A Cost-Benefit Analysis of a Collections Inventory Project: A Statistical Analysis of Inventory Data from a Medium-sized Academic Library

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Using an electronic shelf-reading system a cost-benefit analysis was conducted of an inventory/shelf-reading project in a medium-sized academic library. Analyses include time spent, cataloging discrepancies, books found with active statuses, mis-shelving rate and distance, and subsequent use of found books. Correctly re-shelving "missing" materials was found to be more cost-effective and service oriented than repurchase.

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Introduction

Libraries invest substantial resources in acquiring and maintaining their print collections. A recent publication, ARL Statistics 2006–2007, reported that their 123 members collectively spent more than 315 million dollars for monograph collections.[1] The number of their initial circulations was over 41.8 million, which clearly demonstrated the importance of print collections to contemporary users. Libraries also spend considerable effort enhancing access to these collections, not only by ensuring accuracy in their catalogs, but also by providing a better online presentation of the information in their catalogs. However, accessibility of collections is highly dependent on the physical presence of materials in the stacks, which requires rigorous stack maintenance — an expensive yet indispensable activity, which directly impacts the patron's ability to find materials, as well as the ability of the staff to provide quality public service. Mis-shelved books create an enormous amount of frustration and waste in both patron and staff time in trying to locate them.

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Mis-shelved books in the stacks are those that are most likely to be highly used. If not found when they are in demand, they need to be either repurchased or supplied through interlibrary borrowing. A good inventory system may efficiently and effectively help locate these mis-shelved books in the stacks. Often inventory is perceived as prohibitively expensive. However, should the cost of finding such mis-shelved books be less than the cost of acquiring them, the inventory expense can be justified. In addition, if the found mis-shelved books are used in a greater proportion than the rest of the collections, the justification is intensified. The purpose of the paper is two fold: to give a brief description of an inventory system developed at Booth Library, Eastern Illinois University, and to show that the inventory project conducted at Booth Library was cost effective by comparing the cost of inventory to the cost of re-acquiring mis-shelved books as well as to provide evidence of high subsequent use of found mis-shelved books.

Booth Library of Eastern Illinois University, a medium-sized academic library, is located in a rural community in Charleston, Illinois. It serves 11,000 students, 9500 undergraduate and 1500 graduate students. The number of annual circulations is approximately 150,000. In response to one of the questions in the 2007 annual library satisfaction survey, "Have you used library book collections?", nearly 80% of the 2000 EIU undergraduate respondents indicated that they had used library books. Beyond students at EIU, Booth Library lent books to more than five thousand users from other institutions during the spring of 2007. These statistics support the importance of print materials to EIU users as well as others in the region.

The fundamental ideas on how to conduct inventory have not changed significantly over time. Regardless of the method, two pieces of information are necessary for an inventory: a shelf-list (an exhaustive list of books), and an active-status list (a list of books with statuses such as 'Charged,' indicating items which should not be on the shelf). Until recently, card files served as shelf-lists, which were eventually replaced by computer print-outs during the early library automation. However, comparing call numbers printed line by line on a piece of paper to those on the spine labels could be a challenge to anyone.

Even if libraries are well aware of the necessity of print collections inventory, there are numerous other competing projects in libraries. If it is known that there are substantial benefits from an inventory project, libraries may be more willing to start such a project. Unfortunately, traditional inventory or shelf-reading methods are not capable of collecting data at the item level for an in-depth analysis. Even though most contemporary electronic inventory systems may have the potential to log transactions at an item level which can be used for statistical analysis to extract useful information, these transaction logs are often under-utilized simply because their existence is unknown. To date, studies have mainly reported overall findings rather than in-depth analysis.

Literature Review

Over the years, librarians innovatively incorporated new technologies into different areas in the library work flows. Inventory was not an exception. Card files served as inventory tools for decades even after library automation systems were well in place.[2] However, inventorying collections using shelf-list cards was very tedious. The Johns Hopkins University Library began its inventory in 1967, expecting 10 years to do 1.3 million volumes at the time.[3] Cost and time estimates such as these may have prohibited libraries from conducting inventory. Powell Niland and William Kurth used sampling methods to obtain a missing rate.[4] However, this did not provide a list of books which were missing or lost. To overcome this shortcoming, David Kohl recommended predicting where the greatest amount of missing items were most likely to be by using easily accessible circulation data. These areas could then be targeted for inventory to maximize scarce resources.[5]

In an early stage of computerization of library systems, even punch cards were used for inventory control.[6] Once barcodes were attached to books, librarians quickly adopted devices such as hand-held scanners, portable scanners,[7] or even Palm Pilots[8] in collecting barcodes in the stacks. Even though these methods were capable of logging transactions, the published literature was often limited to explaining the procedure rather than data analysis. Recently, inventory has also become a necessary step in the process to move millions of print volumes to high density storage facilities for some libraries.[9]

Some universities require their libraries to inventory their library collections and report the results to administrative bodies.[10] Many more universities, however, do not require such reporting. Thus, the decision to conduct an inventory often lies in the library administrator's or departmental head's hands. Even though the need for inventory or shelf-reading is recognized, libraries may be hesitant to perform the task. Two major reasons affecting the decision are the shear size of collections and the cost. Michael DiCarlo and Margaret Maxfield at Louisiana Tech University considered that a collection size of more than 100,000 monographs was too large to perform inventory. They concluded that the loss-rate was not sufficient enough to justify full inventory after they performed a cost-effectiveness analysis using a sequential analysis by searching only 82 randomly selected titles in their collections.[11] The inventory method in 1988 may not have been as efficient as contemporary ones, which might have made inventory even more costly at that time.

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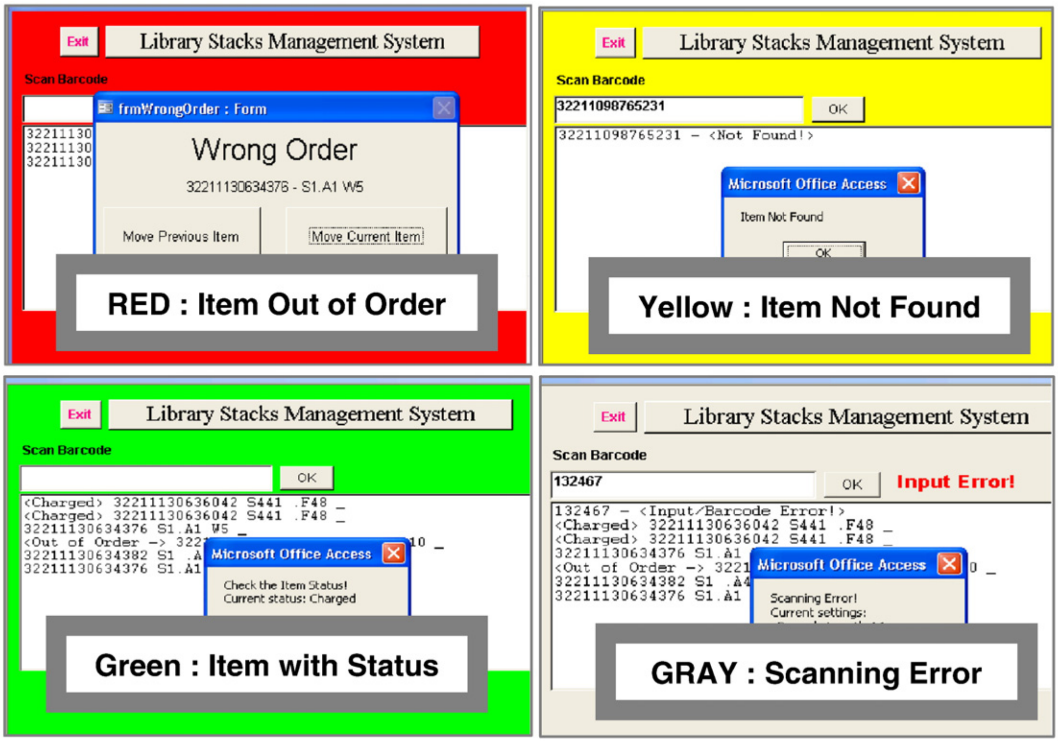
In general, past studies on inventory were more descriptive than analytic, mainly due to the inability to collect meaningful data for analysis. As technology has developed, it has become easier to collect substantially more data during the inventorying process. This data, if used effectively, will generate useful information, which will be a tremendous tool in understanding the importance of collections inventory.

Figure 1
Warning signs that operators may encounter during the process.



Inventory Efforts at EIU

Prior to the current inventory project at Eastern Illinois University, there were two major projects containing elements of inventory work. In the 1970s, the collections were reclassified from Dewey to Library of Congress classification, and in the mid-1990s, we barcoded our collections using "smart" barcodes containing the call number and item information. In both projects, we discovered materials on our shelves that were not reflected in our catalog, and materials in our catalog that were not on our shelves. These discrepancies were resolved as they were discovered. Both projects introduced new errors and problems, with manual errors in call number labels and placement of barcodes on wrong items.

Overview of The Inventory Process and Data Analysis

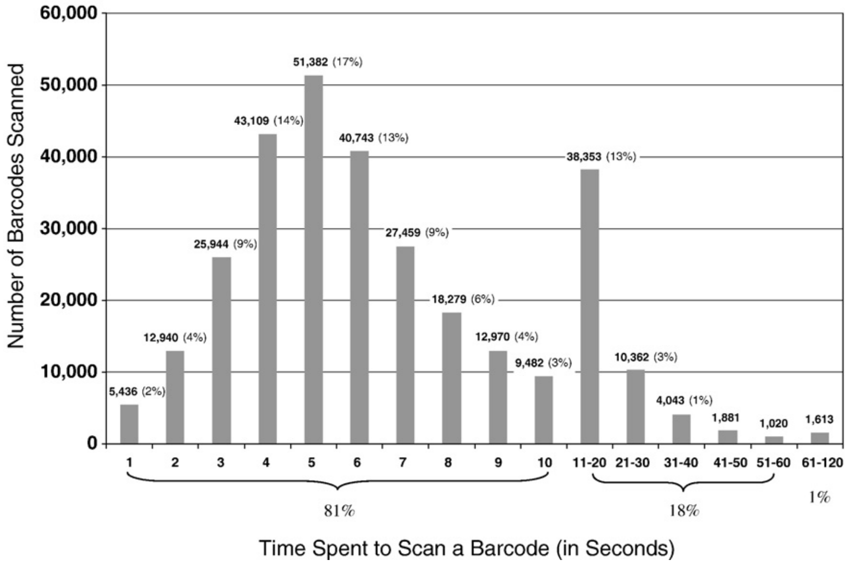
If the goal of inventory is solely to identify missing items, then, identifying these items can be done by

Table 1
Sample log of LSMS data

Scan Time	Barcode	Call Number	Status	Distance	Time
11/29/05 8:25:23 AM	32211130906428	Q11.A1 B3 1958			3
11/29/05 8:25:26 AM	32211131130111	QA11.A1 U5	w	6392	3
11/29/05 8:25:53 AM	32211130575114	Q11.A5			27
11/29/05 8:26:01 AM	32211130645724		N		8
11/29/05 8:26:10 AM	32211130870430	Q11.A53 K63			9
11/29/05 8:26:12 AM	3221113058097		S		2
11/29/05 8:26:22 AM	32211130580970	QA11.B89 1991	w	6439	10
11/29/05 8:26:29 AM	32211998852667	Q11.B45 1993			7

The first four columns are recorded at the time of scan. The last two, 'Distance' and 'Time,' are calculated after an entire section is scanned. W = Out of order, N = Item not in the Shelf-List, S = Scan error.

Graph 1
Time spent to scan a barcode (total number of scans = 305,016*). *The analysis included only scan time less than 120 s. Thus, 476 scans of more than 120 s were eliminated.



simply collecting barcodes in the stacks using a barcode reader and comparing them to those in the shelf-list, which can be obtained relatively easily and effectively with almost any contemporary integrated library system.[12] This procedure is also capable of identifying shelving errors, books found with active statuses, or barcodes not in the system. However, in order to correct the problems, staff must go back to the stacks to collect items that need correction. Identifying books with discrepancies between spine labels and system call numbers would be even more challenging. In short, the lack of immediacy (i.e., the inability to correct problems while scanning barcodes in the stacks) can be costly.

The electronic inventory and shelf-reading program, "Library Stacks Management System" (LSMS),[13] developed at Booth Library, solves these problems by notifying operators of any discrepancies as discovered while they scan barcodes in the stacks. Operators take a laptop computer with an attached hand-held scanner to the stacks. The program is embedded in the MS-Access database, which uses two essential files: a shelf-list and an active-status list. These files can be updated automatically or manually. As barcodes are scanned, the program notifies the operator if books are out of order, not in the system, or found with an active status such as "Charged" or "Renewed." The notification takes place in both sound and color (Fig. 1). Each transaction generates a line in a transaction log which includes a time stamp to the second, the barcode number, and the call number. In addition, it marks books out of order, books not in the shelf-list, or scanning errors (Table 1). It also logs books found with statuses in a separate log. After each session, the system generates a list of "Books not on the shelf." After an entire section is scanned, the distance of mis-shelved books from their proper position and the amount of time between each scan are generated.

Using the LSMS, Booth Library's current inventory project started in November 2004. The project began as an electronic shelf-reading, with only five to 10 h of staff time used per week. When it was learned that the system could do much more than just the shelf-reading, the inventory aspect was added, and nearly 40 h/week were allocated to the project. By the end of 2006, the following LC classifications in the library's monograph collections were inventoried: D through H, N, P and Q. Approximately 300,000 books were scanned, two thirds of the entire monograph collections at Booth Library. Using the data obtained, scan speed for each scan was calculated along with the mis-shelving rate and the mis-shelved distance of each mis-shelved book. The statistical analyses were conducted using SPSS 15.0.

Findings

Time Spent

The amount of time spent is crucial in calculating the cost of inventory. The total number of scans (305,000+) was greater than the actual number of books scanned

Table 2
Estimated time for scanning a million books

Barcode Location	Investing 10 h/day	Investing 20 h/day	Investing 50 h/day
Inside	230 days	115 days	46 days
Outside	110 days	55 days	22 days

Table 3

Mean time spent for scanning a book and mean height of books in different sections (arranged by mean time)

Sections (# of BCs scanned)	Mean time for scanning a book		Mean height of books		Charge rate*	Browse rate**	Misplacement rate (%)**
	Mean (s)	SD	Mean (cm)	SD			
N (16,207)	11.01	15.77	26.87	3.67	.90	.94	8.40
G (16,490)	10.61	16.18	24.32	2.69	.67	.90	8.56
H (81,352)	9.14	12.97	24.31	2.40	.45	.54	6.10
P (82,162)	8.45	10.29	22.17	2.27	.87	.69	5.83
Q (53,873)	7.97	8.82	24.82	2.29	.38	.37	4.60
D (26,706)	7.72	9.73	23.20	2.24	.61	.73	6.02
E (18,646)	7.38	8.86	23.67	2.32	.58	.86	6.44
F (10,056)	6.97	9.52	23.70	2.48	.56	.71	6.35
Total (305,492)	**8.62**	**11.46**	**23.81**	**2.73**	**.64**	**.62**	**6.03**

ANOVA for mean time spent: $F=295.85$, $df=7$, $p<0.001$.
ANOVA for mean height of books: $F=10538.20$, $df=7$, $p<0.001$.
* Charge rate is calculated by total charges from 2002 to 2006 divided by total number of books.
** In our Voyager ILS system, when a discharge transaction is performed against an item that is not charged, a counter called "Historical Browses" is incremented. Typically, an operator processes items picked up within the library as discharges, thus collecting "browse" statistics, which helps to indicate in-library use of materials. Browse rate is calculated by total browses from 2002 to 2007 summer divided by total number of books.

due to some duplicate scans. Time elapsed between scans based on the time stamp logged during the process was calculated (Table 1). The total time spent was close to 707 h. Over 80% of barcodes were scanned within 1 to 10 s, with the mode being 5 s. Another 18% of barcodes were scanned in less than 1 min. Finally, less than 1% of barcodes were scanned more than one minute apart (Graph 1). It may take additional time to evaluate the situation when there are problems. On average, it required 8.35 s (SD = 8.89) between scans with our barcodes located inside the books. This was double the time spent in a traditional shelf-reading, reported in Dawn Anderson's study, which included the vacuuming process as well.[14] The mean time based on Anderson's study was 4.16 s. With the current speed when barcodes are located inside the books, it will take about 230 days to scan a million books when investing 10 h/day. This figure should drop significantly if barcodes are attached on the covers of books.

Based on inventorying Booth Library's CD and DVD collections ($N=11{,}000+$) where staff can scan barcodes without removing CDs from shelves, 63% of them were scanned within 1 or 2 s, on average 3.94 s (SD = 5.59). Table 2 shows the comparison between the estimated time for scanning a million books with barcodes located inside the books and the estimated time for scanning the same amount of books with barcodes located on the outside.

Table 3 shows the mean time spent in scanning a barcode for each section. The longest average time spent for scanning a barcode was in the N (art) section ($M=11.01$, SD = 15.77) followed by G, H, P, Q, D, E, and F. The mean differences were statistically significant ($F=295.85$, $df=7$, $p<0.001$).

Speed of process will be affected by a combination of regularities of book sizes and/or shapes, regularities of call numbers, and the disturbances in the stacks which is affected by use. Books in class N (art) are the largest and most irregular in size ($M=26.87$ cm, SD = 3.67 cm). The mean height was 2 to 4.7 cm greater than the mean heights of other sections (Table 3). In addition, books in this section were circulated and browsed the most. As expected, it took the longest time on average for scanning a barcode in the art section. On the contrary, the shortest average time for scanning a barcode was in the E and F sections. Call numbers in classes E and F begin with a single letter, while other classes often have two initial class letters. Thus, the comparisons of call numbers in these sections were

Table 4

Books found with active status and their subsequent use (as of July 2008)

Status found	Number of books found with status	Number of books used after found (percentage)	Number of charges made (average)
Charged, overdue, renewed	15	10 (67%)	20 (2.0)
In transit	24	18 (75%)	39 (2.2)
Miscellaneous*	24	9 (38%)	10 (1.1)
Missing	228**	115 (50%)	282 (2.5)
TOTAL	**291**	**152 (52%)**	**351 (2.3)**

* At Bindery, Call Slip, Cataloging Review, Damaged, Mending.
** Originally there were 706 missing books in the sections scanned.

Table 5

Where were "Missing" books?

Where 'Missing' books found	# of 'Missing' books found
Where they should be	68 (30%)
1–25 books away	22 (10%)
25–100 books away	21 (9%)
101–1000 books away	30 (13%)
More than 1000 books away	87 (38%)
TOTAL	**228**

much simpler than in other sections, which may have affected the speed of the process.

Interestingly, class Q had the lowest usage in both charges and browses, but it was not ranked as the shortest in time spent per scan. The size of the books may have played a role in spending more time to scan barcodes in this section than books in D, E, or F which had more usages. It would be useful if operators with more skill and experience were assigned to scan or re-shelve books in those areas with more usages and irregularities in shape or size.

Books Found with Active Statuses Attached

In total, 291 books were found with an active status such as "Charged" or "Missing." Table 4 shows the breakdown of statuses with which books were found.

Books with "Charged," "Overdue," or "Renewed" Status

If books are shelved with statuses involving patron responsibility for the item, this situation will eventually affect patrons financially and the library's reputation negatively unless the situation is discovered and resolved. Even though libraries try their best to discharge all books returned, some charged books find their way to the shelves. In this study only 15 books were found with such statuses: four "Charged," seven "Overdue," and four "Renewed."

Among these fifteen books, ten books were found in their proper position, and three books were found 3, 10, and 33 books away. The last two books with "Renewed" status were found more than 1000 books away, well beyond where normal search efforts would find them. These findings imply that when patrons contact libraries to resolve problems like these, in most cases libraries would find books on the shelf. Some books may still disappear in our collections and never be discovered through traditional shelf searching alone.

Considering the fact that approximately 150,000 circulation transactions are made during each year, finding fifteen un-discharged items for a span of four years does not seem to be a significant number. In other words, one out of 40,000 returned books will be shelved without being discharged. It may also indirectly indicate that Booth Library's "Lost Books Billing Procedure" is working well. Before billing, all books in that category are thoroughly searched. If they are found, they are discharged without any charges to the patron.

Books with "Missing" Status

The "Missing" status is given when library staff cannot locate books after a careful search. At the beginning of the project there were 706 books with "Missing" status in the sections scanned. Over 30%, or 228 books, were found during the inventory process. We analyzed how far the found books were from their proper position (Table 5) and discovered that 30% were scanned in their proper position. Another 10% were found 1 to 25 books away, and the next 9% were found 26 to 100 books away. Half of the found "Missing" books were located beyond 100 books from their proper position. Interestingly, more than 40% of the "Missing" books were found within ten books of their proper position. Thus, Wayne Petersen's study,[15] which checked missing status for books only "badly" shelved, may have overlooked where the significant numbers of "Missing" books could be found.

"At the beginning of the project there were 706 books with "Missing" status in the sections scanned. Over 30%, or 228 books, were found during the inventory process."

If a book with active status is found in the stacks, it is very likely that it will be reused. Of the 291 books found with active statuses, 52% were reused on an average of 2.3 times after they were found as of July 2008 (Table 4). This figure will grow as time passes. In contrast, among all the scanned books, 17% were used during the same period with average charges of 1.6. This indicates that the books most likely to be placed mistakenly on the shelf are the books that are most commonly sought out by users.

Figure 2
The relationship between shelf-list, list of books scanned, list of books with active status, and list of books not on shelf.

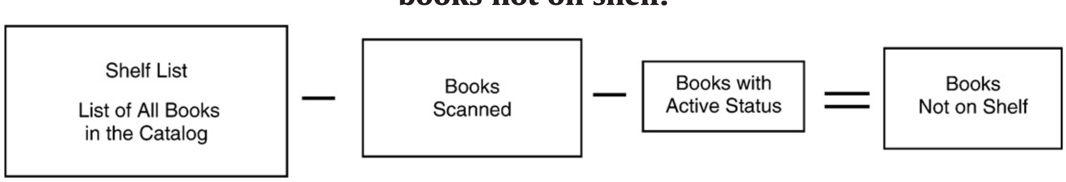


Table 6

Books not on shelf

Section	Books identified as "Not on Shelf" initially	Books not on shelf after searches
D (26,328)	621 (2.4%)	85 (0.3%)
E (18,312)	165 (0.9%)	55 (0.3%)
F (9929)	91 (0.9%)	14 (0.1%)
G (15,295)	99 (0.6%)	16 (0.1%)
H (79,461)	904 (1.1%)	107 (0.1%)
N (15,866)	337 (2.1%)	0 (0%)
P (79,900)	978 (1.2%)	158 (0.2%)
Q (53,171)	673 (1.3%)	81 (0.2%)
TOTAL	**3862** (1.3%)	**516 (0.17%)**

Books Not on Shelf

One of the purposes of performing inventory is to identify books that are not on the shelf when they should be. Theoretically, all books with "Not Charged" status should be on the shelf. Conversely, all books with active status such as "Charged" should not be on the shelf. After each session, the program generates a list of "Books not on shelf" for the area scanned during the session. Books appear on this list because they are not scanned at the expected position due to being mis-shelved but may be scanned later. Therefore, we wait until an entire section has been scanned before generating a list of "Books not on shelf." A query is then run to eliminate books scanned and books with active statuses from the books identified as "not on shelf" (Fig. 2). Other possible reasons for why books are included on the list are: (a) some books may have been missed in the scanning process mistakenly, (b) there are duplicate records in the catalog, and (c) books in use in the building without being checked out may be missed in scanning but will soon be returned to the shelves. The books on this list are searched three times before changing their status to "Missing."

Less than 1.3%, or close to 3870 books, were initially identified as "Books not on shelf." After three thorough searches over a period of 6 months, 516 books still were not found; this was less than 0.17% of the entire section scanned. "Missing" status was given to these books. If they do not surface after 3 years from the time the "Missing" status was given, they will be withdrawn from the catalog. Table 6 shows the number of "Books not on shelf" in different sections.

Label Discrepancies

Discrepancies between call numbers as they appear on book spines and in the catalog are not desired, but are expected to a certain degree. The total number of recorded label discrepancies was 565 incidents. Among them, the discrepancies shown on 40% of the labels were so minor that the resulting misplacement of books was ten or fewer books away from the proper position. The next 10% were misplaced between 10 and 100 books from the proper position, followed by 35% that were misplaced by more than 100 books. The remaining 15% failed to indicate correct locations leading to the books being shelved in wrong collections (Table 7).

The label error rate is probably related to the method of label production. Prior to 1978, all call number labels at Booth Library were produced manually, resulting in a certain number of undetected typographical errors. With the arrival of OCLC in 1978, call numbers were produced directly from the OCLC record, eliminating manual transcription errors. However, workflow and automation changes in the 1990s made this form of label production impractical, and we returned once again to manual creation of call number labels. This continued until 2004, when we were finally able to print call number labels directly from our integrated library system. The current method of label production is still not absolutely error proof, since we produce labels in batches and workers sometimes (but rarely) apply a label to the wrong book. The next round of inventory may verify the effectiveness of the new labeling program. However, the current label discrepancy rate, less than 0.2%, is so low that it would be a challenge to improve upon it.

Mis-shelving Rate and Mis-shelved Distance

Of the 300,000 books scanned, 6.1% were found mis-shelved, almost double the rate that Petersen reported as a mis-shelving rate (3.2%) in his health library at the University of Texas Health Science Center, San Antonio.[16] Beyond the overall mis-shelving rate, the extent of misplacement was further investigated by calculating the distance of mis-shelved books from their proper position in terms of number of books in between. Over 40% were found just one or two books away. If these minimally mis-shelved books were removed, the mis-shelving rate drops to 3.5%. Overall, at Booth Library, 82% of mis-shelved books can be found within 1 to 25 books from their proper position. The next 8% were found between 26 and 100 books away, and the remaining 10%, or over 1,800 books, were found beyond 100 books away (Graph 2).

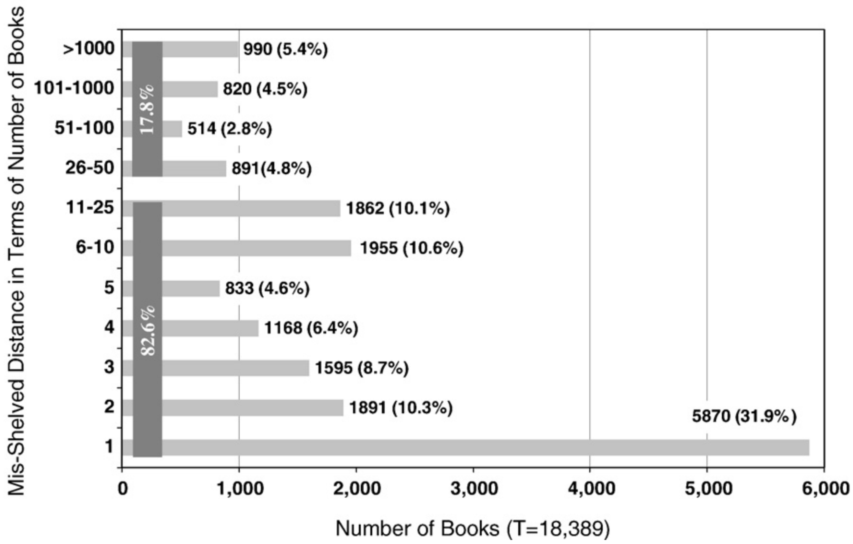
Anderson defined major mis-shelving errors as books out of place beyond the shelves before or

Table 7

Misplacement due to label discrepancies

Misplacement due to label discrepancies	Number of books
No misplacement	142 (25%)
Up to 10 books away	80 (14%)
Between 10 to 100 books away	57 (10%)
More than 100 books away	198 (35%)
Incorrect indication of location	88 (16%)
TOTAL	**565**

Graph 2
Distribution of mis-shelved books.



after the correct shelf.[17] Based on this description, the current study defines badly mis-shelved books as books mis-shelved by more than 25 books either way.[18] We assumed Anderson's ratio of major mis-shelved books was 0.36% (10,863 out of 3 million books).[19] The current study found over 3200 books misplaced more than 25 books from the proper position, which was 1.1% of 300,000 books scanned. The greatest difference between Anderson's stacks and Booth Library's stacks is that Booth Library is open to the public, whereas the central stacks at the University of Illinois, Urbana-Champaign, is open only to staff, faculty and graduate students. This may explain why Booth Library finds a larger percentage of badly mis-shelved books.

Books Mis-shelved More Than 100 Books

Roughly 10% of all mis-shelved books, or 1810 books, were found more than 100 books away from where they should have been. All of them were searched to see if they were re-shelved in their proper places. Most of them were except for a little over 10%, or 198 books. Among them, 178 items were found where they were initially scanned, and 20 items were not recovered. It appears that, in the process of re-shelving, they must have been re-shelved incorrectly again. Among the books found where they were initially scanned, 41 books had wrong call number labels. This clearly indicates that the problems were not handled properly at the time of the initial scanning. Sometimes it is difficult for operators to

Table 8

Subsequent use of found mis-shelved books (as of January, 2008)

Mis-shelved distance	Number of books in the category (a)	Number of books used after replaced (b)	Percentage of books used (b)/(a)	Total charges (c)	Charge rate (c)/(b)
1	5,870	1,309	22%	2,132	1.6
2	1,891	505	27%	844	1.7
3	1,595	470	29%	841	1.8
4	1,168	334	29%	591	1.8
5	833	253	30%	434	1.7
6–10	1,955	629	32%	1117	1.8
11–25	1,862	608	33%	1081	1.8
26–50	891	300	34%	517	1.7
51–100	514	159	31%	360	2.3
>100	1,810	686	38%	1,526	2.2
Total	**18,389**	**5253**	**29%**	**9443**	**1.8**

correctly identify problems such as label discrepancies at the time of scanning. Based on the uncovered problems, further training was provided to staff members more frequently.

Reuse of Mis-shelved Books

Past use of books tends to predict future use. Regardless of who mis-shelved the books, it is obvious that the books were mis-shelved because they were used. The only exception for this would be new books that may have been mis-shelved at their initial shelving. A good way to evaluate the inventory project is to see if the books found were subsequently reused (Table 8). Close to 30% or over 5200 mis-shelved books were circulated since they were found, with a total charge count of 9443 as of July, 2008. Most importantly, more than 36% of books mis-shelved beyond 25 books from their proper position were reused, which is much greater than the overall circulation rate of 17% for our entire scanned books during the same period.

Cost-Benefit Analysis

Cost for Replacing Books Badly Mis-shelved

More books are shelved correctly than not. However, books mis-shelved beyond a searchable range are essentially lost. It was demonstrated that those mis-shelved books, once found, were used more often than the library collections in general. Thus shelving can be viewed as an aspect of collection management. Quantifying the cost of providing books in the stacks beyond the cost of the books themselves will be useful to understand the benefit of inventory. The labor cost would be substantial, especially when each and every book is selected by individual bibliographers, as in Booth Library. However, it is not an easy task to measure the exact amount of time each individual bibliographer spends in selecting books. Thus, we looked at the collective hours assigned to bibliographers and staff members for this activity.

- Selection = $189,000[20]
- Acquisition = $71,000 (salary of two staff personnel who process monographs)
- Cataloging = $180,000 (60% of total salary distributed to the cataloging department)

In sum, $440,000 was spent in labor for acquiring 15,000 monographs during the fiscal year 2008 at Booth Library. Thirty dollars were spent to add a book to the library in terms of labor. If we add other costs such as circulation, maintenance of the ILS, and the purchase price of the books, the cost would be much greater than thirty dollars.

At the time of analysis, approximately 1.1% or over 3,200 among 300,000 books scanned were mis-shelved beyond 25 books away, which we defined as badly mis-shelved books. If the entire monograph collection is considered, this figure would be over 5300 books. If we need to add the 5300 books into our collections the cost will be at least $159,000 (5300 × $30 = $159,000) in labor alone.

If not purchased, these books will be borrowed via interlibrary loan services when requested by patrons. It is even more difficult to calculate cost involved in borrowing a book than purchasing a book because of the involvement of not only the borrowing library but also the lending library. Cost involved in borrowing a book may not be any cheaper than purchasing it based on Ted Naylor's study conducted in his medium-sized academic library. He concluded that it would cost close to thirty dollars for each interlibrary loan transaction in his library back in 1997.[21]

We also look at this in terms of the patron's point of view. Patrons expect that any books shown as available in the online catalog are in the stacks where they should be. If they cannot find them in the stacks, their lost time is a considerable waste. A typical situation when patrons fail to locate books in the stacks is described below:

- Online catalog search for books — 10 min.
- Trying to locate books in the stacks — 10 min.
- Going to a service desk for help — 10 min.

In this scenario, a conservative estimate of at least 30 min is easily wasted. Beyond the waste of time, the frustration can be significant, especially for patrons with an immediate need for the item or those who have traveled a long distance to the library.

Cost of Inventorying

The cost of inventorying was calculated in terms of labor associated with scanning the books. If the average scanning speed per book was 8 s and we applied 10 dollars an hour for labor it was calculated into 2.2 cents per book. The cost for scanning our entire half-million monograph collection equaled 11,000 dollars. Compared with the cost of replacement, estimated above at $159,000, we concluded that the benefit of inventorying and shelf-reading far outweighed the cost.

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After the results of the statistical analysis of the project were shared in the library, we decided to embrace the electronic shelf-reading as a regular daily procedure. More than 40 h/week are assigned to our nine regular staff members and some well-trained student assistants in the circulation department. In short, one full time equivalent job is created without any extra hire. Currently, the second round of the electric shelf-reading of monograph collections is being performed at Booth Library. We have come to understand a great deal about shelving patterns in the stacks since shelf-reading was first done.

Conclusion

David Lewis claimed that we were "at the end of the age of print."[22] It may be true. However, it would be difficult to know where we are situated in the process and to estimate how long the digital age will overlap with the age of print. The behavior of our future generation will be the deciding factor. As long as we serve our patrons with print materials, we need to maintain the stacks in good condition.

Through their catalogs, libraries strive to tell the truth about the materials they make available to their users. However, due to labeling errors, misplacement, and loss of materials, our users are sometimes not served as well as they should be by the information we provide them regarding our holdings. Inventory control is a process for restoring accuracy between what we declare to be available and what a user can actually find on our shelves, and perhaps it is a tool for learning something useful about the dynamics of library usage and staff workflows at the same time. Inventory control is a dull but nonetheless necessary endeavor for libraries to face. The paper proves that highly used books are those most likely to be mis-shelved, and that those mis-shelved books, if found, will most likely be re-used. It also demonstrates that the recovery of mis-shelved items through inventory control is less expensive than repurchasing or borrowing the same number of books. It is not because the cost of the actual book is expensive but because the labor is so dear. Shelf-reading is an almost continuous practice performed in most libraries. If this is coupled with a good inventory tool, substantial benefits can be achieved.

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16. Ibid., 221.
17. Anderson, "Method without Madness," 11.
18. The longest shelving unit at Booth library is 36 inches. If 75% of a shelf is occupied, 27 inches of shelf will be taken up by books. We conveniently assume that the average thickness of books is set at around 1 inch, which we converted into 25 books.
19. Anderson, "Method without Madness," 12.
20. Based on data compiled by the administration office, 110 hours per week, or 5,500 hours per year were assigned to fourteen bibliographers for thirty six subject areas. The salaries of these fourteen bibliographers ranged from $62,000 to $ 113,400 with average of $81,000. Assuming there are 250 working days in a year, on average, $43 an hour is paid to an individual librarian. Collectively, for FY 2008, $215,000 is allocated for bibliographic functions at Booth Library. Eighty percent of $215,000, or $189,000, is considered for collecting monographs.
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