

# Two Characteristics of Circulation and Their Effect on the Implementation of Mechanized Circulation Control Systems

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IN USING data processing or computer techniques for mechanization within the library one is confronted with the problem in circulation control of providing or creating a document in machine-readable form containing identifying information about the volume to be charged. In the majority of the proposed or operating systems this is a machine-readable book card, usually a punched card. Some libraries, for example the Brooklyn College library, require the user to write out the identifying information (title, author, call number, etc.) on a form which is used for the later preparation by the library of a punched-card circulation record.<sup>1</sup> In this case some or all of the information must be key punched each time the book is borrowed, but in the former punched book card system only one initial key punching is required for the preparation of the book card. The punched book card for circulation control is used at the Decatur (Illinois) public library, and is to be used by Johns Hopkins. Hopkins is planning as part of its mechanization to put the union shelf list on magnetic tape and then to prepare punched book cards from this tape.

The question usually raised about cir-

<sup>1</sup> Henry Birnbaum, *Circulation Control at Brooklyn College Library* (White Plains, N.Y.: IBM, 1960). Further background information for this article was drawn from Margery Quigley, "Library Facts from International Business Machines Cards," *Library Journal*, LXVI (December 1941), 1065-67; L. A. Schultheiss, et al., *Advanced Data Processing in the Library* (New York: Scarecrow Press, 1962); and Richard W. Trueswell, "User Behavioral Patterns and Requirements and Their Effect on the Possible Applications of Data Processing and Computer Techniques in a University Library" (Doctoral dissertation, Northwestern University, 1964).

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ulation control with a punched book card is the cost of preparing book cards for all books in the library. This cost, of course, depends upon the size of the library's holdings and would be quite high in large university libraries. If mechanization is to occur, one might expect librarians and users to prefer the punched book card because it provides a more effective system (less time and effort for the user and less key punching during system operation). But the preparation of punched book cards for all volumes in the library is a factor of considerable importance.

This article is an effort to evaluate the need to prepare punched book cards for all volumes in the library. An effective approach is also provided for the implementation of a mechanized punched book card circulation control system without preparing punched book cards for all books. Two factors are considered: the length of time the book has been in the library, and the last previous circulation date. The latter figure appears to have the greatest potential as a predictor of the effectiveness of the method described. It also has other implications that will be discussed later.

Basically, the proposed approach is to prepare a punched book card for the book sometime during the loan period, provided the book does not already have

TABLE 1  
DEERING LIBRARY CIRCULATION (10/8/63)—AGE OF CIRCULATED BOOKS

Age* in Years	Number in sample that are Y years or less in age	Per cent of sample Y years or less in age	Per cent of sample over Y years in age
1	51	10.6	89.4
2	81	16.3	83.7
3	113	22.8	77.2
4	129	26.0	74.0
5	147	29.6	70.4
6	165	33.3	66.7
7	188	37.9	62.1
8	212	42.8	57.2
9	232	46.7	53.3
10	248	50.0	50.0
11	259	52.0	48.0
12	281	56.7	43.3
13	296	59.7	40.3
Greater than 13	497	100.0	—

\* The term age refers to the number of years that the book has been in the library and is based on the accession number.

NOTE: Sample size is 497.

a punched book card from a previous loan transaction. It will be shown that, because of the nature of book circulation, the preparation of the punched book card during circulation is much cheaper than the cost of punching a book card for every volume in the library. As a secondary, but less important, factor a punched book card would be made for all acquisitions. Preparing punched book cards for all new books is desirable but is not necessary if the punched book card is made during the book loan period. The data used in this research were taken from an analysis of book circulation at the Deering library and the technological institute library of Northwestern University. The assistance and cooperation of Jens Nyholm and Marshall Fisher, at these libraries, is gratefully acknowledged.

#### "AGE" OF THE VOLUME

Tables 1 and 2 represent samples of circulation from the Deering library and the technological institute library, respectively. Column three of each table gives the percentage of the circulation sample of books that are "Y" years or less in age. In actuality these age indications are based on library accession number and as such really represent the number of years that a book has been in the library sys-

tem. For example, in the technological institute library 29 per cent of the books in this circulation sample had been in the library for two years or less. Conversely, the last column represents the per cent of the sample that are over "Y" years of age. In the same example 100 minus 29 or 71 per cent of the sample were over two years of age.

Thus, for the technological institute library, if a new system of book purchasing and processing had been put into effect four years ago we would expect to find that approximately 56 per cent of the books now being charged out of the library would be on the old system. Extending this reasoning further and making some rather broad assumptions about continuing circulation patterns one might predict that after, say, eleven years of any new system (such a new system could generate a punched book card for each new book purchased) there would be only about 30 per cent of the currently borrowed books not on the new system, or which would lack punched book cards. The figure of 30 per cent for the technological institute library is lower than the corresponding figure of 48 per cent for the Deering library, indicating that more recent books are used in the former than in the latter. The data and plots cut off

TABLE 2

## TECHNOLOGICAL INSTITUTE LIBRARY CIRCULATION (10/3/63-10/9/63)—AGE OF CIRCULATED BOOKS

Age* in Years	Number in sample that are Y years or less in age	Per cent of sample Y years or less in age	Per cent of sample over Y years in age
1 . . . . .	69	17.4	82.6
2 . . . . .	114	28.8	71.2
3 . . . . .	140	35.3	64.7
4 . . . . .	173	43.7	56.4
5 . . . . .	198	50.0	50.0
6 . . . . .	216	54.5	45.5
7 . . . . .	233	58.7	41.3
8 . . . . .	246	62.0	38.0
9 . . . . .	254	64.1	35.9
10 . . . . .	262	66.0	34.0
11 . . . . .	277	69.9	30.1
12 . . . . .	289	72.8	27.2
13 . . . . .	301	76.0	24.0
Greater than 13 . . . . .	397	100.0	—

\* The term age refers to the number of years that the book has been in the library and is based on the accession number.

NOTE: Sample size is 397.

at thirteen years because further information on accession numbers was not readily available.

Figures 1 and 2 are plots of the information found in Tables 1 and 2. The plots are labeled according to the data; however, these plots could be considered as indicators of the number of years of operating under a new system that would be required before a given per cent of the current circulation would not be under the new system. For example, in Figure

2 one could predict for the technological institute library that after seven years of a new system approximately 41 per cent of the volumes in current circulation would not have been prepared for the new system.

This means that after seven years of preparing punched cards as part of the cataloging function one could expect 41 per cent of current circulation to require newly-punched book cards. The remaining 59 per cent would already have

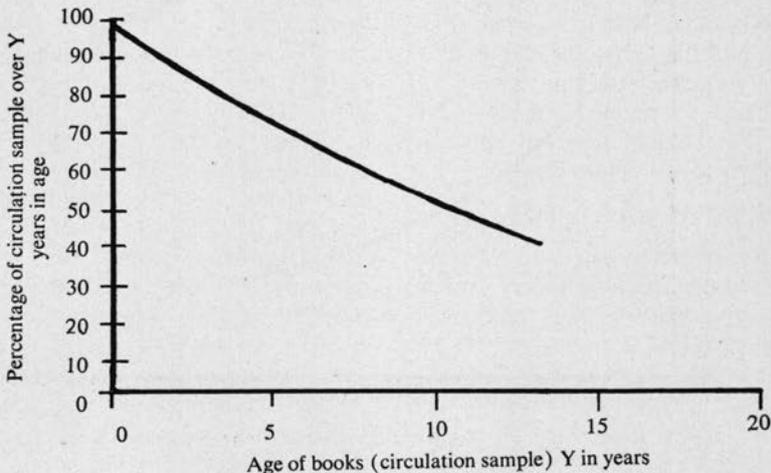


FIG. 1—Percentage of circulation sample over Y years in age vs. age of books in years (Deering library).

punched book cards because they would have been prepared when the book was initially cataloged. Similarly, after eleven years about 70 per cent of current circulation would have book cards. These predictive statements assume that circulation patterns with respect to age of the book will not change considerably and must be evaluated through the collection of additional data.

#### PREVIOUS CIRCULATION DATE

A similar, but perhaps more productive, approach can be made by again analyzing the books that are circulated. From the same circulated books, Tables 3 and 4 give percentages of the circulation sample for those books that have not been previously charged out during the cumulative time period shown.<sup>2</sup> For example, in the sample taken from the technological institute library (Table 4), 26 per cent of the volumes charged out had not been charged out during the preceding five-month period. Conversely, one could say that 74 per cent of the sample had been charged out at least once

<sup>2</sup>The sample was sorted by the previous due date and a cumulative frequency distribution prepared with respect to previous due date over monthly increments.

TABLE 3  
DEERING LIBRARY CIRCULATION (10/8/63)—  
PREVIOUS CHARGE DATE

Time period in months prior to circulation date of sample	Per cent of sample not previously charged out during the cumulative time period
0	100
1	89
2	76
3	68
4	59
5	51
6	49
7	42
8	39
9	38
10	35
11	32
12	29
18	24
24	17
36	11
48	8.2
60	5.8
Prior to 60th month	—

during the preceding five-month period. That is, 74 per cent of the sample had been through the circulation control function of the library one or more times during the preceding five-month period. This information is of particular interest and of possible value to mechanization pro-

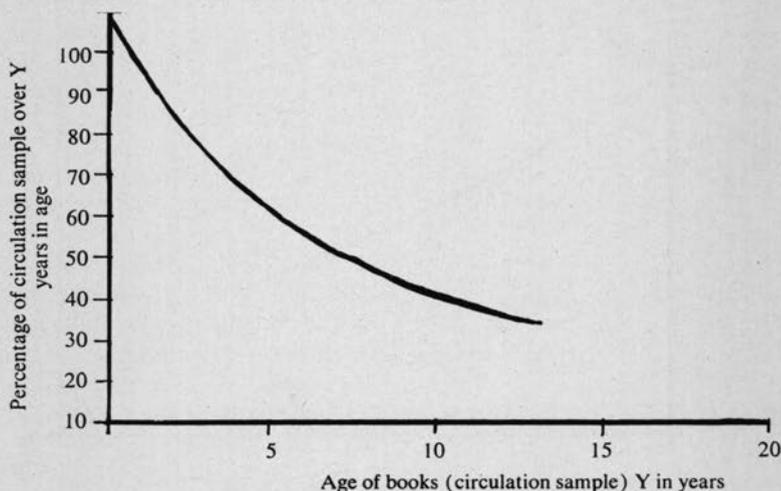


FIG. 2—Percentage of circulation sample over Y years in age vs. age of books in years (Technological Institute library).

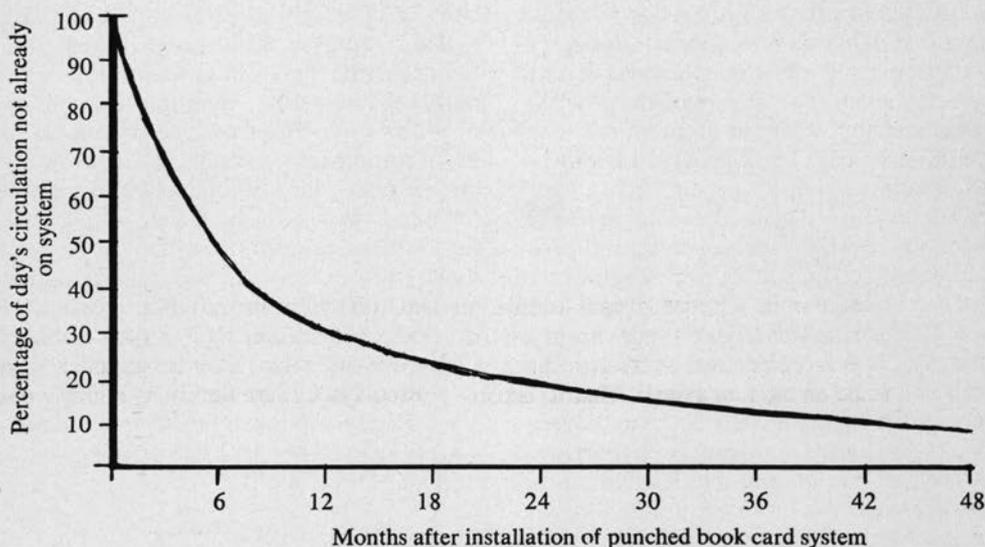


FIG. 3—Percentage of day's circulation not already on the system vs. month's after installation of punched book card system (Deering library).

TABLE 4

TECHNOLOGICAL INSTITUTE LIBRARY  
CIRCULATION (10/3/63-10/9/63)—  
PREVIOUS CHARGE DATE

Time period in months prior to circulation date of sample	Per cent of sample not previously charged out during the cumulative time period
0	100
1	79
2	49
3	42
4	34
5	26
6	25
7	23
8	19
9	17
10	16
11	13
12	12
13	12
14	11
15	11
16	10
17	10
18	9
19	8
20	8
21	7
22	7
23	6
24	6
36	3

cedures because it is an indication of the frequency of book use.

For example, a new mechanized circulation control system could be put into effect, and a new punched book card prepared during the loan period each time that a book was borrowed, provided it did not already have such a card. For awhile all books would need punched book cards, but soon some books would be returned and borrowed again and this time they would already have a punched book card. If the new circulation control system had been started eighteen months before this technological institute sample, one could expect to find approximately only 9 per cent of the books currently borrowed to be lacking book cards.

If one were to assume for argument that the frequency distribution of the circulation sample is representative of future circulation, and it is not completely unreasonable to do so, then certain things can be said about the loan patterns. Within the limitations of such an assumption one could predict the percentage of a given day's circulation that would not be under a new circulation system. Figure 3

and Figure 4 are plots of the same sample data but labeled with respect to the installation of a new punched book card system (given that as part of the new system, books card would be prepared when the book is circulated provided it did not already have one).

For example, from the data in Figure 4 for the technological institute library we could predict that after twelve months of operation of a punched card circulation control system, one would expect approximately 12 per cent of the circulation not to be on the new system. That is, according to the sample, 12 per cent of those books borrowed had not been borrowed in the last twelve months. Extending this further, after twenty-four months approximately only 6 per cent would not be on the new system.

The data for the Deering library as shown in Figure 3 indicate that the system must be in effect for forty-eight months before an 8 per cent conversion level can be reached. The curves in Figures 3 and 4 actually also predict the workload of conversion as they give the per cent of the current circulation that must be converted after the system has

been in operation a given period of time.

Thus, analysis of the user circulation requirements and book loan behavioral patterns has shown that implementation of a new circulation control system could be accomplished through the use of the above rules. Such implementation would be much lower in cost than converting the entire collection, which has been done in some punched card circulation control installations<sup>3</sup> and proposed in others.<sup>4</sup> For example, if a system utilizing the above rules had been installed at the Brooklyn College library, it is highly possible that there might now be punched cards for over 99 per cent of the circulation requirements.

#### CONCLUSION

Thus, the statistic of the previous charge date apparently gives a good indication of the time and workload requirements for the implementation of a punched book card circulation control

<sup>3</sup> IBM, *Circulation Control and Related Applications at Decatur Public Library* (White Plains, N.Y.: IBM, 1962a, b).

<sup>4</sup> Robert Ray, et al., "Progress Report on an Operations Research and Systems Engineering Study of a University Library" (NSF G-N-31, Unpublished report, Baltimore: Johns Hopkins University, 1963).

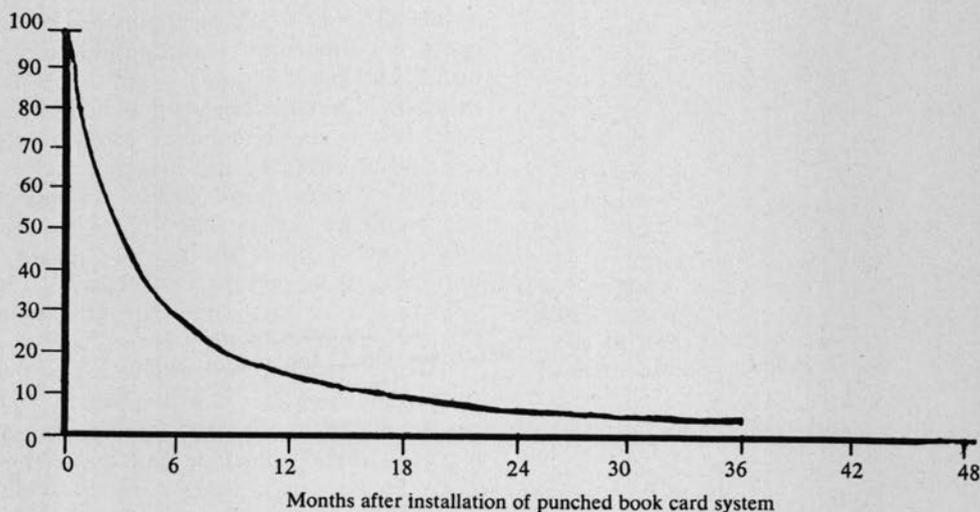


FIG. 4—Percentage of day's circulation not already on the system vs. month's after installation of punched book card system (Technological Institute library).

system. The results indicate that it is not necessary and perhaps relatively more costly to prepare punched book cards for all books in the library's collection. The approach of preparing punched book cards during the book loan period should result in a small conversion workload of approximately a few per cent of the daily circulation after a reasonably short time under the new system. In the case of the technological institute library, the system, if put into effect thirty-six months ago, would have resulted in a current conversion workload of approximately 3 per cent of the current circulation load. The other 97 per cent would already have punched book cards from previous circulation transactions.

This approach to circulation analysis has other perhaps more significant implications in that it indicates a very small portion of the library's holdings is accounting for a large fraction of the daily circulation. The statistic of last circulation date has potential in the preparation of a decision rule for a quantitative method of thinning the stacks. The statistic also has the additional advantage of re-

flecting user requirements and does not reflect the subjective judgment of individuals so often used in stack thinning. It may be possible through the use of this statistic to define quantitatively a core collection of well under 50 per cent of the present holdings that will satisfy over 99 per cent of user circulation requirements. The author is currently preparing for publication a description of this core collection concept and the use of the last circulation date as a criterion for effective stack thinning. Other implications may result from this approach, such as a quantitative answer to the question of multiple copy needs, noncirculating volumes, and the size of a library's holdings. The last point leads one to suspect that a university library can effectively and with virtually no loss to the user restrict its stack holdings to an analytically determined collection that reflects actual user needs rather than continue the trend toward larger libraries and larger holdings which all too frequently contain an increasingly large percentage of rarely used volumes.

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## Microcard Foundation Grant—ACRL

THE MICROCARD FOUNDATION has made a grant of \$100,000 to the Association of College and Research Libraries for distribution to college libraries. The grant will be distributed to one hundred college libraries, to be selected by the ACRL Grants Committee.

Each library selected will receive a package unit, including a Mark VII Microcard Reader and a number of publications on Microcards. The value of each "package" will be approximately \$1,000.

Selection will be made at the December meeting of the ACRL Grants Committee and results will be announced in the January 1965 issue of *CRL*.

OTHER GRANTS: Applications for other grants will be mailed early in September 1964.

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