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EXPANSION OF BRAILLE PRODUCTION IN SWEDEN

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INTRODUCTION

The investigation of any braille production system must involve the analysis of two, superficially distinct, aspects of braille provision. Firstly, investigation of the equipment available to produce the braille, and secondly, a "need analysis" for braille among the population under consideration. Although, traditionally, these two aspects have been considered quite independently of each other (and often the latter aspect has not been seriously considered at all), it is becoming clear now that the "context" of the technical equipment, i.e. the situation within which it is to function, is an important item in the specification of the equipment. In other words, in designing an appropriate braille production system the close interactions between these two aspects are of firsthand importance.

The first section of this report, therefore, considers the current size of the braille market in Sweden, in so far as it is possible to determine within the limitations of the present project. Also, some assessment of priorities are given within the overall picture. The second section outlines the current production of braille, both in terms of techniques used and amount produced, in Sweden. Thus, by comparing the information given in Sections A and B, the type of production that is required from any new equipment can be determined. Alternative systems appropriate to these identified needs are then outlined in Section C. Finally, in Section D, a system is proposed for expanding braille production in Sweden.

SECTION A: CURRENT BRAILLE NEEDS

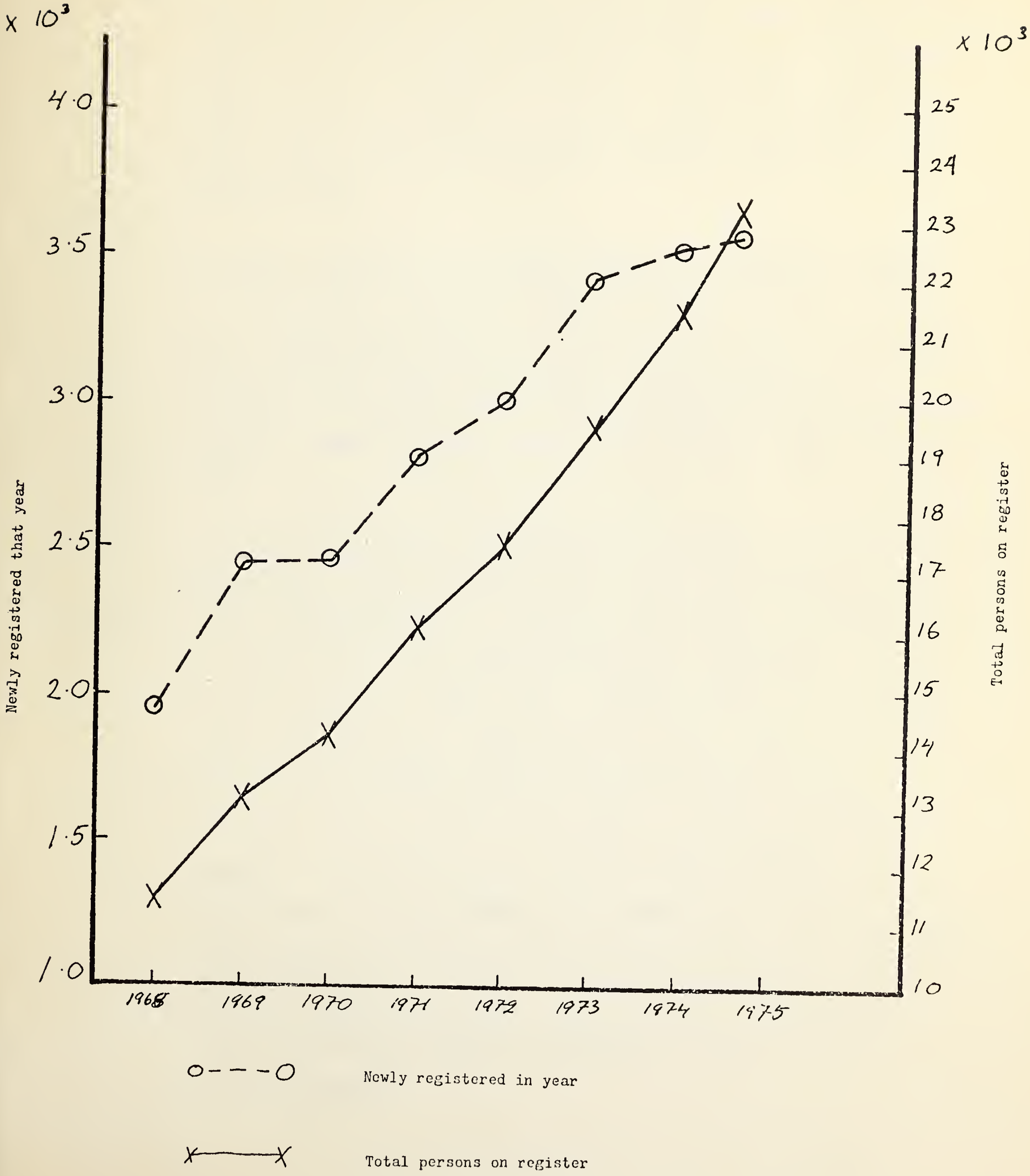
At the end of 1975 there were 23 337 people on the De Blindas Förenings (DBF) socio-medical register. This is not the total population of people in Sweden with eyesight equal to or worse than 3/60 as the register is voluntary, and based on contacts made by the DBF's special consultants based around the country. In other words, the reported population reflects those people who have a visual defect and recognise and accept that they have such a defect. There are almost certainly people, possibly many, who have a visual defect but do not become registered, either because they don´t perceive themselves as "Blind" or don´t realise that their eyesight is impaired.

The number of registered visually impaired persons has been increasing steadily by about 2 000 per year as shown by Figure 1. The number of new registrations per year, however, appears to be levelling off at around 3 500 per year. If this trend is maintained then the registered population should increase at a rate of about 1 500 to 2 000 persons per year. This would give a total number of registered visually impaired of nearly 30 000 by the end of 1978.

Within this inadequately known, minority population there is a further, even more inadequately known minority - that of the braille readers. Braille is not the universally used medium of reading and writing among the blind that many people, unfamilar with this area, imagine. Only something like 10 - 15 % of the visually impaired population can read braille, and even fewer could be described as regular users of braille.

This already small population of braille readers was decreased even further with the increase in use of talking books in the mid-1950's and a general increase in "technological alternatives" to braille during the 1960's. The former factor was particularly marked in Sweden where talking newspapers and magazines became very popular. In the last five years or so, however, a more sceptical attitude towards simple technological solutions to the problems of information access by the visually impaired has developed, with the result that a more inclusive approach is now taken towards information/communication aids (as well as all the other types of aids which now exist). That is, people are now encouraged far more to use a much wider range of techniques for accessing information, Fig 1 New registrations and number of blind on register

1968 - 1975



etc., both old an new. In other words, each particular technique - braille, tapes, Optacon, etc. - each have their own specific advantages and specific situations where they are the best technique to use.

There are, therefore, two developments taking place simultaneously within the braille using population. First, if we look at overall numbers, there is a general increase in readership. This can be demonstrated, for example, by Figure 2 (page 7) which shows the annual loans from the DBF's general library, between the years 1954 and 1974.

The upward trend we can reasonably expect to continue, although it is difficult to predict at what level the ceiling is likely to be. The decrease shown for 1975 was largely due to the closure of the DBF for a month during which time they moved to new premises. The figures for 1976 show an upward turn again, although the total number of annual loans did not return to the level of 1974.

The other development is a differential increase in need and use between the various sectors of the braille-using population. To know simply that there is a need for more braille, therefore, is not sufficient to help design appropriate developments in the braille production system. This is because there isn't a single general technique for producing braille, but rather a number of alternative techniques, each of which tend to be suited to a particualar type of production, either in terms of quantity or in terms of the content of the material to be produced. Consequently, in order to design new production techniques which will be appropriate to needs, it is necessary to consider, separately, the requirements of the individual sectors. By identifying these requirements, and their associated characteristics, the make up of the new production system can then reflect what is needed, rather than simply increasing the amount of braille material generally.

In order to facilitate such an analysis the braille-using population has been categorised into six sectors - school children, students, employed, casual readers, elderly, and the multiple handicapped. Each of these six sectors will be discussed with regard to their braille needs and the type of braille they typically require. It should be kept in mind, however, that these categories are not necessarily mutually exclusive.

School Children:

The number of "known" visually impaired in Sweden, aged between 5 and 20 years, was 1 271 in 1975. This does not represent the total number of such children as some are not detected, not registered, or are registered with other handicap agencies; also some will have left school early, and consequently not found (Lindstedt,1975).

The figure above includes a large range of visual ability, with rather a small percentage totally without sight. This is illustrated by Table 1 below.

Table 1: Degree of Visual Impairment among those registered between the ages of 5 and 20 years

Degree of Visual Impairment	Numbers known	% of Visual Imp. Popul.
Partially Sighted	619	50
Socially blind	311	24
Practically blind	132	10
Totally blind	145	11
Not classifiable	64	5

Thus, Lindstedt (1975) comments that "about 75% have residual vision to allow some kind of perception of figures, thus making the rehabilitation by optical aids and training of vision in some degree."

Fig 2. Annual loans of braille books from DBF library.

1954 - 1976

The numbers of school children totally dependent on non-visual information access is rather small. Furthermore, not all of these children will be braille users, because of additional handicap, for example, (see section on Multiple Handicapped below), and some may prefer alternative methods, such as recorded tapes, so that their use of braille will be relatively small.

Virtually all braille books, articles, etc. for school children are provided by Tomteboda Institute, and an idea of numbers of school children served by this Institute is given in Table 2 below.

Table 2: No. of Pupils Serviced by Tomteboda Library 1974/75

School Level			No. of pupils
Compulsory School:	Lower School		1
	Middle "		9
	Upper "		46
		Total	56
Gymnasium	: Year 1		14
	" 2		16
	" 3		12
	" 4		1
		Total	43
		Grand Total	99

(In addition to these children the library also serviced 221 adults, either in residential schools, undergoing retraining or rehabilitation, or attending People's High Schools, and 29 private requests.)

About 500 books were produced during 1974, of which half were in braille and half Talking Books. From what can be gathered from the available statistics, the numbers of severely visually impaired children are not likely to change drastically in the foreseeable future. However, the present production represents the maximum production possible within the present system and staffing level, rather than the desired level of provision of braille material. Therefore, even with the numbers of children remaining fairly static there is still a need to increase production.

Although the number of children that require braille material are relatively few, the material they require is often specialised and/or complex, and specific to an individual. For example, only certain parts of the contraction system may be used for some pupils. This means that manual transcription of these texts is likely to be the only viable approach for the foreseeable future for a large proportion of the braille requirements of this sub-population of braille users. A further implication is that the numbers of copies required will be small. At present the average number of copies produced is about 2 - 3, with 20 - 25 books per year being produced in about 25 copies.

Students:

This group, although representing the numerically smallest market sector, has, perhaps, the most urgent and difficult needs for braille material for a production system to meet.

There is a special department within the DBF (Study Literature section) which provides course books for visually handicapped students at Universities and other institutions of higher education. They currently have about 4 000 books and cater for about 110 students. Most of these books, however, are talking books. For example, out of 437 books produced by the Study Literature section during 1975, 326 were talking books. It is estimated that about 60 of the 110 students are proficient braille readers and that current demand is above the production capacity of the Study Literature section.

The small numbers of braille books produced reflects, as in the situation with school children, the production possible with the present staff, and this means in the "Study Literature" section, the number of qualified transcribers available. Production of braille is increasing now as more transcribers have beeen obtained. However, in this area it is difficult to foresee a situation where production could meet demand entirely.

As with the needs of school children the main problem is the conversion of inkprint texts into braille, rather than production of material in quantity. Furthermore, in some cases, a student may need a text over a long time and perhaps even after he has finished his studies he may need it for reference. Therefore, a system that would allow single copies to be run-off from a convenient storage medium, e.g. magnetic tape, which had been coded during the original transcription would be a useful facility for this sector of needs.

Employed

Relative to the sighted population the visually impaired are concentrated into only a few occupations (Myrberg, 1973). In Sweden, during 1971, a total of 717 visually impaired persons either working or in training for work were spread across 32 occupations. Of these 32 occupations, 7 required proficiency at braille and 18 required some knowledge of it (AMS, 1973). Thus, lack of braille reading ability by blind persons could significantly limit their occupational choice.

Since 1971 the number of employed visually impaired has increased considerably. A survey conducted in 1975 (Myrberg et al, 1976) showed that there were 1 490 visually impaired employed in the age group 16 - 67 years. If we consider those with less than 2/50 eyesight as representing the maximum population of possible braille readers, then this gives a number of about 600. Although not all of these will use or need braille for their work, the proportion requiring braille for their jobs is increasing as fewer blind go into the traditional "blind trades" such as brush making, and more compete on the open labour market.

Even with the increased level of employment of the visually impaired during the past few yeras, still only 16% of those aged 16 - 67 years are working.

The equivalent figure for the sighted population is 67%. An explanation, in part at least, of this large gap possibly lies in the difficulty adults going blind have in continuing with their old jobs, even after rehabilitation. One factor in this difficulty involves access to, and organisation of, information.

Casual Readers:

This is rather a broad category, and corresponds to some extent to the aspects discussed at the beginning of this section. That is, this category largely reflects general increases in braille readership as , to some extent, all braille readers, not just those who only read for their own entertainment or enlightenment, are included within it. Thus, the number of persons in this category corresponds to the total number of braille readers in Sweden, which is about 2 500. The material included in this section can be usefully sub-divided into three:- i)full-length material, e.g. books, ii) magazines, periodicals, etc. not of lasting value, and iii) short-length material.

i) Full-length material: About 100 braille books of general interest are produced in Sweden per year, and the total number of titles now available is slightly over 4 000. This is small compared to the nearly 10 000 talking books available, and miniscule compared to the 8 000 or so books and pamphlets published in Sweden per year in inkprint.

During 1976, 275 individuals and 29 institutions borrowed a total of 2 630 different titles from the DBF library. Also, during the same year 107 new titles were added to the stocks, of which 41 were fiction, 32 non-fiction, and 34 children's books, also 8 titles were re-copied. There is a definite need to increase production in this area, especially if the trend of increasing numbers of braille readers continues, which seems likely. An initital target has been set to increase book production to 300 titles per year as soon as possible.

ii) Magazines, Periodicals, etc.: At the moment the number of magazines available in braille is rather limited, especially if compared to that available to the sighted. There are nine main magazines published in braille by the DBF printing house. However, it should be noted that there are two or three times as many such publications available on tape, although many of these are produced privately and not by the DBF.

Provision of magazine-type material is becoming increasingly important as "keeping in touch" involves getting better access to more and more information; a task that is difficult enough for the sighted with the enormous range of material available to them. Furthermore, as the kind of reading associated with much of magazine reading is selective rather than starting at the beginning and going through to the end, this material is better suited to the braille medium (for those who are proficient at braille, at least) than to tape recording.

iii) Short-length Material: In addition to transcriptions of ordinary print books, magazines, articles, etc., there is a need for more personal, short-length material, such as agendas and minutes of meetings, instructions for domestic appliances, local and/or internal telephone dialling codes, personal correspondence needed for reference, etc., etc.

This is an important aspect in the overall braille provision system and may well require special, possibly decentralised, facilities. Little is known specifically about the size and type of demands in this category, however, a project to investigate this area has been proposed and should begin early in 1977.

Elderly

Numerically, elderly visually impaired people form a very large part of the total visually impaired population. The detailed figures for Sweden, as of 1975, are shown in Table 3 below.

Table 3: Numbers of Elderly Visually Impaired in Sweden

Age Group	Nos. of Reg. V.I.	% of V.I. Popul.	Newly Reg. 1975	% of newly registered
60-69	3449	14,9	476	13,3
70-79	6071	26,1	1166	32,7
80-89	6610	28,4	1228	34,4
over 90	1456	6,3	170	4,8
Total	17586	75,7	3040	85,2

Table 3 not only indicates the size of the bias towards persons over 60 years old within the visually impaired population, but also that this is a continuing trend. This is indicated by the very large proportion (85%) of new registrations represented by the over 60 age group.

Their demands for reading material, however, especially in braille, do not reflect their numerical size. Some research in England (Gray & Todd, 1967), for example, suggests that achievement of braille reading skills is mainly dependent on age of onset of the visual defect. Their study showed that only 3% of those who went blind after they were 60 years old became good enough to read braille book, compared to 72% of those who were blind from birth. Although this gap might be narrowed, by greater emphasis on teaching this group the read braille, for example, the ratio is not likely to be radically altered.

Furthermore, an additional aspect indicates that such a policy may not be entirely appropriate. Analysis of the new registrations by degree of visual impairment, suggests that a large proportion of this elderly population have some degree of residual vision. The figures for the newly registered in 1973 are shown below in Table 4.

Table 4: Degree of vision in the newly registered of 1973

Age Group	Totally blind	less 2/60	2/60-0,1	0,1-0,2	0,2+	Unclss.	Total Number
16-69	27	154	182	291	355	44	1 053
over 70	40	246	432	687	787	62	2 256
% of age gp.							
16-69	2,6	14,6	17,3	27,6	33,7		
over 70	1,8	10,9	19,3	30,4	34,8		

Thus, Table 4 suggests that greater emphasis on using aids utilising residual vision, e.g. CCTV, might be more useful to this population, especially as these alternatives, unlike braille, would not require such a long and arduous training period before they can be used.

In effect, therefore, those elderly people who are braille readers simply form, a not very large, supplement to the casual reading market.

Multiple Handicapped:

Visually impaired persons with an additional handicap are forming an increasing proportion of the population, especially within the group formed by school children. In a report (Arnör, 1975) of a survey of the multiple handicapped persons in two counties in Sweden, 289 multiple handicapped were found among the 1 535 registered blind in that area. During the survey 24 died, and the remaining 265 were distributed as follows:

107	physically handicapped
43	hard of hearing
33	physically disabled and chronically ill
27	hard of hearing and chronically ill
25	hard of hearing and physically disabled
27	chronically ill
17	mentally retarded
11	hard of hearing, physically handicapped and chronically ill.

Nineteen of these people were less than 30 years old, and 70 were between 31 and 60 years old.

For some of these multiple handicapped people, braille is an important medium, as for the deaf-blind, for example, where the tactile sensory channel is their main (and, in effect, only) means for information acquisition. On the other hand, many of these people will not require braille, either because of too severe mental retardation , or lack of sufficient muscular control to move their hands over the embossed paper. Also, there will undoubtedly remain many who will not be able to cope with the usual material which their peers use, but nonetheless, be capable of being literate to some extent. The main problem for this group lies more in the design of the content and layout of the material, however, rather than in production of the material. This is a problem for overall provision of braille material which must be taken up in the immediate future, but, the problems are too specialised to warrant further discussion here.

Summary and Implications

The number of visually impaired persons registered in Sweden at the end of 1975 was 23 337. If current trends continue this figure is likely to be nearly 30 000 by the end of 1978.

Gross totals of visually impaired, however, are not very useful when considering such a detailed aspect of provision as braille material. Indeed, even considering the overall numbers of braille readers within the visually impaired population could be misleading when planning for provision. Therefore, the braille reading population was categorised into six sectors - schoool children, students, employed, casual readers, elderly, and multiple handicapped.

School Children:- The number of visually impaired school children is about 1 300, although only about 300 of these are completely dependent on non-visual perception. Of this 300, probably around 100 are braille users.

Students:- There are currently about 110 students using the facilities of the DBF's Study Literature section. Demand for braille material is in excess of transcription facilities available as over half (60) of the students are proficient and regular braille users.

Employed:- The number of employed visually impaired persons has increased considerably over the last five years and there are now nearly 1 500. The number of braille users (for vocational purposes) is difficult to estimate. The maximum figure is about 600, although the actual number is almost certainly less than this. On the other hand, use of braille in work situations is an increasing trend among employed blind persons.

Casual Readers:- The total number of braille readers in Sweden is around 2 500. The most popular magazines have a circulation of between 1 500 and 2 000, but numbers of regular borrowers of books are more difficult to estimate. During 1976 there were 275 individual borrowers but in addition a large proportion of the loans were spread among 29 institutions.

There is an increasing use of braille books and magazine-type material for everyday use. This increase began fairly recently (around 1970) and there is little spare capacity at the moment to meet these demands.

Elderly:- Numerically, elderly visually impaired people form three quarters of the total visually impaired population. However, their demand for braille is relatively very small. This is mainly due to the difficulties of learning braille at an advanced age, and the lack of incentive caused by the poor range of material available, even compared with that available in talking book form.

Multiple Handicapped:- Nearly 20% of the visually impaired population are multiply handicapped. As a result of these extra handicaps, however, a lower proportion of this group will be able to use braille. Although, in certain cases, as with the deaf-blind, for example, tactile access to information is effectively the only remaining information processing sensory channel and therefore braille plays an even more important role for these people.

The discussion in this section shows that the use of braille differs considerably between the various sectors. For example, over 50% of students use braille, whereas the corresponding figure for the elderly is probably not more than 5%. Thus, to think in terms of 10% - 15% of the total population as being braille readers is not very helpful and consequently any judgement of the usefulness of braille should be made within these sectors and not in terms of the visually impaired population as a whole. Also, it should be kept in mind that the type of material needed by the different sectors can differ widely, and this has important implications for the development of suitable production equipment. For example, many of the books required by students will be complex, and only required in single copies, whereas large-scale techniques will be required to increase the provision of magazine-type material.

In general, the strongest demands for increased braille provision come from the casual readers, especially for magazine material, and from the specialist sectors - school children, students, and professionally employed. The latter demand, although representing relatively few people, is important because of the serious consequences of not ensuring good provision of braille material of this type; namely, reducing educational level and employment opportunities to many blind people.

SECTION B: CURRENT BRAILLE PRODUCTION

There are two main sources of braille material in Sweden. One, the printing house and libraries within the DBF, and the other, production organised by the special materials department of Tomtebodaskolan. The former deals with all material required by the visually impaired, except educational material. It does, however, cater for the needs of students either at Universities or other higher education institutions. Educational material, including some of that for adult education, is produced by Tomteboda. We will discuss these two braille sources separately.

Production from DBF[1]

Production of braille in the DBF can be categorised into two sections - the printing house, which essentially deals with multiple copy material, and the library departments, which produce mainly single copy material.

The printing house uses conventional stereotype-press production methods. There are 6 Marburg stereotype machines, 2 Heidelberg flat-bed presses and 1 Marburg press. There is one proof-reader working on the premises, but much of the proof-reading is done by proof-readers working at home. Correcting is done by the transcribers, as correcting their own plates provides a useful feedback about the kinds of errors they are making. At the moment there are six transcribers employed, although others are at present undergoing training.

Table 5 (page 20) summarizes the characteristics of the internally published material to be handled by the printing house during 1977.

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1 FOOTNOTE:
From January 1st 1977 De Blindas Förening (DBF) will change its name to Synskadades Riksförbund (SRF). And, from July 1977 the braille printing house will become "SRF Tal och Punkt AB".

Table 5: Material to be printed during 1977

Number of issues per year	Number of pages[2)]/edition Jan-June	July-Dec	Number of copies
10	80	80	200
12	32	40	400
4	16	16	400
10	80	80	400
10	4	4	400
4	24	24	150
52	40	40	1 200
4	20	20	250
47	36	72	150
52	36	36	1 500
52	1	1	1 500
2	16	16	1 500
1	40	40	1 500
1	4	4	1 500
10	36	36	1 500
10	36	36	500
1	92	92	1 000
20	40	40	2 000

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2) "Page" in this report refers to a single side of braille or text

In addition to the material listed above, the printing house prints an additional 2 000 000 or so pages for outside organisations and individuals.

There are three library departments, one for general reading material, and two for special types of material, namely, material for students and material for adult education. These library departments have transcribers (about 40), most of whom work at home, using Perkins braillewriters, to produce their material. Any copying that is required is done by vacuum-forming.

Annual production and loans from DBF's library departments are shown in Table 6 below.

Table 6: Production and Loans from the DBF's Library Departments

	1973	1974	1975	1976
General Library: (Braille only)				
No. of titles available	3 943	3 924	4 025	4 054
No. of loans	2 506	2 813	2 562	2 630
No. of borrowers	270	303	269	275
:(Talking Book only)				
No. of titles	8 665	9 284	9 772	
No. of loans	114 955[1]	128 098	118 126	130 109
Students Library				
No. of Talking Book titles	2 913	3 180	3 472	3 923
No. of Braille titles	219	269	333	398
No. of loans	1 967	2 495	2 107	2 850
No. of users	147	150	160	180

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[1] Not including bulk deposits to institutions

Production for the adult education library ("folkbildningssektionen") is small relative to the other two departments, and also difficult to quantify. This is because production is assessed in terms of number of "study units" (studiepaket) which may correspond to several separate books. This material, both in talking books and braille, is produced for local courses and study circles, at which a fairly small, but increasing, number of visually impaired attend.

Tomtebodaskolan

Tomteboda acts as co-ordinator for the production of braille books for school children and for adult education. The books to be transcribed are decided from requests received from teachers who have blind pupils in their classes or occasionally from pupils themselves. Once a book has been selected, the staff in the special materials department decide what special arranging or editing is required, and whether any maps or diagrams are required.

The book is then sent out to a transcriber (there are about 20 at the moment) who either works at home or in a special workshop for the handicapped in Västerås. When this is finished the braille is returned to Tomteboda where it is proofread and corrected. The braille is then sent to Fagersta where there is a library which makes copies on plastic (usually 2 - 3, but sometimes can be as many as 25), and from which the material is distributed.

In addition there is a small amount of stereotype production from single stereotype machines located in Norberg (not currently in use), Västerås, Fagersta, and at Tomteboda. The plates are sent to Norberg where there is a braille press. The details of this production for the school year 1975-76 are shown in Table 7 below.

Table 7: Book Production organised from Tomteboda - 1975/76

Subject area	No. of titles	No. of vols.
Braille training	8	15
Novels, poetry	7	10
Children, youth	5	5
Educational	10	17
Special handbooks	5	19
"Kultur åt alla"	1	2

These books are normally produced in about 50 copies. Reference books, such as dictionaries, are produced in greater number of copies. A typical example would be about 300 copies which would be expected to last for about three years.

Costs of Present Production Techniques

All prices are in Swedish Crowns (kr) and "page" should be taken to mean one side of braille text, unless otherwise stated.

Stereotyping:

Cost of stereotype machine, including transport, customs, etc. from Marburg to Stockholm	66 000 kr
Investment costs over 10 years at 15% per year (av.)	11 500 kr/yr
Assume 20 working days per month and 6 working hours per day, then investment cost	8.00 kr/hr
Personnel costs	44.00 kr/hr
Other costs, incl. materials, rent, etc.	21.00 kr/hr
Total running cost	73.00 kr/hr
Production speed, including time spent correcting plates	3 pages/hr
Production cost	24.30 kr/page

of which:	personnel costs are	60%
	machine costs are	11%
	material costs are	4%
	other costs are	25%

No detailed breakdown of the costs of embossing the braille on paper is available. However, the average cost taken over the total production during 1976 was 4.6 kr/copy, where the average number of pages per copy was 20.6.

Braillewriter production:

The braillewriter used for all production is the Perkins machine.

Cost of Perkins machine	800 kr
The investment costs can be taken as being neglible for the purpose of these calculations.	
Personnel costs	44.00 kr/hr
Other costs	21.00 kr/hr
Total running costs	65.00 kr/hr
Production speed, incl. time spent correcting	6 pages/hr
Proofreading costs	2.00 kr/page
Production cost	12.80 kr/page

of which:	personnel costs are	56%
	machine costs are	-
	proofreading costs are	16%
	other costs are	28%

Vacuum-forming:

Again no detailed breakdown of costs is available. However, average costs used by the printing house are 1.40 kr/page and 2.15 kr/page, depending on the width of the plastic used. These two widths are used in roughtly equal proportions, thus average production cost is 1.80 kr/page with a production speed of 45 pages/hr.

Development and Expansion of the Braille Production System

From Section A two main areas where expansion of braille provision is particularly needed were identified. These were general braille material, especially magazine-type publications, and specialised material, such as that required by students. These two types of material have important differences with regard to equipment needed for their efficient production.

In the case of general braille material, usually the text will be standard, both in terms of the code system and format, thereby allowing computerised translation of print to braille. Also, in the case of magazines, a large capacity , high-speed output will be necessary, especially where weekly magazines are concerned. On the other hand, many specialised texts do not permit computerised translation because of their complex code system and/or format requirements. This means that manual transcription must be retained. Also, it will be usual to want only single, or a very small number of, copies (less then ten), which would mean very inefficient production if the same large-scale production device had to be used for both magazine production and single copy production.

From this section, we can see that the present production facilities reflect the split between small-scale production of specialised material (mechanical braillewriter, with vacuum- forming for any copying required) and large-scale production of magazine-type material (stereotype-press production). One alternative for expanding the braille production facilities, therefore, would be to simply increase the capacity of the present system by training new transcribers and buying more stereotype machines. However, there are serious weaknesses in these conventional production techniques.

One important aspect not reflected in the present production is the difference in complexity between the various types of material produced. It is not desirable, for example, to maintain the slow manual transcription of straightforward books when a computerised input system could do it many times faster. Also, although it is necessary to retain manual transcription for the more complex material, it is a slow and tedious process to make corrections directly on the paper, as it is to make duplicates by vacuum-forming. By making the original (manual) transcription onto some data processing medium the possibility of fast and easy editing, correcting, and up-dating is allowed, and also, direct braille printers can be used for running off copies whenever they are needed.

With these points in mind we will now discuss some alternative systems for increasing braille production in Sweden.

SECTION C: ALTERNATIVE SYSTEMS FOR EXPANDING BRAILLE PRODUCTION

Introduction

In discussing the new systems that could be introduced, we can consider the transcribing stage (input) and the braille embossing stage (output) as separate processes. That is to say that the new input equipment will produce a data processing medium coded in braille, and the new braille embossers will be able to be controlled by the same data processing medium. This is in contrast to the existing systems as stereotype plates can only be used in conjunction with some kind of press, and mechanical braillewriters produce the braille copy directly. In other words the present production techniques have "inputs" and "outputs" which are fixed in relation to one another, whereas any input with the new techniques will be able to be used with any of the new output devices, thereby providing a considerable increase in flexibility of production.

This difference is the result of using a data processing medium with the new techniques. There are a number of forms which this coding/storage medium could take, for example, punched paper tape, punched cards, magnetic tape, magnetic cassettes, etc.

Figure 3 illustrates the existing and new production techniques.

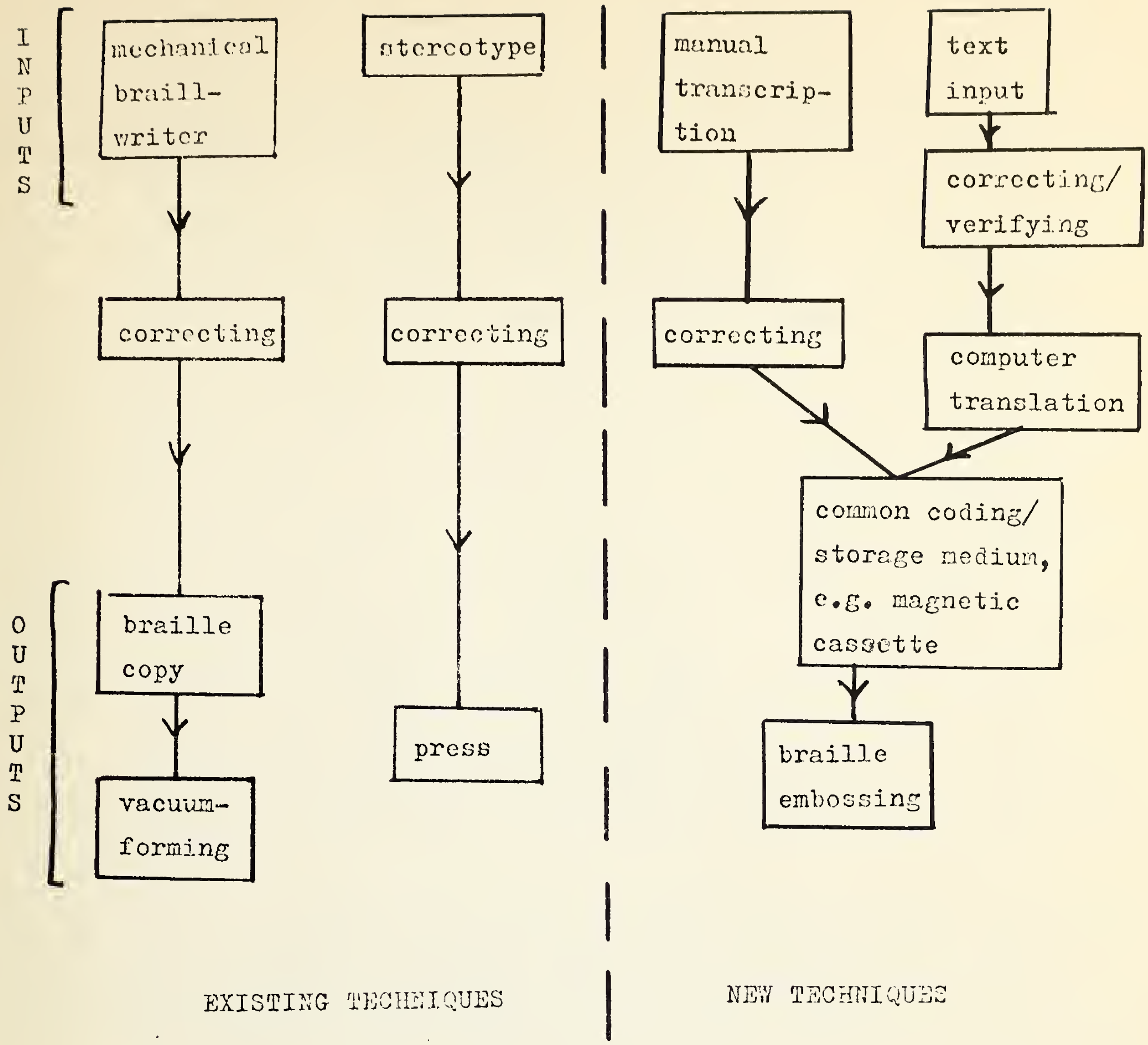

Fig 3. Comparison of existing and new production systems

1) INPUT SYSTEMS: a) Manual

The Potential of Manual Transcription

Despite the innovations in computerised braille production, manual transcription is still in widespread use. Finland and France, as well as here in Sweden, use exclusively manual transcription techniques; West Germany uses a computer in the production of one fortnightly magazine, but otherwise everything is produced manually; U.K., Denmark, and the Netherlands, although they use computerised techniques, extensive use of manual transcribers is still necessary. Even in the U.S.A., where computerised translation has been in operation for more than a decade there is still a need for widespread networks of volunteer transcriber groups to cater for the needs of braille users. Furthermore, this general picture is not likely to change significantly in the forseeable future, despite considerable research and development effort into more sophisticated computerised systems.

One of the main justifications for the continuing emphasis in research and development on computer translation of braille has been the shortage of braille transcribers. There are, however, certain features associated with manual transcription of braille that have considerable potential for exploitation, and, in the process, possibly help to attract more people to become transcribers. These advantageous features are masked to a certain extent, at the present time, by the equipment transcribers have to use.

Increasing the speed of operation of keyboards for ordinary commercial use has received extensive attention, certain aspects of which are relevant here. For example, it has been found that:-

- use of chord[1] keyboards allow entry rates of 150% of standard typing. (Seibel, 1972.)
- "the act of encoding during a data entry task need not slow down the rate of data entry." (Seibel, 1972.) And, "(the process of sub-

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1 Keyboards currently used by braille transcribers are "chord" keyboards. That is, combinations("chords") of the 6 keys can be pressed, thus allowing all 63 braille characters to be generated from the 6 keys.

stituting shortened coded forms for fully spelt text) can be carried on while typing without slowing the keystroke rate." (Schoonard & Bries, 1975.) Thus implying an increase in entry rate proportional to the decrease in number of keystrokes necessary as a result of the code system.

The reasons these findings have not yet been implemented for general use are that the costs involved in retraining staff to use the different keyboard and to learn the coding system for any shortened form of language would not be justified by any savings due to the increased speed, at least in the short term. These inhibiting factors do not apply, however, to the braille transcription situation. Chord keyboards are already used as standard, and the code system must be learnt by all transcribers, whether they are to use the existing or the new braille keyboards.

Two main implications for development can be drawn from this argument:-

i) to produce an improved braille keyboard that keeps and exploits the advantages of chord keyboards, but which is faster and more comfortable to operate than any existing mechanical braille keyboard;

ii) to investigate the training situation of braille transcribers so as to optimise the process of learning the braille code.

The development of an improved keyboard is suggested within the proposals considered in this report. The second aspect, the training of braille transcribers, is less amenable to immediate change.

Basic Design Features to be Considered for a Manual Input System

Manual input consists 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, therefore, the implications of the relationship between transcribing and correcting need to be clarified.

In the existing manual input systems the transcribing and correcting processes are carried out as two, quite distinct, procedures. First the material is transcribed, then it is passed on to the proofreader, errors are located and marked, the material is then handed back to the transcriber for him to correct his errors.

Input equipment has been built, however, which allows these two processes - transcribing and correcting - to be done by the same person at the same time, i.e. they are merged into a single procedure. This equipment, built in prototype form at Stiftung Rehabilitation, Heidelberg, allows a braille transcriber to write a line of text and to have this displayed in either visual or tactile form. This display can be checked for errors, corrected if necessary, then when correct, "dumped" onto a storage medium, e.g. magnetic tape or cassette.

Both these "extremes" have disadvantages. The former, by not allowing the transcriber to immediately correct mistakes that he makes (and some research suggests that almost 70% of keyboard errors are "slips" which are immediately realised by the operator), puts an unnecessary burden of the proofreader, and can be frustrating to the transcriber. On the other hand, giving the transcriber complete responsibility for checking and correcting all his mistakes during the time he is transcribing will slow down the transcribing rate very significantly, especially if conducted on a line-by-line basis.

Thus, there is a need to strike a balance between speed of operation of the 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.

In addition to achieving this balance, an optimum input system must possess the following features:

- well designed, chord keyboard to maximise speed of keyboard operation,
- some display of what has been written so that the transcriber can relocate his position after interruptions, etc.
- sophisticated word processing facilities so that, after proofreading, location and correction of errors can be carried out with the greatest possible speed and ease.

Alternative Manual Input Systems

i) Triformation PBCE

Triformation Systems Inc. have produced their own small-scale, manual production system which they call the PBCE (Perkins Braille Control Electronics).

This system consists of:
a) a standard Perkins braillewriter, slightly modified with wires that feed electrical impulses to
b) a Triformation PBCE. This device codes the keystrokes of the braillist onto
c) a digital cassette tape recorder, which can play back the data into a
d) Triformation LED-120 braille page embosser.

Thus, one line of text is entered from the Perkins into the PBCE memory. By use of a backspace key, characters can be deleted which affords elementary edit/correction ability. One full line of characters (40) is then transmitted to a storage device. As explained at the beginning of this section (C), other braille page embossers than the LED-120 could be used as output. In other words, the PBCE input system forms a complete system in itself and is independent of the LED-120 output.

Editing a line or lines on a given page is accomplished by replaying the tape in the edit mode and rewriting the lines to be changed. Full page or pages can be retyped or added at the end of the tape and moved to their proper position when the book is bound.

Although the PBCE is relatively cheap (ca. 20,000 kr) and offers the advantage of writing onto magnetic cassette tape, thereby facilitating more convenient and economical long-term storage and easier production of subsequent copies, its improvements over the existing mechanical system are limited. It still utilizes the Perkins braillewriter for the keyboard input which many transcribers report as a fatiguing to use over extended periods. Furthermore, the editing facilities are rather limited as they are based on correcting whole lines. This latter aspect is particularly crucial when transcribing longer (book length) material.

ii) Input System Based on a Text-Editing System

These devices are basically similar to the Triformation PBCE system in that they involve writing onto a magnetic tape first, which can then be edited and/or corrected before running off multiple copies of the material.

A survey was conducted of companies in the Stockholm area selling such equipment. Six companies offered equipment that could be suitable for a braille input system. Each company's equipment was compared on the following five criteria: 1) medium used for coding, 2) storage capacity of the medium, 3) code(s) used, 4) editing facilities, and 5) costs. The results are summarized in Table 8 (page 36).

The editing/correcting facilities are one of the most important aspects in deciding on which system to use. All machines use basically the same system which is based on "addressing" certain arbitrary blocks of text (e.g. pages) and lines. Corrections are then achieved by locating a particular line from its address, then rewriting the incorrect line in its correct form. Generally it is possible to write all the corrected lines, together with their addresses, in a block, then the machine will place these corrected lines in their appropriate places in the text automatically.

Three of the machines - Rank-Xerox, Facit, Diehl - also allow editing to take place within a line. That is, it is possible to print out single words or characters at a time and just correct (i.e. insert, delete or overwrite) those characters or words that are incorrect. This facility will speed up the correcting process considerably, especially when only one or two characters need changing, compared with other systems where the whole line must be rewritten every time.

Three machines - Rank-Xerox, Facit, Wang - have a facility for "keyword searching". This means that a word can be typed into the system and this word will then be located automatically by the machine. Two of the machines, however, - Facit and Wang - can only locate words at the beginning of a line (i.e. only words which are at the beginning of a line can be used as keywords). With the Rank-Xerox equipment

Table 8 SUMMARY OF SURVEY OF TEXT-EDITING SYSTEMS

Company	Rank-Xerox	Facit	Ordsystem
Machine Name	800 Series	Redactron Series	Diehl system autotext
Coding Medium	Magnetic Cassette or Cards	Magnetic Cassette or Cards	Magnetic Cassette
Code(s)	ASCII	Selectric, ASCII, EBCDIC	1SO 7-bit code
Storage Capacity	Cassette - ca. 100 000 chs. Cards - ca. 10 800 chs.	Cassette - ca. 80 000 chs. Cards - ca. 10 240 chs.	Cassette - up to 400 00 chs.
Editing Methods	Via block of text, line, word. Manual searching by addresses. Automatic address searching.	Via block of text, line, word Automatic address searching. Keyword seraching.	Via block of text, line, word. Manual searching by addresses. Automatic searching by addresses.
Costs:	Buy: 1 cassette station - 47 710 kr 2 cassette station - 63 170 kr (incl. service)	Buy: 1 cassette station - 31 655 kr 2 cassette station - 49 005 kr (incl. service)	Buy: 1 cassette station - 65 000 kr 2 cassette station - 73 000 kr (Service 7% of buying price)
	Cassettes - 56 kr each Cards - 4:80 kr each (10 cards = ca 1 cassette)	Cassettes - 85 kr each Cards - 7 kr each	

SUMMARY OF TEXT-EDITING SYSTEMS (Contd.)

Company	Hader-Schmidt	Olivetti	Wang
Machine Name	Hermes WP 4200	S 14 & S 24	System 1222
Coding Medium	Magnetic Cassette	Magnetic Cassette	Magnetic Cassette
Storage Capaity	125 000 characters	250 000 characters	133 000 characters
Code(s)	Selectric	-	-
Editing Methods	Via text block, line, or word. Automatic searching of addresses. Direct line searching.	Automatic address searching. Direct line searching.	Automatic address searching Keyword searching. Direct line searching
Costs	Buy: 2 cassette station - 38 900 kr (excl.)	Buy: 1 cassette station - 33 500 kr (excl.)	Buy: 2 cassette station - 58 000 kr ------------------ with visual display unit - 66 500 kr (excl.)

keyword(s) can be taken from any position within the text. This latter facility of the Rank-Xerox equipment is useful in that position of errors can be located directly, with the minimum of operator control. With the other two machines, the line would have to be located first, then the position of the error within the line would have to be located manually by skipping over the appropriate number of words and characters. Therefore, greater speed and less chance of mistakes are probable with the Rank-Xerox machine.

In order to facilitate the writing of braille it would be necessary to interface an electronic "braille" keyboard to these machines. The design and production of such a keyboard is not a major technical problem. Standard keyboard components can be used; the only special feature necessary is an electronic curcuit to ensure correct "chunking" of the keys pressed on the keyboard. This can be achieved by only taking the data from the keyboard after all keys have been released rather than when they are pressed.

Apart from allowing greater speed of operation (See C)1)a)) a well designed "electronic equivalent" of the Perkins keyboard will also remove much of the effort required to operate the mechanical Perkins, thus reducing fatigue in the operators. Initial reports from users of an electronic keyboard developed in England support this contention.

From the text-editing systems surveyed the Rank-Xerox 800 proved to be the one best suited for use in a braille production system. Such a manual encoding system would operate as follows. A braille keyboard would be interfaced to one of the Rank-Xerox 800 text-editing systems. Operation of this braille keyboard would code braille onto the magnetic cassette and simultaneously produce an inkprint output from the typewriter. As there are 88 alphanumeric symbols on the typewheel there is no problem about representing each braille character by a unique print symbol. This output would thus allow easy checking of format arrangement and also of the last characters typed in the case of interruptions of the transcriber. The full editing facilities would be available to the transcriber, but minimum use would be made of these during the first transcription in order to maximise typing speed.

Once transcribing was completed, a braille copy would be run off. This would then be sent to a proofreader who would produce a list of errors and their page location. These would be sent to the original transcriber who would then carry out the necessary correcting. This stage could, of course, be omitted for that material for which proof-reading was considered unnecessary.

There are two systems available. One has a single tape station and the other has two stations. As the double tape station is about 30% more expensive than the single tape station, the latter is preferable for the transcribing unit. However, the single station machine only has facilities for inserting up to 50 characters between any two lines, (this is equivalent to between 1 and 2 lines of braille text). Thus, if a block of text greater than 50 characters needed to be inserted at the editing/correcting stage this would not be possible with a single station machine. In order to be able to deal with such contingencies a double station machine is required. However, the occurance of such exceptional editing requirements does not justify each transcribing unit to be of a double station type. One double station machine could deal with the special editing resulting from several single station transcribing units.

Such a system as the above has a number of advantages over the PBCE. Its electronic keyboard offers improved working conditions and efficiency to the manual transcribers over the Perkins keyboard. Also, the editing facilities with the Rank-Xerox are much more powerful, thus allowing much faster and easier editing and correcting of the text.

Such text-editing systems are designed, however, to be complete systems in themselves, rather than as "system components". This implies that the coding systems used are special and specific to each type of machine. The reason for this is that in order to achieve the high level of editing facilities the coding system is adapted specially to the detailed functioning of the micro-processer within the machine. This can cause problems if tapes prepared on these machines must be used on other equipment as well; on a braille printer, for example. Although code conversion is possible for most of these text-editing machines, such conversion equipment adds significantly to their cost. Furthermore, it is not possible to take a tape prepared elsewhere, from a computer translation, for example, and to edit and correct the text on the tape using a text-editing system.

iii) Input System Based on Equipment used in the Printing Industry

Increasingly, printing houses and newspaper printers are changing over to computer controlled photo setting with on-line text input systems. A common configuration of such a system is to have a number of encoding units, i.e. keyboards with either line or screen display of the text being written, on-line to the company's computer. No hard copy output is produced at this stage. The next step is proofreading, the material for which can be produced at high speed from a separate printer. This text is then corrected using an editing terminal with visual display screen, and then is output directly to the photo setting machine.

There is also a trend in the printing industry in Sweden to use cassettes as an encoding medium for text, even in printing houses which have a computer based photo-setting system. Furthermore, as equipment exists that can run off-line from cassettes for each of the above input stages, it is possible to build up an off-line system that is also compatible and functionally similar with the existing systems used in many ordinary printing houses.

A company - Tele-ekonomi AB - which specialises in producing such cassette-based equipment for the printing industry was contacted and a braille input system based on their standard equipment was drawn up.

In outline, Tele-ekonomi's input system consists of:
1) Encoding Units - These can either be based on a unit with a 32-character moving display or with a visual display screen showing 25 lines at a time. There are also facilities to correct any keying errors.
2) Matrix Printer - This printer is capable of up to 180 chs/sec. and would be used for producing proofreading material required in inkprint.
3) Editing/Correcting Unit - This is based on a Hewlett-Packard HP 2640 visual display screen. It has an internal memory of 8 000 characters and

full text-editing facilities, including automatic search for "keyed-in words" at 500 chs/sec.

Thus, the above system has all the technical features that are found with the text-editing systems and, additionally, some extra advantageous features.

With the Tele-ekonomi system the various stages of the input system take place on separate units. This means that the appropriate balance between encoding units and editing/correcting units can be achieved in a more efficient manner than with text-editing systems. In the latter extensive editing facilities are included even in the simplest single tape-station machines which are not really needed during the initial input (transcribing) stage. Furthermore, there is greater flexibility available in designing the encoding units themselves so that the right balance between units intended for transcribing ordinary running text and units for specialised and/or complex text can be achieved. Such flexibility implies a much better cost effectiveness.

The editing/correcting unit is potentially available for handling tapes from any source, unlike the text-editing systems. It would still be necessary to carry out some conversion to the appropriate code system, but this would be a more straightforward process with the editing unit than with any of the text-editing systems. This means that with the development of additional input techniques - contracted braille from a computerised braille translation system or uncontracted braille direct from a news agency, for example - can be edited, formatted and corrected on the same unit as that used for the "in-house" transcriptions

1) INPUT SYSTEMS: b) Computerised

There are basically two alternative approaches to a computerised input procedure, and choice between these must be made first. One involves the use of commercially available keypunching and computer service bureaux. The other involves owning or renting a small computer and using this on-line.

Use of a large-scale computer, through ordinary keypunch and computer service bureaux, has a number of advantages over having computer facilities on the premises of the Swedish braille printing house for the initial expansion of braille production in Sweden.

Firstly, it would involve a minimum of capital investment and provides a situation where you only pay for what you use. This is a particularly important aspect in view of the fact that a translation program for Swedish has not yet been developed.

Secondly, development of the program would be easier on a large-scale computer; standard high-level languages could be used and access to the program would be more straightforward when any modifications or developments were needed. Also, no employment of staff on a long-term basis would be necessary nor would there be problems of finding space in the printing house to put new equipment.

Thirdly, by not investing any large amount of capital in computer equipment the program and production system can be tested and evaluated in the absence of any large financial committment to continue with it even if it proved unsatisfactory or too expensive. Also, there would be complete freedom to develop just certain aspects, such as the direct translation of tapes bought directly from the inkprint publishers.

2) OUTPUT DEVICES

Basic Design Features to be considered for an Output System

When discussing output devices it is useful to distinguish between two different types. These are parallel embossers - i.e. devices which produce one page (or a double page, or exceptionally, with the Solid Dot, 16 page sections) 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 traditional braille production processes use these kinds of output device, i.e. press braille and vacuum-formed braille. In contrast, we have sequential embossers which produce one complete copy of the transcribed material at a time. Then, if multiple copies are required the braille coded storage medium is run through the printer as many times as number of copies required. All devices of this type are controlled from a coding medium such as paper or magnetic tape, and perhaps the most well known examples of this type of embosser are the Triformation LED-120, used in Holland, England and many places in the US, and the modified IBM 1403 line printer which is used in Denmark and West Germany.

These two different types of embosser have different characteristics depending on the length of material (i.e. number of pages) and number of copies, that are produced.

Assuming that the material has already been transcribed, then the time taken by either type of embosser to produce multiple copies of the braille material will depend 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 parallel embossers the machine is reset, i.e. the stereotype plates are changed, or in the case of the ZBE, the embossing drums reset, 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, i.e. the tape rewound back to the beginning, as many times as there are numbers of copies of the material to be run off.

This means that these two types of embossers show a different relationship between their output time and the variables, number of pages and number of copies. This can best be shown by means of the symbols set out below.

The output time of a parallel embosser can be represented by the formula:

$$N.Rp + N.n.tp$$

where N = number of pages
n = number of copies
Rp = resetting time
tp = time to emboss one page of braille

and the time for a sequential embosser will be:

$$n.Rs + N.n.ts$$

where N = number of pages

n = number of copies

Rs = resetting time

ts = time to emboss one page of braille

These equations were used to produce some graphs of production times comparing two high-speed parallel embossers - high speed rotary press and ZBE - and two sequential embossers - LED-120 and the Delft/Thiel line embosser. These are shown in Figures 4 and 5. (Page 45 and 47)

Comparison of Figures 4 and 5 shows clearly that parallel embossers are very much faster than the sequential embossers. In the time it takes the Delft/Thiel machine to produce about 50 copies of a 100 page book, the ZBE could have produced about 1 500 copies. This speed difference, however, becomes less significant when small numbers (less than 10) of copies are produced. This is because the "setting times" (see Figure) become more significant in the parallel emossers as numbers of copies decrease (but numbers of pages remain constant) whereas the opposite is true of sequential embossers. Therefore, even though parallel embossers are still faster than sequential embossers, the difference is reduced greatly - from about 30 times as fast when considering several hundred copies down to only 3 times as fast when considering about 10 copies.

If we consider the output characteristics of the braille needs identified in Section A we find a strong polarisation between increasing large-scale (i.e. large numbers of copies/several hundred/)production in the form of magazine material and increasing snall-scale (i.e. small number of copies /less than about 10/) production in the form of books or other material for school children, students, employed, adult education purposes and so on.

From our discussion of output devices above it was shown that the existing devices are either suitable for large-scale production (parallel embossers) or for small-scale production (sequential embossers). Therefore, if both priority needs are to be met adequately, then both a parallel and a sequent-

Fig 4. Production times of two high speed parallel embossers

——— ZBE based on 2 revs/sec and 15 secs to set pins in both drums

— — — High-speed rotary press based on 9.000 double interpoint pages/hour and 2 mins. average for changing plates.

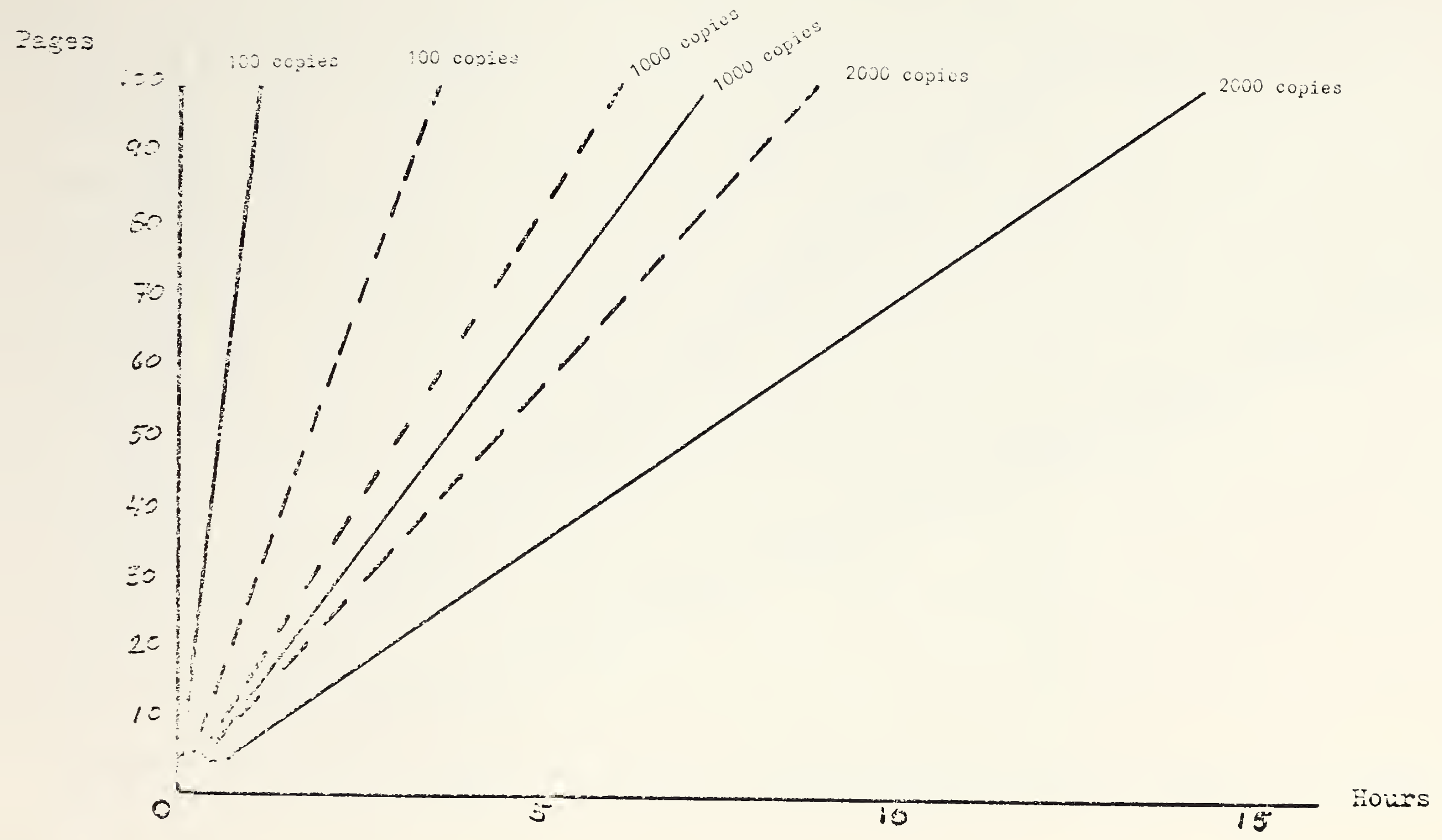
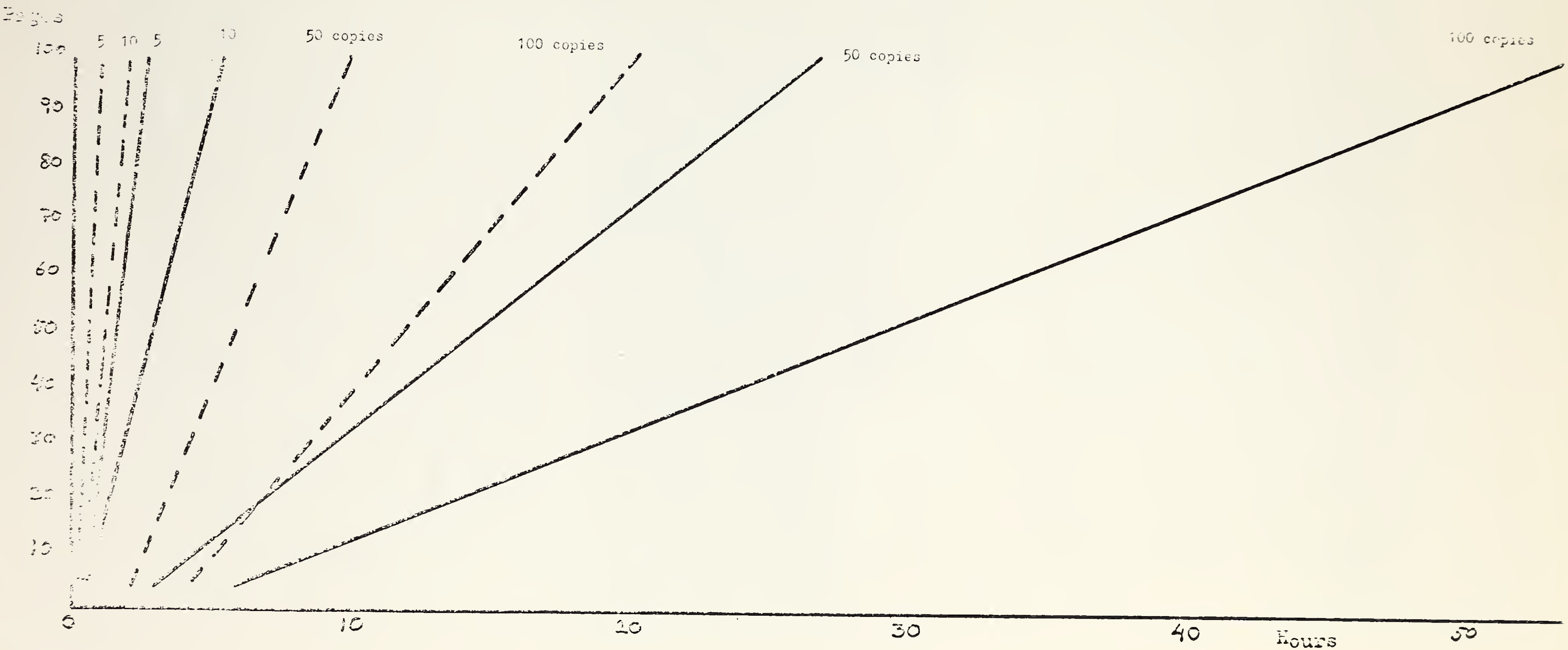


Fig 5. Production times of two medium speed sequential embossers

——— Triformation LED-120, based 60 chs/sec and 2 mins resetting time, avarage.

– – – Delft/Thiel line embosser, based on 5 lines/sec and 2 mins resetting time, avarage.



ial embosser will be required. Not to have both sorts of embosser available would effectively cancel out the gains in input capacity provided by the new techniques.

As well as both machines being necessary to meet the needs for braille, a parallel embosser is necessary to provide interpoint braille - no sequential embosser can produce interprint braille for production purposes, and a sequential embosser is necessary for providing the single copies that will be required, for example, for proofreading material of braille transcribed on the new manual input system, and requests for single copies of a work already transcribed.

Alternative Output Devices

1) Parallel Embossers: i) Zoltan Braille Embosser

This machine is currently under development at Trask Datasystem AB of Stocksund. Its design is based on a rotary press principle, but instead of placing a printing plate around the drums, pins, which can be set in an embossing or non-embossing position, are located in the drums themselves. (See Figure 6.) Thus, each drum contains sufficient pins to be able to write a braille page of 29 lines each of 30 characters.

The embossing cycle first involves setting all the pins in an embossing position (i.e. they protrude from the drum's surface). Then the drums are slowly rotated and each row of embossing pins is set. This is achieved by a row of rods, one correspondning to each pin on a row. When the pins are opposite these rods they are free to move so that those pins which are not required for embossing can be pushed in by their corresponding rods. This is done under control of a mini-computer which is interfaced to the press. As the drums then rotate to the next setting position, the previous row of pins are automatically locked in their respective positions. This process is continued until all the pins are set. The drums are then ready for embossing interpoint braille which can be run off at a high speed (ca. 2-4 revs/sec.).

This machine is now in a preliminary prototype stage; that is the embossing drums have been assembled and tested with sufficient pins to produce interpoint braille pages with 10 characters on each line. The necessary software for controlling the embossing cycle and setting text has also been written. This prototype has successfully produced readable interpoint braille, and is now being modified so that it can produce complete pages of interpoint braille.

ii) Heidelberg Data-Controlled Stereotyper

This machine has been built in prototype form as part of a larger project on the rationalisation of braille production carried out at Stiftung Rehabilitation, Heidelberg. This machine was designed to make the production of metal plates for braille printing more efficient.

The relatively high speed of this machine (10 chs/sec. compared to the 4 chs/sec. achieved by the standard automated Marburg stereotyper) was achieved by the development of a new method of fixing the plate to be embossed so as to make the use of the usual heavy frame unnecessary. (See Glitsch & Rieder, 1976, and Küppers, 1976 for further details.) This machine is to be produced at the Blindenstudienanstalt and will be available during 1978.

iii) Marburg Automated Stereotyper

This is the standard electrically-assisted manual stereotype which has been adapted to run from punched paper tape. It is available on a commercial basis from the Blindenstudienanstalt at a cost of about 54 000 kr. Its speed when run from paper tape is 4 characters per second. It can also be used as a normal manually operated machine.

2) Sequential Embossers i) Triformation LED-120

This was one of the first purpose built, commercially available braille embossers, and is now in use in some thirty different places. Most are in the U.S., but they are also in use in Canada, Holland and England, where they are used both as computer terminals providing braille output and production units.

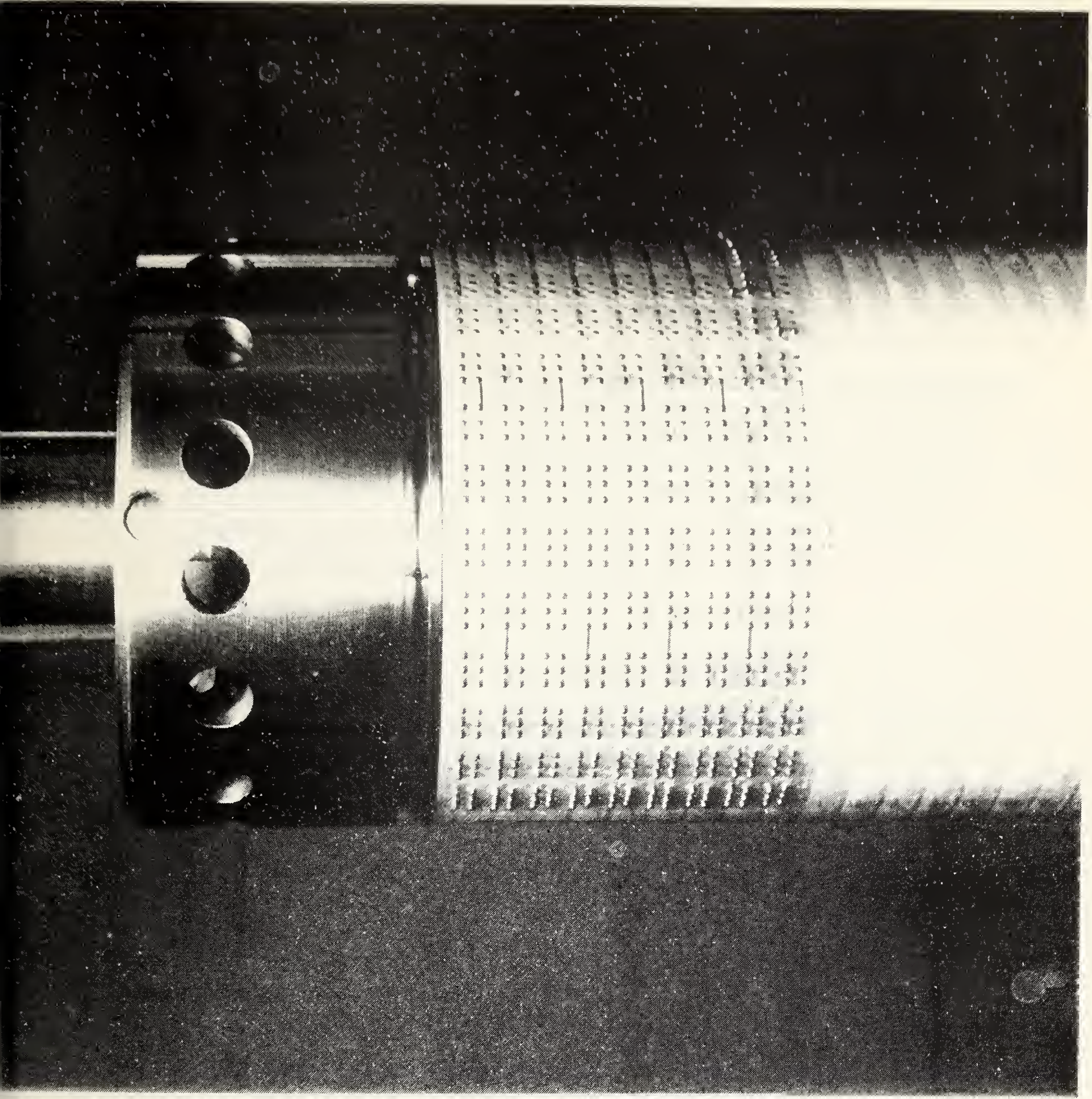


Fig 6.

These printers are free-standing devices which can be driven on- or off-line at a maximum speed of 120 chs/sec. The manufacturers recommend, however, a production speed of 60 chs/sec. if the best quality is to be achieved.

From comments received from various users, the LED-120 appears to function well, although a number emphasized that frequent and careful maintenance was essential. Most of the users stated that they were satisfied with the quality of braille produced, however, comments on the samples received by braille readers in Sweden often criticised the smallness of the dots.

ii) SAGEM

This device has only recently come onto the market, and like the LED-120 can be used either as a terminal giving braille output or as a production device.

At 15 chs/sec. it is considerably slower than the LED-120, however, the quality of braille produced is very good. Another significant feature is that interpoint braille can be produced by manually removing the paper after having been embossed on one side then re-placing the paged reversed so that braille can be written on the other side. Character spacing is then "off-set" on the back as against the front. The basic cost of the SAGEM is approximately one half of that of the LED-120.

iii) IBM 1403 line printer modified for braille

This is a standard line printer, capable of about 3-4 lines/sec., the printing belt of which can be changed so as to produce braille instead of inkprint characters.

This machine is currently in use in Denmark and West Germany. From a sample volume produced on the Danish machine the quality of the braille was found to be rather poor, although readable.

iv) Delft/Thiel line printer

This printer was designed and a prototype built at the laboratory of Fine Mechanics of the Mechanical Engineering Department of Delft University of Technology, Holland. The printer operates on a line printer principle. i.e. the printer has 40 braille cells each consisting of six embossing pins, then all pins that are to form the braille line are selected and then embossed (See Westland, 1976 for further details). A speed of 5 lines/second is possible with this device.

Production development based on this printer is currently being carried out by Thiel GmbH, West Germany, however, no information about availability and costs have been forthcoming as yet.

SECTION D: A PROPOSED SYSTEM FOR THE EXPANSION OF BRAILLE PRODUCTION IN SWEDEN.

Design principles

The main principles influencing the proposed system below are those aspects discussed in this report. That is, the demand for braille material - how large, what sort of braille material, in how many copies? etc. - and the range of equipment available to produce the braille.

In applying these principles the context of braille production in Sweden now has also had a considerable influence in shaping the new system. That is to say, the new system proposed below is not "new" in the sense of being a replacement for the existing production methods but rather is a supplementary production system that will be absorbed into the existing methods and thereby increase their capacity and efficiency.

In actual fact all aspects of the existing production methods and equipment will continue to exist initially. As the new equipment is introduced there will be a slow change over to new working conditions but essentially the same personnel will be maintained, who will carry out basically similar activities, although, hopefully in an improved and more efficient way. There will not, therefore, be any necessity for extensive retraining programs or redundancies.

This has been seen as an important principle as, although cost effectiveness has been an important factor, braille production cannot be seen in exactly the same light as an ordinary company competing in an open market. The braille printing house can, in effect, be regarded as operating as a monopoly producer. The Swedish braille reader cannot demonstrate his likes and dislikes by swopping to another producer! This near exclusive dependence of braille readers on the printing house must be respected and account taken of criticisms and wishes even though, as a result, the efficiency of larger commercial inkprint publishers cannot be matched.

The Proposed System

Input

For the preparation of braille text the equipment used by transcribers should be improved and direct writing of braille should be replaced by a system based on a data processing medium. This has a number of advantages, including:

1) The possibility to change from a mechanical keyboard to an electronic one, thereby allowing improved working conditions for the transcribers.

2) The possibility to utilize available editing systems for the correction of text, instead of the current manual methods of correcting the braille directly.

3) The possibility of cheap and convenient storage of texts on the data medium.

4) The possibility of utilizing automated braille embossing equipment for both large and small editions. Furthermore, this together with point 3) above allows fast and efficient copying of texts at any time after the original transcription has taken place.

From the three manual input systems considered the Tele-ekonomi system offers the best possibility for such a braille production approach.

The configuration of equipment recommended is indicated in Figure 7 (page 57). It consists of six main units - three encoding units, an inkprint matrix printer, a sequential braille printer (which will also form part of the output system), and an editing/correcting unit. One of the encoding units should be based on the standard unit with a 32-character display. The other two encoding units should have a visual display screen available so that a greater amount of text can be seen at any one time. This is especially advantageous for more complicated and/or specialised texts. All three units should have a "braille" (i.e. six key chord) keyboard and, in addition, one of the visual display units should also have a keyboard for writing braille based on the standard QWERTY layout. The text displayed on the screen should be such that there is a one-to-one correspondence between braille characters written and symbols displayed. Thus, the text displayed will have precisely the same format as the eventual braille.

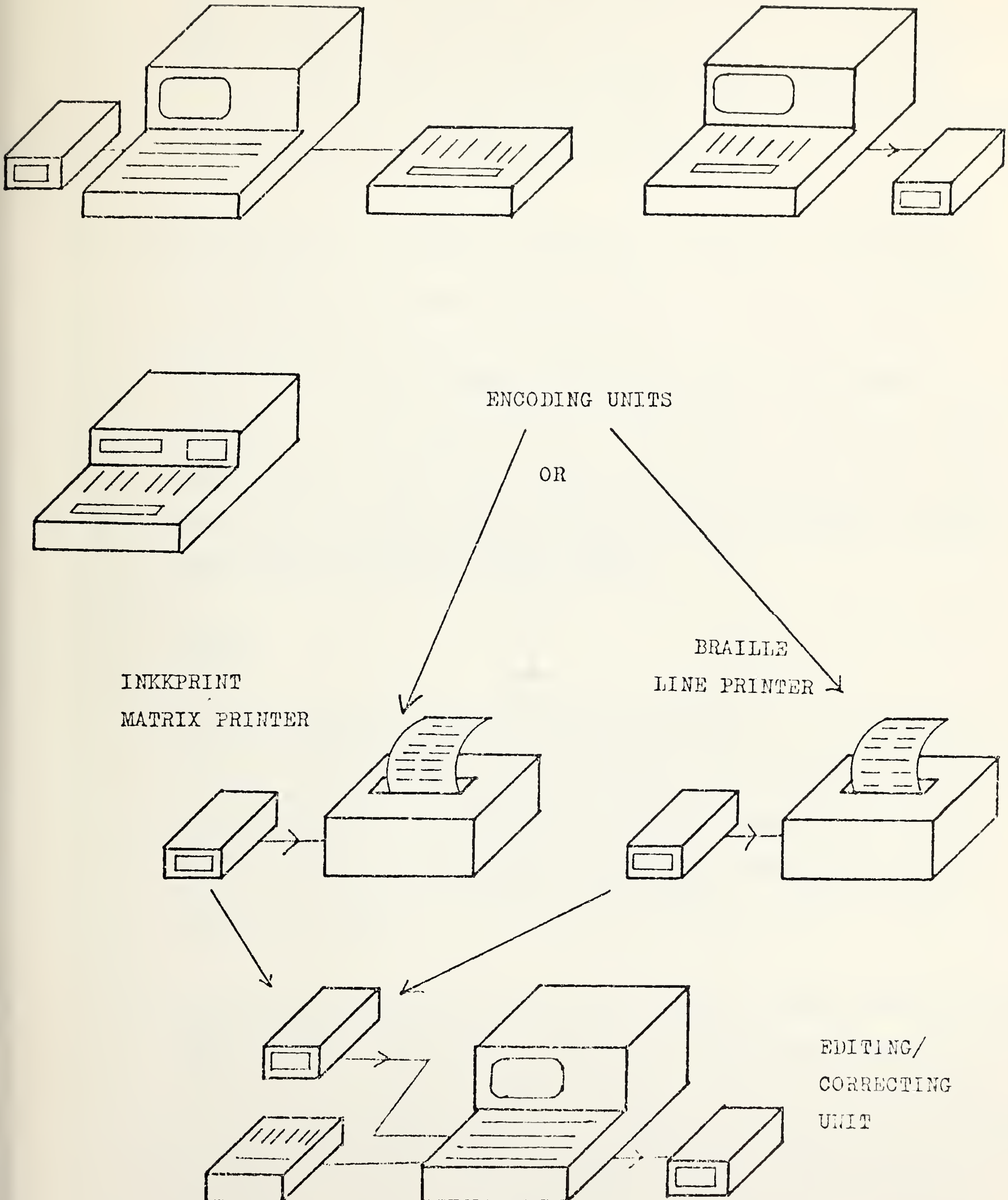


Fig 7: Diagram of Input System

The matrix printer will be as standard, as will the editing/correcting unit, except that this unit should also have both types of keyboard available. The availability of the "braille" keyboard with this unit allows it to be used as an extra encoding unit for complicated text, and the QWERTY based keyboard allows it also to be used by persons not familar with the braille characters to edit (usually uncontracted) braille text.

In addition to this manual system there should also be developed an automated translation system. Initial costings of the automated production route suggest that utilisation of already written texts are potentially very price competitive with the manual methods. This is not so true, however, if the text must be keypunched specially for braille production. Thus, although the program development and initial production trials should take place using a large-scale computer system, the alternative routes by-passing the special keypunching of braille and using texts already available on magnetic tape should be explored in more detail.

Output

In the discussion of output devices in Section C, it was shown that there is a polarisation of the characteristics of available braille printers. On the one hand there are those which operate in parallel and therefore can take advantage of the high speeds possible with ordinary inkprint-type presses. On the other hand, there are the sequential printers, or printers which emboss a complete copy of the text at a time.

Because the production of the printing plates (or the setting of the embossing pins in the drums, in the case of the Zoltan embosser) is relatively slow, parallel output systems are only really suitable for relatively large editions (i.e. about 50 or more, ideally, although an absolute minimum is about 25 copies). Despite the increasing capacity of sequential printers (often with a sacrifice to quality of braille produced), these printers cannot really compete with parallel production for large editions. However, as there is significantly large demand for single, and small numbers of, copies of braille material, there is a need for braille printers suited to this scale of production.

Of the parallel devices discussed, only the Marburg automated stereotype is available today. The new Heidelberg automated embosser will almost certainly be a significant improvement over the Marburg, however, when it becomes available during 1978. Thus, any further increase or improvement of large-scale production should await the availability of this machine. As an initital step, however, an ordinary Marburg machine has been ordered.

There is rather more choice of available machines among the sequential printers, and an initial evaluation suggested either the LED-120 or the SAGEM.

Factors in favour of the LED-120 are its higher speed (4 times faster than the SAGEM at its recommended production speed of 60 chs/sec.), and that it is a well-developed device now in use in some thirty different organisations and institutions. The SAGEM, on the other hand, is a fairly new and untried device.

Factors in favour of the SAGEM are its very good quality braille, its ability to produce (with some editing of the tape) doublesided braille, and its cost is about half that of the LED-120. One additional factor is that the SAGEM, which is produced by a French company, has an agency in Sweden so that maintainence and service would be relatively easy to arrange. Triformation, however, which is an American company, has no such facilities in Europe and difficulties or delays could possibly arise as a result with regard to servicing and/or spare parts. Furthermore, several users of the Triformation machine emphasized the importance of careful and regular maintainence.

At the time of writing (June) the final decision about which of these machines to use has still to be made.

Cost of Production Using New Techniques

Manual Encoding of Braille Texts:

Cost of encoding units -		
a) 32 character display, chord keyboard	38,500 kr	
b) visual display unit, chord keyboard	54,000 kr	
c) visual display unit, chord and standard-type keyboard	63,500 kr	
Average cost of encoding units	52,000 kr	
Investment cost over 5 years at 15% per year per machine (average)	15,100 kr	
Assume 20 working days per month & 6 working hours per day, then investment is		10:50 kr/hr
Cost of correcting/editing unit	83,700 kr	
Investment costs over 5 years at 15% per year (av.) and half-time use. (The other half of the cost will be taken by the computerised input system and other direct input routes, via telephone network, for example.)	12,140 kr	
Therefore, 3 hours/day this unit will be used for the three encoding units. Investment costs per encoding unit will be		1:40 kr/hr
Cost of matrix printer & data cassette	29,000 kr	
Investment cost over 5 years at 15% per year	8,400 kr	
Half the cost to be taken by the manual encoding system (For the same reasons as given for the correcting unit).		2:90 kr/hr
Personnel costs (assuming same person writes and corrects any piece of text)		44:00 kr/hr
Other costs		28:00 kr/hr
Total running cost		86:80 kr/hr

Assuming no increase in production speed, over braillewriter production, i.e. 6 pages/hr (incl. correcting), productions costs will be	14:50 kr/page
Proofreading costs	2:00 kr/page

Total production costs are, therefore, 16:50 kr/page. However, with the improved keyboard and correcting possibilities an increase in production speed is certain. If we assume this increase to be 10% (i.e. 6.6 pages/hour) the total production cost will sink to 15:20 kr/page, and if 20% (i.e. 7.2 pages/hour) then production cost will sink to 14:00 kr/page.

Automated stereotyping

Cost of automated stereotype (Marburg) incl. transport, etc. and data cassette and interfacing	89,000 kr	
Investment cost over 10 years at 15%	22,770 kr	
Assume 6 working hours per day and 20 working days per month. Then, investment costs		15:80 kr/hr
Personnel costs - half time (The same person will be able to look after both this machine and the braille line printer)		22:00 kr/hr
Other costs		16:00 kr/hr
Running costs		53:80 kr/hr
Production speed		12 pages/hr
Total production costs		4:50 kr/page

Sequential Braille Line Printer
Alternative 1: Triformation LED-120

Cost of LED-120, incl. transport, etc., and data cassette player plus interfacing	98,800 kr	
Investment costs over 5 years at 15%	28,650 kr/yr.	
Assume 6 working hours per day and 20 days per month. Then, investment costs		19:90 kr/hr

Personnel costs - half-time (with automated stereotype)	22:00 kr/hr
Other costs	16:00 kr/hr
Running costs	57:90 kr/hr

Recommended production speed - 240 pages/hr. However, there is insufficient production to maintain this speed for 6 hours per day. Therefore, assume machine will work at:-

Half-capacity (120 pages/hr.)

Then, <u>production costs</u> with paper at 0:40 kr/page	<u>0:90 kr/page</u>

Quarter capacity (60 pages/hr.)

Then, <u>production costs</u> including paper	<u>1:40 kr/page</u>

<u>Alternative 2: SAGEM</u>

Cost of SAGEM printer, incl. transport, etc., and data cassette player plus interfacing	54,300 kr
Investment costs over 5 years at 15%	15,750 kr
Assume 6 working hours per day and 20 working days per month. Then investment costs	10:90 kr/hr
Personnel costs - half-time (See above)	22:00 kr/hr
Other costs	16:00 kr/hr
Running costs	48:90 kr/hr
Production speed	45 pages/hr
<u>Production costs,</u> with paper cost of 0:40 kr/page	<u>1:50 kr/page</u>

<u>Post-Embossing Operations</u>

Naturally, any increase in production of braille also implies an increase in collating and binding capacity. This aspect of the expansion of braille production will be the subject of a separate report. However, it can be stated briefly that it is intended to introduce an automated collating, folding, and stitching machine in order to handle the magazine type material. These machines are in common use in ordinary printing houses, however, they require some special modifications in order to be used for braille. At present, both the Scottish Braille Press and the American Printing House, Louisville, use such equipment.

In addition, a spiral binding technique will be introduced. This binding technique is simply to carry out, relatively cheap, and allows the book to be opened out flat or even turned back-to-back without damage to the binding - a particularly useful feature for braille books.

SECTION E: SUMMARY

The first part of this study was aimed at trying to determine and describe those areas where there is a need for increasing the provision of braille. An idea of the size of these needs was also given where figures were available, however, exact quantification in this area is not easily obtainable.

The population of braille users in Sweden (around 2 000 - 3 000) was analysed in six different, although not mutually exclusive, categories. These were school children, students, employed, casual readers, elderly, and multiply handicapped. The main result of this analysis can be summarized by saying that there are two main areas where there is a priority need for increased braille production. The first is specialised material, including books for school children, students, and professionally employed people. Also included are general reference books, such as dictionaries. The common characteristic of this type of material is that it is complex; either in terms of the code system used, for example, maths, scientific, music, etc., or format, e.g. tables, or both. The second area is that of general material which can be subdivided into three categories - short documents, magazines, and books, pamphlets, etc.

It is meant by short documents such material as agendas and minutes of meetings, instructions for domestic appliances, local and/or internal telephone dialling codes, personal correspondence needed for reference, etc. Little is known about the exact needs in this area, but basically, this kind of material is used by sighted people everyday and is becoming increasingly important. There are special problems, however, in providing this material in braille. For example, some of it may be confidential, often single copies will be required but occasionally several (20 or so) may be required, and so on. Such questions have important implications for the type of production equipment used, and especially for how it is organised, (should it be centralised or decentralised, for example). In view of these factors a specific project has been proposed to study the needs of this area and the equipment which can best meet these needs. This project should be carried out during 1977.

At the present time there are only nine braille magazines available, and there is a clear need to expand the amount of this kind of material. Although the magazine with the largest circulation is produced in 2 000 copies, seven of the remaining eight are produced in less than 500 copies.

An increase in borrowing of braille books of general interest has been going on since 1970, and as braille is continuing to be encouraged by teachers in schools and rehabilitation centres, one must assume that this trend will continue. The numbers of braille books available for borrowing at the DBF is only about 4 000, compared to about 10 000 in Talking Book. There is clearly a serious shortage of this type of braille material.

The above discussion is summarized in Figure 8.

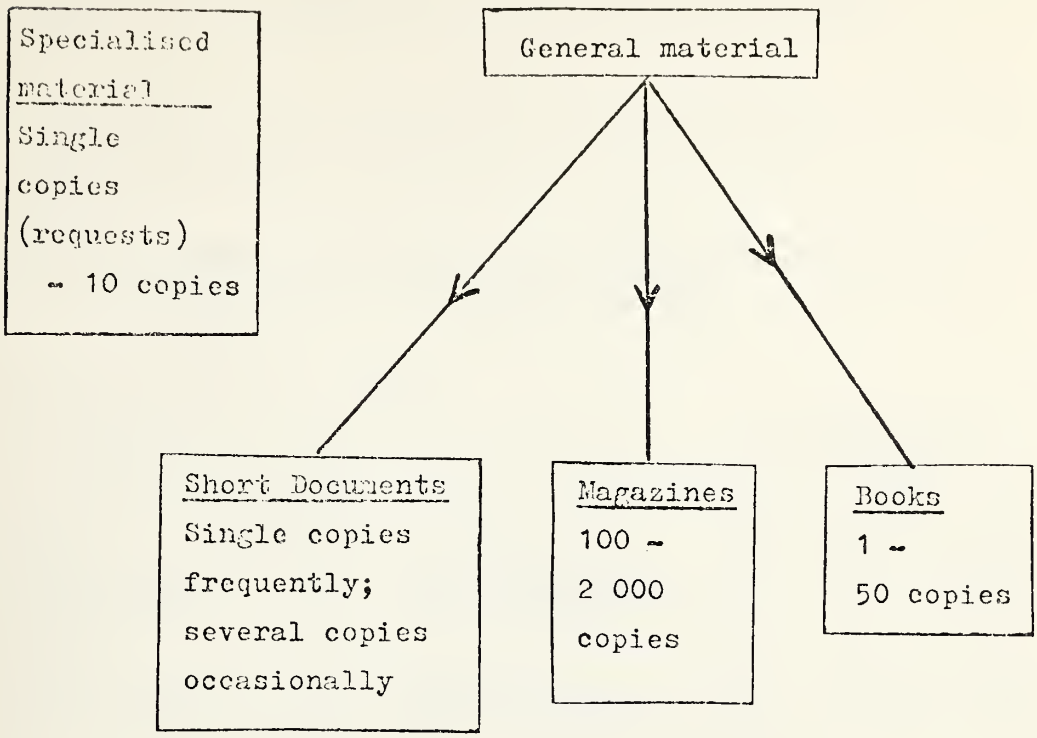
Straightforward expansion of the present techniques for braille production - i.e. stereotype-press production and mechanical braillewriters, with the possibility of vacuum-forming - would be rather an inefficient way of trying to cope with the above demands for increased provision; especially in view of recently developed techniques and equipment.

As a result a new system for production has been proposed, part of which is based on input systems to phototypesetting machines in common use in the printing industry. This proposed input system is outlined diagrammatically in Figure 7. (See page 57).

The new keyboard units will be used for both large- and small-scale production, and for both simple and complex texts. This is made possible through the use of a common encoding medium (data cassettes) which can be used to control both the automated stereotype and the sequential braille printer. They will also act as long-term storage medium.

In addition to the manual input system, a computerised input system is under evaluation. A preliminary investigation indicated that such an input route, utilizing texts already encoded onto cassettes at ordinary printing houses would be very price competitive and would provide a significant

Fig 8. Priority Needs for Braille Material in Sweden



boost to production capacity. A short study prior to the writing of a translation program is ongoing, and if successful, should result in a first program at about the end of the year.

A comparison of costs and capacities of the present and the proposed manual systems are summarized in Table 9 below.

Table 9: Comparison of Costs and Capacities of Present and Proposed Manual Production Systems.

Existing Production Methods:

Method	Capacity	Production Cost
Manual Stereotyping	3 pages/hour, incl. proofreading and correcting.	24:30 kr/page
Perkins transcription	6 pages/hour, incl. correcting	12:80 kr/page
Vacuum-forming	45 pages/hour	1:80 kr/page

New Production Methods:

Method	Investment Costs	Capacity	Production Costs
Encoding Units	52,000 kr (average)		
Correcting/ Editing Unit	83,700 kr	c.a. 7 pages/hour incl. correct.	c.a. 14:00 kr/page
Matrix Printer	29,000 kr		
Automated Stereotype	89,300 kr	12 pages/hour	4:40 kr/page
Braille Line Printer: LED-120	98,000 kr	1/2 cap. - 120 pages/hr.	0:90 kr/page
		1/4 cap. - 60 pages/hr.	1:40 kr/page
SAGEM	54,300	45 pages/hour	1:50 kr/page

Thus, the new production system implies a reduction in cost of the production of stereotype plates from 24:30 kr/page with the present manual system to about 18:50 kr/page with the new system. For the production of small numbers of copies there will be a slight increase in cost compared with the present vacuum-forming production. Namely, from the present 14:60 kr/page to 15:50 kr/page with the new system. This assumes the use of the SAGEM; if the LED-120 was used the cost would be slightly less at around 15:00 kr/page. However, the new system has the not insignificant advantage of producing the copies on ordinary braille paper instead of plastic.

As well as cost comparisons it is also interesting to look at savings in production time (including post-embossing operations). Figures 9, 10 and 11 compare production times for three different types of production.

Figure 9 shows the production time for an "average" braille book, such as a novel, or general reading matter, of 500 braille pages and in 50 copies. With the present system this would be produced using a manual stereotype machine. With the new system the encoding units would be used to produce an encoded data cassette, which in turn would control an automated plate embosser (stereotype). The more efficient writing and correcting facilities with the new system imply that something of the order of 40 hours would be saved in the preparation of the (250) plates needed for this book. Embossing of the braille on paper and post-embossing operations would be about the same for both systems, although some saving may be created by the use of the spiral binding system in the new system.

Figure 10 shows the production of a similar sized book (500 pages) but in only 5 copies. This could be a book for study purposes, for example. With the present system this would be written on a Perkins machine with copies made by vacuum forming onto plastic. With the new system the manual encoding units would be used to produce a data cassette as before, but now they will control a braille line printer instead of the automated plate embosser. Only a fairly small amount of time would be saved during the writing stage, and the actual production time of the braille itself would depend on which braille printer is used. If it were the SAGEM, this has roughly the same production rate as vacuum forming (45 pages/hr.), thus no extra time would be saved. A LED-120, on the other hand, operates at 240 pages/hour so considerable time saving would be gained if this machine was used.

Finally Figure 11 shows the production of a typically sized braille magazine, i.e. 40 pages and in 1 000 copies. Here again a stereotype would be used in the present system, followed by embossing and manual gathering and stitching. With the new system there would be about a two hour saving on the production of the embossing plates, however, the largest saving would come from the use of the automated gathering and stitching machine which would save a further 6 hours over the manual system.

Altogether, then, there are substantial gains to be had from the new equipment. Both in terms of the more quantifiable aspects such as cost and time and in the more subjective aspects also, such as use of paper instead of plastic for small numbers of copies and better working conditions for the braille transcribers.

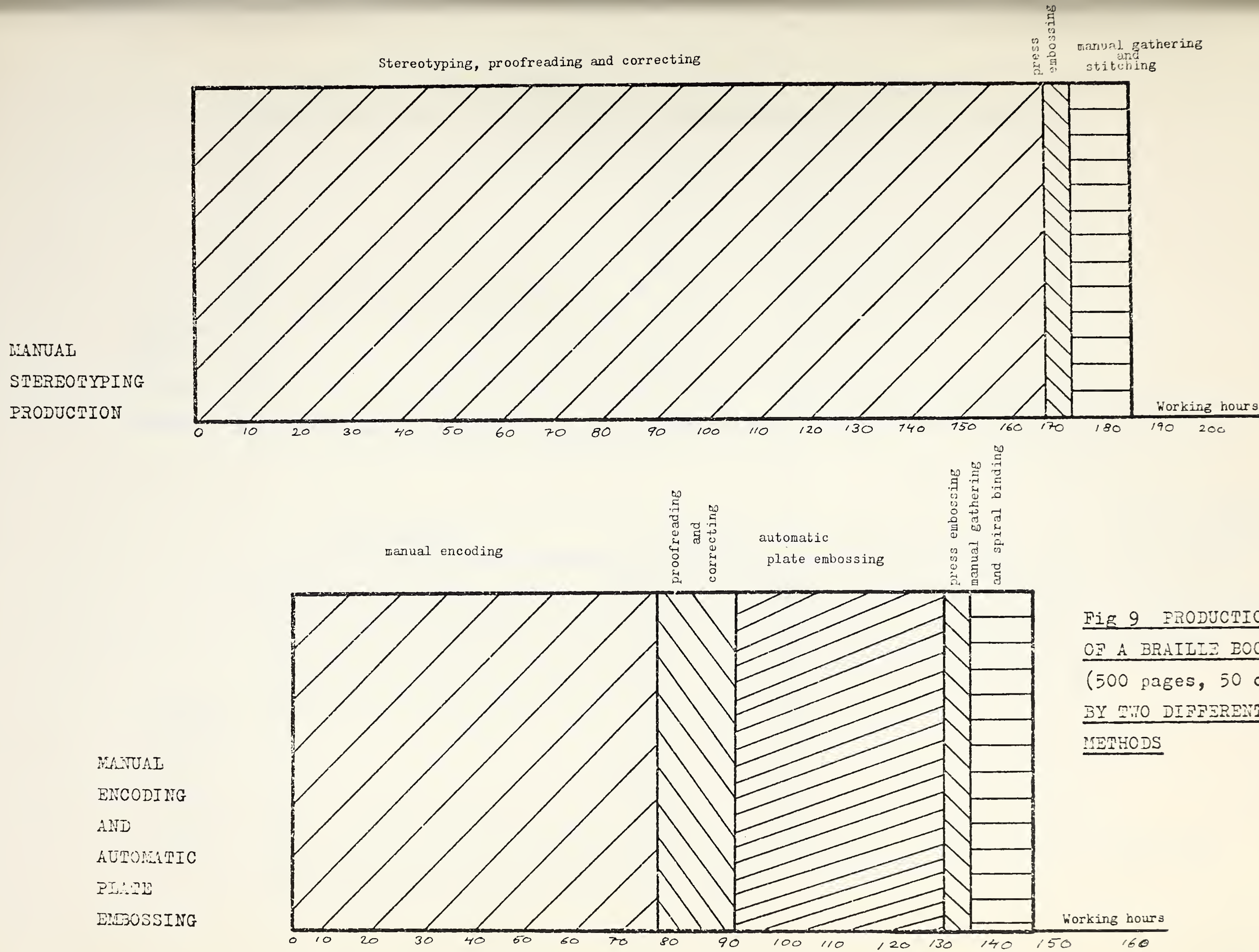


Fig 9 PRODUCTION OF A BRAILLE BOOK (500 pages, 50 copies) BY TWO DIFFERENT METHODS

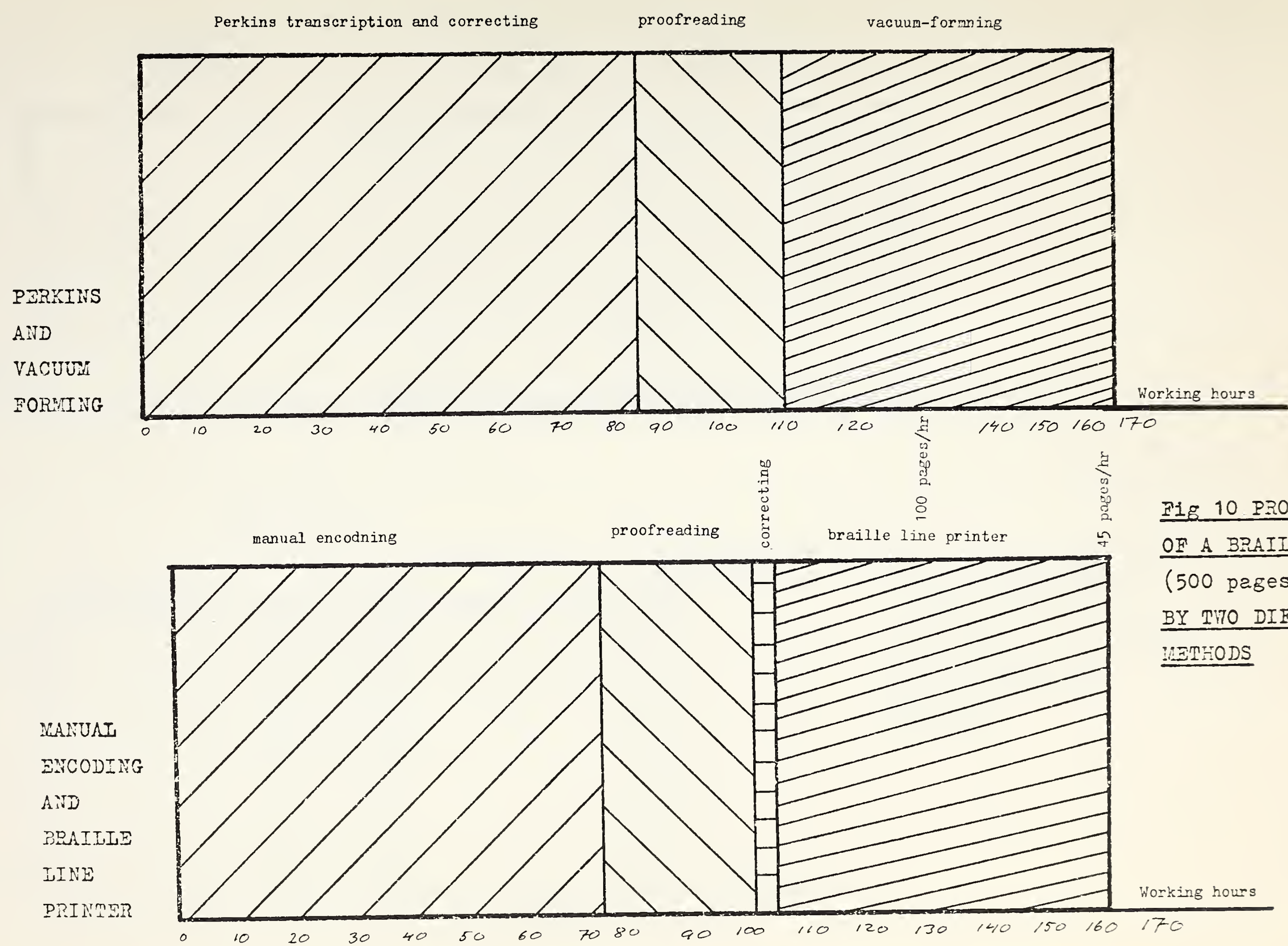


Fig 10 PRODUCTION OF A BRAILLE BOOK (500 pages, 5 copies) BY TWO DIFFERENT METHODS

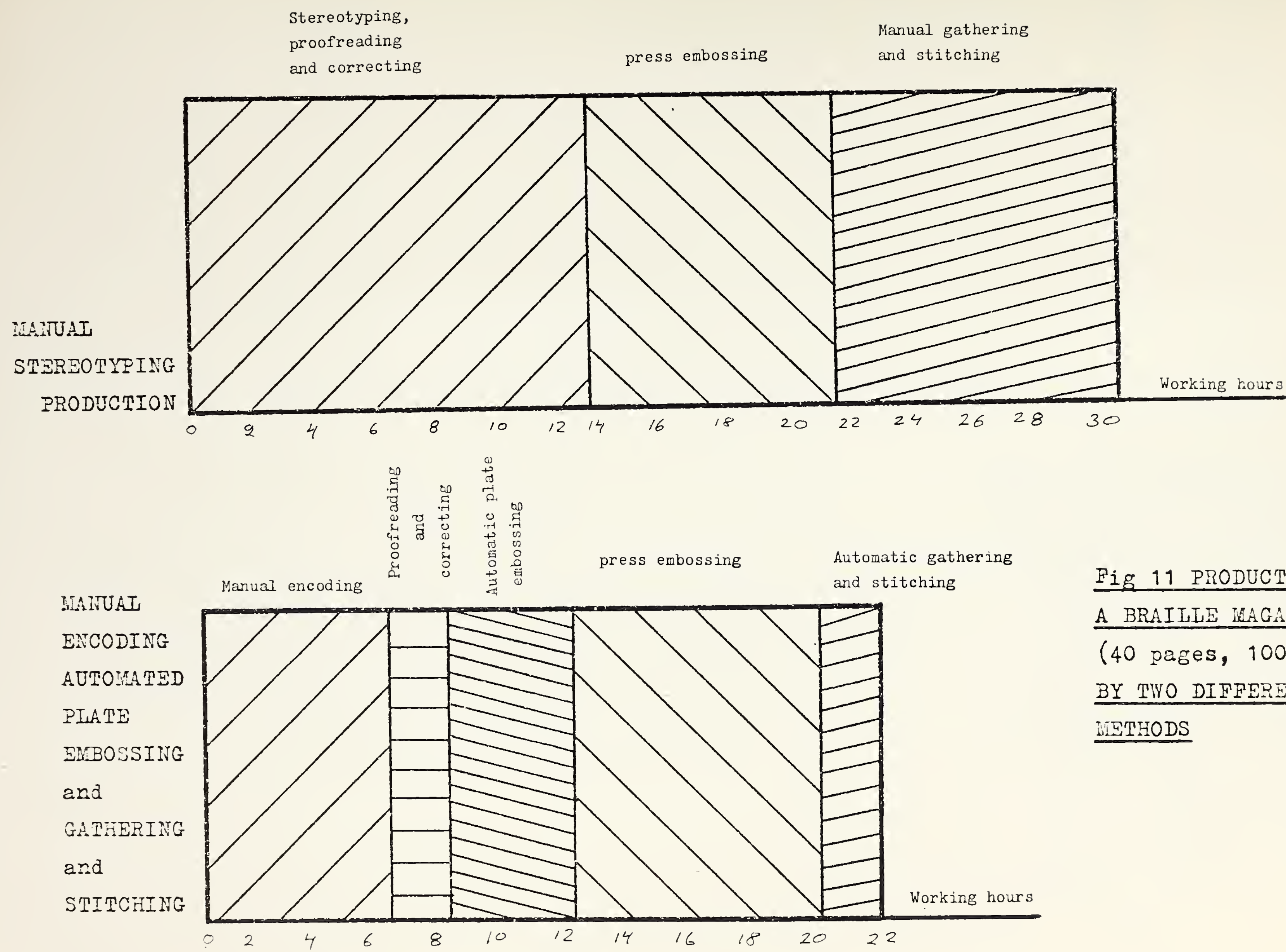


Fig 11 PRODUCTION OF A BRAILLE MAGAZINE (40 pages, 1000 copies) BY TWO DIFFERENT METHODS

Schoonard, J.W. & Boies, S.J. 1975 "Short-Type: A Behavioral Analysis of Typing and Text Entry". Human Factors. Vol. 17 No. 2. pp 203-214.

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Myrberg, M., Trowald, N., Johansson, K. & Bakolas, V. 1976 — "De Synskadade i Förvärvslivet". Projekt-rapport: II "Foukus" - "Arbetsmiljö för Synskadade". Rapport Nr. 60. Pedagogiska Institutionen, Uppsala.

13/1973 Delrapport II över det kliniska arbetet med en- och flerfunktionell handprotes, den s k SVEN-handen

Pris: 4:50 kr exkl moms

1/1974 Se 4/1977

2/1974 Larm- och signalsystem för handikappade. Slut

3/1974 Bröstproteser - sammandrag av en utredningsrapport

Pris: 8:25 kr inkl moms

4/1974 Se 9/1976

5/1974 Simhallar för alla - handikappsynpunkter

Pris: 8:25 kr inkl moms

6/1974 Samnordiska organisationer med verksamhet inom handikappområdet

Pris: 12:25 kr inkl moms

7/1974 Handikapp och bostadskrav

Pris: 14:75 kr inkl moms

8/1974 Report on European Conference on Technical Aids for the Visually Handicapped, March 1974

Pris: 20:- kr inkl moms

9/1974 Verksamhetsplan för handikappinstitutet för budgetåret 1974/75 och åren närmast därefter

10/1974 Vissa åtgärder för patienter med missbildningar i ansiktet

Pris: 6:25 kr inkl moms

11/1974 Verksamheten vid handikappinstitutets synsektor 1973-07-01 -- 1974-06-30

Pris: 7:75 kr inkl moms

1/1975 Se 7/1975

2/1975 Registrering av nordiska projekt inom handikappområdet 1975-01-01

Registration of Nordic Projects Relating to Disability 1975-01-01

Pris: 20:- kr inkl moms

3/1975 Se 9/1976

4/1975 Handikapp och bostadskrav

Pris: 7:50 kr inkl moms

5/1975 Verksamheten 1974-07-01 -- 1975-06-30 inom synhjälpmedelsområdet vid handikappinstitutet

Pris: 8:50 kr inkl moms

6/1975 Telekommunikationer - betydelsefulla instrument för handikappade

Pris: 7:50 kr inkl moms

7/1975 Se 12/1976

I DENNA SERIE HAR TIDIGARE UTKOMMIT

1/1972	Se 1/1974	
2/1972	Teknisk undersökning av elektrisk armbåge - USAMBRL	Pris: 3:50 kr exkl moms
3/1972	Provning av handskar till handproteser	Pris: 4:- kr exkl moms
4/1972	Verksamhetsberättelse för handikappinstitutets synsektor 1971-07-01 -- 1972-06-30	Pris: 4:- kr exkl moms
5/1972	Rapport från en studieresa till Jerusalem 12 - 15 november 1972	Pris: 4:- kr exkl moms
1/1973	Handikappinstitutets projektverksamhet. Översikt av pågående projekt 1973-01-01 The Swedish Institute for the Handicapped a summary of current projects	Pris: 3:50 kr exkl moms
2/1973	Nordisk samverkan inom handikappområdet och handikappinstitutets aktuella uppgifter inom denna samverkan. Slut	
3/1973	Delrapport över det kliniska arbetet med en- och flerfunktionell handprotes, den s k SVEN-handen. Slut	
4/1973	Formgivning av vred på hushållsmaskiner	Pris: 6:50 kr exkl moms
5/1973	Värdering av egenskaper hos stomibandage. Resultat från en enkätundersökning Evaluation of Qualities of ostomy appliances. Results of a questionnaire	Pris: 4:50 kr exkl moms
6/1973	Certain Types of Personal Hoists (2nd edition)	Pris: 4:50 kr exkl moms
7/1973	Se 9/1976	
8/1973	Handikapp och telekommunikationer. Föredrag från ISIMA-konferensen	Pris: 12:- kr exkl moms
9/1973	Verksamheten vid handikappinstitutets synsektor 1972-07-01 -- 1973-06-30	Pris: 3:50 kr exkl moms
10/1973	Utredning om behovet av tekniska hjälpmedel för laryngektomerade	Pris: 5:- kr exkl moms
11/1973	Telefon för döva, dövblinda och talskadade	Pris: 4:50 kr exkl moms
12/1973	Registrering av nordiska projekt inom handikappområdet 1973-07-01. Slut Registration of nordic projects relating to disability. Slut	

3/1977 Förstudier och utvecklingsarbete kring kassettbandspelare för förstånds-handikappade

Pris: 9:25 kr inkl moms.

4/1977 The Swedish Institute for the Handicapped - A survey

Pris: 6:- kr inkl moms.

5/1977 Rehabilitation in Sweden

Pris: 6:50 kr inkl moms

Price: SKr 21:50
300.IX.77. Pogo Print, Stockholm

8/1975 Hur används bostadsanpassningsbidraget? Exempel från Stockholms och Värmlands län

Pris: 8:25 kr inkl moms

1/1976 Bilen och den handikappade. Internationell enkät 1975

Pris: 13:50 kr inkl moms

2/1976 Sortimentsöversikt
- hjälpmedel för av- och påklädning (E2)
- hjälpmedel för intagande av mat och dryck (E5)
- hjälpmedel för vila (E6)

Pris: 16:- kr inkl moms

3/1976 Se 4/1977

4/1976 De handikappade i trafiken - förflyttning med eget fordon

Pris: 25:25 kr inkl moms

5/1976 Rapport från en studieresa till Schweiz 24 mars 1975 och till Tyska Förbundsrepubliken, Holland och England 15 - 30 april 1975

Pris: 10:75 kr inkl moms

6/1976 Undersökning av handikappades funktionskrav på tvättställsblandare

Pris: 17:50 kr inkl moms

7/1976 Rehabilitation in Sweden

Pris: 6:25 kr inkl moms

8/1976 Försöksverksamhet med bokstavstelefoner för döva och talskadade i storstockholmsområdet

Pris: 17:25 kr inkl moms

9/1976 Landstingens hjälpmedelsorganisation. Ersätter nr 7/1973, nr 4/1974, nr 3/1975

Pris: 20:50 kr inkl moms

10/1976 Utredning kring telekommunikationer för döva, dövblinda och talskadade i Norden

Pris: 24:75 kr inkl moms

11/1976 Förstudier och utvecklingsarbete kring rullstolar för förståndshandikappade

Pris: 23:00 kr inkl moms

12/1976 Utrustningsenheter för handikappade i bostaden. Ersätter nr 7/1975

Pris: 11:00 kr inkl moms

13/1976 Hjälpmedel tillverkade hos landstingen. Resultat från en inventering

Pris: 13:00 kr inkl moms

1/1977 Gravt synskadades möjligheter till registrering, arkivering och sökning av information

Pris: 14:75 kr inkl moms

2/1977 Rapport från en studieresa till USA och Canada 5 - 30 maj 1976

Pris: 13:25 kr inkl moms

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