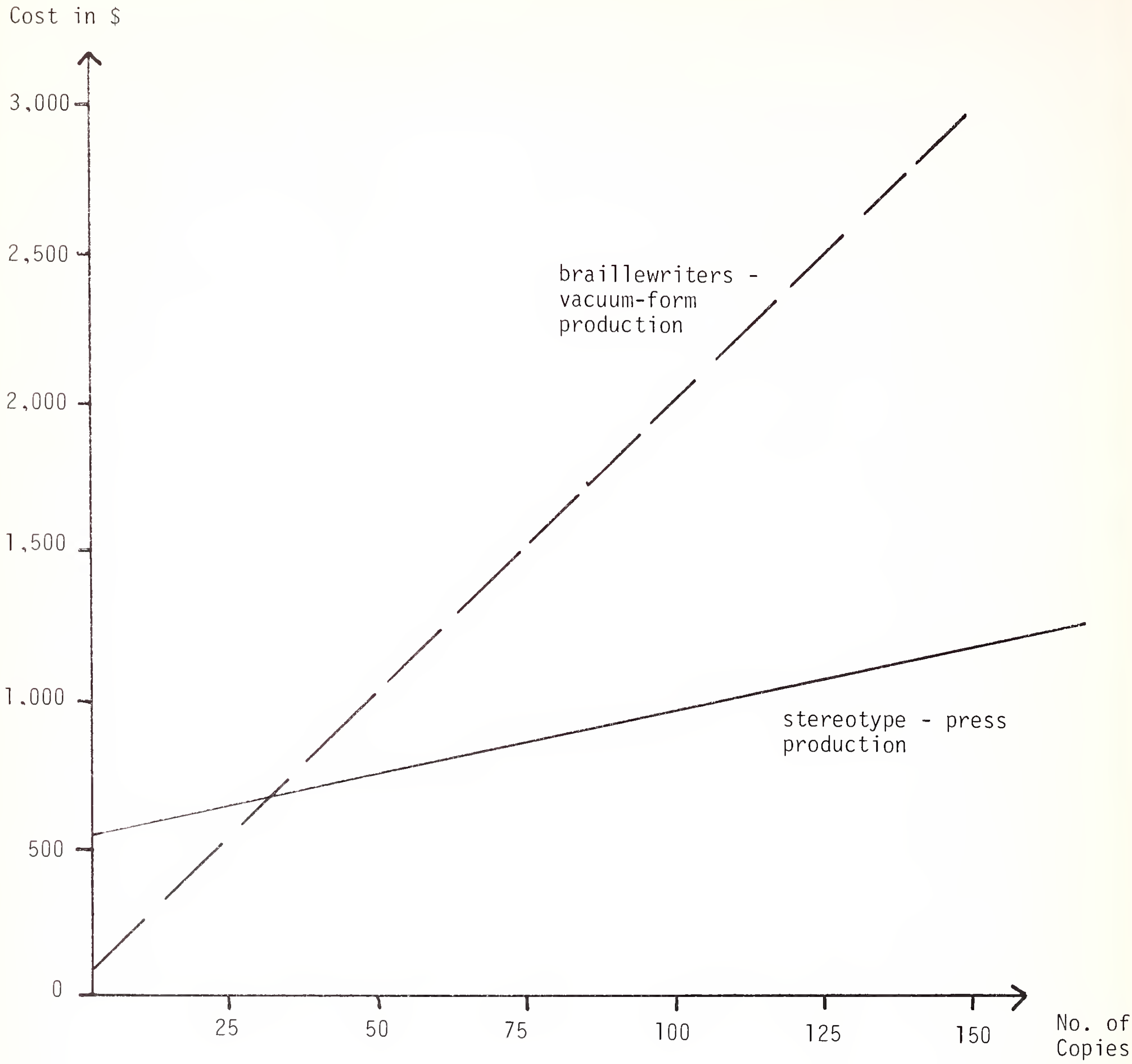

Figure 11.5: Comparison of costs between vacuum-form and press production for a 100 page, 2-volume book

The above illustration of how the cost of braille production can be calculated is, of course, much simplified. However, a number of important aspects are illustrated.

1. An underlying basis from which the unit costs are calculated is the quantity of braille produced each year. This means that it is important to keep detailed statistics of production from year to year so that the coming years probable production can be used for working out price levels for this year's production. Production quantities should be checked monthly to see whether predicted quantities more or less agree with actual quantities produced.

2. It is possible using the above figures to see whether investment in new machinery is economically worthwhile. A new investment will increase "equipment" costs, but it will also increase production capacity. Thus, if there are sufficient orders, the increase in the number of braille pages produced should counteract the investment costs. Ideally, investment in new machinery should not incur an increase in unit (i.e. per page) costs.

3. By comparing costs of stereotype/press and braillewriter/vacuum-form production, the cross-over point in costs of these two methods can be determined. That is, the maximum number of copies that should be produced by vacuum-forming or the minimum number of copies that should be produced using a press.

The importance of keeping economic and production statistics cannot be over-emphasised. One of the most important functions of the manager of a braille printing press is to ensure that there is a rational basis underlying the costs of the braille material produced.

Notes:

SRF Tal & Punkt, Stockholm 1980