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Academic Librarians’ Salaries

One out of every five librarians in American academic libraries was polled as to his current salary. Mean salary reported was $8,425, although men’s salaries generally were higher than salaries of women with similar qualifications. Salaries in church-related schools were below average, and those in junior colleges were above average. When salaries of male librarians are compared to those of male college professors and those of female librarians to those of female professors, the differences are not as substantial as they are normally assumed to be. Other useful comparisons are also reported.

The level of librarians’ salaries is an important indicator of the value society places on librarianship. During the present period, salary levels are rising, beginning salaries are higher for each new crop of library school graduates (the average beginning salary of $7,300 reported for 1967 is $2,200 higher than it was in 1960),¹ and attractive job openings are widely available.

Along with the apparent overall improvement, librarians are also becoming more concerned about their economic status. Long outdated minimum salary goals are presently being reformulated, and there are many other signs of activity on the economic front. While librarianship appears to be achieving a new recognition in contemporary society, this in turn may be serving to encourage librarians to expect higher rewards for the services they perform. Despite rising salary levels for the profession as a whole, however, salaries for many of its members remain relatively low, and serious inequities continue to exist.

Data from a recent national survey of academic librarians (Characteristics of Professional Personnel in College and University Libraries, study performed pursuant to a contract from the U.S. Office of Education) make it possible to describe the salaries of this professional group in some detail. The study provides salary data by sex, age, experience, education and other variables; reports academic librarians’ opinions of their salaries in terms of their professional experience; and considers the salaries of academic librarians in relation to those of other librarians and other academic faculty.

Population, Coverage and Analysis

The survey was based on a two-stage stratified probability sample of approximately one out of every five individuals employed in professional positions in the more than two thousand college and university libraries in the United States in 1966–67. All types and sizes of higher educational institutions, both public and private, were represented in the sample.


Mrs. Schiller is Research Associate in the Library Research Center in the University of Illinois.
In Stage I, 95 per cent of 580 sampled institutions supplied lists of all their professional staff. In Stage II, 2,251 individuals, or over 90 per cent of the 2,459 full-time personnel selected from the staff lists to receive a mail questionnaire, supplied salary information.

The following salary analysis excludes seventy of these respondents who work on a “contributed services” basis in church-related institutions, but it includes all others, regardless of whether they work on a 9–10 month or 11–12 month contract. The former constitute 14 per cent, and the latter 86 per cent of the 2,181 respondents who reported a specific basic annual salary figure. Since not all respondents who supplied salary information reported on all other items, such as years of professional experience and faculty rank, the totals may vary from one table to another. In each of the tables, salary data are reported for men and women separately, as well as for all librarians as a group. Of the total who reported salary, 37 per cent are men, and 63 per cent are women.

**Basic Annual Salary, 1966–67**

The distribution of basic annual salaries for academic librarians in 1966–67 is shown in Table 1. The mean salary (aggregate salaries divided by the total number of respondents reporting) is $8,425. The median salary is $7,925 (half earn more and half earn less than this amount). The mean salary is higher than the median because a small minority earn exceptionally high salaries. Four per cent of the respondents earn $14,000 or more, and the highest salary reported is $28,000.

The salary reported most frequently (the mode) for men and for women is close to $7,000. One-quarter of the respondents earn within $500 of this amount, but this modal salary range ($6,500–$7,499) is reported more commonly by the women (29.9 per cent) than by the men (18.7 per cent). Generally, the women tend to be most heavily concentrated at the lower ranges of the salary distribution. Slightly over half (51.3 per cent) of the women, compared to 27.8 per cent of the men, earn less than $7,500. On the other hand, while about one-fifth of all the respondents earn $10,000 or more, only 12.0 per cent of the women, compared to 37.3 per cent of the men, are in this upper salary grouping. The median salary for the men ($8,990) is higher than the median salary for the women ($7,455) by about $1,500. The difference between the mean salaries of men and women ($9,598 and $7,746 respectively) is even greater.

**Control and Type of Institution**

It is widely recognized that salaries in public institutions tend to be higher than in private institutions, both for library and other faculty. For librarians, however, data have not been available to describe the breakdown between pri-
Private independent and private church-related institutions. As shown in Table 2, the median salary for librarians is lower in church-related institutions ($6,999) than in private independent colleges and universities ($7,395). The figure for public institutions, however, ($8,390) is considerably higher than either of the above.

Salaries are more directly related to control of institution than they are to institutional type. Although it was unexpected to find that the median salary in two-year institutions is somewhat higher than it is in those of other types (Table 3), the differences between the median salaries in universities, teacher’s colleges, and two-year institutions are relatively slight, and may be too small to be statistically significant. The fact that the figure reported for two-year institutions is not considerably lower than it is, however, may be a reflection of the very rapid growth of public junior colleges within the recent period, spurred by greatly increased financial support.

**Some Salary Comparisons**

The library profession competes among other professions to attract able recruits, and college and university libraries compete with other types of libraries for trained personnel. If academic libraries seek to draw qualified personnel from the national manpower pool, salaries in these libraries must be on a comparable level with salaries in

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**TABLE 2**

**Median Annual Salary by Control of Institution Where Employed, by Sex**

(Per Cent Distribution)

<table>
<thead>
<tr>
<th>Control of Institution</th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>59.3</td>
<td>60.8</td>
<td>58.4</td>
</tr>
<tr>
<td>Private</td>
<td>40.7</td>
<td>39.2</td>
<td>41.6</td>
</tr>
<tr>
<td>Private, Independent</td>
<td>24.7</td>
<td>24.9</td>
<td>24.6</td>
</tr>
<tr>
<td>Private, Church-Related</td>
<td>16.0</td>
<td>14.2</td>
<td>17.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Base</td>
<td>2,181</td>
<td>802</td>
<td>1,379</td>
</tr>
</tbody>
</table>

---

**TABLE 3**

**Median Annual Salary by Type of Institution Where Employed, by Sex**

(Per Cent Distribution)

<table>
<thead>
<tr>
<th>Type of Institution</th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>47.8</td>
<td>51.7</td>
<td>45.5</td>
</tr>
<tr>
<td>Liberal Arts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College</td>
<td>27.6</td>
<td>23.4</td>
<td>30.0</td>
</tr>
<tr>
<td>Teacher’s College</td>
<td>9.8</td>
<td>9.9</td>
<td>9.7</td>
</tr>
<tr>
<td>“Other Prof. &amp; Tech. School”*</td>
<td>5.6</td>
<td>6.2</td>
<td>5.2</td>
</tr>
<tr>
<td>Two Year Institution</td>
<td>9.2</td>
<td>8.7</td>
<td>9.5</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Base</td>
<td>2,181</td>
<td>802</td>
<td>1,379</td>
</tr>
</tbody>
</table>

* Includes independent technological, theological, fine arts, and other professional schools.
other libraries and with the earnings available in other professions. (For academic librarians who are part of the higher educational community, faculty salaries provide an additional yardstick for comparison.)

Referring to the "NEA Salary Goal which had been set in 1966 at $8,000 a year for a classroom teacher with a Bachelor's degree and no experience . . . ," Mary Gaver, a past president of the American Library Association, has urged that "beginning graduates with a Master's degree in Library Science receive a salary of $8,500 a year." The results of the present survey indicate, however, that of those 1,292 respondents reporting salary who hold the fifth-year MLS as their highest library degree, 64 per cent earn less than this amount, regardless of experience.

Nonetheless, academic librarians as a group seem to earn higher salaries than school and public librarians. In 1966-67, for example, the median salary for academic librarians in the present survey ($7,925) was considerably higher than that for school librarians ($6,708). A review of existing data suggests that public librarians also are in a less favorable salary position. National salary data describing each of the separate portions of the library profession are not regularly available, and salary figures rapidly become out-of-date.

Meaningful comparisons between the salaries of academic librarians and other academic faculty are also difficult to make. Figures showing overall faculty salaries, for example, typically exclude the salaries of administrative personnel, whereas standard summary figures for librarians' salaries include the salaries of administrators (mainly chief librarians) as a matter of course. This has the effect of raising the apparent salary for librarians in comparison to other faculty. When chief librarians' salaries are included in the salary tabulations, the median figure ($7,925) for academic librarians is somewhat higher than it is for this professional group ($7,717) when chief librarians are excluded. It may be of interest to note here that the median salary of chief librarians alone is $9,750 (Table 4).

Another point of difference between librarians and nonlibrary faculty is the varying length of their respective contract years. While faculty salaries generally are reported on a nine-month basis, most librarians are employed for eleven months. Furthermore, the salary reported by librarians employed on the 11–12 month contract is not commensurately higher than that reported by librarians employed on the 9–10 month contract (Table 5), whereas among other faculty, increments are probably more directly proportionate to the longer work year where this type of contract obtains. Differences in the nature of the sample selected, in the response totals, and in the way in which survey data are reported, are additional factors which should be considered when comparisons are made from one professional group to another.

Once aware of these qualifications, none of the available salary figures for academic faculty appear to be precisely

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1 Quoted in Library Journal, XCI (September 1967), 2713.
3 Salary data from two recent consecutive surveys of state library consultants revealed, for example, that between 1965 and 1967 "some rather spectacular gains have been made." At the earlier date, only 12 per cent earned $10,000 or more annually, while the more recent survey reported 44 per cent at this salary level. Marie Ann Long, "A Reconsideration of the State Library Consultant at Work," in The Changing Role of State Library Consultants, ed. by Guy Garrison, University of Illinois Graduate School of Library Science Monograph Series, No. 9. (Urbana, Ill.: University of Illinois Graduate School of Library Science, 1968), p. 7.
Academic Librarians' Salaries

TABLE 4
MEDIAN ANNUAL SALARY BY POSITION LEVEL, BY SEX
(PER CENT DISTRIBUTION)

<table>
<thead>
<tr>
<th>POSITION LEVEL</th>
<th>TOTAL</th>
<th>MEN</th>
<th>WOMEN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per Cent</td>
<td>Median Salary</td>
<td>Per Cent</td>
</tr>
<tr>
<td>Chief Librarian</td>
<td>13.6</td>
<td>$9,750</td>
<td>20.4</td>
</tr>
<tr>
<td>All Others</td>
<td>86.4</td>
<td>7,717</td>
<td>79.6</td>
</tr>
<tr>
<td>Assoc./Asst. Librarian</td>
<td>10.3</td>
<td>8,300</td>
<td>11.5</td>
</tr>
<tr>
<td>Dept./Div. Head†</td>
<td>36.7</td>
<td>8,600</td>
<td>37.7</td>
</tr>
<tr>
<td>Other Prof. Assistant</td>
<td>39.4</td>
<td>7,195</td>
<td>30.4</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>$7,925*</td>
<td>100.0</td>
</tr>
<tr>
<td>Base</td>
<td>2,178</td>
<td>802</td>
<td>1,376</td>
</tr>
</tbody>
</table>

* Median for those reporting position level.
† Includes Heads of School, College, and Departmental Libraries.

comparable to the present ones for academic librarians. Certain generalizations are nonetheless possible, and it does seem reasonable to conclude that academic librarians earn less, on the average, than other faculty, although they are likely to work as much as two months longer. The mean salary for academic librarians in the present study ($8,425), is considerably lower, for example, than the mean salary of $10,354 reported by the AAUP for full-time faculty in 936 institutions. Similarly, the median salary of academic librarians ($7,925) is lower than that reported by the NEA for teaching faculty in degree-granting institutions for the preceding year. In 1965–66, “the median salary of all full-time faculty personnel is $9,081.”

One particularly striking point is revealed by the additional comparative data for men and women, for this appears to explain some portion of the salary differential between academic librarians and other faculty. The NEA goes on to report, for example, that “as in other professions, the median salary of women faculty personnel, $7,732, is lower than among men ($9,275).”


TABLE 5
MEDIAN ANNUAL SALARY BY LENGTH OF CONTRACT, BY SEX
(PER CENT DISTRIBUTION)

<table>
<thead>
<tr>
<th>LENGTH OF CONTRACT</th>
<th>TOTAL</th>
<th>MEN</th>
<th>WOMEN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per Cent</td>
<td>Median Salary</td>
<td>Per Cent</td>
</tr>
<tr>
<td>9-10 month</td>
<td>13.9</td>
<td>$7,595</td>
<td>11.6</td>
</tr>
<tr>
<td>11-12 month</td>
<td>86.1</td>
<td>7,964</td>
<td>88.4</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>$7,919*</td>
<td>100.0</td>
</tr>
<tr>
<td>Base</td>
<td>2,164</td>
<td>792</td>
<td>1,372</td>
</tr>
</tbody>
</table>

* Median for those reporting length of contract.
Among the academic librarians surveyed here one year later (differences in reporting date, length of contract, etc., should continue to be recalled), the median salary for women is $7,455, compared to $8,990 for the men. Thus, median salaries of academic faculty and of academic librarians correspond much more closely when men and women are considered separately than when each professional group is considered in the aggregate.

Nearly two-thirds of all academic librarians are women. In contrast, almost four-fifths of all faculty positions are held by men. Since women’s salaries tend generally to be lower than those of men in all professions, the disproportionately high representation of women among librarians, and the disproportionately low representation of women among other faculty, serves to intensify the salary differential between librarians and other faculty when contrasted to one another as aggregate groups.

**Faculty Rank**

The median salary of $8,260 for librarians who hold faculty rank is higher than the median salary of $7,537 for librarians without faculty rank (Table 6).

The corresponding figure for those with the rank of instructor ($7,250) is in turn, however, somewhat less. Beginning at the level of assistant professor, median salary rises with rank to $12,370 for those who are full professors.

Other survey data show that there is a strong association between formal teaching activities and faculty rank. It is not unexpected to find, therefore, that those librarians who teach formal courses tend to earn more than those who do not. The median salary for the former group is $9,230, while the median salary for those with no formal teaching responsibilities (this group constitutes 86 per cent of 2,153 individuals reporting salary) is $7,745.

In *The Academic Marketplace*, Caplow and McGee point to an interesting paradox. They claim that

> For most members of the teaching profession, the real strain in the academic role arises from the fact that they are, in essence, paid to do one job, whereas the worth of their services is evaluated on the basis of how well they do another. . . . Most professors contract to perform teaching services. . . . When they are evaluated, however, either as candidates for a vacant position, or as candidates for promotion, the evaluation is made principally in terms of

### TABLE 6

**Median Annual Salary by Faculty Rank, by Sex (Per Cent Distribution)**

<table>
<thead>
<tr>
<th>Faculty Rank</th>
<th>Total Per Cent</th>
<th>Median Salary</th>
<th>Men Per Cent</th>
<th>Median Salary</th>
<th>Women Per Cent</th>
<th>Median Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Rank</td>
<td>49.2</td>
<td>$7,537</td>
<td>45.6</td>
<td>$8,730</td>
<td>51.3</td>
<td>$7,285</td>
</tr>
<tr>
<td>With Rank</td>
<td>50.8</td>
<td>8,260</td>
<td>54.4</td>
<td>9,220</td>
<td>48.7</td>
<td>7,815</td>
</tr>
<tr>
<td>Instructor</td>
<td>20.8</td>
<td>7,250</td>
<td>16.6</td>
<td>7,540</td>
<td>23.3</td>
<td>7,130</td>
</tr>
<tr>
<td>Asst. Professor</td>
<td>16.5</td>
<td>8,765</td>
<td>18.8</td>
<td>9,160</td>
<td>15.1</td>
<td>8,535</td>
</tr>
<tr>
<td>Assoc. Professor</td>
<td>6.9</td>
<td>10,360</td>
<td>8.5</td>
<td>11,270</td>
<td>6.0</td>
<td>9,445</td>
</tr>
<tr>
<td>Professor</td>
<td>4.5</td>
<td>12,730</td>
<td>8.9</td>
<td>14,330</td>
<td>1.9</td>
<td>9,750</td>
</tr>
<tr>
<td>Has Rank, but not Specified</td>
<td>2.1</td>
<td>7,750</td>
<td>1.6</td>
<td>9,000</td>
<td>2.4</td>
<td>7,333</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>$7,931†</td>
<td>100.0</td>
<td>$8,983†</td>
<td>100.0</td>
<td>$7,460†</td>
</tr>
<tr>
<td>Base</td>
<td>2,157</td>
<td>799</td>
<td></td>
<td></td>
<td>1,358</td>
<td></td>
</tr>
</tbody>
</table>

* Includes Lecturers.
† Median for those reporting rank.
their research contributions to their disciplines.\textsuperscript{8}

It seems particularly ironic, therefore, to note that although librarians are employed to perform library services, they seem to be evaluated, at least where salary or rank is concerned, on the basis of their formal teaching activities.

Some institutions have begun to take more seriously the librarian’s educational role, to recognize the importance of this role regardless of formal classroom teaching responsibilities, and to bring librarians’ salaries more closely into line with other faculty salaries. In some cases this recognition has resulted in part from the strong position taken by librarians themselves. At the City University of New York, where professional librarians have full faculty status, including faculty titles and salaries,\textsuperscript{9} the “... first library rank now carries the title Instructor with a salary range from $8,100 to $11,950.” Even here, however, where librarians are “entitled to sabbatical leave, and all the other benefits and responsibilities of faculty membership,” they are not entitled to equal annual vacation.\textsuperscript{10}


\textsuperscript{9} “Librarians Get Faculty Status at City University of New York,” \textit{Library Journal}, XCI (January 15, 1966), 219.

\textsuperscript{10} Ibid., 220.

Table 7 shows that median salary by age reaches a high point of $8,700 for those who are in their forties, drops off to $8,375 for those who are in their fifties, and increases slightly to $8,499 for those who are sixty and over. Thus, when all respondents are taken together, it appears that those who are in their forties tend to earn higher salaries than those who are older. Upon closer examination, however, it will be seen that a somewhat different pattern emerges when men and women are considered separately.

Among men, for example, the median salary is $9,999 for those in their forties, but it rises to $10,280 for those in their fifties, and to $10,750 for those who are sixty and over. The corresponding figures for women are $7,790, $8,025, and $8,150. Thus, median salary rises with age for both groups. Women tend to earn less than men at any corresponding age level, however, and salary differentials between men and women increase with age. For those under thirty, the differential in median salary between men and women is $255, whereas for those who are sixty and over, the median salary differential is $2,600. The disproportionately high representation of women and the disproportionately low representation of men in the upper age

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|}
\hline
\textbf{Age (Years)} & \textbf{Total} & \textbf{Men} & \textbf{Women} \\
\hline
 & \textbf{Per Cent} & \textbf{Median Salary} & \textbf{Per Cent} & \textbf{Median Salary} & \textbf{Per Cent} & \textbf{Median Salary} \\
\hline
Under 30 & 15.1 & $6,785 & 11.3 & $6,965 & 17.3 & $6,710 \\
30-39 & 24.2 & 7,890 & 35.0 & 8,345 & 17.9 & 7,395 \\
40-49 & 24.2 & 8,700 & 30.0 & 9,999 & 20.8 & 7,790 \\
50-59 & 24.7 & 8,375 & 17.9 & 10,280 & 28.6 & 8,025 \\
60 and over & 11.8 & 8,499 & 5.8 & 10,750 & 15.4 & 8,150 \\
Total & 100.0 & $7,925$ & 100.0 & $8,991$ & 100.0 & $7,455$ \\
Base & 2,172 & 799 & 1,373 & \\
\hline
\end{tabular}
\caption{Median Annual Salary by Age, by Sex (Per Cent Distribution)}
\end{table}

* Median for those reporting age.
brackets are also factors which influence median salaries by age where men and women are considered in the aggregate.

**Professional Experience**

Several previous studies have suggested that salaries of academic librarians do not keep pace with experience. Randall found among college librarians over thirty years ago, for example, that “in the group as a whole, there is no significant relationship between length of experience and salary.”\(^{11}\) More recently Morrison reported that “length of experience as reflected in the age of librarians at the time of the survey is virtually unrelated to salary.”\(^{12}\) While beginning salaries of recent library school graduates have been rising steadily, particular concern has been expressed about whether salaries increase thereafter with professional experience.\(^{13}\) Many respondents to the present study were similarly concerned and considered this a question of direct self-interest. One of them, a woman department head with a professional degree and twenty-five years of professional experience, whose annual salary is just over $9,000, wrote:

> A lot more attention needs to be paid to the economic status of professional librarians, particularly to that of people like me, in the middle group between the beginners and the administrators. . . .

The survey findings appear to support the legitimacy of this claim, but in several respects the results are rather surprising.

Experience does pay, but just how much it pays depends on who is being described (Table 8). While the findings indicate a direct relationship between experience and salary, this relationship is stronger for the men than for the women. The median salary for all respondents rises from $6,940 for those with less than five years of professional experience to $9,205 for those with twenty or more years of professional experience. Among men, however, the figures are $7,330 and $12,570, respectively, compared to $6,750 and $8,745 for the women.

Salary differentials between men and women may be due in some measure to their differing educational qualifications.

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\(^{13}\) See, for example, John Weatherford, “The Price of Obsolescence,” Library Journal, XCI (March 1, 1966), 1182.

---

**TABLE 8**

<table>
<thead>
<tr>
<th>Number of Years Professional Experience</th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 5</td>
<td>33.0</td>
<td>35.5</td>
<td>31.6</td>
</tr>
<tr>
<td>5-9</td>
<td>20.2</td>
<td>23.0</td>
<td>18.6</td>
</tr>
<tr>
<td>10-14</td>
<td>14.3</td>
<td>17.2</td>
<td>12.6</td>
</tr>
<tr>
<td>15-19</td>
<td>11.6</td>
<td>11.7</td>
<td>11.6</td>
</tr>
<tr>
<td>20 and over</td>
<td>20.8</td>
<td>12.6</td>
<td>25.6</td>
</tr>
<tr>
<td>Total</td>
<td>99.9</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Median for those reporting years of professional experience.
Academic Librarians’ Salaries / 109

TABLE 9
RESPONDENTS WITH FIFTH YEAR MLS AS HIGHEST LIBRARY DEGREE AND NON-LIBRARY BACHELOR’S AS HIGHEST “OTHER” DEGREE—MEDIAN ANNUAL SALARY (11-12 Mo.) BY NUMBER OF YEARS PROFESSIONAL EXPERIENCE, BY SEX (PER CENT DISTRIBUTION)

<table>
<thead>
<tr>
<th>Number of Years Professional Experience</th>
<th>Total</th>
<th></th>
<th>Men</th>
<th></th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per Cent</td>
<td>Median Salary</td>
<td>Per Cent</td>
<td>Median Salary</td>
<td>Per Cent</td>
</tr>
<tr>
<td>Under 2</td>
<td>19.2</td>
<td>$6,660</td>
<td>15.5</td>
<td>$6,825</td>
<td>21.5</td>
</tr>
<tr>
<td>2-4</td>
<td>28.2</td>
<td>7,235</td>
<td>26.7</td>
<td>7,565</td>
<td>29.1</td>
</tr>
<tr>
<td>Under 5</td>
<td>47.4</td>
<td>6,986</td>
<td>42.2</td>
<td>7,250</td>
<td>50.6</td>
</tr>
<tr>
<td>5-9</td>
<td>26.6</td>
<td>8,090</td>
<td>29.5</td>
<td>8,770</td>
<td>24.8</td>
</tr>
<tr>
<td>10 or over</td>
<td>26.0</td>
<td>9,070</td>
<td>28.3</td>
<td>10,165</td>
<td>24.6</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>$7,515</td>
<td>100.0</td>
<td>$8,345</td>
<td>100.0</td>
</tr>
<tr>
<td>Base</td>
<td>854</td>
<td>329</td>
<td>525</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Among the men, for example, 87 per cent have at least the first professional library degree compared to 82 per cent of the women; and about one-third of the men, compared to one-fifth of the women, hold graduate degrees in other fields. While it was not possible to examine the salaries of men and women by every possible combination of professional and academic degree, that particular combination of degrees which was held most typically was selected for such analysis. Table 9 shows median salary by years of professional experience for those with a master’s degree in library science and a non-library bachelor’s degree. In order to eliminate the possible distorting effect on salary of the 9–10 month contract, Table 9 considers those on 11–12 month contract only.

This table shows that among those with the educational qualifications defined above, salaries increase with professional experience. Furthermore, men whose highest degree is the fifth-year master’s in library science are likely to receive substantially higher rewards for experience than women with the equivalent education. Median salary differentials exist between men and women at all levels of experience; but here again, the gap in median salaries between the two groups widens as experience increases.

It is small wonder then, that women tend also to be more dissatisfied with their salaries as their experience increases, while among men the level of satisfaction with salary varies only slightly at each of several levels of experience (Table 10). It is also worth noting, however, that a large proportion of men (46.2 per cent) as well as women (49.3 per cent) considered that they were inadequately compensated for experience. In the light of other survey data which show that only 11 per cent are dissatisfied with their library careers generally, dissatisfaction with salary seems particularly widespread.

EDUCATION

Over 98 per cent of all the respondents have at least a bachelor’s degree; five-sixths have at least the first professional library degree; and one-quarter hold advanced degrees in other fields, generally in combination with their library training. Altogether, nearly nine out of ten academic librarians hold either a professional library degree, a graduate degree in another field, or both.

Table 11 shows that median salary rises as the length of professional study increases. Caution must be urged in interpreting the specific figures however;
### TABLE 10

**Opinion of Salary by Number of Years Professional Experience, by Sex**

(Per Cent Distribution)

<table>
<thead>
<tr>
<th>Considers Salary Adequate</th>
<th>Number Years Professional Experience</th>
<th>Total Per Cent</th>
<th>Under 5 Yrs. Per Cent</th>
<th>5-14 Yrs. Per Cent</th>
<th>15 Yrs. &amp; Over Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Respondents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>51.9</td>
<td>58.8</td>
<td>49.9</td>
<td>46.8</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>48.1</td>
<td>41.2</td>
<td>50.1</td>
<td>53.2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Base</td>
<td></td>
<td>2,129</td>
<td>709</td>
<td>738</td>
<td>682</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>53.8</td>
<td>55.0</td>
<td>51.9</td>
<td>55.2</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>46.2</td>
<td>45.0</td>
<td>48.1</td>
<td>44.8</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Base</td>
<td></td>
<td>796</td>
<td>280</td>
<td>322</td>
<td>194</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>50.7</td>
<td>61.3</td>
<td>48.3</td>
<td>43.4</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>49.3</td>
<td>38.7</td>
<td>51.7</td>
<td>56.6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Base</td>
<td></td>
<td>1,333</td>
<td>429</td>
<td>416</td>
<td>488</td>
</tr>
</tbody>
</table>

*The questionnaire item on which this table is based, read: "Relative to your professional experience, do you consider your salary adequate?"

### TABLE 11

**Median Annual Salary by Highest Professional Library Degree, by Sex**

(Per Cent Distribution)

<table>
<thead>
<tr>
<th>Highest Professional Library Degree</th>
<th>Total Per Cent</th>
<th>Median Salary</th>
<th>Men Per Cent</th>
<th>Median Salary</th>
<th>Women Per Cent</th>
<th>Median Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td>$6,905</td>
<td>12.8</td>
<td>$7,800</td>
<td>18.5</td>
<td>$6,695</td>
</tr>
<tr>
<td>First Professional Degree</td>
<td>77.4</td>
<td>7,980</td>
<td>80.7</td>
<td>8,920</td>
<td>75.5</td>
<td>7,495</td>
</tr>
<tr>
<td>Fifth Yr. Bachelor's in L.S.</td>
<td>17.7</td>
<td>8,585</td>
<td>10.8</td>
<td>11,130</td>
<td>21.7</td>
<td>8,265</td>
</tr>
<tr>
<td>Fifth Yr. Master's in L.S.</td>
<td>59.7</td>
<td>7,775</td>
<td>69.8</td>
<td>8,710</td>
<td>53.8</td>
<td>7,315</td>
</tr>
<tr>
<td>Second Professional Degree (Sixth Yr. Master's in L.S.)</td>
<td>5.5</td>
<td>9,940</td>
<td>4.8</td>
<td>11,670</td>
<td>5.8</td>
<td>9,390</td>
</tr>
<tr>
<td>Doctorate in L.S.</td>
<td>8.2</td>
<td>15,600</td>
<td>1.8</td>
<td>10.6</td>
<td>.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>$7,920†</td>
<td>100.0</td>
<td>$8,999†</td>
<td>100.0</td>
<td>$7,455†</td>
</tr>
<tr>
<td>Base</td>
<td>2,165</td>
<td>796</td>
<td>1,369</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Median not calculated.
† Median for those reporting highest library degree.
‡ This category includes the undergraduate degree in library science.

first, because the present library degree structure differs from that which prevailed earlier, and particular degree labels therefore represent particular levels of experience as well as levels of training; and second, because some portion of the respondents in each category hold other advanced degrees in combination with their professional degrees, and this additional training may affect
the salary figures. Furthermore, the number of persons (seventeen) reporting that they hold the library science doctorate is so small that the median salary figure derived from this group may not be entirely representative of others who hold this degree, but were not selected in the sample.

The figures are nonetheless suggestive. Indeed, the very fact that there are so few librarians with the doctorate in library science while the demand for them is great may provide one explanation for the exceedingly high median salary of $15,600 which is tentatively reported here. This figure is considerably higher than the median salary for librarians with doctoral degrees in other fields. Based on sixty-three individuals reporting, median salary for the latter group is $10,500. The doctorate in library science appears, in contrast, to be particularly highly valued.

Although the median annual salary of $15,600 (1966-67) for those with the library science doctorate can only be considered as suggestive (the number of persons reporting such degrees is minute), this salary compares favorably with those reported by the National Science Foundation for scientists with the PhD degree. Among PhD scientists employed full-time by educational institutions, the median salary for calendar year 1966 was $12,800. Some of the individual fields for which corresponding median salary figures are reported are sociology ($10,500), anthropology ($11,000), physics ($12,000), and mathematics ($13,600), while the highest figures reported are for economics ($14,000), and for "other fields" ($14,800).

* It will be noted, for example, that the fifth-year bachelor's degree appears to be more highly rewarded than the fifth-year master's, both for men and for women. It is not clear, however, what portion of these differences may be due to the effect of experience (those with the bachelor's degree graduated earlier and have more professional experience), and what may be attributed to other non-library training. (A somewhat larger percentage of those with the BLS than of those with the MLS hold other graduate degrees in addition to their professional degrees.)

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15 Ibid., p. 2-3.
Implications of On-line Systems Techniques for a Decentralized Research Library System

On-line and batch mode computer-based library systems are defined to show their basic differences. This is related to how on-line systems can provide an operating framework for the large research library, thus providing the groundwork for a national information network. This article also discusses systems design factors, operating system and application software, various geographic implications, user services, and library staff effects. Additionally, certain problems are noted which libraries face as they proceed toward design, debugging, and installation of computer-based on-line operating systems for record and information control and dissemination.

On-line and Batch Mode Systems

Predominant among the computer-based library systems representing the current state-of-the-art are systems operating in the batch mode. In such systems, input data are gathered for processing at stated time intervals, and required outputs are produced by the processing of these data. These outputs are usually printed or punched. Corrections, additions, or changes must wait until the next processing time. For many tasks, such as order printing, circulation card punching, and various listing functions, this mode has provided sufficiently current service on an economical basis without detriment to user services.

Certain library-user-related functions do suffer, however, because of the time lag between processing, correction, and desired output when batch mode is employed. Functions such as recording receipt of periodicals, charge-out of bibliographic materials, file searching, file correcting, and timeliness of information are directly affected by the batch mode. It is highly desirable to perform these functions within the framework of an on-line computer-based information system. Such a system would permit a return to the “real-time” environment which does exist when making changes in manual systems, yet provide all operating units with access to the total record base of the library system without file duplication. Operating in an on-line mode would mean that updating of files, initiation of transactions of various types, and certain output functions would be processed in what appears to be “real-time” to the system user through the direct man/machine interface of a console unit. Such a library system can be designed today for the large, decentralized research library since hardware
Decentralized Research Library System / 113

and operating system software are available for such systems. Project Ballots1 and work carried out at the University of California, Berkeley, under Professor Maron2 show that progress in this direction is being made. In addition, our national libraries are devising standard record formats for bibliographic information as typified by Project MARC.

This on-line library system would be developed to serve library user and staff needs by creating a centralized, integrated data store of the library’s bibliographic and in-process information. Such a system would operate via keyboard display consoles, data collection units, and other necessary equipment connected to a central computer over various types of communication lines. Certain tasks would be performed in the batch mode, but main emphasis of the system to serve current user needs would structure the system to require short user response time, let us say, under four-second maximum delay on a message sent in response to a console inquiry. Therefore, the on-line, integrated record system envisioned by this author in future large libraries will combine both modes of operation for maximum efficiency, service, and economy. Such a record system will be compatible to standard bibliographic information disseminated through our three national libraries, the Library of Congress, the National Library of Medicine, and the National Agricultural Library.

1 Stanford University. Bibliographic automation of large library operations using a time sharing system (Project Ballots), a proposal for research and/or related activities submitted to the U.S. Commissioner of Education for support through authorization of the Bureau of Research. Principal Investigator: Allen Barnet Veaneer. Project Director: Rutherford David Rogers. May 1967, granted October 1968.


**System Design Factors**

No library system exists which truly integrates all of the total library operations from the original order of an item to its eventual delivery to the user. Certain of these segments are being performed by computer-based systems in various ways by many institutions. To achieve maximum benefit from an on-line application it is highly desirable to interface as many operations and tasks as possible, i.e., to have the system perform as much work as possible within limits of the hardware procured. This serves to create orderliness in processing, efficiency on the part of the staff, and economical equipment utilization. For example, present circulation control systems of either operational mode record the necessary transaction information, but the machine readable input card used to record the transaction in most of these systems is not a by-product of the original book processing operation, nor are these circulation files accessible by any other means than telephoning the circulation department, consulting their file listing, or using their console for file inquiry. Further, the typical circulation file provides a record of materials charged out, temporarily in a processing department, or special stack location. This file may provide for some queuing of users to a specific bibliographic volume but does not automatically balance the waiting users among widely scattered copies which may be duplicated in the total library collection. In addition, such a batch mode circulation system does not serve as a locator tool for volumes on the shelf in a geographically decentralized library environment.

From the above example, we can see the need for integration of circulation operations with the total processing operation. To carry our example a step further, the following benefits would ac-
crue from integrating the circulation file function:

1. determining specific location of volume;
2. determining availability by location;
3. queuing of user to item having immediate availability or shortest waiting list or time until return;
4. triggering order of additional copies according to user demand;
5. handling user cancellations by automatically shifting user queues;
6. determining storage transfers or withdrawals of volumes by their use history according to library standards;
7. full bibliographic information easily available for the issuance of recalls and overdues.

This means that the on-line library system must have at its heart a file structured to handle both bibliographic and operational data, meeting generally the following requirements:

1. bibliographic information for each volume added to the collection compatible with national systems requirements;
2. subject searching and specific entry searching capabilities;
3. library operational data, including ordering, accounting, routing, location, processing history, and management information relative to file use and transactions involving use or change of the files;
4. service file information, such as:
   a. vendor name and address files,
   b. borrower name and address files (probably the above two are institution-wide shared files),
   c. account or fund files,
   d. user interest profiles;
5. special depth indexed bibliographic files for special subsystems such as selective dissemination in delimited subject areas.

As noted above, portions of this file may operate in a file-sharing mode so that a file connected to one central processor may be accessed for inquiry by another computer over a communication line. This can give important cost savings within an institution.

Systems design will evolve which fits individual library needs yet maintains compatibility with national bibliographic sources. Since libraries differ vastly in their accounting, processing, and subject matter, these factors, together with size and user services, will determine the system requirements. Therefore, prime systems design factors will be the structuring of the integrated data base, using as many practical economics, such as file sharing, as possible, yet carrying out required applications and allowing flexibility for further system evolution and size growth.

**Operating System Software**

The operating systems supplied with medium- to large-scale computers most frequently used in on-line commercial systems, enable the computer to receive, process, and transmit data to and from various communications devices connected to the system. By buffering and memory paging such software permits the computer to maximize its efficiency, handling many jobs, seemingly simultaneously. By the establishment of priorities in processing and queues of jobs waiting to be processed and then polling these queues, many users of the system can be served with minimum response times. It is the development of this operating system software together with large mass storage files which has made on-line library systems as possible today as the airline reservation systems of this type currently operating and being developed. In fact, in certain situations, on-line processing becomes more feasible from a service and cost viewpoint than any other type. This analyst believes that in years to come this will also prove true for large research libraries.
Present developments on a national scale certainly point to the time when large libraries will become stations in a national library network system, each responsible for a segment of the world's published literature, by subject or by type. The heart of such a system would depend upon rapid communication between its stations to answer user requests. Messages consisting of bibliographic information, availability, and facsimile transmission of the document itself will be initiated through use of consoles operating as part of an on-line system. If these networks are really going to develop, machine readable data bases must be at their heart to enable remote communication and exchange of information. Therefore, it behooves large libraries to develop such systems to prepare for national interaction. As operating system software improves, a library's systems design task is strengthened so that future developments will undoubtedly offer the library a framework for even more effective systems.

Operating system software is complex, extremely expensive to develop, and up to now has been the prime responsibility of the computer manufacturer. Most installations have added their own improvements faster than they could have become available for release from the manufacturers. Libraries, as an applications user group, will be no exception to this when they operate their own computer systems or share a super-scale system within their parent institutions. Libraries will find it necessary to support further operating systems development and become vocal on their requirements to the computer manufacturers. Because of the technical lag between what present hardware and software can accomplish, it may be left up to the library to undertake modifications in operating system software where needed and not wait for the manufacturer if long systems delays are to be avoided.

**Applications Software**

Programs designed to process information and produce required output for library staff and users will be the prime responsibility of the library systems group. Certain types of applications programs, SORT/MERGE, for example, may be written for use in the library community by cooperating libraries to achieve specially tailored printed output such as book catalogs. Filing standards presently used should be evaluated according to ease of use by the user of the catalog. When more libraries begin to depend upon computer based systems, filing standards deemed absolutely necessary are bound to result. Certainly, it is possible to program the ALA/LC filing rules, but there is a high degree of variation in present practices in most libraries. A national standard specially suited to machine processing will undoubtedly result in time through the cooperation of the three national libraries. Some, however, would feel that each library should form its own conclusions on filing and build from this point initially.

In on-line processing systems operating in a time sharing mode, a limited block of core storage will be available for each program during its execution time. Therefore, one application program characteristic will be structural modularity. Segmentation of programs, small routines, overlaying, and use of common subroutines for programs operating in on-line applications will keynote program design. Operating time efficiency and minimization of core storage required will assume increased importance. For this reason many programs may be written using assemblers rather than higher order languages.

In libraries, as in the computer industry, attempts at standardization have not really resulted in much standardization. Only recently with the formation of EBCDIC codes in use on IBM Sys-
tern 360 equipment has the computer industry attempted to offer more than the usual 64 character set. For library use it would seem that standard codes allowing 128 characters would be minimal for representation of European alphabet languages, lower case, and of enough special symbols. With an increased use of extended character set chain printers beyond libraries, the manufacturers should be urged to base future hardware designs on eight level codes rather than the various six bit codes now used by all except IBM. It may be that libraries will want to base their systems plans and requirements on the hexadecimal code structure to enable direct encoding of up to 256 separate characters. Character set developments put into practice by MARC will be watched with interest by all libraries attempting to decide upon basic encoding techniques or what hardware to buy. Certainly libraries will be faced with generating software to convert machine readable data to fit new expanded code structures as new hardware is procured.

Software for applications must be the responsibility of the library systems group. In a large system contractors may be employed to write certain software as specified by the library. Strict control must be maintained, however, to assure a successful end product and the library's ability to take over maintenance of such programs once installed. This will be one of the most challenging administrative areas for project management in development of the library's online system.

**Geographic Implications**

Both national and local geographic implications result from the installation of on-line computer-based systems in large research libraries. National implications, of course, depend upon the role the library chooses in its relation to a national information network. The application of computers on a batch mode to libraries has brought about the possibility of increased cooperation beyond merely interlibrary loan services. Swapping of basic bibliographic information and access to greater index facilities is now possible by construction of suitable on-line communications systems permitting remote queries to search another library's catalogs. Therefore, on a national basis, large research libraries will send and receive queries to search their data base. Thus, some information needs will be met without intervention of more than one librarian in the originating library. This can mean an immense saving in man-hours and effective provision of additional reference librarians without the addition of extra staff.

On a local level implications of online systems techniques will completely change the present trend of library science toward centralization of processing activities. With centralized processing and subsequent dissemination of the physical volumes to scattered physical locations, cumbersome order and in-process files are created, as well as manual material sorting operations, and routing of materials to many people, to name only a few salient characteristics. Computer-based batch processing has encouraged this centralization trend to economically justify computer use, maintain audit control of the work processed, and build suitable clerical support necessary for a computer-based system. The advent of on-line techniques has made it possible to remove all the delay and inefficiencies of either a manual or centralized batch processing mode system. Because of the ability to query a central data bank, with file security provisions built into the system, along with memory protection, it becomes more desirable to structure large library systems for decentralized acquisitions and processing. This would elim-
inate the physical routing of volumes, cut the cataloging time, and yet give the advantages of centralization without the disadvantages. Branch libraries for geographic or subject areas could be built to be serviced more fully than one-man departmental libraries could ever be serviced, by providing longer open hours, more professional help to the user, and more timely delivery of new materials.

In such a decentralized system, each individual branch would have equal access to query the central data bank. It would be able, however, to change or add to only its designated portion of the file. Through security and access codes only appropriate personnel could query levels of management information. File accuracy would be the responsibility of the individual branch library working together with an audit section of the library's systems group, each library having one representative responsible for solving errors or file problems when they occur. This audit pool technique as the human interface between error checking software and the individual user of the system has proved effective in many large corporations operating time-sharing systems. In this environment many different departments maintain such liaison personnel to take care of problems.

To summarize, on-line query would give the geographically decentralized library system the advantages of centralization because of the central data bank of information. It would effectively combine the advantages of smaller libraries and decentralized physical processing activities. The disadvantage of cumber-someness on the part of centralization of manual activities would not exist. Secondly, the disadvantage of split records, ineffective procedural control, and lack of the right operational information in the right physical location would cease to be a problem. For better service and staff utilization such an on-line system would aid the library administrator effectively to extend and increase service.

**User Services**

One of the most perplexing problems for the user of a large research library is the complexity of finding information rapidly and receiving current information only after delays of six months to a year from its publication. Some reference requests may involve much physical travel between various departments of the library system, even just to find out whether a certain book is in a particular department. Finding locations of the actual material, once promising bibliographic references have been located, consumes much valuable time for user and library staff. In the typical large research library reference help is limited and the user is forced to fend for himself, much of the time inadequately. Librarians wish to alleviate this situation, but because of limited staff, certain antiquated procedures, and lack of the proper files in the right places, progress in solving this problem is slow.

Use of modern indexing services and techniques, a redefinition of reference service goals, and the design of thoroughly modern on-line systems designed to free librarians for the most important task in the library—the provision of adequate reference service—will alleviate the situation described above. By using such centrally procured services as MARC and MEDLARS, the library will capture basic bibliographic information for a large percentage of references at the time of their order. Upon receipt of an order this information will be added to for more rapid processing of new items. Other factors, such as publisher's standards, title page standards, universal book numbers, and further delineation of various record types to handle publication types not covered by
MARC, will undoubtedly be implemented in the coming years.

Library Staff Effects

Staff members in most large research libraries are familiar with what computer systems may do for the library, either through direct experience or through related professional activities. Every library should have a program of in-service education in this area to lay groundwork for systems work being done in the library without arousing apprehensions among staff. With this point in mind, on-line systems should have a positive effect on all staff members if the system’s capabilities are understood. Library staff must be made to feel a part of any systems development which takes place in their library since they place the requirements in the hands of the system designers.

It is said that many librarians are utilized in libraries for work more properly performed by senior clerical personnel. If it be true, their retraining may become a necessity and their employment as librarians in future years called in doubt unless they are utilized to provide reference, indexing, acquisitions, or in managerial functions. Much less professional staff and more clerical staff within the library itself will need to be concerned with purely processing work. This will permit more librarians to be engaged in the much more creative and professional task of helping the library user to solve his information problems in depth.

Librarians should feel much more in control of their libraries, because of the availability of basic information throughout the system, ease of handling many routine requests, time to manage effectively, to decide acquisitions, and to make full use of centrally procured pre-processing information. Librarians may turn their fullest attention to the design and provision of new services such as in-depth reference searches, selective dissemination, or other custom tailored information routing. Through effective systems groups trained to develop and maintain the library’s computer-based systems, a high confidence level should be achieved among the whole library staff.

Conclusion

As always, librarians are striving to provide increased service to their clientele who increase in number as well as sophistication in their service expectations. On-line systems will do much to make library use easier for the patron and less time-consuming on both his part and the library’s; it will also provide a base for the development of national library networks. When each large research library has basic bibliographic data machine-readable and serviced by on-line systems permitting remote query between geographically separated computer systems, quicker information processing will result for the information user. A depth of resources will be made available to every library on a faster basis than through the present complex procedures of writing or teletype communication and subsequent checking operations performed on each request no matter how routine in nature.

Librarians will be free to decentralize their collections yet retain the efficiencies of centralized processing and record systems. Rapid copy service, facsimile transmission, microfiche dissemination, and many other techniques will be employed to expand library services to an ever more demanding user group. The system work to now and that planned for the immediate future should effectively prepare the large research library for the development of on-line computer-based record systems for information processing and dissemination. Systems librarians face a great challenge to put together well designed systems and effectively communicate the library’s needs to the library’s computer center personnel.
Random Sampling: a Tool for Library Research

Questions about the accuracy of library records, the behavior or attitudes of patrons, or the conditions of the books in the collection can often be answered by a random sampling study. Use of this time and money saving technique requires no special mathematical ability or statistical background. The concept of accuracy is discussed and a table is provided to simplify the determination of an appropriate sample size. A method of selecting a sample using random numbers is shown. Three examples illustrate the application of the technique to library problems.

Librarians are continually called upon to make decisions based on imperfect data. How many books in the collection are in need of repair? What percentage of our patrons use the card catalog? Which categories of books can be stored without greatly inconveniencing our patrons? The cost of keeping accurate records to answer this type of question is great. On the other hand the librarian should have something better than an informed guess. One way of providing this information is to study a small sample of the collection or user population, and to draw conclusions based on this sample.

Sampling is, of course, a compromise measure. If unlimited amounts of time and money were available there would be no need for using methods of approximation. But if one is faced with both a need for information and limited resources, it is an important management tool. In order to make the most effective use of this tool statisticians have developed scientific sampling methods. These methods, based on mathematical precepts, assure maximum usefulness and validity of sampling data.

Accuracy and Sample Size

One of the first things to decide upon is the size of a sample. Intuitively one recognizes that larger samples give rise to more accurate data. To quantify this accuracy he must distinguish between two types of errors possible in a sampling study.

The first type of error is one which might be called tolerance. Most commonly, results are reported as percentages, for example, “25 percent of the books in our collection have circulated in the last two years.” Because they are based upon a sample these figures are not exact. Thus we say something like, “Between 23 and 27 percent of our collection has circulated in the last two years.” This tolerance is commonly written 25% ± 2 and is read “twenty-five percent plus or minus two.” This tolerance is a measure of the accuracy of our result.

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The second type of error measure is called confidence. It is a measure of how certain one is that the true answer lies within the limits stated in his tolerance. For instance a confidence of 90 per cent means that there is one chance in ten (10 per cent) that the true value of the number he is predicting lies outside of the tolerance he has set. A statement that 10% ± 4 of the patrons entering the library go directly to the card catalog reported with a 95 per cent confidence means that there is only one chance in twenty (5 per cent) that the actual percentage of patrons going directly to the catalog is either greater than 14 per cent or less than 6 per cent. Confidence can also be interpreted in terms of the results expected if a sampling study were repeated. Thus a 90 per cent confidence means that if a sampling study were repeated ten times (using the same sample size and tolerance but each time using a different sample) the results would be correct within the specified tolerance for nine of the replications.

Once a tolerance and a confidence have been decided upon one can use Table 1 to find the appropriate sample size. There are several important points in the use of the sample size table. First, the sample size needed for a given tolerance and confidence is dependent on the relative percentages which are observed. The correction can be made by applying a very simple formula. First estimate what per cent of the sample will be in the most important category you are dealing with. For example, if we were sampling the number of patrons who go directly to the card catalog, we might estimate on the basis of preliminary observation that the number is no greater than 20 per cent. We write this as decimal fraction .20. Next we subtract the fraction from one (1.00) and multiply our two fractions together.

Thus: 

\[
1.00 - .20 = .80 \\
.20 \times .80 = .16 
\]

This result multiplied by four (4) gives our correction factor.

\[
.16 \times 4 = .64 
\]

This factor is to be multiplied by the sample size in Table 1 to give a revised sample size. If in the example above we had decided on a confidence of 95 per cent and a tolerance of 2 per cent Table 1 gives a sample size of 2,401. Multiplying by our correction factor gives a revised sample size of 1,737. If we cannot predict our sample percentage in advance we can use the sample sizes directly from the table since these represent the most conservative size estimates.

Two further points should be observed in using the sample size table. The first is that the approach used in preparing the table is valid only for sample sizes which are greater than thirty but less than 10 per cent of the total population. A second point is that the sample size must be calculated before performing the survey. The table is not appropriate for calculating the confidence and tolerance of a sample already collected.

**SELECTING THE SAMPLE**

The entire validity of this sampling technique is based upon the use of an unbiased sample. That is to say the sample must be as representative as possible of the entire population. To this end one should use the mathematical concept of a random sample. Randomness in this sense means that for each selection (collecting one datum) every member of the population has an equal chance of being drawn. For example if we wanted to select several cards randomly from a new (ordered) deck of playing cards we might throw
the cards into a hat, stir them around, and draw the sample with our eyes closed. On the other hand suppose we were to close our eyes, remove a small stack of cards from the top of the deck, draw the next card for our first datum, remove another small stack, draw our next datum, and so on. This would not be a random sample since by removing the stack of cards we gave them no chance of being selected in the following draws. This kind of non-randomness most often appears in so-called fractional sampling. An example of this would be sampling a card catalog by taking every twenty-fifth card (from a random starting point). The effects of this type of violation of mathematical randomness are often difficult to determine. Sometimes the results of a study may be invalidated, other times the violation may have no effect. The critical factor is the order in which the population is arranged.

Let us consider two examples from public opinion surveys. In the first situation respondents were selected by calling at every twenty-fifth house. The interviewers proceeded from block to block in an orderly manner. As they went around each block they stopped at every twenty-fifth dwelling. When the results were compared to known data they were found to be unbiased. The order in which peoples' houses are arranged in a neighborhood seems to be independent of their opinions. Thus the fractional technique did not introduce any bias. In another survey respondents were selected by contacting every twenty-fifth person in the telephone book. The results of this survey were found to be incorrect. It was later recognized that the relationship between names and ethnic groups introduced opinion bias when the names were in an alphabetical list.

To summarize, sampling techniques which are non-random can produce serious and often undetectable errors. Techniques do exist for using certain types of structured samples but these designs require careful statistical analysis and should only be employed after careful consideration.

We have stressed the importance of choosing a random sample, but how does one assure randomness? One method makes use of random number tables. Many books on sampling or statistics include tables of random numbers (see bibliography). For example in a random number table we may find a column of numbers like this:

| 174393 |
| 533251 |
| 081831 |
| 987384 |
| 381849 |

To use these numbers in sampling we must develop rules for each sampling situation. Suppose we wish to draw a sample from a shelflist which consists of 9 drawers, each drawer having no more than 1,600 cards (about 16 inches). First we select a drawer. For this we can use a very simple rule. Namely, let the first digit of the random number equal the drawer number. We will delete any numbers which begin with zero, since there is no drawer zero. Next, to select a card within a drawer we could use the next four digits of each random number and count that number of cards into each drawer. This, however, would make the data collection extremely tedious. We may decide that measuring a distance into each drawer would be sufficiently unbiased for our purposes. Thus we will wish to choose a number of inches between zero and fifteen and a number of sixteenths of an inch between zero and fifteen. In combination this will allow us to have measurements of from zero to almost sixteen inches. First let us devise a rule for converting
the second and third digits of our random number to a number of inches between zero and fifteen. The two random digits form one hundred combinations from 00 to 99. Since we want sixteen numbers (counting zero and fifteen) each group will have six numbers per group. This is because sixteen goes into one hundred a little over six times. Our rule will be:

<table>
<thead>
<tr>
<th>If the random digits are:</th>
<th>Convert them to inches:</th>
</tr>
</thead>
<tbody>
<tr>
<td>00 to 05</td>
<td>0</td>
</tr>
<tr>
<td>06 to 11</td>
<td>1</td>
</tr>
<tr>
<td>12 to 17</td>
<td>2</td>
</tr>
<tr>
<td>18 to 23</td>
<td>3</td>
</tr>
<tr>
<td>24 to 29</td>
<td>4</td>
</tr>
<tr>
<td>30 to 35</td>
<td>5</td>
</tr>
<tr>
<td>36 to 41</td>
<td>6</td>
</tr>
<tr>
<td>42 to 47</td>
<td>7</td>
</tr>
<tr>
<td>48 to 53</td>
<td>8</td>
</tr>
<tr>
<td>54 to 59</td>
<td>9</td>
</tr>
<tr>
<td>60 to 65</td>
<td>10</td>
</tr>
<tr>
<td>66 to 71</td>
<td>11</td>
</tr>
<tr>
<td>72 to 77</td>
<td>12</td>
</tr>
<tr>
<td>78 to 83</td>
<td>13</td>
</tr>
<tr>
<td>84 to 89</td>
<td>14</td>
</tr>
<tr>
<td>90 to 95</td>
<td>15</td>
</tr>
<tr>
<td>96 to 99</td>
<td>Delete</td>
</tr>
</tbody>
</table>

To get a number of sixteenths of an inch, we want to convert the fourth and fifth random digits to numbers between zero and fifteen. We can use exactly the same sixteen division rule developed above. Thus to convert a random number to a card location we convert the first random digit to a drawer number, the second and third digits to a number of inches, and the fourth and fifth to sixteenths of an inch. For example if our random number is 17439 we would draw a card from drawer number one at a distance of 12\%s inches from the front.

Note that we have not permitted a sixteen since this could have given us 16\%. This illustrates a very important point. Suppose for example we had allowed 81\%6 to equal nine (9). Then there would be two ways to get a nine (9\%6 or 81\%6) but only one way to get a number like 9\%. This means that whole numbers (like 9) would be more likely to occur than fractional numbers (like 9\%). But our definition of randomness required that all numbers be equally likely. This is the reason that sixteen has been excluded.

Now let us consider some applications of this sampling technique to specific problems. These examples involve the three most commonly sampled items in the library; card files, patrons, and the collection itself.

Example 1

A large research library is concerned about recent discoveries of inaccuracies in their holding records. An inventory would be extremely expensive and would consume a great deal of professional time; thus the librarian wishes to conduct a sample study to determine if an inventory is actually necessary.

In order to set a tolerance and confidence the librarian considers what he will do with the results of his study. The librarian has decided that if less than 2 or 3 per cent of the collection is missing he will take no action. If more than 6 per cent of the collection is missing he is certain that he will conduct an inventory. He is not sure what action he will take if the percentage missing is between 3 and 6 per cent. We can see that the tolerance must be less than 3 per cent; in making a decision it will be important to distinguish between 3 and 6 per cent. The librarian believes that a tolerance of 1 per cent will make this information most useful to him. He is not certain exactly what confidence he desires, but because of the costs involved in being wrong (e.g., performing an unnecessary inventory) he has tentatively set a confidence of 99 per cent. The table indicates a sample size of 16,590 for these values. The librarian is certain that no more than 10 per cent of the collection is missing. Therefore we can calculate a correction factor for the sample size as follows:

\[.10 \times .90 \times 4 = .36\]
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We multiply our sample size by this correction factor to get a revised sample size of 5,973. Because of the importance of this measurement the librarian is willing to take a sample of the required size. Thus readjustment of the tolerance and confidence is not necessary.

The sample will be drawn from the shelflist. Since this source is biased against serials and other series, only monographic entries will be considered. The shelflist consists of 1,200 drawers (all numbered consecutively) each containing up to 14 inches of cards. The sample will be drawn by measuring the cards. The random number table used by the library has the digits arranged in columns thus:

| 47 | 68 | 96 | 90 |
| 38 | 14 | 42 | 64 |
| 18 | 11 | 30 | 98 |
| 55 | 60 | 53 | 30 |
| 97 | 83 | 71 | 30 |

Drawer numbers must be numbers from 0000 to 1199. To make drawer numbers the first two random digits must be converted to numbers between 00 and 11, while the next two digits must become numbers between 00 and 99. To convert the first two digits the following rule is developed:

If random digits are:  Convert them to:  
00 to 07  0  
08 to 15  1  
16 to 23  2  
24 to 31  3  
32 to 39  4  
40 to 47  5  
48 to 55  6  
56 to 63  7  
64 to 71  8  
72 to 79  9  
80 to 87  10  
88 to 95  11  
96 to 99  Delete

Each group of random numbers includes eight numbers because twelve (the number of numbers in the range 0 to 11) goes into 100 (number of numbers in the range 00 to 99) eight times plus a fraction. The second part of each drawer number can come directly from the random list. To pick a number of inches between 0 and 13 a similar rule is used except this time each division contains seven numbers thus the rule will be:

| 00 to 06 | 0  |
| 07 to 13 | 1  |
| 91 to 97 | 13 |
| 98 to 99 | Delete |

To get sixteenths of an inch we use a rule with six numbers per division:

| 00 to 05 | 0  |
| 06 to 11 | 1  |
| 90 to 95 | 15 |
| 96 to 99 | Delete |

This is the same rule developed earlier.

We can now use all of our rules to pick a sample. For example, using the random numbers we would have:

<table>
<thead>
<tr>
<th>Random Number</th>
<th>Drawer</th>
<th>Inches</th>
<th>16's</th>
</tr>
</thead>
<tbody>
<tr>
<td>47 68 96 90</td>
<td>568</td>
<td>13</td>
<td>15/16</td>
</tr>
<tr>
<td>38 14 42 64</td>
<td>414</td>
<td>6</td>
<td>10/16</td>
</tr>
<tr>
<td>18 11 30 98</td>
<td>211</td>
<td>4</td>
<td>Delete</td>
</tr>
<tr>
<td>55 60 53 30</td>
<td>660</td>
<td>7</td>
<td>5/16</td>
</tr>
<tr>
<td>97 83 71 30</td>
<td>Delete</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To make the actual task of taking the sample easier the selection can be ordered by drawer number before collecting the data. If in collecting the data we should find too few cards in a drawer to take the required measurement the data point should be deleted. This is important in order to preserve randomness.

**Example 2**

A library is taking a survey of user's opinions about library services. The data will be collected by handing out questionnaires to a random sample of patrons as they enter the library. This survey will be only one of many things which the librarian will use in deciding on changes in user service. Thus a tolerance of 5 per cent and a confidence of 90 per cent seem adequate. The librarian has no idea what percentages of the users will hold various opinions thus the sample size of 271 will be used directly from the table. The librarian has decided that the survey should cover a
period of two weeks to assure a representative sample of users. The sample will be drawn by converting random numbers to times. The library is open Monday through Friday from 9:00 A.M. to 9:00 P.M. and Saturdays from 9:00 A.M. to 6:00 P.M. We will need rules to convert random numbers to twelve days, twelve hours, and sixty minutes. Our rule for converting to days will use the first two random digits.

If random digits are: Convert them to:
00 to 07 1
08 to 15 2
16 to 23 3
88 to 95 12
95 to 99 Delete

The same rule can be used on the next two random digits to give us time. In this case one will be equivalent to 9:00 A.M., two to 10:00 A.M. and so on, with twelve being 8:00 P.M. Next we need to convert to minutes. A rule with sixty steps would be tedious to construct and to use. We may decide that no bias would be introduced by using time in five-minute intervals. Since there are twelve five-minute intervals in an hour, we need a rule with twelve divisions. We can use the same rule that we developed above. We can convert by setting one equal to five minutes after the hour, two equal to ten minutes after, and so on with twelve being equal to sixty minutes after which is the next whole hour. Part of our sample would look like this:

<table>
<thead>
<tr>
<th>Random Number</th>
<th>Day</th>
<th>Hour</th>
<th>Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>0301 1594</td>
<td>1</td>
<td>9 A.M.</td>
<td>10</td>
</tr>
<tr>
<td>8460 8881</td>
<td>11</td>
<td>4 P.M.</td>
<td>60 (5 P.M.)</td>
</tr>
<tr>
<td>8393 6703</td>
<td>11</td>
<td>8 P.M.</td>
<td>45</td>
</tr>
<tr>
<td>6694 4640</td>
<td>9</td>
<td>8 P.M.</td>
<td>30</td>
</tr>
<tr>
<td>9632 0065</td>
<td>Delete</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note that even though we have used the same rule we used different random digits. The last two random digits in each line were not used. In taking the survey a questionnaire will be given to the first person (old enough to understand it) to enter the library after each sampling time.

**Example 3**

A librarian wishes to determine whether significant shelf space can be obtained by removing little-used books from the collection. The criterion has been established that a little-used book is one which has not circulated in the last five years. The sample will be drawn by examining the date due slips and book cards in the back of randomly selected books. If 15 per cent or more of the collection can be removed, the librarian will take action. A confidence of 95 per cent and a tolerance of 3 per cent are desired. But budgetary restrictions limit the sample size to 500. The librarian believes the confidence to be more important and thus adjusts the tolerance to 5 per cent. The sample size from Table 1 is 384. There is little doubt that the number of books satisfying the criterion will be less than 25 per cent of the collection. Thus the correction factor is:

\[ .25 \times .75 \times 4 = .75 \]

This gives a final sample size of 288.

**TABLE 1**

<table>
<thead>
<tr>
<th>CONFIDENCE AND TOLERANCE</th>
<th>DETERMINE SAMPLE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conf.</td>
<td>Tol.</td>
</tr>
<tr>
<td>99%</td>
<td>± .5%</td>
</tr>
<tr>
<td>1.0</td>
<td>16,590</td>
</tr>
<tr>
<td>2</td>
<td>4,147</td>
</tr>
<tr>
<td>3</td>
<td>1,843</td>
</tr>
<tr>
<td>5</td>
<td>664</td>
</tr>
<tr>
<td>7</td>
<td>339</td>
</tr>
<tr>
<td>10</td>
<td>166</td>
</tr>
<tr>
<td>95%</td>
<td>± .5%</td>
</tr>
<tr>
<td>1.0</td>
<td>9,604</td>
</tr>
<tr>
<td>2</td>
<td>2,401</td>
</tr>
<tr>
<td>3</td>
<td>1,067</td>
</tr>
<tr>
<td>5</td>
<td>384</td>
</tr>
<tr>
<td>7</td>
<td>186</td>
</tr>
<tr>
<td>10</td>
<td>96</td>
</tr>
</tbody>
</table>

*Values in this table are based upon formulae derived in Report No. MG-ML-100, Community Systems Foundation, Ann Arbor, Michigan.*
The collection consists of about 19,000 volumes arranged on 234 sections of shelving. Each section has six shelves and there are 25 books or less on each shelf. To pick a section we will want rules to convert the first random digit to a number between zero and two. This calls for a rule with three numbers per division.

<table>
<thead>
<tr>
<th>0 to 2</th>
<th>3 to 5</th>
<th>6 to 8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>Delete</td>
</tr>
</tbody>
</table>

We can use the second and third random digits directly as the second and third digits of the section number. It is important that we recognize that the second and third digits must range from 00 to 99 since we need to be able to obtain section numbers such as 095 and 173.

To select a shelf within a section we need a rule with six divisions (there is no shelf zero). We will use the fourth and fifth random digits. Each division will have sixteen numbers in it.

<table>
<thead>
<tr>
<th>00 to 15</th>
<th>16 to 31</th>
<th>32 to 47</th>
<th>48 to 63</th>
<th>64 to 79</th>
<th>80 to 95</th>
<th>96 to 99</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>Delete</td>
</tr>
</tbody>
</table>

To pick a book from the chosen shelf we need a number between 00 and 25. We can use the rule developed for the section number to convert the sixth random digit to a number between zero and two. The seventh random digit can be taken directly to be the second digit of the book number. Combining all of our rules we can draw our sample.

<table>
<thead>
<tr>
<th>Random number</th>
<th>Section</th>
<th>Shelf</th>
<th>Book</th>
</tr>
</thead>
<tbody>
<tr>
<td>17340</td>
<td>44906</td>
<td>073</td>
<td>3</td>
</tr>
<tr>
<td>37589</td>
<td>96988</td>
<td>175</td>
<td>6</td>
</tr>
<tr>
<td>70322</td>
<td>75172</td>
<td>203</td>
<td>2</td>
</tr>
<tr>
<td>63402</td>
<td>26401</td>
<td>234</td>
<td>6</td>
</tr>
</tbody>
</table>

Again in drawing the sample it may be convenient to convert all of our random numbers first and order them by section and by shelf before drawing the sample.

**Final Remarks**

Random sampling is not necessarily an easy operation. Much thought must go into selecting a confidence and tolerance and developing rules for converting random numbers. Furthermore the tasks of actually converting random numbers and drawing the sample may be tedious. On the other hand the entire job of running a library is becoming more complex. To make decisions which are more technical and involve larger amounts of money librarians need both data and an understanding of how accurate it is. The material presented in this article should make it possible for librarians to perform many sampling studies by themselves. For more complex studies there are specially developed statistical techniques. Among these are methods of analyzing data in order to obtain more information from them, methods for more efficient sampling, and for recognizing and avoiding biases. Finally computers may be used for generating the sample and for analyzing the results. These techniques, however, are in the domain of the specialized researcher rather than that of the librarian.
J. MARTIN KLOTSCHE

The Role of the Academic Library in Urban Development

Many of the problems of the city can best be resolved within the urban university because it is one of the few agencies which in one way or another is concerned with all urban problems. The same range of interest and breadth of mission should be assumed by the urban university library. Three special problems faced by the library in the urban institution are 1) the need to serve well the part-time student; 2) its responsibilities to the local business and professional communities; and 3) its obligations to the general public. It cannot, however, be all things to all men so must always seek to fulfill those functions which it is uniquely qualified to do well.

No one can any longer question the fact that the central issue of our times revolves around the problem of our cities. Yet to conclude that the metropolis, because it is no longer viable, is obsolete, is unrealistic and irrelevant. For a society based on science and technology is inevitably urban, and the trend cannot be reversed. Our cities are here to stay. As a matter of fact, those who contend that the city is doomed fail to understand its historic role. The very word "city" suggests that it is the generator of civilization. Cities can be the repository of good things and centers of innovation if we but have the will and courage to make them so.

Here the university in the city can play a major role, for success in overcoming our urban ills will depend in large part upon whether or not the university scholar is able to focus new directions of inquiry and investigation upon some of the problems of our cities. It has always been a responsibility of the university to relate itself to the changing needs of society, and the evidence is substantial and conclusive that it has done so in the past. All aspects of life whether they be government, industry, agriculture, or labor, have benefited from universities in the past. There is no reason why the complexities of urban life should be an exception. If the universities cannot intellectualize our communities and influence the social and economic currents of our cities, then they have little reason for existence.

Most universities located in cities have not seen their task in this light. Some, like Columbia and Harvard, view themselves as national and not urban. Others, not typically urban, have been too preoccupied with their own shortcomings and have thus been more oriented to the avoidance of failure than

Dr. Klotsche is Chancellor, University of Wisconsin-Milwaukee. This paper was read to ACRL's Urban Universities Libraries Committee meeting on June 25, 1968.
to a positive affirmation of their role. This no longer suffices, for the urban university must identify itself with its environment in the same manner that land-grant institutions of the past related themselves in a meaningful way to the problems of field and farm. In short, the urban university must provide the intellectual muscle to give our cities strength and viability.

The academic library of the university has a special role in this respect. The problems of our cities are complex and multi-faceted. They cut across many lines and are not the monopoly of any one department or unit of the university. The training of professionals, which has always been the responsibility of the university, is a case in point. Today all of the major disciplines of the university are being called upon to train manpower for our cities. Our metropolitan areas need the urban sociologist, the human ecologist, the public administrator, the cultural anthropologist, and the legal specialist versed in zoning and land use, to cite a few examples. Poverty and the ghetto are the concern of all, and the university needs to make a total commitment of its resources in this area if it is to make a contribution. The social scientist, the philosopher, the artist, the engineer, and the natural scientist—all touch aspects of urban life, whether the problem is one of sanitation and transportation, of land use, of the disadvantaged in our ghettos, or of crime and poverty.

Since the university, of all institutions in our society, comes closest to being able to identify itself with the whole of the urban scene, the academic library can become one of the units within the university to reflect that totality. Administrators and university librarians should view the university library in that light.

In addition to the general commitment of relating itself to the totality of the urban scene, there are specific areas to which the library should address itself. Traditionally it has concerned itself with the full-time undergraduate and graduate student, providing them with instructional materials and other aids. The library has also been a central tool for full-time faculty members in pursuit of their own research. But the library located in a city has some additional requirements imposed upon it. Three of these are:

1. It has responsibility to the part-time commuting student. Many students enrolled in our urban universities work during the day and come to the campus only once or twice a week in the evenings. As a result they find the regular service of the university library inapplicable to them. Yet in many urban universities the part-time student represents more than one-half of the total enrollment. The Association of Urban Universities, in a recent study of its eighty-seven members, found that fourteen institutions had over 60 per cent of their students enrolled part time, eighteen had at least 50 per cent, forty-seven enrolled between 25 and 50 per cent on a part-time basis, while only eight had less than 25 per cent.

   Too often the university is geared to the full-time student. The pressure, for example, to extend library hours on university campuses has come from the full-time student. The part-time student is usually an after-thought and is shortchanged in many ways. Many library departments are not open to him. Nor are many of the professional staff available to him. Furthermore, part-time faculty seldom participate in the collection development of a library. Often they limit course readings to textbooks rather than utilizing special library assignments.

   The special requirements of the part-time student need to be examined by the university library. The new policy of the University of Wisconsin-Milwau-
kee of remaining open twenty-four hours a day was designed to meet this situation. The part-time student needs to have continuous access to the library on the one or two days a week that he is on campus attending classes. The one-year experiment has been a success and will be continued in the future. It is unlikely, in fact, that it will ever be given up. The opening of the library around the clock has had some other interesting by-products. Night hours have now begun to attract daytime students, especially at examination time, while increasing pressure is being put on other university units, such as the student union and recreation facilities, to remain open around the clock.

Administrators and librarians should examine carefully the special needs of the part-time student. Often he is accused of being less able and soft on intellectual matters. Actually he is serious, mature, and highly motivated. The real problem has often been that the university has not been geared to his needs and requirements, and the library is no exception.

2. **It has responsibility to business, industry, and the professions.** There are, of course, many special libraries in this country, created to meet the special requirements of a specialized and industrialized society. But in spite of this fact, business and industry still need to depend on the large research library and other facilities of the university that can never be matched by the special library.

The relationship of the university library to research and development in the community has not yet been fully understood. Again, the traditional position of the library as catering primarily to the full-time student and faculty member has stood in the way. Yet more and more, industries, especially those that depend on research and the new technology, identify proximity to the university as a major consideration in site location. The clustering of research laboratories around Harvard and MIT are classic examples. The availability of libraries and the policy which the library has about its use by non-university students has often appeared as a factor in inquiries made by industries seeking new locations.

At the University of Wisconsin-Milwaukee library services to industry, business, medicine, and education represented 16 per cent of its total business during the academic year 1967–68. A question does arise about how such services are to be financed and whether special fees should be charged. At the University of Wisconsin-Milwaukee no charge is made. The fact that it is state supported is a partial answer, although there are some private universities that provide such services on a non-fee basis. But whatever policy is pursued, it is important to remember that the university library can become an important connecting link between the university on the one hand and the research and development elements of industry on the other.

Also, we should not lose sight of the fact that there are often tangible rewards with compensations that come back to the university when such service is rendered. In Milwaukee, for example, such corporations as A. O. Smith, Allis-Chalmers, and Allen Bradley have given substantial collections to the university which in turn contribute to the enrichment of its total resources.

3. **It has responsibility to the general public.** Continuing education is one of the essential parts of the educational revolution taking place in this country today. Full-time employees seeking to keep abreast of developments in their area of concentration, advanced professionals wanting to keep current in their areas of specialization, housewives released of the responsibility of pre-school children, and citizens who simply want to satisfy some special interest of their
own, are all turning to the university to satisfy these needs. With advances in technology, increased specialization, and additional leisure time, adult education has already become one of this country's growth industries.

Evening instruction, part-time courses, seminars, and conferences are a part of this story. But the library also has a role to play. Too often it has ignored its responsibilities in this area and has not seen itself as a service agency designed to help satisfy the ever-growing, insatiable appetite of adults to continue their education. To meet this need, the University of Wisconsin-Milwaukee now issues patron permits to people of the area who, as holders, are given the privilege of using library facilities.

A word of caution does need to be expressed. The university always needs to see its special and unique role and not duplicate services already being performed by special libraries in the community or by public libraries. There also needs to be greater recognition of the interdependence of libraries with better coordination among all of them for common library use.

In pursuing a selective course, the academic library is no different from the urban university itself. It is constantly being subjected to community pressures to accept new responsibilities and engage in new activities. If it moves ahead without discrimination and care, it will spread its limited resources too thin and will be carrying on activities not in keeping with the true purpose of the university. The university has a more important role than simply being the servant of society. It should aim to be respected, not to be popular. This can best be done by performing those functions which only a university can perform and reserving for others activities not properly those of a community of scholars, namely, those of promoting the cause of learning and scholarship. The training of the intellect must at all times be the primary concern of the university. The university, including its library, would do well to be governed by this precept in examining its role in urban society.
The Empirical Study of Reference

The first section of this essay reconstructs four empirical studies of reference, which then serve as a basis for the discussions which follow. Section II shows that the principal notions on which these studies are based are deficient. It is observed that their deficiencies do not permit reliable results. Section III discusses the conventional concept of reference, through which reference is perceived as performed only by reference librarians; it concludes that the empirical interpretation of the conventional concept is fruitless as a framework for the development of the empirical study of reference. Section IV considers reference outside of librarianship. It suggests that reference is a special case of problem solving. On the basis of this consideration, Section V proposes a new framework for the empirical study of reference.

SECTION I

FOUR EMPIRICAL STUDIES of reference are briefly reconstructed in this section. Of the studies of reference with which the author is familiar, they appear to contain the most insight. They are presented in chronological order. By chance the first two studies were written by librarians; the second two, by non-librarians. The reconstructions serve as a basis for the discussions of the following sections.

Cole understood reference to be the "queries which people bring to the desk of the reference librarian" and the librarian's response to the queries in terms of "materials best suited to the needs of the reader."¹ Her objective was "to identify reference questions . . . and describe . . . the sources of reference information"² in public, academic, and special libraries.

The data of her study were the result of a questionnaire. For each reference, as interpreted under Cole's definition, the questionnaire requested the following returns:

1. What the patron wanted. 2. Exact statement of the question. 3. Occupation of the patron. 4. Specific books and other tools used in finding the answer. 5. Other functions performed. 6. Was the question answered satisfactorily. If not, indicate reason.³

Fourteen libraries reacted to the questionnaire. Four of them were public, four were academic, and six were special libraries. The data were first manipulated for readings on reference questions, then for readings on reference sources.

² Ibid., p. 2.
³ Ibid., p. 24.

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The first set of manipulations included these. The returns of No. 2, above, were classified by subject. That is, each statement of a question was mapped into one of the divisions of the Decimal Classification. The subject of a question was then characterized as a function of its origin, i.e., public, academic, or special library. The returns of No. 3 were classed into such occupational categories as housewives, unskilled laborers, and skilled laborers. The returns of No. 2 were classified by time. The temporal classification consisted of the following historical periods: -499, 500-1899, 1900-1940, 1941, 1942-. The subject of a question was characterized as a function of its time. The returns of No. 2 were classified by complexity. This classification, in outline, included: fact, how-to-do, supporting evidence, and general information categories. The returns of No. 1 were classed by specificity. The returns of No. 1, that is, were compared with the respective returns of No. 2. If "what the patron wanted" was the same as "the exact statement of the question," then that question was classed as specific; otherwise it was classed as nonspecific. Specificity was then characterized as a function of both origin and occupation.

The second set of manipulations required the following operations. The returns of No. 2 were classified by complexity. The returns of No. 4 were classified by form, i.e., such as reference, non-reference, periodical, and document. The form of a source was then characterized as a function of the complexity of a question.

Unlike Cole, Breed did not indicate his concept of reference. Since his study was largely a follow-up of Cole's study, it was entirely unnecessary that he should. Indeed, as the following reconstruction will show, it is reasonable to assume his entertainment of a concept of reference more similar to Cole's than to any alternative. Breed undertook the study of difficult reference questions in a large university library.

To Breed a difficult reference question was one for which "the ordinary reference sources failed to produce an answer." Breed purposed "to discover something about the persons asking the questions . . . the kinds of questions asked" and "to compare the extent to which certain kinds of knowledge . . . were called upon by the reference librarian in the search process." Breed's knowledge typology included knowledge associated with a general liberal arts background, subject specialization, personal knowledge, knowledge gained in the process of search, and library school and library experience. These knowledge types were intended to explain each step of the reference librarian's search. A reference step was defined as the reference librarian's consultation of any source or entry in a source.

The data of Breed's study was the result of a questionnaire. The questionnaire provided for the following returns on each reference:

1. A precise statement of the information wanted. 2. The name and/or occupation of the person or organization making the request, and the manner in which it was made (telephone, letter, or in person). 3. The time required to answer the question. 4. A step-by-step account of the method employed to deal with the question. 5. Whether the question was answered, partially answered, or not answered.

The reference staff of Harper Library, University of Chicago, acted upon the questionnaire. After difficult questions were isolated from other questions, the data were manipulated for readings on those questions and for readings on the

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5 Ibid., p. 19.


7 Ibid., p. 4.
processes by which those questions were answered.

For readings on the difficult questions the following manipulations were made. The returns of No. 1, above, were classed by subject, i.e., social, biological, or physical sciences, and the humanities. The returns of No. 2 were classified by origin, campus or non-campus. The questions falling into the former category, "were examined for deviations from a known subject specialization."8 The returns of No. 1 were classified as being specific or general. Generality was indicated if a question "called for broad treatment of a subject or . . . involved a process of selection and evaluation of material."9 There were very few general questions; they were not given further consideration in Breed's study. Those questions characterized by specificity were dichotomously classed as bibliographical or factual. Bibliographical questions were first classed by form, i.e., questions about books, periodicals, learned society publications, or U.S. government documents, then classed by inaccuracies of personal or corporate authorship, title, and date of publication. The inaccuracy of a question was then characterized as a function of its form. Factual questions were classified into numerous categories, often individual categories.

The second set of manipulations were undertaken for readings on the librarian's search process. The returns of No. 4 were categorized by knowledge, as indicated above. The subject of a question was then characterized as a function of the knowledge required to answer it. Final steps used in answering questions were isolated. A final step was defined as "the step which resulted in a solution."10 Such steps were not necessarily final in the sense of last steps. The subject of a question was then characterized as a function of the knowledge utilized by the librarian in taking final steps.

To the Herners, reference consisted of "all the problems within organizations or among groups of workers which require searches for information."11 Though they condemned a study of reference "which leads or permits the information seeker . . . to place the task of getting the information he needs in the hands of a person or group outside of himself" as "a study of a certain, narrow type of information requirement,"12 they produced such a study. And, though their concept of reference differed from Cole's, the concept of reference which guided their study did not. Their objective was to define "those information requirements which reference librarians and other information specialists are likely to be called upon to meet."13

The data of the Herners' study also resulted from a questionnaire. It requested the name of the organization receiving the question and the question itself. Fourteen atomic energy research and reference organizations forwarded to the Herners all questions received from the fall of 1956 through the fall of 1957. The data which the Herners received were manipulated only for readings on the questions.

After technical questions, those "involving one or more of the natural or engineering sciences,"14 were isolated; technical as well as non-technical questions were separately classified by subject. Non-technical questions were then disregarded. Technical questions, however, were further classified by number of discrete concepts and the logical re-

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8 Ibid., p. 22.
9 Ibid., p. 24.
10 Ibid., p. 52.
12 Ibid.
13 Ibid.
14 Ibid., p. 173.
relationships among the discrete concepts. A discrete concept was defined as a significant concept which could not be subdivided without changing its essential meaning. For example, "the question 'Give me information on engineering in nuclear reactors,' was taken to contain two concepts, 'engineering' and 'nuclear reactors.'" Only questions containing two or more discrete concepts were classed by logical relationships. The logical relationships were defined as logical sums, "where the requestor would settle for information about concept A or concept B"; logical products "where the requestor had to have information about concept A and concept B"; and logical differences, "where the requestor was interested in concept A, but not concept B."

Carlson described reference as "human searching behavior." His study emerged from the problem of determining an optimum search procedure of a very large file. Reference librarians were chosen as subjects for his study for they are "the most trained in search procedures." Like the Herners, though his concept of reference differed from Cole's, the concept of reference which guided his study did not. The objective of Carlson's study was to describe search procedures used by reference librarians in order:

1. To illustrate that human search behavior can be precisely described. . . . 2. To improve the present search procedures used by humans. . . . 3. To develop new training procedures for librarians. 4. To make it possible to develop computer routines that could assist the human in making complex searches of a file.

Three persons served as subjects.

They were the reference librarians in a university medical library. The file searched was the library collection with which the subjects were familiar. "The basic procedure was to present a search problem to a reference librarian and then record in detail his search techniques." Protocols, verbatim records, and descriptions of all that subjects say and do during a study, were obtained from the observations of two persons. The observers recorded everything they could see or hear during the searches. Presumably the subjects were requested to "think aloud" during the searches. After several protocols were gathered, they were analyzed for consistent search routines. The resultant routines were then tested against another protocol. The process was repeated. The product of these operations was a flow chart. The initial flow chart was compared with and modified by the original and additional protocols.

Section II

In this section it is argued that the major notions on which the reconstructed studies of reference are built are productive of results which are unreliable. For various, often similar reasons, these notions are in need of serious explication. In several cases it is noted that such explication does not seem forthcoming.

That the notion, the subject of a question, warrants discussion is by no means obvious. Cole was unable to correlate the subject of a question with either its origin or its historical period. Indeed, the Herners observed that "the results of a study such as the present one, based on questions from workers in a field other than atomic energy, would produce results quite different from those obtained in the present one . . . conducted at some future time, would also produce results at a variance with the present ones."
To Cole the significance of the subject of a question was its conjectured power to predict subject interests of reference patrons. Its significance to the Herners presumably was quite similar. It is questionable, however, that either Cole’s or the Herners’ results characterized the subject interests of patrons in the simple one-to-one correspondence supposed.

Cole defined the subject of a question by those operations which specify the class number of a book by means of the Decimal Classification. The subject of a question, then, was the subject as interpreted under that scheme. The interpretation of questions under that scheme, however, has several obvious disadvantages.

Under interpretation of the Decimal Classification, for example, it is obvious that two or more questions about the same subject are not necessarily mapped into the same class. Though the pair of questions “Who chopped down the cherry tree?” and “Who was the first president of the U.S.?” both have the same subject, the latter is decimally classifiable under history but the former is classifiable under the social sciences. Or, given the pair of questions “What are the properties of an irregular cube?” and “What are the basic tenets of Lawsonomy?” the latter is unclassifiable until or unless it is known what indeed Lawsonomy is and the former, though it has no subject, is classifiable in the pure sciences.

To circumscribe the artificiality of the Decimal and similar classification schemes, consider criteria for a more natural scheme: 22 (1) the subject of a question is independent of its various formulations and (2) it is about the extension of its subject term(s). Though these criteria dispel some of the difficulties just observed in connection with the Decimal scheme, they create difficulties of their own. By condition 1, question (a) “Is Henry Miller the author of Little Women?” is by subject equivalent to question (b) “Is the author of Little Women, Henry Miller?” By condition 2, however, question (a) is about Henry Miller and question (b) is about Louisa May Alcott; therefore, questions (a) and (b) do not have the same subject and criteria 1 and 2 are contradictory.

Indeed, besides the absence of a simple one-to-one correspondence between the subject of a question and its interpretation under a classification scheme, as well as the lack of a formalization of our concept “about,” there is experimental evidence that subject classification is far from the objective process assumed by either Cole or the Herners. 23 Appropriately recast, the subject of a question undoubtedly has something important to tell us of reference behavior. Under its present formulations, however, it has almost nothing to tell us.

Breed’s notion of the difficulty of a question is similar to Cole’s notion of the specificity of a question in several respects. Rather than descriptive of the patron, as she supposed, Cole’s notion of the specificity of a question was equally descriptive of the librarian. Cole defined specificity as the absence of a difference between the patron’s question and the librarian’s interpretation of that question. To exemplify non-specificity Cole wrote of the student who asked for the other author of The Taming of the Shrew and the librarian who gave Henry James as the answer. If the librarian of Cole’s example arrived at his answer by comparing the formulation of the question and the formulation of the solution at hand, then it is ob-


vious that a librarian who held "the Taming of a Shrew," or possibly Turn of the Screw as well, in his cognitive structure, undoubtedly would have answered the student of Cole's example in quite another way. Indeed, rather than exemplifying non-specificity, the question "Who besides Shakespeare wrote The Taming of the Shrew?" would have exemplified specificity.

Breed observed that, when they were received, difficult reference questions "appeared on the surface to be unexceptional questions which the usual reference books would answer." For that reason he defined difficult questions as those for which "the ordinary reference sources failed to produce an answer." Like Cole's notion of specificity, Breed's notion of difficulty is indeterminately characteristic of either the patron or the librarian or, indeed, the environment in which the question is asked. Under Breed's definition the difficulty of a question is an empty notion. Under Breed's definition, that is, a question is difficult only if a question is difficult. Breed's manipulations on the set of difficult questions were productive, then, of a miscellany of tenuously related results.

Let us probe this matter somewhat further. Given Reitman's description of a problem as having an initial state and a terminal state, a problem solution may be described as being a set of operations by which the former is convertible into the latter. On the basis of this description it is possible, for example, to express the question "How is a sow's ear changed into a silk purse?" by the following rule:

Description—contains sublist 1.
sublist 1—is, initial state; contains sublist 5.
sublist 2—is, initial state; contains sublist 4.
sublist 3—is terminal state; contains sublist 6.
sublist 4—process; input, sublist 5; output sublist 6.
sublist 5—is, sow's ear.
sublist 6—is, silk purse.

If a person has an element in his cognitive structure which satisfies this rule, then that person has a solution to this question. If, however, that person does not have an element in his cognitive structure which satisfies this rule, then he cannot achieve a solution to the question unless he is successful in setting up substitutive or subordinate questions to the one at hand. For example, it is possible to achieve a solution to the question given above by replacing the implicit physical constraint by a value constraint such that the value of the sale of a sow's ear will equal the value, or partial value, of the purchase of a silk purse. In any case, short of knowing precisely what elements are held by a given cognitive structure and its environment and, indeed, of knowing what counts as a satisfactory solution to a given question, the task of explicating the notion "the difficulty of a question" will prove a formidable task.

At various points in his study Breed observed deficiencies in his knowledge typology. For example, he observed that liberal arts and personal knowledge "were too subtle to be grasped in a study of this kind," that knowledge gained in the process of search and library specialized knowledge were not readily distinguishable "where final successful steps were concerned," and that "the separation of kinds of knowledge is slightly unrealistic; the reference librarian combines knowledge of many differ-

26 Ibid.
ent kinds in his exercise of judgement and his interpretation of the data at hand." Although almost nothing is known about one's personal knowledge, what is reasonably conjectured when related to Breed's self-criticism, makes that criticism seem largely understated. Newell, Shaw, and Simon, for example, have conjectured that cognitive domains are structured by

1. A control system consisting of a number of memories, which contain symbolized information and are interconnected by various ordering relations.  
2. A number of primitive information processes, which operate on the information in the memories.  
3. A perfectly definite set of rules for combining these processes.

If this conjecture is correct or even nearly correct, then one's knowledge consists not only of hierarchies of information but also hierarchies of rules for manipulating and modifying the information as well as the rules themselves. In that case, each sort of one's knowledge would be so intimately bound up with every other sort that to speak of identifying the sort of knowledge which led to a specific action would be misleading; to suppose the reality of such identification would be ridiculous.

Breed defined a reference step as the librarian's consultation of any source or entry in a source. Use of the reference step as the basic unit in the process of answering reference questions, however, has the same obvious disadvantages as the use of the human pulse beat to measure time. Like the human pulse beat, the reference step would differ for different people and would differ for the same person at different times, at different places, and under different conditions of mental and physical health.

Gagné has suggested several variables of individual difference which point up the problems inherent in such notions as the specificity or difficulty of a question, the knowledge used in answering questions and the reference step as defined by Breed. One person, for example, may possess more information and more rules for applying that information than another; be more facile in the recall of stored information; more able to select and maintain conceptual distinctions in the face of conflicting cues; more fluent than another in formulating hypotheses; more steady in the retention of a solution model; more rapid in verifying a solution. Implicit in Gagné's comments in relation to such notions is that variables of individual difference must be given experimental control or that such notions must be given independent study and explanation. Simon and Kotovsky, for example, have proposed a theory which "predicts rather successfully which problems, from a set of letter series completion test items, will be the more difficult for human S's." In Section VI Hayes's experimental control over variables of individual difference is observed in a study of problems characterized by sequences of well-defined steps.

Though the Herers interpreted their results on the conceptual structure of reference questions into information retrieval, intuitively at least, these results would seem to have implications for reference. It is intuitively reasonable to suspect that in a spoken question-answering system, the number of significant concepts per question will not exceed the span of immediate memory, i.e., the number of symbols which a person can repeat, orally or manually, in

31 Ibid., p. 58.  
correct sequence and without error after a single presentation. For example, as Miller has observed, “a person who can repeat nine binary digits will have a span of about eight decimal digits, seven letters of the alphabet, or five monosyllabic English words.” Also, it seems reasonable to expect a human encoding device to produce logical products more frequently than logical sums and to produce logical sums more frequently than logical differences. Several studies have suggested that humans categorize conjunctively more readily than disjunctively and prefer, in categorizing, positive over negative instances. Quite why and under what conditions these results obtain is barely speculated upon as, in Bruner’s words, “one eventually begins to wonder whether Nature herself does not abhor disjunctive concepts.” The Herners’ results on the conceptual structure of reference questions reinforce these suspicions.

Recall that a discrete concept was defined by the Herners as a concept which is both significant to the information desired and indivisible with respect to its essential meaning. Essential meanings, however, presuppose criteria, determinacy, and uniformity of usage, which common language does not meet. At the present time it can, at best, be said that a person “has a concept if he has a disposition on the basis of which he can make nominal classificatory statements or responses (‘this is X that is not X’); it is assumed that the disposition is learned from a number of instances which vary among themselves; it is assumed that the responses also be made to instances other than those contained in the set on which the concept was learned; it is taken that the classificatory response should not be the only possible one.” Indeed, the essential meaning of little from the essential subject of a question in Cole’s study. In Cole’s study it was the Decimal Classification which seemed to provide intersubjectively synonymous interpretations of subjects. In the Herners’ study it undoubtedly was “a special classification scheme for librarians in the atomic energy field,” a question in the Herners’ study differs rather than the questions alone, which provided the results shown in Table 1 on the number of discrete concepts per question.

Logical products were defined by the Herners as information about A and B; logical sums, as information about A or B; and logical differences, as information about A and not B. Under this interpretation of the conceptual structure of reference questions the Herners reported the results shown in Table 2.

What is of interest to reference about these results is that they need not have turned out as they did. Assuming the psychological reality of discrete concepts, for the sake of argument, it is possible to interpret the logical relationships among the discrete concepts of the question, “Who besides Shakespeare wrote The Taming of the Shrew?” in any one of the following ways: (author and The Taming of the Shrew), (Henry James and The Taming of the Shrew) or (Henry James and Turn of the Screw), (The Taming of the Shrew and not Shakespeare) and so forth. Indeed, it is entirely clear that such re-

27 Ibid., p. 162.
30 Herner and Herner, op. cit., p. 171.
sults as those given in Table 2 are largely dependent on the experimenter. For a more general example, from an arbitrary array of four attributes of two values each, as Bruner has observed, "one can define the same subset of instances with different types of concepts . . . the way in which a person will categorize new instances encountered will depend drastically upon the type of concept he has constructed . . . when one learns to categorize a subset of events in a certain way, one is doing more than learning to recognize new instances . . . One is also learning a rule that may be applied to new instances." \(^{42}\)

The major notions around which the results of Carlson's study were developed are what he called regular human behavior and inconsistent human behavior. Since what he intended by either regular or inconsistent human behavior is not at all clear, the following paragraphs attempt to clarify the meanings of these notions and to point up their shortcomings.

One of Carlson's "most encouraging findings" was that "human search behavior is really quite regular."\(^{43}\) By this he meant, as he explained two sentences below, that "there is a great deal of common behavior"\(^{44}\) in human search behavior. If regular behavior is that behavior which is common among searchers, then it is not unreasonable to expect inconsistent behavior to be that behavior which is not common among searchers. As Carlson was at pains to point out by numerous examples, however, inconsistent behavior was consistently practiced by the subjects of his study. In other words, it was also found to be quite common. Indeed, he explained that inconsistent behavior is that behavior which is both common and detrimental to a successful search, e.g., "human searchers are often influenced by the physical environment . . . he scans mostly those documents at a convenient eye level . . . he has a strong tendency to select clean, brightly colored books."\(^{45}\) If, then, inconsistent behavior is that behavior which is both common and detrimental to a successful search, it does not seem unreasonable to surmise that regular behavior, in contrast, is that behavior which is both common and characteristic of successful searches. If these are the meanings which Carlson intended for these notions, then we shall see in

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\(^{42}\)Bruner, Goodnow, and Austin, op. cit., p. 44-45.
\(^{43}\)Carlson, op. cit., p. 28.
\(^{44}\)Ibid., p. 175.
\(^{45}\)Ibid., p. 131-32.
considering his flow charts of regular behavior and his discussion of inconsistent behavior that he stipulated unfortunate meanings for both of these terms.

If Carlson has indeed flow-charted human search behavior, then his flow charts must tend to meet at least one criterion. They must tend to specify a set of operations which is sufficient to achieve an answer to a question much as a reference librarian would. However, since a description of human search behavior must account for both that behavior which is successful and that behavior which is not successful in a search, Carlson's elimination of unsuccessful search behavior from regular behavior, indeed from the entire study, precludes that possibility. One is led to suspect, in fact, that instead of preparing a flow chart of human search behavior Carlson prepared a flow chart of information retrieval.

Considering Carlson's Generalized Flow Chart, reproduced on the following page, first from back to front, it is evident, on inspecting the second level of detail, that his "Exit" intends the printout of a bibliography. Unless Carlson intends something more general than what is ordinarily intended by "bibliography," then one must conclude that either Carlson equated the conclusion of all successful searches with listings as outputs or that Carlson has, indeed, not flow-charted human search behavior at all. That is, certainly, successful searches conclude with answers other than bibliographical listings, as answers which are simply affirmatives or negatives.

Considering this Generalized Flow Chart from front to back, again on the second level of detail, his "Select 2-4 keywords" intends: If terms of input not previously encountered, generate synonyms from a general dictionary; otherwise, generate synonyms from memory; then, if synonyms are not available from either a general dictionary or from memory, generate synonyms from a medical dictionary. "Enter synonyms into synonym list; enter adjectives into search list, and rank."

"Delete common nouns. Finally, place the remaining nouns on the search list and rank them. Surely, however, "Select 2-4 keywords," as just one detailed example from the Generalized Flow Chart, is not representative of successful or unsuccessful human search behavior, not even in Carlson's own terms since he observed that the reference librarians of his study never checked "the accuracy of their spellings, pronunciation, and meaning before the search starts." Indeed, if in an act of communication, the decoding process of the listener is an approximate inverse of the encoding process of the speaker, then Carlson's "Select 2-4 keywords" taken inversely will surely not elicit a question from any speaker. The suspicion that Carlson's Generalized Flow Chart is a model of information retrieval rather than of human search behavior, as advertised, is more than warranted.

One of Carlson's "most significant findings" of the inconsistent sort was that "there is no feedback of the results of their search to the librarian." On the basis of this finding Carlson inferred that "the reference librarian has no consistent way of improving the quality of his search." He concluded that "any searches completed for a requestor should only be given out on the strict condition that the librarian be told about the usefulness or inadequacies of the result." The inference that there is no feedback to the reference librarian was based on evidence illustrated by the following example: During the recording of protocols one of the librarians

\[\text{Ibid., p. 8.}\] \[\text{Ibid., p. 29.}\] \[\text{Ibid., p. 35.}\] \[\text{Ibid., p. 35-36.}\] \[\text{Ibid., p. 36.}\]
Select 2-4 key words

Determine requestor language restrictions

Determine citation age restrictions

Derive general approach

Determine next source

Scan for match with search terms and develop synonyms from present source

Use criteria to accept or reject each entry

Any more entries for this term match?

Are criteria met to terminate search of this source?

Are criteria met to terminate search?

Exit

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stated, "I've never had a reader along on this kind of search." On the basis of this protocol, it seems reasonable to conjecture that on other kinds of searches the librarian was sometimes accompanied by the reader. According to Carlson's construal of feedback, then, feedback must have occurred in such cases as these. It seems more reasonable to assume, however, that patron feedback can occur only after the patron has had time to evaluate the work done for him in relation to the work for which he requested the librarian's help. In that case, having the reader along would for the most part be irrelevant. But what does Carlson intend by feedback? Surely in a complex question-answer system as the one under discussion, feedback is not the simple or obvious activity which Carlson describes as "He receives a request from a person; makes the search, often without the requestor present; gives the requestor the results; and hears no more." In the simplest manner feedback should have to be described as the librarian's response to the patron's output in such a way as to reduce the difference between it and a prescribed input and the patron's response to the librarian's output in such a way as to reduce the difference between it and a prescribed output. "The picture roughly resembles two rings (but rings each of which is composed of a series of ongoing and intervening events) that are placed in planes at an angle to each other and touching each other at common points in their circumferences." To describe feedback in this, the simplest of ways, makes it absurd to assert the absence of feedback on the basis of data derived from protocol analysis of the librarian alone. Indeed, to refuse the reader the desired information until he feeds back to the librarian in an obvious manner surely makes this the most absurd of Carlson's findings, especially since Carlson's construal of inconsistent behavior implies that it, like regular behavior, results in a successful search.

**SECTION III**

This section of the essay discusses the conventional concept of reference and its relationship to the empirical study of reference.

Derived from the preparation for and the practice of reference, the conventional concept is made explicit in numerous definitions in the literature of librarianship. In these definitions it is clearly asserted that only reference librarians perform reference. As focal points for our discussion, let us consider several definitions of reference; as our point of departure, Pierce Butler's counter to the conventional concept.

To Pierce Butler such definitions of reference as "the assistance given by the librarian to readers in acquainting them with the intricacies of the catalogue, in answering questions, and, in short of doing anything and everything . . . to facilitate access to the resources of the library," were invalid. To Butler such definitions were invalid in that they tended to define reference in the trivial circle as "what goes on in the reference room" and the reference room as "the

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place where reference work is carried on.”55 Pierce Butler proposed that reference is “that process by which civilized man is able to obtain specific information at will by use of books which have been organized into a library.”56 Unlike other definitions of reference, Butler suggested that reference is not performed solely by librarians and is not performed solely in reference rooms. Butler’s counter to the traditional concept of reference, however, has made little impression.

In her empirical study of reference, Dorothy E. Cole observed no difference between Butler’s concept of reference and her own, as we have noted, the “queries which people bring to the desk of the reference librarian” and the reference librarian’s response to the queries in terms of “materials best suited to the needs of the reader.”57 Indeed, Cole felt Butler’s to be supportive of her concept of reference. In another empirical study of reference a difference was observed. With unshaken confidence in the traditional concept, however, Lois Fern58 rejected Butler’s counter. Fern, that is, first observed that Butler’s concept was inconvenient, i.e., she would have had to consider “those hundreds of instances in which the patron engaged in reference work without the librarian’s assistance”; she then observed that Butler’s concept was absurd, i.e., she would have had to entitle her study “Use of Library Catalogs by Reference Librarians Engaging in Reference Work.”59

As students of reference, librarians either have not perceived Fern’s “hundreds of instances” or perceived them, like Fern, as something different from reference, perhaps something less than reference. They have perceived reference through the conventional concept. They have perceived only what experience in the preparation for and practice of reference has led them to expect.

There is evidence that “when such expectations are violated by the environment, the perceiver’s behavior can be described as resistance to the recognition of the unexpected or incongruous.”60 In the familiar Bruner and Postman experiment “On the Perception of Incongruity,” subjects were shown by tachistoscope a series of five playing cards at controlled and gradually increasing levels of exposure. Some of the playing cards were normal, i.e., expected, as the five of hearts; others were incongruous, i.e., unexpected, as the red six of clubs. “At each exposure the subject was asked to report everything he saw or thought he saw.”61 A stimulus series was completed by three successive correct responses to each of the five cards at various exposure levels from ten up to one thousand milliseconds.

A few of the subjects perceived the normal cards erroneously. One subject, for example, mistook the black five of spades for the red five of hearts. The vast majority of subjects, however, perceived the incongruous cards erroneously. Subjects identified the red six of spades, in a number of cases, as the six of spades or as the six of hearts. The subjects reported such perceptions with considerable assurance. Without uncertainty, that is, they fitted what they presumably saw into a normal form or color pattern that they expected to see. Often subjects compromised on what

56 Ibid., p. 11.
57 Ibid., p. 1.
59 Ibid., p. 8.
61 Ibid., 210.
they saw. With the red spade and club cards, for example, subjects reported seeing such colors as black with red lights, lighter than black but blacker than red, olive drab, and so on. A few of the subjects came suddenly to recognize the incongruity of the trick cards. Other subjects found something wrong with them and came to recognize the incongruity gradually. "A subject viewing a red spade may start by reporting a red tint which gradually becomes redder on succeeding trials until he finally asserts that the card is a red spade." Indeed, there were several subjects who never managed to unmask the incongruity of certain of the playing cards.

Analogically, the Bruner-Postman experiment provides a suggestive schema for viewing the librarian's perception of reference; fitting, that is, the incongruity of reality to one of the neat conceptual categories prepared by prior training and experience, training and experience which do not and never need to indicate that anyone other than librarians perform reference. Let us consider now some of the implications of the librarian's perception of reference.

If the student of reference perceives reference as performed only by reference librarians, then in his research he is constrained into conceptually setting reference librarians apart from other human beings. In setting reference librarians apart from other persons, it has seemed manifest to the student of reference that what differentiates the reference librarian from other persons is his preparation for and practice of reference librarianship. Under the conventional concept of reference, then, the empirical study of reference poses two pertinent questions to the student of reference: How efficient is education for reference librarianship? How successful is the practice of reference librarianship? In the former case the empirical study of reference has become an instrument for investigating some aspect of that preparation and, in the process, for suggesting some modification of it; in the latter case, an instrument for investigating and modifying some aspect of that practice. Indeed, the results of the reference studies reconstructed above were interpreted in just that manner. Cole, for example, observed that classifying reference questions should aid the library administrator in evaluating "the amount and kind of work done by the reference department" and aid the library training agencies in determining the nature and scope of the reference courses. Breed wrote, "The findings concerning the reference process related to difficult questions have implications for library schools and the material presented in courses on reference work. More attention might well be paid to the analysis of the reference process itself—and problems on the advanced level might include more examples of the kind of incomplete and inaccurate data with which the reference librarian must so frequently work." The Herners said, "It is evident that useful data on the information requirements of a body of users can be obtained from collecting and analyzing statistical quantities of their reference questions." By useful the Herners presumably meant helpful in specifying "those information requirements which librarians... are likely to be called upon to meet." Carlson declared that "In many cases, human behavior is inconsistent to the detriment of successful search. These [inconsistencies] could be used as guidelines by librarians to improve their search procedures. Perhaps some of these inconsistencies or omissions could

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62 Ibid., 222.
63 Cole, op. cit., p. 58.
64 Breed, op. cit., p. 65.
65 Herner and Herner, op. cit., p. 176.
66 Ibid., p. 172.
be generalized and provide guidelines for the training program of reference librarians.\(^6\)

This viewpoint, of course, does not at all invalidate the results of the empirical studies of reference. It does, however, make the process by which they are derived circular. It does, therefore, profoundly affect the manner in which they are perceived. Given that the preparation or practice of reference is both point of departure and point of conclusion of the empirical studies of reference, the results of these studies must often seem, then, to be little more than reflective formulations of the very observations which reference librarians encounter in their education or the very observations which reference librarians make in their work. Consider now several of the results derived from these empirical studies of reference. Cole, again as an initial example: Reference patrons most frequently ask questions in the social sciences, useful arts, and history. Breed: Difficult questions are characteristically specific rather than general and involve bibliographical references rather than facts. Bibliographical questions are difficult to answer because of omissions or inaccuracies in the patron's citation of author, titles, and dates of publication. The Herners: Patrons generally ask non-technical questions about descriptions of processes or methods of procedure. Carlson: "Human searchers should be very careful to write down their search terms and check the accuracy of their spellings, pronunciation, and meaning before the search starts, and whenever they adopt a new search term as the search progresses. . . . A human searcher would be more consistent if he would follow more rigid rules in checking every document or source. . . . The reference librarian has no consistent way of improving the quality of his own search. Any searches completed for a requester should only be given out on the strict condition that the librarian be told about the usefulness or inadequacies of the results."\(^6\)

If the results of the empirical studies of reference seem to be little more than reflective formulations of everyday observations, observations for which there are hundreds of counter-examples ready at hand, then it is hardly surprising that Ennis, for example, has characterized the endeavor which has produced such results as "among the weakest in all library research."\(^6\)

To the non-librarian, the librarian's commitment to the conventional concept of reference in his empirical research perhaps seems strange. To the librarian, for the non-librarian to condemn and then use that concept to guide his empirical study of reference must likewise seem strange. Consider, then, two cases: the one illustrated by what psychologists have called functional fixedness, the other illustrated by what they have called distortion produced by popular opinion.

First consider the case for librarians, as Cole and Breed. "The student attends an educational institution on the presumption that the training he receives there will enable him to solve problems in later life more adequately and efficiently than would be the case had he not received this training. . . . It is also possible, however, that the training which the student receives may often, alas perhaps more often than we are aware of, make the student less able to solve certain new problems."\(^7\) The classical description of functional fixedness is Maier's pendulum problem.\(^7\)

\(^{67}\) Carlson, op. cit., p. 28.

\(^{68}\) Ibid., p. 29-36.


Subjects were introduced into a room where two pieces of cord were suspended from the ceiling. The room contained, besides the suspended cords, "many objects such as poles, ringstands, clamps, pliers, extension cords, tables and chairs." The subjects were told to tie the two pieces of cord together. The cords, however, were too far apart for a single individual to hold both ends simultaneously. Though several solutions to the problem were possible, one seemed especially difficult for the subjects to grasp. It was the solution achieved by weighting one of the cords with pliers, setting the cord in motion and catching it after the other cord had been seized. Most of the subjects did not perceive the cord as a potential pendulum and the pliers as a potential weight. In general terms the subjects of Maier's study demonstrated an inability to displace old, learned concepts with new ones required by a novel task. Similarly, the subjects who are our concern in this essay have demonstrated an inability to displace that concept of reference learned in the preparation for its practice and in the practice itself by concepts required for the task, generally novel to librarians, of the study of reference.

Consider now the case for non-librarians as the Herners and Carlson. Recall that the Herners condemned and that Carlson called the conventional concept of reference into question. Recall that unlike Cole and Breed, who were committed to that concept by prior training and experience, the Herners and Carlson were not. Recall that though their concepts of reference differed from that of Cole and Breed, the concept of reference which guided their studies did not. The evidence here suggests that "the interfering influence of the familiar extends even to situations where the subject is presumably confined to rigid rules of thought that should exclude it." In a series of tests on "The Distortion of Syllogistic Reasoning Produced by Personal Convictions," Morgan and Morton showed that subjects tend to reach conclusions which, though logically invalid, are consistent with popular opinion. The subjects of these tests were required to draw conclusions from two premises by the process of immediate inference, as

If all men are mortal (major premise), and
If John is a man (minor premise); then John is mortal (conclusion).

The subjects of this study were given two sets of fifteen syllogisms in parallel form. In the first set of syllogisms letter symbols as X, Y, and Z were used as terms of the premises; in the second set, "vital issues which were being currently discussed in the papers and over the air were" incorporated as the terms. Given the invalid syllogism, for example,

Some ruthless men deserve a violent death; since one of the most ruthless of men was Heydrich, the Nazi hangman:
1. Heydrich, the Nazi hangman, deserved a violent death.
2. Heydrich, the Nazi hangman, may have deserved a violent death.
3. Heydrich, the Nazi hangman, did not deserve a violent death.
4. Heydrich, the Nazi hangman, may not have deserved a violent death.
5. None of the given conclusions seems to follow logically.
lar-affirmative atmosphere of this syllogism. Given the same syllogism as a popular issue, however, the same subjects tended to shift from the second to the first conclusion, an opinion which was "quite strong at the time that this test was given." In general terms the subjects of the Morgan-Morton study believed that they were guided in their choice of conclusions by logical thought, though, in fact, when current issues were embodied in the syllogisms, they were being guided by popular opinion. Similarly, it is not implausible that the other subjects who are our concern in this essay were influenced by a point of view traditional among librarians even though they faced a situation requiring rigid rules of thought which should have eliminated that point of view from consideration.

Whether it has been librarians or non-librarians who have used the conventional concept of reference to guide their empirical studies is largely unimportant. What is important is this. Under the conventional concept it has been assumed in the empirical study of reference that only reference librarians perform reference, that the librarian's proficiency in the performance of reference is the result of his professional training and experience, that the goal of the empirical study of reference is the modification of the librarian's education or of his practice, that observations of the librarian's performance are a sufficient basis on which to propose those modifications which will improve the librarian's proficiency. Since the empirical study of reference under these assumptions is capable only of augmenting the rules of thumb which underlie the librarian's professional training and practice, it is clear under these assumptions that no amount of study will permit an explanation of how the performance of reference takes place except in the trivial sense that a manual of reliable reference guidelines, e.g., Downs's *How to Do Library Research*, explains the performance of reference. Though the conventional concept of reference serves a useful purpose, the basis for an *esprit de corps*, in the training and molding of reference librarians, it can hardly be surprising that this section of the essay concludes that empirical interpretation of the conventional concept is fruitless as a framework for the development of the empirical study of reference.

Section IV

In a previous section of the essay we observed that the notions basic to four empirical studies of reference were deficient. They did not permit results which are reliable. In the last section, we observed that the empirical interpretation of the conventional concept of reference is fruitless as a framework for the development of the empirical study of reference. For these reasons, this section of the essay considers reference outside of librarianship. It suggests, intuitively, that reference is a special case of problem solving.

First, several definitions of problem-solving behavior are discussed, then several approaches to the study of problem solving are described, first on the theoretical, then on the empirical level. The studies of problem solving which are described below were selected from those known to the author as the most suggestive for reference. In the next section, these studies are briefly compared with the studies of reference previously reconstructed.

To Duncker "a problem arises when a living creature has a goal but does not know how this goal is to be reached. Whenever one cannot go from the given situation to the desired situation simply..."
by action, then there has to be recourse
to thinking."\textsuperscript{79} Duncker, as have many
psychologists, differentiated between
routine and non-routine problem solving.
In the terms of Dollard and Miller, that
is between problems solved by automatic
habits and trains of thought.\textsuperscript{80} Surely,
however, this distinction, used to differ-
entiate illegitimate from legitimate prob-
lems, is a fruitless one. What is reflexive
to one may well be cognitive to another.
To Reitman "a system has a problem
when it has or has been given a de-
scription of something but does not yet
have anything that satisfies the descrip-
tion."\textsuperscript{81} But in emphasizing what he calls
"degrees of problematicality,"\textsuperscript{82} Reitman
must tend to ignore a question implicit
in Duncker's definition, why may a
given task be reflexive to one but cog-
nitive to another person. Indeed, Gagné
suggests that "one of the fundamental
criteria of problem solving is that a kind
of performance which could not be ex-
hibited before the 'problem' was solved
can be exhibited after the 'problem' is
solved."\textsuperscript{83} To Gagné problem solving is
"an inferred change in human capability
that results in the acquisition of a gen-
eralizable rule which is novel to the in-
dividual, which cannot have been es-
ablished by direct recall, and which can
manifest itself in applicability to the
solution of a class of problems."\textsuperscript{84}

The simulation of cognition is one
theoretical approach towards an under-
standing of problem-solving behavior. A
computer is programmed to respond as
a human would respond within a speci-

\textsuperscript{79} Karl Duncker "On Problem Solving," \textit{Psychologi-
cal Monographs}, LVIII (1945), 1.
\textsuperscript{80} John Dollard and Neal E. Miller, \textit{Personality and
Psychotherapy}, An Analysis in Terms of Learning,
Thinking, and Culture (New York: McGraw-Hill Book
\textsuperscript{81} Reitman, \textit{op. cit.}, p. 126.
\textsuperscript{82} Ibid., p. 130.
\textsuperscript{83} Gagné, \textit{op. cit.}, p. 130.
\textsuperscript{84} Ibid., p. 132.

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esses in Solving Algebra Word Problems.”

The question posed was what cognitive processes are necessary in solving algebra word problems; what processes are sufficient?

The model is STUDENT. STUDENT communicates with human beings over a limited range of natural language. Its task environment is algebra word problems as

(A NUMBER IS MULTIPLIED BY 6. THIS PRODUCT IS INCREASED BY 44. THIS RESULT IS 68. FIND THE NUMBER.)

STUDENT reads a problem statement, rewrites it as a set of simpler sentences, transforms these sentences into equations, and attempts to solve the resultant set of equations. The student model understands a problem statement by “transforming it into an equivalent (in meaning) sequence of simpler kernel sentences. A kernel sentence is one which the listener can understand directly; that is, one for which he knows a transformation into his information store.”

Paige and Simon compared STUDENT’s methods of transforming with human methods of translating algebra word problems into algebraic equations. The humans in this comparison were largely students. The students’ processes were established on the basis of protocols; STUDENT’s processes, on the basis of Bobrow’s descriptions of his computer program.

STUDENT’s transform of the problem statement given above reads:

( THE EQUATIONS TO BE SOLVED ARE )
( EQUAL X00001 (NUMBER) )
( EQUAL (PLUS (TIMES (NUMBER) 6) 44) 68 )

Some of the students translated the same problem statement in a similar manner, as

The unknown is a ‘certain number,’ which would be x. Multiply x by 6. Write down ‘6x’ please. ‘Increased by’ means add, so you put a plus 44. ‘The result is’—indicate equals—write please—68.

Paige and Simon labeled this method direct translation, “a step-by-step substitution of algebraic symbols and expressions for the English words and phrases of the original problem statements.”

One of the sub-processes of translating English prose into algebraic equations, observed in both students and STUDENT, is the labeling of variables. The labels are of two sorts, conventional, i.e., x may be used as the abbreviatory name of some unknown, and relational, i.e., 6x or 6x + 44 = 68 may be used as the relational names between the same unknown and some known quantity. Unlike the students, however, STUDENT “introduces relational names only in the special case . . . where it is cued by the occurrence of the word ‘this.’”

A sub-problem of naming, again observed in both STUDENT and students, is ambiguity of names. Two similar but distinct common language terms, for example, may refer to the same object, Russian soldiers, STUDENT responds:

(The number of soldiers they have is one half of the number of guns they have. The number of guns they have is 7000. What is the number of soldiers they have Q.)

A problem in which two different terms, “Russian soldiers” and “they,” refer to the same object, Russian soldiers, STUDENT responds:

91 Bobrow, op. cit., p. 604.
92 Ibid., p. 593.
93 Ibid., p. 604.
94 Ibid., p. 70.
95 Ibid., p. 82-83.
96 Ibid., p. 78.
97 Bobrow, op. cit., p. 605.
THE EQUATIONS WERE INSUFFICIENT TO FIND A SOLUTION
(assuming that)
((number of soldiers (they/pro) (have/verb)) is equal to
(number of soldiers russians (have/verb))
(the number of soldiers they have is 3500)\textsuperscript{97}

To the problem
The number of quarters a man has is seven times the number of dimes he has. The value of the dimes exceeds the value of the quarters by two dollars and fifty cents. How many has he of each coin?\textsuperscript{98}
a problem in which the expressions number and value are synonymous in certain contexts, a student responded in this fashion:
Let's represent—the fir—\textsuperscript{—}x as the dimes. Write down x please. The number of quarters is—is seven times the dimes. Therefore, the number of quarters is represented by 7x. Put "7x." The value of the dimes exceeds the value of the quarters by two-fifty; therefore, x . . . Since it really is a money problem we will check this and discover that we really should multiply to make this—ah—to make it equal in value. Since we have 250 pennies we have to multiply the dimes by 10. So that should be 10x and a plus. Since it's quarters it would be 7 times 25 times x, on the other side. That is the correct solution.\textsuperscript{99}

In the former, the soldier problem, the cue through which student achieved a sufficient equation was a grammatical cue. The relationship, that is, between "Russian soldiers" and "they" is a grammatical one. In the latter, the coin problem, the cue was a substantive one. The student, that is, had to "know that the value of a quantity of coins equals the number of coins times the value per coin."\textsuperscript{100} Given the problem

(\textit{if 1 span equals 9 inches, and 1 fathom equals 6 feet, how many spans equal 1 fathom q.})\textsuperscript{100}

like a student, student "is able to draw on a body of facts, picking out relevant ones, and use them to obtain a solution"\textsuperscript{101} from its store of global information. To that problem student responds:

THE EQUATIONS WERE INSUFFICIENT TO FIND A SOLUTION
(using the following known relationships)
(equal (times 1 (feet)) times 12 (inches))
(1 fathom is 8 spans)\textsuperscript{102}

It became evident, however, that the students were using more powerful processes than those exhibited by student's use of definitional relationships. In translating the coin problem, one of the students

\ldots found incongruity . . . if a man has seven times as many quarters as he has dimes and the value of the dimes exceeds the value of the quarters by two-fifty, the quarters must really not be worth too much, because if he has 7 times as many quarters as he has dimes, the number of—the value of the quarters must exceed the dimes by 7 * 2.5 - x, or what not . . . negative quarters—no such thing exists.\textsuperscript{103}

Presumably, student would not have perceived this incongruity. Indeed, given the problem

A car radiator contains exactly one liter of a 90 per cent alcohol-water mixture. What quantity of water will change the liter to an 80 per cent alcohol mixture?\textsuperscript{104}

which is anomalous in the sense that it cannot be translated solely on the basis of the information given, it became obvious that those students who achieved a successful translation of the problem statement did so by creating a physical representation of the problem which en-

\textsuperscript{97} Ibid.
\textsuperscript{98} Paige and Simon, op. cit., p. 79.
\textsuperscript{99} Ibid., p. 80-81.
\textsuperscript{100} Bobrow, op. cit., p. 604.
\textsuperscript{101} Ibid., p. 605.
\textsuperscript{102} Ibid., p. 604.
\textsuperscript{103} Paige and Simon, op. cit., p. 86.
\textsuperscript{104} Ibid., p. 90.
abled them to read off certain conservation assumptions as though they were stated as part of the problem. As illustrated by De Soto, humans translate such problems as “Alice is taller than Mary; Elsie is shorter than Mary: Is Elsie taller than Alice? . . . into an ‘up-down’ image and the answer is ‘read off the image.’” 105 On this level, the iconic, STUDENT exhibits no processes similar to those of humans. Presumably, such processes “will have to be added to that program if it is to provide a satisfactory theory of the human behavior observed in handling these problems.” 106

The theoretical approach to problem solving behavior has experimental analogs. In one a human is programmed to respond like a computer. “A list containing objects and relations between objects is stored in [human] memory, problems are presented to the human which require discovery of implications of the relations by successively operating on objects, the operations defined by the stored relations.” 107

Hayes, for example, has been concerned with problems solved by “a sequence of linked phases or steps which form a chain or path connecting the initial conditions of the problem with its goal.” 108 These problems are characterized by homogeneity, information control, and modularity. That is, each step is of the same kind and of the same difficulty, the information necessary for solution is under the control of the problem solver, and each problem can be constructed to any length with any number of blind alleys. Hayes has referred to these as spy problems.

In a spy problem a subject was to imagine that he was running a spy ring. For security reasons some spies could communicate with each other, other spies could not. Prior to a run, subjects were required to commit to memory connection lists as

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SHOWER ———> CLERK
DROUGHT ———> HILL
LARYNX ———> BETH
ADJECTIVE ———> SHOWER
HILL ———> HORSE
BEEF ———> LARYNX
ADJECTIVE ———> PARCHESI
DROUGHT ———> KEVIN
SHOWER ———> BEEF
LARYNX ———> DROUGHT
BEEF ———> TAFT
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“to the criterion of three successive error-free trials.” 109 The subjects were then set problems to solve as “Get a message from HILL to ADJECTIVE.” During the problem solutions subjects were requested to think aloud.

Almost all of the subjects attempted to solve the problems by starting either at the initial state or the terminal state. Given the problem noted above, that would be either at HILL or at ADJECTIVE. Twenty-five per cent of all steps were executed in a backward direction. In general, however, subjects attempted backward solutions only when forward solutions failed. In some cases subjects employed list searching, a link-by-link search from the beginning to a desired point in the list under consideration. Like backward searching, list searching was also infrequent. It was frequently


106 Paige and Simon, op. cit., p. 118.


observed, however, that as subjects approached the solution to a problem, their rate of progress increased. A second experiment, with a second set of subjects, was designed to probe this observation.

The second experiment bore out the observation of the first, that as subjects approached solution their rate of progress accelerated. A second observation was made. When steps to go were taken into account, progress time did not vary with problem length. The rate of progress, that is, was being determined, not by the number of steps completed in a solution, but by the number of steps to be completed. Presumably subjects were covertly planning steps to be taken.

Hayes inferred two sorts of strategies to account for these observations, local and remote planning. If, that is in the latter case, a subject was working through the ordered sequence A to F, for example, and noted "connections in the neighborhood of F, specifically 'E-F,'" then, "when S gets from A to E, the step 'E to F' occurs rapidly because it has been planned." Indeed, it seems reasonable that a subject would not enter a blind alley at E, if he knew that the link E to F leads to the desired solution. If, in the former case, a subject was exploring a few steps ahead "of his present position to a depth of one or perhaps more steps," then he is unlikely to fall into blind alleys especially when "with fewer steps to go, S is more likely to discover a solution path in his local covert exploration."112

In another experimental analog to the theoretical approach to problem solving, human responses are compared with postulated computer responses. That is, given a problem to solve a human, in his response, would tend towards an ideal strategy of solution; a computer, on the other hand, presumably would be programmed to employ an ideal strategy. Thus, according to Bruner, Goodnow, and Austin, an ideal strategy is "an analytic device used as a yardstick against which to compare the performance of human operators in the situations we set them."113

A Study of Thinking, by Bruner and his associates, concerned itself with problems of concept attainment, the task in which a "human being seeks to sort the environment into significant classes of events so that he may end by treating discriminably different things as equivalents." Presumably, when a human organism has attained a concept he has done so by discovering cues by which he can infer the category membership of the objects and events he encounters. Presumably, that is, the organism has learned a set of relevant attributes and the conceptual rules by which the appropriate values are combined to form the concept. For example, the concept spades, associated with playing cards, is cued by the relevant attributes, color and form, and is satisfied just by the joint presence of the values, black and spade-shaped. Presumably an organism attains a concept through his cognitive commerce with the environment by testing a series of exemplars and non-exemplars of the concept. When the organism is free to choose instances to test, presumably he employs selection strategies. For example, "a neurologist is interested in six cortical areas and their bearing on pattern vision. He knows that with all six areas intact, pattern vision is unimpaired. With all six areas destroyed, pattern vision is absent. In planning his research, how shall he proceed? Destroy one area at a time? All but one at a time? In what order shall he do his successive experiments?"115

One of the numerous empirical questions asked in this study of thinking was

111 Ibid., 377.
112 Ibid., 377-78.
what effect does a disordered environment have upon human selection strategies.

Two groups of fifteen subjects each were set in the following task environments. An array of instances each exhibiting one of two possible values of six attributes was presented each subject. Each subject was shown a card exemplifying a concept to be attained. The subject was to attain the concept by selecting instances from the board for testing. Each time he selected a card the subject was told that the choice either satisfied or did not satisfy the concept. Once per choice, whenever he wished, a subject could venture the identity of the concept. "The only difference between the two groups of fifteen subjects was in the arrangement of the cards on the board in front of them." For one group the environment was made orderly; for the other, it was made random or disordered.

Presumably both sets of subjects would attempt to insure each instance selected for testing, informative. The subjects working in the ordered environment, however, clearly had an advantage over their colleagues working in the disordered environment. "The Random Group," that is, "was faced with an array of instances whose arrangement gave little or no visual support to the subjects in the task of sorting out positive from negative instances in order to attain the correct concept." Presumably both sets of subjects would attempt to insure each instance selected informative within the constraints imposed by the environment in which they worked.

Under ideal conditions a concept could be attained in six choices. It was predicted that the Ordered Group would tend toward a conservative-focussing strategy, i.e., "finding a positive instance to use as a focus, then making a sequence of choices each of which alters but one attribute value of the first focus card and testing to see whether the change yields a positive or a negative instance." It was predicted that the Random Group would tend toward a successive scanning strategy, i.e., testing a single hypothesis at a time until the correct one is found.

The results of the experiment generally confirmed the predictions. The Ordered Group required an average of 6.1 choices per problem to attain the correct concepts; the Random Group required 10.4 choices. The former group employed 1.1 attribute values which distinguished a first choice and the first positive card given, made an average of 1 redundant choice per problem and offered an average of 0.5 incorrect hypotheses per problem; the latter group, respectively, 1.8 attribute values, 4.1 redundant choices and 1.4 incorrect hypotheses. Presumably the Ordered Group was successful in selecting informative instances, largely focusing on the first card given, whereas the Random Group was unsuccessful, selecting redundant and inconsistent instances.

SECTION V

This, the final section of the essay, compares briefly and generally the studies of reference reconstructed in Section I with the studies of problem solving described in Section IV. It poses to indicate several ways in which the study of reference may be clarified when interpreted as a special case of the study of problem solving.

The studies of problem solving either inferred human competence, i.e., what can reasonably be hypothesized about the internal processes underlying the performance of a task, from performance, i.e., what a person does in the performance of a task, or inferred per-
formance from competence. In Bruner’s words:

To infer a person’s representation of the world, if we are uncanny experimenters, we design tasks that permit us to infer how he does these things. We ask him to tell us the fifty states of the Union. If he ‘reads out’ in this order, ‘Maine, New Hampshire, Vermont . . . ’, we can guess that the supporting representation for his recital is spatial. If the order is ‘Alabama, Arkansas, California . . . ’, the support is inferred to be more list-like, ordered by an alphabetic rule.\(^\text{119}\)

The studies of reference, on the other hand, inferred performance from particular performance. Generated by the inference of performance from particular performance, the results of the studies of reference, unlike the results of the studies of problem solving, are devoid of any generality whatever. Devoid of generality, these results cannot reasonably be used to satisfy the objectives of the study of reference, the modification either of the preparation for the practice of reference or of the practice of reference itself.

What the empirical studies of reference have to tell us about reference was told by a direct confrontation with reality, a reality, we observed in Section IV, which has been perceived imperfectly. The studies of problem solving have eschewed a confrontation with reality. They have thereby been freed to invent a modeled reality.

Though other models have been devised,\(^\text{120}\) the basic models used in the studies of problem solving were information-processing models. These models were variously formulated as a computer program, as a human programmed like a computer, or as a human with processes analogous to the routines of a computer program. In all cases, these models were set to operate over models of well-defined task domains. By virtue of the information processing models, it was possible for the studies of problem solving to specify and verify complex human processes as focusing and scanning strategies, local and remote planning, and routines for translating algebra word problems into algebraic equations. Indeed, given the information-processing models of human competence, it becomes clear that what differentiates the reference librarian from other human beings is not simply his preparation for and practice of reference, but the way in which he has learned to encode the task domain over which he works.

The concepts which structured the studies of problem solving differed drastically in precision and predictive content from the deficient notions which structured the studies of reference. This was especially noticeable of the constructs governing the task domains. Paige and Simon, for example, were able to identify nine distinct substantive quantities entailed by the physical circumstances described in the mixture problem:

### Initial Situation
- \(T\) — total quantity of original mixture
- \(A\) — quantity of alcohol in original mixture
- \(W\) — quantity of water in original mixture

### Changes
- \(AT\) — quantity of liquid added
- \(AA\) — quantity of alcohol added
- \(AW\) — quantity of water added

### Final Situation
- \(T_f\) — total quantity of final mixture
- \(A_f\) — quantity of alcohol in final mixture
- \(W_f\) — quantity of water in final mixture

\(^\text{120}\) Bruner and Others, Studies in Cognitive Growth, p. 7.


\(^\text{121}\) Paige and Simon, op. cit., p. 100.
As a result, they were able to infer just those conservation assumptions which must have been used by the subjects who solved this problem.

The ubiquitous construct of the information processing models was the strategy. Though referred to by different terms, simply as routines and sub-routines in the Paige and Simon paper and as planning in Hayes's papers, a strategy is generally a sequence of decisions, some conscious and others not, which governs the order and placement of transformations and storage holds through which a set of problem data is manipulated in an attempted problem solution.

The basic method of probing strategies in these studies was protocol analysis, a method of tracing human data processing by means of a stream of conscious verbal behavior. Though superior to the questionnaire, protocol analysis has several disadvantages which we shall note. Nevertheless, in the hands of Paige and Simon it was cleverly used to its fullest advantage. By setting their subjects incongruous problems to solve, Paige and Simon were able to elicit the employment of conservation assumptions and the visual representations from which they emerged. Presumably these are human processes which are not consciously used by sophisticated subjects in handling routine problems.

Studies of problem solving are not, of course, without internal difficulties. Protocol analysis is often cited as being intersubjectively variable. When sophisticated subjects are used, the extent of previous processing of problem data prior to the emission of protocol statements is indeterminant. As a construct, the strategy has not been made entirely clear. What occurs, for example, when a step in a strategy is executed? What unit of information undergoes transformation in a single step, a word, a phrase, or is it even a linguistic unit? Current studies seem to imply different strategies for different tasks, an inelegant implication at best. Indeed, the information-processing models have several obvious drawbacks. They have proven useful only over well specified task domains as algebra word problems and stripped down concept attainment tasks. Statements of artificial intelligence and simulation of cognition are limited by the exigencies of computer programming and model, generally, a particular individual, possibly the programmer himself.

It has been observed that to state an empirical problem “which will not be either completely trivial or hopelessly beyond the range of present-day understanding and technique,” is extremely difficult. The studies of reference are surely a case in point. A ubiquitous concern of these studies, what is a reference question, has clearly preceded the delimitation of a necessarily prior concern, what is a question.

Indeed, what is a question? As Hamblin has put it by these examples,

(a) Rhetorical question: 'I ask you, gentlemen of the jury, can such a man be innocent?' is really not a question but a statement.

(b) An indicative sentence with a characteristic tone of voice: 'This is the Canberra train I'm on?'—not really a statement but a question.

(c) 'Tell me how many fingers I'm holding up.' a command, but at least almost equally a question. A question is not a simple grammatical distinction. Sprotsy has identified questions as psychological phenomena, as phases in problem solving:

A question follows the detection of a gap in what can be termed . . . one's cognitive map of an area. But it seems likely that as soon as this gap is identified the thinker bridges it with some concept or idea based on the knowledge he has at hand. Further-

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more, the extent to which he can communicate the nature of this 'bridge' varies. . . . Questions, then, are not simply requests for information. The information that a subject seemingly requests and receives, actually confirms or refutes . . . the cognitive bridge he has already erected to close a cognitive gap. 124

In transformational generative grammar, it has been posited that questions are both a linguistic and psychological concern. Transformation grammar has hypothesized three sets of rules, phrase structure, transformation, and morphophonemic, through which sentences of the language are generated. Under this view of grammatical structure, the sentence "What are you looking for?" can be described as a what-question transform of You are looking for it, and "What are you running for?" as a why-question transform from You are running." 125

There is some evidence for the psychological reality of such transformations. Savin and Perchonock, for example, assuming that "immediate memory has a small fixed capacity and that sentences are encoded in the way that a transformational grammar suggests," 126 had human subjects encode such transformations as negatives, passives, questions, into immediate memory. If, Savin and Perchonock hypothesized, transformations required more space in immediate memory than kernels, short active indicative assertions, then spatial differentials were calculable on the basis of the number of words a subject could recall after the encoding of sentence plus word string. The results of this and similar studies have nicely supported the theoretical predictions that transformations, as negatives and questions, are encoded in human memory independent of other characteristics of a sentence. Though the evidence is still questionable, i.e., the results of the Savin-Perchonock study, may, as the authors suggest, be explicable on such grounds as sentence length or retrieval interference, it is clear that the transform hypothesis will have to be taken into account in any serious formulation of our concept of questions.

In part the basic question posed here, what is the disposition of the empirical study of reference, has been answered. But only a very small part of that question was asked in this essay. From many points of view the specific questions asked were probably not pertinent to the basic question. Nevertheless, a posit of criticism is that criticism begets criticism. Hopefully, then, other points of view will be heard from. Hopefully, some will be given expression as empirical studies, others as critical studies.
Program Budgeting and Cost Benefit Analysis in Libraries

Libraries in academic institutions have traditionally prepared annual budgets based either upon subjective judgments or upon oversimplified formulas. Two budgeting techniques recently introduced into universities from the defense establishment are program budgeting and cost benefit analysis. Properly applied they can be utilized to gain better decisions in problems facing academic library managers and improved allocation of library resources.

The analysis of budgetary problems in such an industry as defense can be very complex, but not so difficult as those of the university environment, where outputs—both quantitatively and qualitatively—are somewhat more difficult to measure, and where costs are more difficult to come by. But even the difficulties of attempting to apply rational budgetary analysis to educational institutions generally are less complex than those of library management, where products are even harder to measure and where systematic effort to measure true total systems costs related to programs is a new activity. The literature reveals considerable dissatisfaction with the present state of library budgeting, even though the present fad of formula budgeting is a distinct improvement over the subjective judgment and arbitrary standards or requirements previously used.

There is now a new kind of budgeting process in government-type enterprises, and such other nonprofit activities as hospitals, churches, and education, which is not subject to the normal forces of a competitive economy or the price determination of the marketplace. Originally utilized in the defense establishment, these new techniques have been imported into the university world where they have proved to be tools of superior effectiveness in the general problem of resource allocation. These tools are program budgeting and cost benefit analysis.

Among institutions now coming to utilize these techniques for resource analysis—or “budgeting,” which is the more colloquial term—are the Universities of Colorado, Hawaii, Washington, and California. It seems inevitable that sooner rather than later these techniques of program budgeting and cost benefit analysis will be applied to library operations. “Forewarned is forearmed,” so it is better that librarians come to understand them before they are misused against them; being a sharper sword, they can cut a little more quickly even where it is not intended. More constructively, however, properly utilized they can also enable librarians to achieve a little more of what they
want within the constraints of available resources.

The normal budgeting process has two parts. First there is the resource acquisitions process; in that context formula budgeting may not be as unmitigated an evil as it sometimes appears on the surface. Second there is the problem of allocating resources among the competing demands for them. In the first part, some easily understood “gearing ratio”—which is all that formula budgeting really is—can aid the librarian in crossing the credibility gap and communicating effectively his need for funds to legislators, administrators, and other laymen who may not understand the subtleties and intricacies of his business. Once returned home, however, with the new resources, the librarian enters the second step, namely that of distributing them among his needs so as to maximize the benefits from them, and it is here that these new devices can aid him most. Sometimes, of course, they can also help the librarian to cross swords more effectively with competitors for the university or the public dollar, by putting up a more sophisticated and convincing analytical argument for his needs.

Let us first look at the problem of efficient resource allocation. We all live and work in a world in which our needs, or our requirements, or our objectives, are for all practical purposes unlimited; the wherewithal, however, to achieve these goals is indeed highly constrained. Thus the fate of librarians is the same as that of managers in any other industry: unlimited objectives and limited resources. To the extent therefore that a librarian or any other manager inefficiently allocates—not willfully, or maliciously, or consciously, but innocently—the limited resources available to him, he simply winds up with less of what he wants.

The real price of inefficient allocation, moreover, is not the misspent dollar, but the foregone benefits that were lost with it. For example, say a librarian would like to accomplish three programs: increased circulation (Program A); extended reference service (Program B); and provision of new study space (Program C). You allocate your resources and find that they are being wholly devoted to Programs A and B, with C receiving no funds at all. If you later find that A and B received more dollars than they needed because you made a poor resource allocation decision, the misspent dollars are an inadequate way of calculating the cost of the bad decision; it is better to calculate the cost in terms of the foregone benefits from Program C, which was never implemented. This is because Program C, if you were justified in wanting to do it in the first place, would doubtless have produced results worth more than the funds to have been invested in it. In the jargon phrase of the economist, these are known as “opportunity costs.”

There are several common causes of poor resource allocation. One is ignorance of, or the overlooking of, a better alternative for accomplishing an objective. This happens most frequently in highly disciplined organizations that have strong policy orientations—for example, in the military establishment with its strong doctrinal biases. Thus when presented a military problem, the Air Force typically finds that it needs more airplanes for its solution rather than, say, ships. The Army, on the other hand, seldom finds that it needs airplanes to solve its military problems; it is much more likely to recommend more divisions of men. There is in all organizations this kind of inertia and resistance to the unorthodox, although sometimes the unusual response will resolve a problem at lower total cost than will the orthodox. Thus decision-makers should always study the entire range of alternatives available to them before allocating resources.

A second, but less common, reason for
poor resource allocation is the pursuit of the wrong objective. At the outset of World War II, for example, there was need to develop anti-submarine forces since German submarines were very active; the objective of anti-submarine warfare was obviously to maximize the sink-rate of enemy subs. That sounded reasonable until people began to ask “Why sink subs?” When it was remembered that the fundamental reason was that they interrupted logistics flow, however, a new range of possible resolutions to the problem became apparent.

Another example of seeking a wrong objective involves the current and anticipated doctor shortage. People are tempted to view a formula that calls for a certain number of doctors per capita, observe increasing population and the output of existing medical schools, and conclude that vast amounts of money are needed immediately to mount new kinds of medical training programs. But many variables need to be introduced to get the true picture. First is the inflow of doctors from other geographical areas, second is the rapidly increasing individual productivity of doctors as a result of new technology, and third, of course, is the changing sociology of medicine that now makes it easier than it used to be for sick children to be brought to a clinic rather than the much less efficient method of bringing the doctor to them. After all this is done, however, one can ask, “Why do we really want more doctors?” When it becomes clear that the main problem is to improve the health of the community, it might become more desirable to put money into a school lunch program, or a TB testing center, or a measles vaccination program.

A third fairly common error in resource allocation is the pursuit of the right objective but beyond some reasonable point of diminishing returns. Some people enjoy a good cigar after dinner, for example, but a second cigar is less rewarding than the first, and certainly the pleasure diminishes with the third and fourth. Indeed if attempted with martinis, certain disutilities eventually begin manifesting themselves.

Another common failing in making resource allocation decisions is the failure to recognize all the costs involved in an alternative. An example is the VA hospital that weighed two methods of effecting better TB cure—one which involved intensive nursing care and another which relied more heavily on drugs and equipment—and settled on the former because it appeared to be 20 per cent cheaper. What was not taken into account, however, was that a new wing had to be built on the nurses’ quarters to house the enlarged staff necessitated by the decision. In this case also there were added social costs imposed not upon the VA but upon the small town near which the hospital was located. The highway to the hospital had to be widened, traffic lights had to be installed, as did a new sewer system. Good costing would have recognized these secondary and tertiary costs as well as the primary costs.

Typically, financial disaster lurks five, seven, or ten years down the road from what appears to be a simple cost decision today. Computers in universities, for example, originally came free. Computer manufacturers, and agencies like NIH and NSF, encouraged universities to accept them and begin work on them. Five or six years later the “free” computers began showing mounting operations costs to keep them going. In fixed budget situations these new charges began displacing other activities; thus again the true costs of computers in universities are the opportunity costs—the benefits that were foregone in activities that could not be undertaken because of the rising costs of the computer installations.

The function of a good cost benefit analyst is to bring some notion of op-
Program Budgeting and Cost Benefit Analysis

opportunity costs to the attention of decision-makers. He could talk about the number of nurses needed to reduce the days a patient must spend in a hospital bed; perhaps the fourth nurse on the average would produce a very small improvement, and the opportunity costs of assigning her elsewhere would be too great to forego. The fourth highway patrol car in an area will reduce the accident rate by a much smaller per cent than numbers one, two, and three; the real measure of insisting on the fourth car is the forfeited benefit of putting that money elsewhere. The same thing can be true in the circulation department of a library where the length of time a patron has to wait for service can be driven down as more staff members are added to the desk. There are curves one could make here, however, which would show that the nth person produces a quite small improvement in comparison with the beneficial effect that same person could have had at some other point in the library’s operation. Thus cost benefit analysis can help to produce a higher proportion of better decisions in resource allocation than can traditional methods of budgeting.

What then, against this background, really are program budgeting and cost benefit analysis? A program budget is a technique for organizing and displaying information about the activities or programs of an organization and their resource implications. It is intended to facilitate “eyeball” analysis by decision-makers and managers and provide the basis for more formal analysis of cost benefits. It is a way of budgeting which is concerned not with items, or objects of expenditure, or aggregations of cost categories for such things as personnel and travel, but with activities. The provision of reference service, circulation service, study space, microfacilities, are all activities in terms of which the program budget can be structured. These activities should all be looked at with objective orientation; in other words, your objectives should not be to fill a building full of books or to attain some laudable book-to-student ratio, but rather to see that the information at the library’s disposal is somehow got into the heads, or at least the hands, of the people who claim to need it.

What activities best enable you to attain these objectives? The program budget is then structured in these terms. For each so-called program element—such as personnel, equipment, facilities, supplies—one needs to determine the benefits, goods, utilities, or satisfactions produced. Often a proper measure of the output is difficult to settle upon; perhaps they could include the number and minimization of unfilled needs. In addition to determining the output of each program element, one needs also to determine the input of resources necessary to accomplish those outputs. A diagram showing each output and related input can help focus attention on the program and facilitate the identification of those activities with high and low payoffs.

Cost benefit analysis, on the other hand, is primarily an attitude. There are specific and formal techniques that can be applied in cost benefit analysis, such as multiple regression analysis and linear programming, but one does not need to master these techniques in order to possess a cost benefit analysis attitude. Even for persons who do possess such an attitude, the formal analytic techniques can aid in the process of decision making in matters of resource allocation. The problem of having a wide range of demand functions competing for limited resources faces us in corporate as well as in personal life. Program budgeting and cost benefit analysis, while not constituting a panacea, do provide a better way of maximizing the benefits and effectiveness of what inputs one is able to make.

Librarians are in a particularly diffi-
cult position to apply these techniques because they are purveyors of a free good, and when a valuable service is provided free, customers can be counted upon to avail themselves fully of it. Since the service is free, demand for it will increase vastly over time, and upon the librarian falls the task of having to go back to the university annually and justify the cost increment which this increasing activity represents. This is a real problem for librarians.

Why do not librarians charge for their services? Rationing of service is now done on the basis of rules and priorities—only faculty members have unlimited loan privileges; only graduate students can have access to the stacks, and many other constraining conventions keep service demands from overtaxing the budget. Would it not be possible to put a budget in the hands of a department, a school, a student, and then tell that individual or office that its budget is not only to cover its secretarial needs, computer time, supply costs, and such items, but its library service as well; the customer would simply have to decide for himself just how much he was willing to spend on library service in competition with his other expenditure categories. Such a situation might do much to rationalize people's demands for library service and make them more prudent than they sometimes are now. It would relieve librarians of that dilemma of having to say "No" to people, or after having said "Yes" of having to go to a disinterested third party and elicit the money to satisfy the customer's whim.

Or why do not librarians diminish their stocks of hard-cover books and acquire in their stead substantial inventories of paperbacks which they would then give away free? We are inclined to reply, "Why, that would be crazy; our budget would soon be exhausted." And yet that is exactly what librarians are doing now except instead of giving books away free they are giving staff services away free. A system of internal pricings could be established which would make people more reasonable in their library demands and would help to regulate the highly valuable service libraries can render.

A student fee charge could be applied to an internal pricing schedule in a library. Students could actually be charged in cash or at the end of a term for the library services they drew upon, or all registered students could get an automatic library allowance that would be drawn upon every time they use the library. Once given its building, grounds, collections, and equipment, a library under this arrangement would turn into a so-called working capital fund which would support itself through the sale of its services. This would furnish to the library a dedicated fund source that would make it financially independent.

Such proposals as these, made in Socratic dialogue format and drawing upon the fundamental objectives of library service as their stimuli, can do much to prompt new approaches to old problems, to elicit new awareness of opportunity costs in the library industry. Taken together with program budgeting and cost benefit analysis, they can perhaps help in their own way either to gain new answers, or new support for old answers, to the major questions of resource allocation in libraries.
Exemption Tests in Library Education

Exemption tests have sometimes been used in library schools to enable persons with adequate knowledge of a subject, either from previous study or experience, to eliminate otherwise required courses from their programs. In an effort to determine their value, the Graduate School of Library Science at Drexel Institute of Technology studied the results of exemption tests taken there in 1962, 1963, 1964, and 1965. Circumstances under which they were taken, the ratio of passes to failures, and their correlation with previous study and experience are described. Conclusions are given.

BACKGROUND

A distinctive feature of graduate library education is the widely varying backgrounds brought by students to the program—both in terms of previous library experience and library education. The existence of both graduate and undergraduate library education creates a situation in which some students enter graduate school after having completed undergraduate courses closely paralleling part of the graduate curriculum. While occasionally, students with undergraduate course work matriculate directly from college, more often they obtain library experience before entering graduate school. In addition, despite the profession’s emphasis upon separation of professional from nonprofessional tasks, in many libraries personnel without library education perform both kinds of duties. In this way, many students have learned much about library objectives and procedures. Thus, while some graduate library science students have been only library patrons, others bring to graduate work considerable experience or undergraduate library science course work, or, frequently, both.

To allow for this variance in student backgrounds and to avoid the criticism of requiring students to repeat course work already covered, the Drexel Institute of Technology Graduate School of Library Science devised a system of exemption examinations. Before or during his first six weeks of Drexel course work, a student who felt competent in a particular course area might take an exemption test covering that area. If, on either of two attempts he passed the exemption test, he was exempted from the course and given credit for it. In general, only the basic core courses required of all students were exempted, although occasionally, due to special experience or preparation, students were given permission to take examinations in such other subjects as School Library Administration or Reference Materials in the Humanities. At present, four basic courses are required of all students: Library in Society, the historical development of libraries and their role in today’s society; Basic Reference Sources;
Introduction to Cataloging and Classification; and Selection of Library Materials. Previous to the college year 1963-1964 there was a fifth basic required course—Introduction to Library Service—which provided an orientation to librarianship, but with the Fall term 1963 its content was incorporated into other courses.

Such exemption examinations were not new in higher education nor even in library education, but Drexel’s application of them may have been more extensive than usually has occurred. Michigan State University has used exemption testing extensively in its Basic College to allow students to take final sequential course tests one or more terms earlier than was scheduled, and if passed successfully, the student was given credit and exempted from the remainder of the course. The University of California at Davis has awarded credit to beginning freshmen who passed successfully the CEEB Advanced Placement Examination and allowed them to take more advanced courses. The University of Chicago College examination program of the 1930’s and 1940’s was famous. Advancement in the college was based on passing examinations rather than on course work, and the student who could pass examinations faster than the average could graduate sooner.

Other library schools have used such tests, but there seems to be no recent literature on it. Shearhouse comments that librarians have not generally foreseen the use of standardized tests, there being few if any available on a graduate level. Illinois, Peabody, Albany, Denver, and Columbia have had such experience. At Denver such tests were used extensively in the 1930’s, and students who scored well on them were excused from the particular course and given credit for it. All tests in these schools (except Columbia) were constructed by individual faculty members, as at Drexel.

Examinations Taken

In order to evaluate the Drexel exemption system and gain an insight into its use, the 1962–65 examinations were studied. During this four-year period a total of 481 examinations were taken by 252 students, so students using the exemption system averaged 1.9 examinations a piece. The greatest number of examinations was taken in 1962, 216, or seventy examinations per one hundred students enrolled (using the Spring Quarter enrollment figures as the standard), as shown in Table 1. Thirty-one tests or 12 per cent of the total number taken in four years were retests. Apparently, the chances of passing a test on the second attempt were not much better than on the first attempt, with 52 per cent of the retests being passed.

In 1963, although enrollment had increased by 39 per cent, the number of examinations taken decreased by 36 per cent and the ratio taken per one hundred students enrolled figures as the standard, as shown in Table 1. Thirty-one tests or 12 per cent of the total number taken in four years were retests. Apparently, the chances of passing a test on the second attempt were not much better than on the first attempt, with 52 per cent of the retests being passed.

In 1963, although enrollment had increased by 39 per cent, the number of examinations taken decreased by 36 per cent and the ratio taken per one hundred students enrolled.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Examinations Taken Per Each 100 Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962</td>
<td>70</td>
</tr>
<tr>
<td>1963</td>
<td>33</td>
</tr>
<tr>
<td>1964</td>
<td>31</td>
</tr>
<tr>
<td>1965</td>
<td>29</td>
</tr>
</tbody>
</table>

**Table 1**

Number of Drexel Exemption Examinations Taken Each Year Per 100 Students
Exemption Tests in Library Education / 163

dressed students decreased to thirty-three. In 1964 and 1965 the number of examinations taken rose slightly, but the ratio taken per one hundred students continued to drop, to thirty-one in 1964 and twenty-nine in 1965.

One explanation for the sharp drop between 1962 and 1963 was that Introduction to Library Service was a course which many students attempted to exempt, often successfully. In 1962, it accounted for one-third of the examinations taken and was passed 70 per cent of the time. With the school year 1963–1964 this course was dropped from the curriculum, so in 1963 it accounted for only one-fifth of the examinations. If we temporarily exclude the figures for Introduction of Library Service and consider only those for the four basic examinations offered throughout the entire four-year period, the ratio of examinations taken per one hundred students in 1962 through 1965 becomes forty, twenty-five, twenty-nine, twenty-eight. There is still a definite drop between 1962 and the following years, but the difference is reduced. Perhaps their novelty in 1962 attracted more students to the exemption tests than in later years.

RATIOS

What was the rate of successful completion? Over a seven-year period Haak found the students in one of the Michigan State University Basic College courses, Effective Living, to have included 18 per cent of the students enrolled in the Basic College courses, and that 94 per cent who took the examination early passed. Wayne found 49 per cent of those who took the Advanced Placement Examination to have passed. In 1948 Illinois embarked on a program of exemption test development to cover its undergraduate library science prerequisites. Of the forty-four students reported to have taken the tests, seven were exempted from courses, and some from all of the core course program.

The rate of successful Drexel examination completion was considerably lower at the end of the period than at the beginning, but in this case there was a pattern not of sudden change but of steady decline (see Table 2). In 1962 59 per cent of the examinations taken were passed, in 1963 the rate was down to 48 per cent, in 1964 to 43 per cent, and in 1965 only 38 per cent were passed. It is clear, then, that in 1963, 1964, and 1965, there were considerably fewer examinations taken in relation to enrollment than in 1962, and that each year the examinations were

<table>
<thead>
<tr>
<th>TABLE 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUCCESSFUL COMPLETION RATE FOR EACH COURSE</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td><strong>Course</strong></td>
</tr>
<tr>
<td><strong>Library in Society</strong></td>
</tr>
<tr>
<td><strong>Cataloging and Classification</strong></td>
</tr>
<tr>
<td><strong>Basic Reference</strong></td>
</tr>
<tr>
<td><strong>Selection of Library Materials</strong></td>
</tr>
<tr>
<td><strong>Introduction to Library Service</strong></td>
</tr>
<tr>
<td><strong>Advanced Courses</strong></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

failed more frequently than the year before. Apparently, either standards for successful completion of the examinations went up or the quality of students deteriorated. Evidence from the Drexel Admissions Office suggests that qualifications improved and the School became more selective during this period, so apparently faculty members made the examinations more difficult to pass.

In considering the frequency with which each course examination was taken and the frequency with which each was passed, it is not surprising to find a correlation between the two: in general those examinations on which students were most often successful were those most frequently attempted. Apparently word got around among the students about the levels of difficulty of the examinations. We have already seen that the examination for Introduction to Library Service, which was taken far more frequently than any other in 1962, was also passed with considerably more frequency than any other. Similarly, of the four basic examinations taken over the entire four-year period, the two most frequently taken were also the two with the highest rate of successful completion. Library in Society and Basic Reference, each of which accounts for 23 per cent of the total number of examinations taken, were also the ones most frequently passed, 58 per cent and 57 per cent respectively (see Table 3). In comparison, over the four-year period Introduction of Cataloging and Classification accounted for 17 per cent of the total number of examinations taken and Selection of Library Materials for 16 per cent, and both were failed four of every five times they were taken. However, even though there is a correlation between the frequency with which the examinations were taken and the frequency with which they were passed, it should be noted that the variance between the two most frequently taken examinations and the two least frequently taken is considerably greater in terms of success rate than it is in terms of frequency rate.

WERE PREVIOUS EXPERIENCE AND LIBRARY EDUCATION HELPFUL?

As previously mentioned, one of the prime reasons for using exemption tests

| TABLE 3 |
| Number of Times Each Examination Taken and Its Percentage of the Total Number of Examinations Taken That Year |

<table>
<thead>
<tr>
<th>COURSE</th>
<th>1962</th>
<th></th>
<th>1963</th>
<th></th>
<th>1964</th>
<th></th>
<th>1965</th>
<th></th>
<th>TOTAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Times Examined</td>
<td>Per Cent of Total</td>
<td>Number of Times Examined</td>
<td>Per Cent of Total</td>
<td>Number of Times Examined</td>
<td>Per Cent of Total</td>
<td>Number of Times Examined</td>
<td>Per Cent of Total</td>
<td>Number of Times Examined</td>
<td>Per Cent of Total</td>
</tr>
<tr>
<td>Library in Society</td>
<td>25</td>
<td>16</td>
<td>23</td>
<td>24</td>
<td>41</td>
<td>36</td>
<td>23</td>
<td>20</td>
<td>112</td>
<td>23</td>
</tr>
<tr>
<td>Cataloging and Classification</td>
<td>16</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>27</td>
<td>23</td>
<td>28</td>
<td>24</td>
<td>81</td>
<td>17</td>
</tr>
<tr>
<td>Basic Reference</td>
<td>29</td>
<td>19</td>
<td>22</td>
<td>23</td>
<td>27</td>
<td>24</td>
<td>34</td>
<td>29</td>
<td>112</td>
<td>23</td>
</tr>
<tr>
<td>Selection of Library Materials</td>
<td>16</td>
<td>11</td>
<td>17</td>
<td>17</td>
<td>15</td>
<td>13</td>
<td>28</td>
<td>24</td>
<td>76</td>
<td>16</td>
</tr>
<tr>
<td>Introduction to Library Service</td>
<td>53</td>
<td>35</td>
<td>20</td>
<td>21</td>
<td>not offered</td>
<td>not offered</td>
<td>73</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced Courses</td>
<td>13</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>7</td>
<td>3</td>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>152</td>
<td>100</td>
<td>97</td>
<td>100</td>
<td>115</td>
<td>100</td>
<td>117</td>
<td>100</td>
<td>481</td>
<td>100</td>
</tr>
</tbody>
</table>
was to allow for the differences in previous experience and library science course work which incoming students brought to graduate school. Naturally the assumption was that such experience and education would assist the student in passing the examination. What was experience in other fields? Allison and Bloom found the number of previous courses in a subject to correlate positively with success on Chicago examinations.8

Ostlund tested science teachers to find a positive correlation between course work background in a subject and knowledge of it. He concluded that background and achievement were related predictably and that "as one increased in background and experience, subject matter and reasoning became augmented concomitantly."9

In order to see what effect previous experience had on the examinations, the Drexel students who had taken them were divided into four categories (see Tables 4 and 5). Group A was composed of students who had had both previous library science course work and working library experience. Group B consisted of students with working library experience but no library science course work; Group C of students who had had previous course work, but no library experience; and Group D of those students who had had neither experience nor course work. No attempt was made to distinguish between previous

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8 Allison and Bloom, op. cit., 221-33.


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### TABLE 4

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Students</th>
<th>Per Cent of Total</th>
<th>Number of Examinations Taken</th>
<th>Per Cent of Total</th>
<th>Average Number of Examinations Per Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Experience and Course Work</td>
<td>66</td>
<td>26</td>
<td>164</td>
<td>34</td>
<td>2.5</td>
</tr>
<tr>
<td>B Experience</td>
<td>99</td>
<td>39</td>
<td>176</td>
<td>37</td>
<td>1.8</td>
</tr>
<tr>
<td>C Course Work</td>
<td>7</td>
<td>3</td>
<td>26</td>
<td>5</td>
<td>3.7</td>
</tr>
<tr>
<td>D No Experience or Course Work</td>
<td>80</td>
<td>31</td>
<td>115</td>
<td>24</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>252</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 5

<table>
<thead>
<tr>
<th>Course</th>
<th>Group A Per Cent of Times Passed</th>
<th>Group B Per Cent of Times Passed</th>
<th>Group C Per Cent of Times Passed</th>
<th>Group D Per Cent of Times Passed</th>
<th>Total Per Cent of Times Passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library in Society</td>
<td>45</td>
<td>43</td>
<td>50</td>
<td>83</td>
<td>58</td>
</tr>
<tr>
<td>Cataloging and Classification</td>
<td>14</td>
<td>36</td>
<td>43</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>Basic Reference</td>
<td>53</td>
<td>48</td>
<td>54</td>
<td>79</td>
<td>57</td>
</tr>
<tr>
<td>Selection of Library Materials</td>
<td>23</td>
<td>17</td>
<td>0</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Introduction to Library Service</td>
<td>85</td>
<td>58</td>
<td>100</td>
<td>73</td>
<td>68</td>
</tr>
<tr>
<td>Advanced Courses</td>
<td>67</td>
<td>73</td>
<td>0</td>
<td>33</td>
<td>63</td>
</tr>
<tr>
<td>TOTAL</td>
<td>40</td>
<td>45</td>
<td>42</td>
<td>64</td>
<td>48</td>
</tr>
</tbody>
</table>
graduate or undergraduate course work. However, it may be assumed that the course work was usually undergraduate, because graduate courses could be transferred into Drexel, thereby eliminating the need to take exemption examinations. It would seem logical that the majority of the students taking examinations would have had previous course work or experience, and this was the case, with Group A accounting for 26 per cent and Group B for 39 per cent. However, a surprisingly large minority (31 per cent) belonged to Group D. Group C consisted of only 3 per cent of the total number.

Of the four groups, students in Group C tended to take the largest number of examinations, averaging 3.7 examinations each, while students in Group D who were the most successful on the examinations taken, attempted the fewest number, only 1.4 each. Perhaps this group attempted only the examinations they were confident of passing. It is interesting, also, that the number of examinations taken by Group D decreased markedly over the period studied, in 1962 accounting for 30 per cent of the total taken; in 1963, 35 per cent; in 1964, 20 per cent; and in 1965 only 10 per cent. Perhaps this group was quite sensitive to the increasing difficulty of the examinations, or perhaps the school administration began to discourage such students from taking the examinations.

Although theoretically it would seem that students with previous experience or course work would be most successful on the examinations, the results did not bear this out. It was found instead, that of the total number of examinations taken by students in Group D, 64 per cent were passed, while students in Group B passed only 45 per cent and students in Group A, with previous working experience and course work, passed only 40 per cent of the examinations taken. Group C took twenty-six examinations and passed 42 per cent of them. Apparently neither the students’ previous experience nor course work was sufficiently similar to Drexel course work to be particularly helpful.

Students in Group D did extremely well on the examinations for Library in Society and Basic Reference, and reasonably well on Introduction to Library Service, but this was true also for Groups A and B. However, Group D was able to pass only 10 per cent of the Introduction to Cataloging and Classification examinations which they took. Group A did only slightly better, passing this examination only 14 per cent of the time, but Group B was relatively successful, passing it 36 per cent of the time, presumably showing the value of experience. Perhaps Group A was overconfident because of their course work background, so took more examinations than they were well prepared for.

In considering the frequency with which the examinations were taken by each group of students, we find a correlation with the frequency of successful completion for Groups B and D, but not for Groups C and A (see Table 6).

**Success for Specific Colleges**

As a sidelight to the student success based on previous course work, it was possible to determine the success of the graduates of particular undergraduate departments of library science in the Philadelphia area. These results are shown in Table 7. The graduates of two colleges had reasonably good success, and the graduates of two others did not. However, no group of graduates was successful more than 57 per cent of the time, and for the four colleges together the percentage of success was only 40 per cent, lower than the overall average. Apparently these students were overconfident and their undergraduate course work not as suitable as expected in preparing them for Drexel graduate work. Their overconfidence was shown by the fact that they took more exami-
TABLE 6
NUMBER OF TIMES EXAMINATION TAKEN BY MEMBERS OF A CATEGORY AND ITS PERCENTAGE OF TOTAL NUMBER OF EXAMINATIONS TAKEN BY MEMBERS OF THAT CATEGORY

<table>
<thead>
<tr>
<th>Course</th>
<th>Group A Number of Times Examination Taken</th>
<th>Group B Number of Times Examination Taken</th>
<th>Group C Number of Times Examination Taken</th>
<th>Group D Number of Times Examination Taken</th>
<th>Per Cent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library in Society</td>
<td>33</td>
<td>20</td>
<td>35</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Cataloging and Classification</td>
<td>36</td>
<td>27</td>
<td>28</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Basic Reference</td>
<td>45</td>
<td>22</td>
<td>42</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>Selection of Library Materials</td>
<td>19</td>
<td>16</td>
<td>23</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Introduction to Library Service</td>
<td>13</td>
<td>8</td>
<td>33</td>
<td>19</td>
<td>26</td>
</tr>
<tr>
<td>Advanced Courses</td>
<td>6</td>
<td>4</td>
<td>15</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>164</strong></td>
<td><strong>100</strong></td>
<td><strong>176</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

nations than the average per student, 2.8. Several graduates of College B took exemption tests for advanced courses with very good success. Obviously results such as those in Table 7 help Drexel's Admission Office assess credentials for particular colleges for particular periods of time, at least when the data are statistically significant.

**MALE vs. FEMALE**

When the exemption examination performances of male and female students were considered, it was found that 23 per cent of the students taking examinations were men, about the same as the per cent male in the student body, and that male students took an average of 1.66 examinations each, while women students took an average of 1.97 each. No reason is known for this difference. Men passed 44 per cent of the examinations taken, while women passed

**TABLE 7**
EXAMINATIONS TAKEN BY THE GRADUATES OF SPECIFIC UNDERGRADUATE DEPARTMENTS OF LIBRARY OF SCIENCE

<table>
<thead>
<tr>
<th>College</th>
<th>Number of Students</th>
<th>Number of Examinations Taken</th>
<th>Average Number of Examinations Per Student</th>
<th>Per Cent Examinations Passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12</td>
<td>33</td>
<td>2.8</td>
<td>36</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>30</td>
<td>3.3</td>
<td>57</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>14</td>
<td>2.8</td>
<td>14</td>
</tr>
<tr>
<td>D</td>
<td>5</td>
<td>10</td>
<td>2.0</td>
<td>50</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>31</strong></td>
<td><strong>87</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
</tr>
</tbody>
</table>
about the same, 48 per cent (see Table 8). Women had a higher success rate in each examination except Introduction to Cataloging and Classification, but the two examinations on which women did significantly better than men were Basic Reference and Selection of Library Materials. The frequency with which men and women took the various examinations is remarkably similar (see Table 9). The only examination with a variance of more than five percentage points was Selection of Library Materials, which accounted for only 8 per cent of the total number of examinations taken by men but 18 per cent of those taken by women.

Wayne reported males and females at Davis to have passed their examinations with the same percentages in the only other case found in which sex was reported.10

**Withdrawals vs. Graduates**

There is some literature from both library education and other fields which suggests that students who passed exemption tests also did unusually well scholastically in later course work. This conclusion was touched on at Drexel only remotely, and the conclusions tended to confirm it in a negative direction. Van Der Jagt and Mesner found that students who passed exemption tests at a lower college level also made better than average grades in upper level courses.11 Wayne discovered at the University of California at Davis that students who were given credit for freshman course work after having passed CEEB Advanced Placement Examinations also made better than average grades in their freshman courses.12 Allison and Bloom also found grades in a specific subject area on an advanced level to be better than average for those students who had passed a test in that area on a lower college level at an earlier than average time.13

11 E. Van Der Jagt and D. M. Mesner, “Predictability of Success in College Courses by Accelerating and Non-Accelerating Students as Measured by Scores Made by Entering Freshmen on ACE and Cooperative Reading Tests,” Science Education, XL (October 1956), 327-31.
13 Allison and Bloom, op. cit., 221-33.

**TABLE 8**

<table>
<thead>
<tr>
<th>Course</th>
<th>Men Per Cent of Examinations Passed</th>
<th>Women Per Cent of Examinations Passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library in Society</td>
<td>54</td>
<td>59</td>
</tr>
<tr>
<td>Cataloging and Classification</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>Basic Reference</td>
<td>42</td>
<td>61</td>
</tr>
<tr>
<td>Selection of Library Materials</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>Introduction to Library Service</td>
<td>59</td>
<td>68</td>
</tr>
<tr>
<td>Advanced Courses</td>
<td>64</td>
<td>49</td>
</tr>
<tr>
<td>TOTAL</td>
<td>44</td>
<td>48</td>
</tr>
</tbody>
</table>

**TABLE 9**

<table>
<thead>
<tr>
<th>Course</th>
<th>Men Number of Examinations Taken</th>
<th>Men Per Cent of Total</th>
<th>Women Number of Examinations Taken</th>
<th>Women Per Cent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library in Society</td>
<td>26</td>
<td>27</td>
<td>86</td>
<td>29</td>
</tr>
<tr>
<td>Cataloging and Classification</td>
<td>15</td>
<td>16</td>
<td>66</td>
<td>17</td>
</tr>
<tr>
<td>Basic Reference</td>
<td>24</td>
<td>25</td>
<td>88</td>
<td>23</td>
</tr>
<tr>
<td>Selection of Library Materials</td>
<td>8</td>
<td>8</td>
<td>68</td>
<td>18</td>
</tr>
<tr>
<td>Introduction to Library Service</td>
<td>17</td>
<td>18</td>
<td>56</td>
<td>14</td>
</tr>
<tr>
<td>Advanced Courses</td>
<td>6</td>
<td>6</td>
<td>21</td>
<td>6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>96</td>
<td>100</td>
<td>385</td>
<td>100</td>
</tr>
</tbody>
</table>
Illinois found its students who exempted core courses to have obtained better grades than average in advanced library science courses.\textsuperscript{14}

Sixty-one examinations (12 per cent) were taken by Drexel students who later withdrew without completing their degree programs. This included students who failed, who were on probation, and who discontinued course work for personal reasons. Among the students who withdrew, the examination success ratio was only 20 per cent as compared to the overall success rate of 48 per cent, thereby suggesting a positive correlation between examination grades and graduation, or between examination grades and course grades. Nevertheless, a dozen of these students were sufficiently knowledgeable to pass exemption examinations so their loss to the profession was regrettable.

**CONCLUSIONS**

1. There is some body of literature reporting higher education experience in exemption testing, all of which is favorable to such a program and to the success of well qualified students in it and in later course work.
2. There was a sharp decline in the number of examinations taken between 1962 and 1963 and the following years.
3. There was a steady decline in the percentage of examinations passed, as they became more difficult.
4. Success rate for retests was similar to the overall success rate.
5. There was a general correlation between frequency rate and success rate—the examinations most frequently taken were those most frequently passed.
6. Library in Society, Basic Reference, and Introduction to Library Service were most frequently taken and passed.
7. Students in Group D, with no previous course work or library experience, took the fewest examinations per person and had the highest success rate, though findings in other fields were the opposite.
8. The number of students in Group D taking examinations decreased sharply each year.
9. Of four undergraduate library science departments on which evidence was available, the graduates of two scored somewhat above the overall average, and two scored significantly below.
10. Success percentage on advanced course exemption examinations was significantly higher than the overall coverage.
11. Women did slightly better than men on all but one examination.
12. For students who later withdrew before completing graduation requirements, the success ratio was well below the overall average, suggesting conformity with previous findings.

\textsuperscript{14} Shearhouse, op. cit., 481-9.
BOOK REVIEWS


Three university librarians have collaborated to fill in what is being done by a quarter of a billion people to provide themselves library service. The study is a country-by-country description—more comprehensive as well as more detailed than we have had before—of library problems and activities in a great arc comprising South Korea, the Republic of China (Taiwan), the Philippines, South Viet Nam, Laos, Thailand, Malaysia, Singapore, and Indonesia. Malaysia and Singapore are treated as one.

The authors draw on more than a hundred references, some of them not generally accessible, and on the results of study in the field to describe libraries of various types (public, school, university, national, and special) both indigenous and foreign. In addition, they look past libraries themselves and take into account two sets of factors that are less palpable. One set has to do with how favorable the social climate is to library development—whether a sound political and economic base for the purpose exists, to what extent continuing social commitments and in particular educational commitments are generating a real need for national library development, what teaching customs or other cultural characteristics put the brakes on creating library services to meet these needs, what the language of learning is and how many are equipped to use it, whether there is an indigenous booktrade to provide readable books in the vernacular, and what use is made of non-print media.

The other set has to do with how favorable the climate of management is to library development—the condition of library legislation and government, the place of library planning in national planning, established arrangements for the development of librarianship as a profession, arrangements that affect the attractiveness of librarianship as a personal career, the organization of librarians and their national activities, and measures that the nation supports to further bibliographical control.

Using this general pattern of analysis, the study sketches not one picture but eight pictures of what is to be done next. It is here that the significance of the study begins to emerge. It has not been common since the Commonwealth library program of the Carnegie Corporation to treat library development as a problem that requires more than perfunctory attention at the level of national policy. More commonly governments of developing countries and their foreign advisers on national planning treat it as a cluster of problems bounded by four walls—problems that may require outside purchases of books for shelf enrichment, gifts of scholarships for training, expatriate librarians, foreign libraries to serve as substitutes for local libraries, but no real involvement of the indigenous power structure. This study throughout considers outside aid as important in its place, and the place is a large one. But while the work was largely sponsored by a foreign agency, USAID, it reflects a consciousness that the best way to develop a national library program is not to try to buy it or give it or throw it together in haphazard fashion, but to build it, each nation according to its own specifications.

Does the study provide a satisfactory set of specifications for each of these eight countries?

No, this would be too much for a territory so large in time so short, especially when there is such a big bundle of problems to be sorted out. The authors set for themselves the more modest goal of producing a first draft to aid all those who may be interested in Asian libraries. Their work will provide readers, native and foreign, useful information on these libraries; it shows refreshing recognition of national

Recent Publications
library development as a necessary element in nation-building; and it illustrates needed use of professional guidance in shaping this aspect of national policy.—Carl M. White, University of California, San Diego.


Early in 1967 officers of the Association of Southeastern Research Libraries decided to sponsor publication of a guide to research collections in the libraries holding membership in their organization, and Professor Thomas H. English, scholarly chairman emeritus of Emory University's Department of English, was selected as compiler and editor. Professor English proceeded with dispatch and good judgment to produce within slightly more than a year's time this useful, small volume. *Roads to Research* is a collection of fifty-one brief sketches each of which describes a special collection that can be regarded as of value to serious scholars. The collections are listed in the table of contents and by each title is the name of the library of which it is a part. The range is surprisingly broad; included, of course, are the regional collections—Georgiana, South Caroliniana, Virginiana, etc.—but in addition one finds such diverse topics as emblem books, detective stories, ornithology, children's poetry, Irish literature, and New Orleans jazz. Twenty-eight libraries are members of ASERL and sixteen of them reported collections which the librarians and Professor English judged worthy of inclusion. Those reporting the largest number of research collections were Duke and the University of North Carolina at Chapel Hill with eight apiece; they were followed by Louisiana State University with six.

The descriptive notes were prepared in collaboration with the holding libraries, and the editor visited the libraries to gain firsthand knowledge of the collections and to bring a measure of uniformity to the whole. In spite of this the reports vary in quality and usefulness, but perhaps this is only natural since the collections themselves vary so widely. However, by bringing this information together in one published work ASERL has performed a service that will be appreciated by librarians. With the collections identified and the general facts made available, scholars who need detailed information can inquire directly and more intelligently.

In general the format of the volume is good. There is a bibliography which is probably too general to be of much help, and there is a well-prepared, selective index. It is to be regretted that at least three of the more important libraries in the Association are conspicuously absent. Also, this reviewer wishes that the essays had been arranged by some plan or classification; an alphabetical arrangement might have served nicely.—J. Isaac Copeland, University of North Carolina at Chapel Hill.


Publication of the first of the projected eighteen volumes of this work has partially satisfied the curiosity and expectation of many librarians, information specialists, and possibly others. Although a studied and just review of the encyclopedia should await completion of the set with its index, a preliminary estimate may now be based on Volume 1, A to Associac. This reviewer's evaluation is mixed, but with the balance on the plus side. The work establishes two major firsts: it is the first encyclopedia published anywhere covering the two related fields of library and information science, and it is the first American encyclopedia on the former discipline. Information science is well represented, filling about 40 per cent of the first volume, but in terms of articles it is outnumbered by library science by about three to one. There has been a recognized effort to be international, both in choice of articles and in the information included in the articles, rather than limiting the scope to topics and practices applying only in the United
States. Some contributors seem to have taken too literally the instructions to represent world library practice, as in the article “Abbreviations,” where nearly half of the titles cited are either in a language other than English or refer to practice in countries other than the United States. But in “Academic Status of Librarians” the international approach is well handled and appropriate.

Within the intended scope of the work, the selection of articles appears to be, for the most part, adequate. Contributors, at least those whose names are known to this reviewer, are well suited to their assignments. But a reference work of this kind is barely begun when decisions have been made on articles to be included and contributors have been invited and have submitted their articles. There remains the long and painstaking job of editing the contributed pieces for length, style, level of information, and bibliographic form. This kind of editing is conspicuously absent in the work. No control seems to have been exercised on the length of articles commensurate with their importance. The article on “Airlie House Conferences” runs to nine pages, the one on “Abbreviations” more than eleven pages, and that on “Abstracts and Abstracting” twenty-two pages; but the article on “Acquisitions” is given only nine pages, that on “Administration” only six pages. Further inequities in length are “Armed Forces Libraries” twenty-eight pages, and “Art Libraries and Collections” fifteen pages, but “Architectural Libraries and Collections” only five pages! Style differences are more difficult to control than those of length, and rigid standardization of style is not desirable. But the opening sentences of the article “Airlie House Conferences” hardly seem appropriate to a work of this kind: “Airlie House is a 'U-Haul' think-tank situated, very appropriately for those who remember Oscar Wilde’s definition, in the fox-hunting country of Virginia. The style is English country house; the menu is hearty, is uninspired.” The desirable level of information and sophistication for the expected reader should also be sought and ensured by careful editing of each article. In this first volume most articles are written on a level that should provide helpful information to the average reader. But the opening paragraphs of the first article, “Abbreviations,” are almost meaninglessly elementary. Good editing would have eliminated some articles like that on “Aden, Libraries in,” the first sentence of which states that practically no information is available on the subject, with the remaining few sentences quoting matter from the yearbook, Middle East and North Africa. There need be no compulsion to include articles like this simply because articles on libraries of other countries are included.

Mention has not been made of the many excellently written articles or of the quantity of useful information in this volume. While it may be unfair and unnecessary to single out any articles for specimen mention, those on “Abstracts and Abstracting,” “Aldus Manutius,” “Algorithms,” “Alphabet,” and “Ancient and Medieval Libraries” seem to this reviewer especially informative and well written. Despite any faults it has, the set will, when completed, serve a much felt need and be a useful reference work.—Rolland E. Stevens, University of Illinois.


The author of this book is a law professor at Vanderbilt University. As would be expected, therefore, it is written with an eye to its value to his colleagues in the legal profession as well as to those who have a more general interest in the history of copyright.

It should be of interest to any librarian who is concerned with protecting the respective rights of users, authors, and the publishers of books. And at this point, there is hardly any librarian who is responsible for the copying policies of a research library who should not be so concerned. Whether we like it or not, librarians are in the middle of these conflicting interests which are becoming more complicated by the day.

The book presents a dispassionate legal history of the development of the idea and use of copyright from a device to protect the printer-publisher through its use by the
Crown as a censorship device—on to the concern with protection of the author's rights. Interwoven in its history through the centuries are the concern of Parliament and the Congress of the United States with the problem of monopoly and with the use of copyright as a device to promote learning.

It is interesting and helpful to anyone concerned with the history of printing to see the roles of such institutions as the Stationers Company and the Star Chamber presented in their purely legal relationship to printing and copyright and their use of each other to effect censorship and monopoly. The author also explains the intent and purpose of the Statute of Anne in 1709 and its effect on the American view of copyright. Indeed as is the case in so many of our legal concepts all of the ideas originated in the English history of copyright. The early state acts and the federal acts were based on the Statute of Anne.

No place else have I seen presented so clearly the purpose of copyright as understood at the time of the framing of the Constitution of the United States and the first Federal Copyright Act of 1790. As advanced in the constitutional provision, they are 1) to promote learning, 2) to secure the author's right, 3) to provide order in the book trade by government grant, and 4) to prevent monopoly. These same ideas appear in the first Copyright Act and in the first important copyright case to come before the United States Supreme Court, Wheaton vs. Peters, 33 U.S. (8 Pet.) 591 (1834).

Oddly enough, in view of its current importance, historically there seems to be little evidence of any concern for the rights of the user. Perhaps this has become a problem only since the development of rapid copying devices. In this connection, however, the author raises the point of the potential danger to the user's right to freedom of expression if the author should be allowed to control the work completely.

Perhaps the most intriguing and in a sense disturbing of the author's themes, however, is his concern with failures on the parts of the courts and the legislatures to understand the elements involved in literary property—and more especially the rights of the author which go beyond the present concept of copyright. He is concerned with the author's creative interest in his work—"his right to protect the integrity of his work and his reputation in connection therewith." Most people are probably aware that these rights exist. But exactly what are they? How can they be identified? Do they differ with the nature of the work itself? Does the librarian have responsibilities in this area also? The solution which he offers is that the courts take jurisdiction of many of these complex issues and that they distinguish them from the area controlled by statute and proceed to develop a common law of copyright which could case by case distinguish and preserve the rights of the various interests involved.

This is a fine, carefully written book and within the limits imposed by the discipline of legal writing can be considered creative in its approach to some of the elements of copyright. I hope it will become part of the literature of librarianship.—Stanley West, University of Hawaii.
ABSTRACTS

(Abstracts given below are selected from those prepared for publica-
tion in Research in Education by the ERIC Clearinghouse for Library
and Information Sciences at the University of Minnesota. Unless
otherwise noted, copies of the following documents are available, by
purchase, in microfiche or hard copy format, from the ERIC Docu-
ment Reproduction Service, National Cash Register Co., 4936 Fairmont
Avenue, Bethesda, Maryland 20014. Orders must include ED or LI
number.)

Academic Librarianship in the International Milieu, Proceedings of a Confer-
ence for Academic Librarians . . . , October 14, 1967. Manhattan: Kansas
State University, 1968. 84p. (ED 022 515, MF——$0.50 HC——$3.44).

This collection of papers provides a
kind of handbook for academic librarians
who are preparing to serve as library con-
sultants in foreign countries. The papers
describe challenges facing the American
librarian working with and adjusting to
foreign cultures. The papers include (1)
“On Getting Ready for an Overseas Li-
brary Assignment” by Thomas R. Buck-
man; (2) “Afghanistan: Libraries and Li-
brarianship” by Neva L. White; (3) “The
Literary Tradition” by James A. McCain;
(4) “Land-grant College Libraries in the
Moslem World” by Wayne R. Collings;
(5) “Pressures on the Consultant” by G. A. Rudolph; and (6) “International
Dimensions of Librarianship Influencing
Libraries in the United States” by Marietta
Daniels Shepard. A list of participants in
the conference is provided.

An Analytical Approach to Duplication
and Availability. By M. K. Buckland
and I. Woodburn. Lancaster: Lancaster
University, 1968. 26p. (University of
Lancaster Library Occasional Papers,
No. 2; ED 022 560, MF——$0.25 HC——
$1.12).

As part of a project designed to con-
struct a mathematical model of the opera-
tion of an academic library, a research
team determined the usefulness of a quan-
titative approach to making decisions about
the number of copies of each item that a
university library should provide. Using
the reserve collection of the University of
Lancaster Library as a basis, a mathemati-
cal relationship was established between
the number of requests, the length of the
loan period, the number of copies, and a
standard of service (defined as “immedi-
ate availability”). It was found that the
Poisson distribution could justifiably be
used to relate the average request rate to
the number of copies and the degree of
availability likely to be achieved. A table
was produced which can be used in a
predictive manner insofar as the request
rate itself can be predicted. A method of
estimating the average request rate from
incomplete data was also devised. It was
concluded that a mathematical relation-
ship between the factors concerned can be
established. The chief difficulty lies in pre-
dicting the level of demand for library
services and, more generally, in under-
standing the factors which determine it.

Some Implications for Library Manage-
ment of Scattering and Obsolescence.
By M. K. Buckland and I. Woodburn.
Lancaster: Lancaster University, 1968.
28p. (University of Lancaster Library
Occasional Papers, No. 1; ED 022 502,
MF——$0.25 HC——$1.20).

A research project is being conducted to
construct a mathematical model of the opera-
tions of an academic library to be
used in making managerial decisions. As
part of this project, this report examines
Bradford’s Law of Scattering and the fall-
off of use of documents as they age. A
series of mathematical analyses indicates
how these two laws can be used together to indicate optimal decisions in the management of collections of journals. These decisions include the number of titles to be taken, the length of time retained, and the choice of binding policies. Imaginary petroleum libraries in various circumstances are used to illustrate the conclusions.


This study analyzes the basic cost factors in the automation of library catalogs, with a separate examination of the influence of typography on the cost of printed catalogs and the use of efficient automatic error detection procedures in processing bibliographic records. The utility of automated catalogs is also studied, based on data from a random sample of the shelflist of a medium-sized university library. An investigation of several large university and public libraries shows that the collections of mature libraries grow at a rate close to the rate of growth of the Gross National Product, and the significance of this relationship as a library management tool is discussed. Numerical methods for determining useful ratios of the size of library files and the number of entry fields in the structure of the record are given and applied to the use of machine-readable catalog data in the production of bibliographies. It is concluded that mechanization of the cataloging function is necessary and inevitable, and it is recommended that the machine-readable catalog data be used to produce printed book catalogs and special purpose bibliographies. Appended is a description of the selection of a random sample from the shelflist of the Fondren Library at Rice University.


This document examines the feasibility of including school and college libraries in a public library centralized processing system proposed in LI 000 343, "Centralized Processing for the Public Libraries of New York State" (Nelson Associates for the New York State Library, 1966). It is concluded that school and college libraries should not be included in the proposed system at first since their inclusion would result in delays in service to all libraries involved. However, there is no reason why a joint program for processing school, college, and public library materials might not be established in the long run. Analysis of the school and college library reaction to a questionnaire on centralized processing is appended.


This comparative survey of current practices in classification and cataloging of printed materials was concerned with six questions: (1) What procedures are involved in cataloging and classification? (2) Could some of this work be done by a centralized cataloging service? (3) Who is doing the work of cataloging now and what are his qualifications? (4) What proportion of library time and money is being spent on cataloging? (5) Is there any degree of uniformity in the cataloging practices of the various university libraries? (6) Are the resultant catalogs being used? The questionnaire used as a basis for the survey was distributed to sixty-nine British college and university libraries with a return rate of 74 per cent. The information given relates to the situation as of the end of 1965 and for the purposes of the analysis the replies were categorized according to type and size of library. The major part of the document presents the analysis of each question in the questionnaire and also the relationships found among some of the questions. It was concluded that more study of classification schemes and the kinds of information desirable in a catalog
entry is needed. The effective use of mechanized techniques in the future will demand more standardization of practices among librarians than exists at the present.


The project's second year (1967/68) was devoted to upgrading the computer operating software and programs to increase versatility and reliability. General conclusions about the program after twenty-four months of operation are that the project's objectives are sound and that effective utilization of computer-aided bibliographic data processing is essential to the objectives. The difficulty in debugging an integrated on-line system of programs, problems with transitions from non-automated to automated systems, and the lack of some necessary peripheral equipment for library operations have resulted in some delays. In 1967/68 the project involved the following tasks: (A) development of bibliographic data processing system; (B) implementation in library operations; (C) character sets; (D) Project MARC; (E) circulation; (F) processing operations studies; and (G) cooperative library systems development. Appendix A is a diagram of the University of Chicago computer network. Appendix B presents production samples from high-speed printer with library print train. Appendix C is a brief listing (28 pages) of the University of Chicago Library processing programs.


A batch-mode, computer-based, serials system was developed for the bio-medical library, a departmental library at the University of Minnesota. Patterned after the "arrival card" system now in use in several libraries, it is designed so that serial check-in is done by marking off the issue on a printed list of serial issues expected during the month, based upon predictions made by the computer. Any gifts or unexpected issues or supplements (about 20 per cent of the total) which do not appear on the check-in list are handled by use of a serial check-in form. This information is added to the master file and at the end of the month corrections to the prediction codes, if necessary, are made. Other monthly printouts are: (1) a serials master list which contains all the information collected about each serial title (7,500 in all); (2) a patron holdings list, a list to be used by patrons containing less information than the previous list; and (3) bindery list of items for which volumes are completed. The first two lists are supplemented by daily cumulative supplements prepared from the daily input cards made when a serial issue arrives. A cost analysis made in connection with the project shows that the average cost per transaction is $0.71 in the new system.


Under funding from the National Science Foundation, the Institute of Library Research of the University of California (Los Angeles) has carried out a study of mechanized information services in the university library. The basic premise of the study is that magnetic tape data bases are becoming available from a variety of national sources and that they are a form of data which university libraries will begin to acquire. The purpose of the study was to explore the validity of the premise and define some of its consequences. The results of the study have been prepared as a
final report, consisting of thirteen parts (LI 000 494-LI 000 506). The first part is the "Introduction and Summary." It presents, as the context within which to view the study, a projection of the role which mechanization will play in the university library and the pace at which it will develop over the next ten to fifteen years. Within that context it then discusses the issues—policy as well as technical—raised by mechanized information services in the university library. For each issue, the approach taken to study it is described and the results (as reported in other parts of the report) are summarized.


This report summarizes the results of a fourteen-month study to (1) examine the feasibility of establishing a book processing center to serve the nine state-supported college and university libraries in Colorado; and (2) conduct a simulation study of the proposed center. The report covers: background, operational characteristics of participating libraries, cost analysis, business office procedures, proposed operating specifications for the book processing center, approval plan utilization, a generalized stochastic model for simulating the operation of a book processing center, and results of a library user attitude survey. It is concluded that a centralized book processing center is feasible, with benefits for participating academic institutions in the cost savings, personnel specialization, and library automation. Recommendations emphasize establishment of a processing charge, processing both English language and foreign language materials, an automated bookkeeping system, automated processing procedures, development of current awareness bibliographies, and a central depository of standard times for performing technical services activities to be established by the ALA Resources and Technical Services Division. Appendices include a sixty-eight item bibliography, detailed numerical data from the study, and the questionnaires and research tools used.


Three makes of telefacsimile equipment are described and compared: (1) Xerox Magnavox Telecopier; (2) Datafax 1824 and Dial/Datafax; and (3) Alden II Docufax. The models described are thought to be potentially useful to libraries, specifically for the purpose of transferring copies of printed pages from one library to another. Each system is capable of operating at minimum cost by using a single voice-grade telephone line. In this report the operating principles and characteristics of each model are described and the reliability and copy quality assessed. Costs are compared and tabulated for equipment, supplies, and telephone line service in two hypothetical library systems, one comprising two libraries and the other, ten libraries. It is concluded that all three of these makes of equipment perform with sufficient reliability and copy quality for most library purposes. The type of equipment to select for a specific library application is determined primarily by the anticipated volume of use, the quality and capacity of telephone lines to be used, and the nature of the material to be transmitted.


This report describes various aspects of generalized or task-oriented programming systems and in particular, how their fea-
tures can be adapted for retrieval from (typical) information center and library data bases such as those described in a previous report (LI 000 498). It is not meant to be comprehensive in the sense that all such systems are discussed; indeed, many systems have necessarily been omitted. The discussion begins with already existing systems (Control Data Corporation’s Information Oriented Language (INPOL), the IBM-1401 Combined File Search System (CFSS)). It then turns to systems now or about to be available in the near future (Informatics Inc.’s MARK IV). The final portions treat more advanced systems not now available (International Business Machine’s Generalized Information System (GIS)). The treatment is primarily descriptive and to some extent provides a survey of the features of the above systems as they might be exploited in an environment characterized by a very large-scale (both in the format and content senses) data base problem.


The nature of typical mechanized data bases with which university information centers and libraries will be working is examined to provide background information for data base retrieval efforts. Format and content of the data must be taken into consideration before meaningful retrieval can be achieved. Hence both of these aspects are treated in detail. The discussion covers a range of data bases, including nationally sponsored projects such as Medical Literature Analysis and Retrieval System (MEDLARS), Machine-Readable Cataloging (MARC), the United States Census Tapes (1/1000 sample), and the Educational Resources Information Center (ERIC) report résumés. Also discussed are some local projects, including the University of California, Los Angeles, Brain Information Service System and a generalized Metropolitan Center Data Bank. Various types of formatting are presented in this array of data bases, and several examples among types of requests that can be directed against such data bases are considered. The report is followed by another which assesses the applicability of generalized or task-oriented programs to these data bases (LI 000 499).


A Mathematical Citation Index was started in March 1965 under the auspices of the University of California, Los Angeles (UCLA), Computing Facility. Before the compilation of citations for this index could begin, however, it was necessary to produce an index to abbreviations of serial titles in the field of mathematics. The result of this effort was the first volume of a projected series of Minimum Abbreviations of Serial Titles (MAST) indexes, which are permuted indexes to serial title abbreviations. Twenty-five journals of significance in mathematical research were then chosen for further processing by asking mathematicians to list those journals in which significant research appears. The citations from these journals were key-punched and then edited using an on-line cathode ray tube display terminal system. Seven hundred citations to books were also checked to determine why each had been cited. Until authors differentiate between pedagogic and research citations to books and are specific as to pages or chapters, there seems little to be gained by their inclusion in a citation index. Appendices include examples of the MAST index, a list of core journals in mathematics (as determined by this and other research), a list of the mathematics books most frequently cited, and keypunching instructions for the Mathematical Citation Index.

A series of symposia were conducted to provide forums for discussion of the problems arising when introducing into the single campus university library media which can be processed by computers. The first symposium explored the relationship between the university library and national network systems. The second concerned the relationship of mechanized clerical processing to mechanized information systems in the library. The other three symposia brought information scientists together with University of California faculty in the social, physical, and life sciences. The emphasis was on pragmatic problems—economic, technical, and administrative—which confront the university library in efforts to supply expanded information services. The specific issues which were discussed were (1) whether information systems are viable in themselves; (2) whether a single university should acquire its own machine readable stores or use the service from tapes stored elsewhere; (3) what types of data bases satisfy the needs of the faculty and students; (4) whether such services in the university should be lodged in the library or the computer center; and (5) what are the technical problems which arise? This report presents a general discussion of these issues, some likely answers to them, and what appeared to be the opinion of the attendees of the symposium. The background material presented at the symposia are summarized in the appendices.


This survey of data bases emphasizes reference data bases only and is intended to be indicative of the variety and number of magnetic tape files in existence of a type which might be utilized in an information service center in a university library. It reflects both projects undertaken on a large national scale and those which serve the needs of particular organizations. The information assembled about each of the twenty-nine tape files, where possible, is: (1) address and director of the creating agency; (2) a brief description of its nature and contents; (3) file characteristics and size; (4) availability and cost; and (5) references to further documentation. It was found that those files created for specific purposes of a parent organization were not necessarily designed for capability for each readability for other purposes, while data bases available from organizations in the business of maintaining data bases and providing a variety of services are generally easy to read and well documented. Most of the existing data bases have simple, hierarchically arranged, field structures. Record formats, however, from one file to another are virtually unrelated.


A method is defined for library cataloging of magnetic tape files. The needs of the reference librarian and the patron are taken into consideration, as well as the particular requirements inherent in the form of the material. Basically, the catalog record must serve three functions: (1) it must present a conventional and approachable record of library holdings, including entry, title, date, a brief description, a
serials holding record where applicable, and subject analysis; (2) it must indicate the physical and logical nature of the material on a tape, including the format of the data and any associated programs and documentation; (3) it must serve as an aid in formulating search requests relating to a file. A sample catalog format and associated instructions, as well as illustrative examples, which fulfill these requirements are presented. The possibility of a union catalog is also discussed.


This study was conducted to assess undergraduate and junior college libraries and to consider future development. Major trends are seen as: resources not increasing as rapidly as the college population; increased demands on libraries due to changes within colleges; new technology; changing characteristics of library materials; increased pressure for inter-library cooperation and service to the non-college public; greater participation by the federal government; more selective acquisition; library experimentation and changing staff needs. Problem areas include: increased demand for college library facilities; inadequate collections; staffing; unique problems of junior college libraries; the need for national leaders in technical areas; copyright restrictions; a need for research and planning; existing federal legislation and governmental programs affecting college libraries; and lack of focus in college educational programs. A major recommendation is the establishment of a national commission to plan and coordinate programs and determine which college library projects should be approached at the federal, regional, and state levels. Other recommendations involve the Higher Education Act, library education and job classification, a demonstration project for junior college libraries, and copyright and other legislation. A bibliography of forty-eight items is appended.


The purpose of the Library of Congress Machine-Readable Cataloging (MARC) pilot project was to provide libraries with catalog data encoded on magnetic tape in order to determine the feasibility of centralized computerized cataloging in support of library functions. Sixteen participants were selected on the basis of expressed interest, available staff, access to computers and associated equipment, and proposed applications. The weekly tapes were used by the participants for two basic purposes: (1) using the data in everyday library processing, and (2) using the data to provide extra services such as machine searching. Experiences at the University of California, Los Angeles (UCLA), which used the MARC information to produce catalog cards and alphabetize subject lists for use in book selection, indicated that there were problem areas both in using the programs provided and in creating new programs for processing tapes organized in the MARC format. In general the experiments at UCLA demonstrated that (1) it takes longer to plan and implement automated library procedures than most library administrators suspect, and (2) a full-scale nationwide MARC distribution service could not be realistically utilized without a substantial "lead time" for libraries to prepare themselves for processing the data. A listing of the programs developed at UCLA is also given.
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