USE OF PUNCHED CARDS IN PREPARATION OF LISTS OF PERIODICALS

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INTRODUCTION

SCIENTIFIC and technical periodicals and other serial publications are purchased by the Main Library at Harwell for its own collections and for those of twenty-two divisional libraries. Subscriptions are placed through a bookseller for all serials other than Government publications which are purchased direct from HMSO. In addition, a number of journals are presented to the library from various sources. All serial publications are recorded in the library catalogues and individual copies are checked in by the Main Library using conventional visible index equipment. For quick reference a strip index of holdings and locations is kept in the Reading Room of the library.

Just over 1,400 titles are taken by the libraries, representing about 3,200 copies, and the task of providing Divisions and Outstations with complete and up-to-date information on serial holdings has always proved extremely difficult when conventional listing methods are used. In addition, periodical lists of various kinds are required by the Main Library from time to time for record purposes, and it has been found useful to supply the bookseller and HMSO with a check list of journals for which subscriptions must be placed for the ensuing year.

Table 1 shows the various kinds of lists which need to be produced, their coverage, frequency, and the number of copies required of each. The 'holdings' list gives the holdings of the Main Library or, if the journal is not taken in the Main Library, of that Division which has the longest run. It includes entries for journals not taken currently but of which back numbers are worth retaining in the library, but it does not contain entries for certain serials such as timetables and directories although the latter are included in the 'periodicals purchased' list. The holdings list is widely distributed within the Establishment and is also sent to other Authority libraries and to external organizations.

Lists 2, 3, 4, and 6 are required to furnish Divisional libraries with such information as they need for ordering and maintaining their own periodicals, and copies of the first two are also sent to the main agent and HMSO respectively for use as check lists. The remainder are used for record and administrative purposes, although the last has an obvious information value. The layout of lists 1, 2, and 4 is shown in the appendix.

LIST	Information required	Entries	Frequency	Copies
1. *Periodical holdings*	Title, holdings class no. or divisional location	1350	Annual	1000
2. *Periodicals purchased through main agent*	Title, price, no. of copies, location	900	Annual	100
3. *Periodicals purchased from HMSO*	Title, price, no. of copies, location	60	Annual	100
4. *Periodicals presented*	Title, source, no. of copies, location	400	Annual	100
5. *Periodicals received on exchange. (Extract from list 4)*	Title, source, no. of copies, location	60	Annual	10
6. *Divisional lists (One for each division)*	Title, price, no. of copies	Varies	When required	5
7. *List of bound journals*	Title	250	Annual	10
8. *List of periodicals by subject*	Class number, title	1350	When required	200

TABLE I

CHOICE OF PUNCHED-CARD SYSTEM

By conventional methods each of these lists had to be prepared separately from original records, itself a time-consuming process, and it was impracticable with the effort available to keep them fully up to date. It was thought that photographic reproduction of the strip index might provide an answer but this did not give all the information required and, in any case, no simple way of selecting only the information required for a particular list could be found. It was noted that Massachusetts Institute of Technology had found this method troublesome and it was decided not to proceed with it.[1] On the other hand the experience of both MIT and DSIR in the use of punched cards seemed to indicate that this method was worth considering and the co-operation of the Computer Group of the Theoretical Physics Division at Harwell was sought.

It was apparent that once the task of compiling the basic information in a suitable form was completed, the use of punched cards seemed to offer a number of advantages. No typing effort was involved once the cards had been punched and this was an important factor in reaching a decision. The machine speeds

for sorting, collating, and tabulating are such that a master copy, suitable for reproduction, of a list of nine hundred titles showing location of all copies could easily be produced in one day, thus ensuring that the lists, when reproduced and circulated, were as up-to-date as possible. Once the punched cards had been verified no proof checking was necessary and the need for keeping separate records for each variety of list was abolished.

METHOD OF COMPILATION

The basic information was prepared from available records in column form as shown in Table II. This was probably the most arduous part of the exercise, requiring over two hundred man-hours of work. Information in columns 2, 3, 4, 5, 6, 7, 8, and 9 must be printed out selectively according to the type of list being compiled. For example, columns 2, 3 and 4 are used to print the holdings list, columns 2, 6, 7, 8, and 9 to print the list of journals purchased and so on. Information in columns 4, 5, and 9 is also used as a selection medium and that in columns 10 and 11 for selection only.

This is more information than could be handled by a single sequence of eighty-column punched cards, although the amount of information to be printed out on any one type of list was well within the capacity of the ICT 901 tabulator which has forty characters at each of one hundred printing positions.

1	2	3	4	5	6	7	8	9	10	11
Serial number	Title	Holdings	Class no.	Source	Cost per copy	Total no. of copies	Number of copies in each location	Location	Bound	Country of origin

TABLE II

It was decided to run two sequences of cards, one for titles and one for the information about each title, and to use a set of number codes to control sorting and printing. Examples of title and information cards are shown in Figs. 1 and 2, the allocation of columns being as follows:

Title card

Columns	1– 6	Serial number
	7–41	Title
	42–80	Blank

FIG. 1. *Title card*

FIG. 2. *Information card*

Information card

Columns		Columns	
1– 6	Serial number	64	Blank
7–21	Holdings	65–72	Location
22–31	Class number	73	Code indicating title or information card
32–41	Source		
42–48	Cost per copy	74	Code indicating type of list (i.e. purchased, presented, etc.)
49–50	Total no. of copies		
51–58	Blank		
59	Code indicating title to be omitted from list of periodicals purchased or presented	75	Code indicating bound or not bound
		76–79	Country of origin. * added indicates translated version
60–61	Blank		
62–63	No. of copies in each location	80	Blank

The serial numbers are common to both sets of cards and enable titles and information to be collated for any particular listing. The first four columns give the serial number allocated to each title on the original listing and the fifth column allows for insertion of new entries. If the title requires more than one card the additional cards are designated by numbers in the sixth column. Similarly each location requires an additional card in the information pack and these too are designated by numbers in the sixth column.

Cross references from one form of title to another were included by using columns 7–40 of the information card to print the 'see' part of the reference. Each of these cards is coded in column 59 so that they will be selected only for the holdings list and not for the purchased and presented lists.

Shelf or classification numbers presented something of a problem. There are two sequences in the library: abstracting and bibliographical serials, which are classified at 016 colonned to the UDC number for the subject, and other periodicals classified at 05 : . . . . For simplicity it was decided to omit the 05 from the latter entries and to print only the subject part of the number. The 016 numbers were printed out in full leaving a blank space for the colon which was inserted later. The tabulator has only one punctuation sign—the hyphen—and as this is a recognized UDC symbol it could not be used to take the place of the decimal point. The only solution was to leave blank where the point occurred and insert later.

For selection purposes the source of the journal is coded in column 74 as follows:

Main agent	Blank	HMSO	2
Presented	1	Subscription	4

For the list of presented journals the source is actually printed out from the information in columns 32–40. The letter P indicates that the journal is presented by publisher or originator and P* indicates that it is received on exchange.

Periodicals received by virtue of a subscription to an organization are also included on this list.

Abbreviations generally recognized within the Establishment are used to show location. The tabulator adds the number of copies in the different locations as it prints and the total is printed out on the last line of the entry for that particular title.

Punching was carried out direct from the eleven-column record prepared by the library staff, and the fitting of information (e.g. long titles) into the spaces available was done as punching proceeded. When all the cards were punched, two check lists were run off, one showing all the material on the title cards, the other that on the information cards. These were checked by the library staff and the punched cards corrected where necessary. The final pack contained two thousand two hundred title cards and two thousand seven hundred information cards, an average of 3.5 cards per title.

PREPARATION OF INDIVIDUAL LISTS

In order to produce any particular list the required information cards are selected and collated with the cards bearing the corresponding serial numbers in the title card pack. The programme boards for the ICT 901 tabulator are arranged so that all lists can be printed by a suitable choice of 'selector set-up' positions and only a small amount of plug-board rewiring is needed for any list. The cards can be sorted at the rate of six hundred cards per minute, collated at 13,000 cards per hour and the tabulator will handle eighty-five cards per minute. In a normal operating schedule about six hundred titles and associated information can be printed in one hour.

In terms of total time taken the work on the collator is the most important part of the job. Some ingenuity is required in making the selections and matchings for the various lists and it is on this that success or failure largely depends. Up to the present it has always been possible to find a solution to any problem that has arisen. The collator used is numeric only so that the letters used in the location symbols have to be assigned a numeric code in order to make selection possible. This difficulty could be overcome by the use of an alpha-numeric collator.

The tabulator prints on to rolls of paper or on to folded sheets which may be perforated at intervals. The size of the page is determined by the number of lines per page required in the final copy, subject to the condition that an incomplete title does not appear at the end of the page. The tabulator is set up so that approximately 13 in. of printing appears on each sheet. The particular tabulator used has no automatic paper feeding device so that the tabulator counters are used to control all calculations needed for determining the page size.

Several methods of duplication are possible and the next step was to decide on the method most suitable for each type of list, bearing in mind the number of copies which would be required and the use to which they would be put. Methods considered were carbon copies, spirit duplication, dyeline copying, direct litho reproduction, stencil, and xerography. Of these all but the last are direct methods producing a copy the same size as the original. With xerography,

however, the image can be reduced photographically so that smaller page sizes may be used and a more pleasing result obtained.

A comparative study of the various processes, based on a 16-in. page size carrying a 13-in. print image, yielded the information set out in Table III. The costs quoted are based on bulk buying of materials and some adjustment must be made if materials are purchased in smaller quantities. The costs given for each master include an allowance for labour and overheads (e.g. setting up the machine, etc.) and the costs per copy include a similar allowance.

Direct methods

1. Carbon copies

The paper is fed from a folded pack, perforated at intervals, with interleaved carbons. The cost of each page is approximately o.5*d* and of each carbon (used only once) 2*d*. The maximum number of readable copies is four.

2. Spirit duplication

The master paper can be obtained in roll form for feeding into the tabulator. The cost of each master is about 8*d* (including cost of carbon). Copies are approximately o.4*d* per page and the maximum number of readable copies is about three hundred.

3. Dyeline copying

The cost of the translucent master is about 2*d* per page if fed into the machine in roll form. Copies have to be made individually and cost about 2*d* each including labour charges. Any number of copies can be made in theory but because of the time factor it would be impracticable to use it for more than ten copies.

4. Direct litho

The material used for litho paper plates can be obtained in roll form but the individual pages have to be separated after tabulation so that the allowance for labour and overheads must be slightly higher. The cost per plate is about 7*d* and the cost per copy o.4*d*. The maximum run is in the region of seven hundred and fifty copies.

5. Stencil duplication

A plastic ribbon is required for printing on to stencils and as the speed of tabulation is considerably reduced by having to feed in separate sheets, the allowance for machine time must be raised accordingly. The cost per master in these circumstances is about 15*d* and copies cost about o.6*d* each. The maximum run is about one thousand.

Indirect methods

The only one considered was xerography using a 16-in. page original and reducing photographically to produce a quarto-sized image. No special paper is required in the tabulator although some care in selecting the ribbon is necessary in order to produce as black an original as possible. The cost of the xerography master is about 14*d* which includes the cost of the tabulator paper.

These figures are based on an output from the Xerox cameras of about one thousand plates per week. As the method uses a smaller paper size for the copies the cost per copy should not exceed 0.2d and the maximum number of copies is in the region of eight thousand.

No. of copies	Direct carbon	Spirit dupl.	Dyeline	Direct litho	Stencil	Xerox
Master	0.5d	8.0d	2.0d	7.0d	15.0d	14.0d
1	3.0d	8.4d	4.0d	7.4d	15.6d	14.2d
2	2.7d	4.4d	3.0d	3.9d	8.1d	7.2d
3	2.7d	3.0d	2.7d	2.7d	5.6d	4.9d
4	2.6d	2.4d	2.5d	2.1d	4.3d	3.7d
5		2.0d	2.4d	1.8d	3.6d	3.0d
10		1.2d	2.2d	1.1d	2.1d	1.6d
20		0.8d		0.7d	1.3d	0.9d
50		0.6d		0.5d	0.9d	0.5d
100		0.5d		0.45d	0.7d	0.3d
200		0.4d		0.4d	0.65d	0.25d
500				0.4d	0.6d	0.2d
1000					0.6d	0.2d

TABLE III. *Cost per sheet by various methods*

For up to four copies the direct carbon method is obviously cheaper and quicker since no duplicating machinery is involved. For between four and fifty copies direct litho is slightly cheaper than the xerographic method but has the disadvantage that it involves feeding special paper into the tabulator. For any number of copies over fifty xerography is cheaper and more flexible and no special feeding of the tabulator is needed.

Using the above figures an estimate of comparative cost for each type of list may now be made. The number of lines of print per title is determined largely by the number of information cards per title as only very occasionally are there more cards in the title pack than in the information pack for a given title. A check of both packs showed the average number of print lines per title to be 2.2. Hence, with single spacing, the average number of print lines and spaces per title is 3.2 and, since there are eighty-one lines in 13 in., one page will take about twenty-five titles. With double spacing the average is 20. In the first case a list of one thousand titles will occupy forty pages; in the second case fifty pages. On the basis of these figures the comparative costs of a one thousand title list may be calculated. The results are shown in Table IV.

Up to fifty copies the direct litho is the most economical but there is really very little to choose between the various methods. For over fifty copies the xerographic method is preferable on all counts and was therefore used for all lists other than nos. 5, 6, and 7. The double spacing is slightly more expensive but produces a more pleasing result in the finished list. The divisional lists (no. 6 in Table I) are produced by the direct carbon method and lists 5 and 7 by any method which happens to be most convenient at the time they are required.

No. of copies	Spirit dupl.	Direct litho	Stencil	Xerox	
				Single spacing	Double spacing
10	£2	£1 17s	£3 10s	£2 13s	£3 6s
20	£2 13s	£2 7s	£4 10s	£3	£3 15s
50	£4 13s	£4 3s	£7 10s	£4 3s	£5 4s
100	£8	£7 5s	£12 10s	£5	£7 2s
200	£13 6s	£13 6s	£23 6s	£10	£12 10s
500		£33 7s	£52 10s	£16 13s	£25
1000			£102	£33 16s	£44

TABLE IV. *Cost of producing x copies of a* 1000-*title list.*

METHODS OF KEEPING THE LISTS UP TO DATE

Purchase of new journals, cancellation of existing journals and changes in title are responsible for about 150 alterations a year. Changes in price, in locations, and in the number of copies taken are much more numerous and probably result in about 750 amendments a year to existing cards. As the more important lists are made up only once in each year there is little point in feeding these amendments in day by day, or even week by week, and it was decided to bring the punched cards up to date once every quarter.

For this purpose an amendment slip is prepared by the library staff every time a change of any kind is made in the periodical record. These slips are passed to the punched card operators at the end of November, February, May, and August. The last date is chosen so that the check lists of periodicals purchased, which are sent to the agents in September, shall be as up-to-date as possible.

New journals are given a serial number which fixes their position in the alphabetical sequence. For example the *British journal of non-destructive testing,* which must be inserted between

        0264   *British journal of industrial safety*
and   0265   *British journal of nutrition*

is given the serial number 02645. Further insertions in this area would be given serial numbers 02642 or 02647 and so on. As there are ten spaces for insertion between each four-figure serial number it should be some time before all the possibilities are exhausted. When that happens re-numbering will be necessary. A copy of the periodical amendment slip is shown in Fig. 3.

ECONOMIC CONSIDERATIONS

Not infrequently, the criticism has been made that people who use expensive machinery to do comparatively simple jobs seldom attempt an economic justification of their methods. Although this is a perfectly valid criticism it must be noted that there are very considerable difficulties in the way of making

such an assessment. Obviously machines costing thousands of pounds are not purchased just to carry out simple library routines; a condition of any project such as the one described is that they have already been made available for other purposes and that there is sufficient free machine time during the year to enable such additional work to be carried out. Machines of this kind render a variety

PERIODICAL LISTS		Corrections to punched cards
Serial number	New entry	Amendment
TITLE		
Holdings		
UDC number	Source	Cost
No. of copies	Location	Bound
		Country of origin
		Remarks

FIG. 3. *Periodical amendment slip.*

of services to the organization possessing them and the costs of any one job are not easily computed, especially if that job takes up a negligible fraction of the total annual machine operating time.

What is clear is that if punched card machines are available, they can make a positive contribution to the efficiency of the library service. In the present case there was a significant saving in the time of the library staff responsible for compiling the lists, it became possible to produce a greater variety of lists more frequently and, because very careful preparation is required for such an exercise, it resulted in a general tightening up of the routines used for recording and maintaining information relating to periodicals. At the time of writing the system had not been running long enough to make it possible to compute the total effort expended by the library staffs on producing the lists by the new method over a twelve-month period but it is hoped that such information will be available in due course. In the meantime the experience gained is being used to estimate the value of these techniques from the point of view of their application to other similar library routines.

REFERENCE

1. NICHOLSON, N. N., *and* THURSTON, W. Serials and journals in the MIT library. *American documentation,* vol. 9, no. 4, Oct. 1958. pp. 304–7.

APPENDIX

1. *Layout of holdings list*

TITLE	HOLDINGS	SHELF MARK
Academy of Sciences USSR	See Akademiya Nauk SSSR	
Accidents	1949 Vol. 1–	614.8
Accountant	1950 Vol. 122–	PL – ACCTS
Acoustical Society of America—Jnl.	1947 Vol. 19–	534
Acta metallurgica	1953 Vol. 1–	669
Acta radiologica	1940 Vol. 21–	PL – MED
Advancement of science	1946 Vol. 3–	5

2. *Layout of list of journals to be purchased*

TITLE	PRICE	NO. OF COPIES	LOCATION
Journal of metals	3 15 0		2 RR
			1 MET
		04	1 ISOT
Journal of meteorology	4 17 6	01	1 HP
Journal of molecular spectroscopy	6 01 6	01	1 RR
Journal of nuclear materials	6 10 0		2 RR
		03	1 MET
Journal of physical chemistry	9 09 0		1 RR
			1 CHEM
		03	1 ISOT

3. *Layout of list of journals presented*

TITLE	SOURCE	NO. OF COPIES	LOCATION
Nucleonics	P		2 CTR
			1 BRACK
			1 APP SCH
		06	2 R–SER
Nucleus—Chicago	BCSO	01	1 RR
O and M bulletin	SUB		1 RR
		02	1 ADMIN
Osaka Institute of Science and Technology—Jnl.	P*	01	1 RR

DISCUSSION

The Chairman, DR D. J. URQUHART, introduced the speakers and urged that the discussion should be linked to five questions: *i*, why use punched cards?; *ii*, what are the limitations of punched cards for library purposes?; *iii*, what is my library doing with punched cards?; *iv*, what is the future?; *v*, what will be the effects?

MRS MACKENZIE (DSIR) said that DSIR had been using punched-card methods for ten years. 3,000 separate titles were listed on 7,500 cards for thirty separate establishments. They used much the same methods as Mr Anthony had described and had found the system particularly useful for annual ordering and collating lists for suppliers. She felt that the possibilities had not been exhausted and looked forward to further developments.

MR J. D. BLACK (IBM World Trade Laboratories) said punched cards were not yet in use at Hursley, but were being used for tabulating monthly accessions in the education and programme libraries in Wigmore Street. IBM were using them also in the USA for loans and for checking library contents and holdings lists. They had developed a 'quickie' indexing system, by punched cards, for IBM reports.

DR C. GROENEVELD (Koninklijke/Shell Laboratorium) recommended the punched-card system for its versatility, by which books could be sorted by origin, author, editor, title, subject field, and language. He had an index of 50,000 cards covering abstracts of books from *Chemical abstracts*.

MR J. R. STOCKS (Shell International Petroleum Co. Ltd) wished to know if Mr Anthony or Mr Hailstone could give the minimum number of subscriptions which would make it worth while to install a machine system; he was particularly interested in the running costs, assuming the machinery to be available.

Mr Hailstone said that there were many variables such as time, number of staff, quality of staff, etc., to be considered in estimating the cost of a machine system, but if machinery were already available he would consider it worth while to adopt mechanical methods if only one of these variables could thereby be improved.

Dr Urquhart said that DSIR had first investigated the punched-card system because they were unable to find enough typists of the right quality, and without this experience it would have taken much longer to set up the Lending Library Unit; 25,000 punched cards had proved also to be a useful by-product. He thought that librarians should worry less about the cost of establishing a mechanized system but study the capabilities of the machines more closely. DSIR had acquired a 'Cardatype' machine and had now found that it would be possible, by careful programming, to use it also for Russian-English and English-Russian transliteration.

MR D. E. COLINESE (Central Electricity Generating Board) said he thought the degree of application of machine systems to library work would depend largely on the accessibility of machines. Many requirements could not be scheduled as they were only known at short notice and the machines might not then be available to give an immediate answer.

Mr Anthony, replying, said he did not think the machine system was suitable for information retrieval processes but it was ideal for routine purposes.

MR FELIX LIEBESNY (The British Aluminium Co. Ltd) said he was surprised that no mention had been made of the punched-card service of the Patent Office, through which lists of numbers of patents could be obtained.

Dr Urquhart closed the meeting with an invitation to all those interested to come and see what uses DSIR had made of punched cards during the past ten years.