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Shelving Special Collections Materials by Size[1]

Shelf space is a precious commodity in libraries, especially for special collections, which rarely deaccession materials. To deal with this problem, many librarians try to maximize efficiency in their shelving approaches. A common solution to space constraints is adjusting shelves to store materials by size categories. This approach is understudied, however, and projects to reorganize materials by size are often undertaken with little more than anecdotal evidence or intuition to support them. Using a reorganization of the oversize materials at Special Collections at the University of Missouri as a case study, this article lays out some concrete numbers for librarians who are considering shelving their books by size. The study indicates that subdividing oversize materials into upright and flat shelving can result in an increase in shelving efficiency of up to 600 percent for the materials that are stored upright. A systemic approach to shelving by size also offers some preservation benefits, especially for materials that are stored flat.

Shelving special collections materials by size is nothing new. Many libraries differentiate between oversize and regularly sized materials, though most will not go quite as far as Samuel Pepys, whose books were not merely organized by size but sometimes also given individual pedestals to make short volumes appear the same height as their neighbors.[2] As closed-stack collections expand but shelving spaces do not, libraries sometimes opt to reorganize their collections by size, albeit often with little more than anecdotal evidence, intuition, and/or willfulness to support the decision. Particularly for larger collections, creating and implementing a size-based shelving system requires a considerable investment of labor.

A reorganization of the oversize special collections book holdings at the University of Missouri at Columbia (MU) in 2019–20 provides some concrete data to help

1. The author acknowledges Kelli Hansen, Ruthann Mowry, and Richard Saunders for their assistance in preparing this article.

2. Jeremy M. Norman, "Samuel Pepys' Library: One of the Most Significant Private Libraries Preserved Intact from 17th Century England, in Its Original Bookcases," Jeremy Norman's HistoryofInformation.com: Exploring the History of Information and Media through Timelines, 12 July 2022, https://www.historyofinformation.com/detail.php?id=1693

institutions considering a similar move. We undertook the project of standardizing our collection's classification by size to solve specific problems arising from our space constraints (described below). Having completed the project, we found that shelving by size, particularly when considering whether an item should be shelved upright or flat, has two major benefits:

1. Upright shelving for books above 30 cm in height proved three to six times more efficient in terms of storage space than shelving the same books flat.
2. Once the reorganization had been completed, all oversize materials, whether shelved upright or flat, could be shelved less tightly, which made it easier to retrieve materials from the shelves.

Less direct benefits included opportunities to survey the oversize collection; to review and improve cataloging guidelines for greater clarity; and to upgrade some shelving while it was conveniently empty.

This article presents a case study of the Rare-XL collection at MU Special Collections and draws broader conclusions about the advantages of shelving by size and some of the conditions needed to implement such a system.

Shelving by Size

Shelving efficiency is a perennial concern for libraries. As early as 1887, Melvil Dewey argued that, where possible, shelves' spacing should be adjusted to fit the books stored on them if doing so made it possible to install additional shelves.[3] In 1934, Norman L. Kilpatrick and Henry B. Van Hoesen at Brown University published tables of the average book heights within their library's holdings. After measuring 350,000 books in their library, Kilpatrick and Van Hoesen concluded that 75 percent of books were 25 cm (9.8") or less in height.[4] From this, they concluded that the best cutoff for measurements determining oversize volumes would be 26 cm (10.2") and proposed three oversize categories, which would be shelved separately: 26–33 cm (10.2"–13.0"), 33–45 cm (13.0"–17.7"), and over 45 cm (17.7").[5] Overall, Kilpatrick and Van Hoesen's measurements and calculations were aimed at a standardization of library stacks rather than a specific subdivision of books by size: their first joint article included a tongue-in-cheek observation that "It seems too funny to be true that we have determined our book sizes without reference to shelving and the height of our stack ranges without reference to the heights of the books shelved there."[6] Kilpatrick and Van Hoesen concluded with a recommenda-

3. Melvil Dewey, "Distance between Shelves," *Library Notes* 2 (1887): 105–107.
4. Norman L. Kilpatrick and Henry B. Van Hoesen, "The Heights of Three Hundred and Fifty Thousand Volumes," *The Library Quarterly: Information, Community, Policy* 5, no. 3 (1935): 341–347.
5. Kilpatrick and Van Hoesen, "The Heights of Three Hundred And Fifty Thousand Volumes," 343, 346.
6. Henry B. Van Hoesen and Norman L. Kilpatrick, "Heights of Books in Relation to Height of Stack Tiers," *The Library Quarterly: Information, Community, Policy* 4, no. 2 (1934): 352–357.

tion that library shelves either be 2.18–2.24 m (86"–88") or 2.46–2.54 m (97"–100") tall, depending on whether seven or eight shelves were desired for 26 cm books.[7] Today, the National Information Standard Organization (NISO) recommends that the uprights on single-tier steel bracket library shelving be 2.13 m (84") or 2.28 m (90") tall, falling just between the recommended sizes suggested by Kilpatrick and Van Hoesen.[8]

In his 1960 survey of shelving options, Louis Kaplan used the Van Hoesen-Kilpatrick data mainly as part of a discussion of stack height and calculating capacity, not in terms of recommendations for size-related shelving.[9] Ralph Ellsworth noted in 1960 that "as the open shelf idea became popular in the 1930s, few libraries could make use of the Van Hoesen-Kilpatrick data because of the difficulty readers would have in locating books that would be shelved in two or three separate series of numbers."[10] A decade later, Manuel D. Lopez echoed Ellsworth's concerns, arguing that misshelving would be a consistent concern and that "sizing eliminates the value of shelf access" to patrons.[11] In the 1960s and 1970s, industrial engineers at Purdue University became interested in the problem. Ferdinand Leimkuhler and Julius Grady Cox tried to develop an algorithm for an optimal shelf height that would promote shelving efficiency.[12] Their work was continued by Surendra Mohan Gupta and Arunachalam Ravindran, who proposed designing a computer program that, if provided with a list of book heights, could calculate a list of optimal shelf heights that could then be implemented by library staff.[13] The Purdue librarian Michael Buckland cautioned, however, that the greater the number of partitions within a collection, the greater the cost of implementing any new system would be, and suggested a simplified approach.[14]

7. Kilpatrick and Van Hoesen, "The Heights of Three Hundred and Fifty Thousand Volumes," 341–2. As these recommendations indicate, Kilpatrick and Van Hoesen provided measurements for books in both metric and Imperial measurements, though their measurements for shelving are offered exclusively in Imperial measurements. In cataloging, RDA best practices for the 300 field in MARC use the metric system, and most American institutions today use metric measurements, though shelves are still commonly described in imperial measurements using linear or cubic feet or inches.

8. National Information Standards Organization, *ANSI/NISO Z39.73-1994 (R2012): Single-Tier Steel Bracket Library Shelving* (Baltimore: National Information Standards Organization, 2012), 6.

9. Louis Kaplan, *Shelving*, The State of the Library Art, Volume 3, Part 2 (New Brunswick, N.J.: Graduate School of Library Service, Rutgers, the State University, 1960), 7–8.

10. Ralph E. Ellsworth, *Buildings*, The State of the Library Art, Volume 3, Part 1 (New Brunswick, N.J.: Graduate School of Library Service, Rutgers, the State University, 1960), 59.

11. Manuel D. Lopez, "Compact Book Storage: Solutions Utilizing Conventional Means." *Library Trends* 19, no. 3 (1971): 352–361.

12. See Ferdinand F. Leimkuhler and J. Grady Cox, "Compact Book Storage in Libraries," *Operations Research* 12, no. 3 (1964): 419–27; Julius Grady Cox, "Optimal Storage of Library Material," PhD diss. (Purdue University, 1964).

13. Surendra Mohan Gupta and Arunachalam Ravindran, "Optimal Storage of Books by Size: An Operations Research Approach," *Journal of the American Society of Information Science* 25, no. 6 (1974): 354–357.

14. Michael K. Buckland, "Notes on the Gupta-Ravindran Optimal Storage Model," *Journal of the American Society for Information Science* 26, no. 6 (1975): 351–352.

As Buckland's observation indicates, the discussion outlined above took place with an eye towards the cost of shelving in terms of budget rather than space efficiency. Kaplan is most explicit in this regard, citing the specific cost of different authors' books per shelf or per volume.[15] When Van Hoesen and Kilpatrick measured books in terms of size to determine standardized shelving, Robert W. Henderson critiqued them for not measuring the width of books as well as their height.[16] Henderson would go on to propose a unit of measurement called the "cubook" (likely a portmanteau term of *cube* and *book* and play-on-words reference to *cubic*) to define the volume of space needed for a typical book.[17] While the cubook did not take root in the profession, it highlights that the discussion of shelving solutions, especially by engineers, emphasizes the design (and implicitly the construction) of new shelving spaces rather than the rearrangement of extant shelving.

The conversation about shelving by size changed tracks with the rise in the numbers of off-site repositories. Off-site repositories typically required high-density storage beyond mere compact shelving. The Harvard Depository, which was built in 1984 and shelved all materials by size, proved both successful and influential.[18] Without needing to facilitate patron access or topical browsing, the question moved away from *whether* books should be shelved according to size and *toward* the logistical matter of how this might best be accomplished. Due to the advent of high-density repositories, the discussion of shelving by size in on-site shelving effectively ended in the 1980s. Books became merely volumetric objects, and their storage merely a question of the most efficient use of space, which provided a new line of professional discussion. Erik T. Mitchell, writing as recently as 2017, evaluates two different storage models: the "Harvard model" based on the Harvard Depository and the "California model" based on the University of California's two Regional Library Facilities. Both models shelve by size: the difference between them is whether books are grouped into single-row storage trays (Harvard) or shelved two books deep in regular fashion (California).[19]

The emphasis in the literature on off-site repository shelving rather than on-site shelving within closed stacks has left a gap in the scholarly record. Further, because

15. Kaplan, *Shelving*, 12, 28.
16. Robert W. Henderson, "Tiers, Books and Stacks." *The Library Journal* 59 (1934): 382–383.
17. Robert W. Henderson, "The Cubook: A Suggested Unit for Bookstack Measurement," *The Library Journal* 59 (1934): 865–868.
18. Ron Lane and Reese Dill, "What to Build," in *Library Off-Site Shelving: Guide for High-Density Facilities* (Englewood, CO: Libraries Unlimited, Inc., 2001), 73–87. For more on the impact of the Harvard Depository, see David Weeks and Ron Chepesiuk, "The Harvard Model and the Rise of Shared Storage Facilities," *Resource Sharing & Information Networks* 16, no. 2 (2002): 159–68, also published in *Cooperative Efforts of Libraries*, eds. William Miller and Rita M. Pellen (New York: The Haworth Press, 2002), 159–68.
19. Erik T. Mitchell, "Optimizing Storage in High Density Shelving," *Technical Services Quarterly* 34, no. 1 (2017): 54–67. For more on the comparison described in Mitchell's article, see [also Erik T. Mitchell and Jeffery L. Loo, "Optimizing Storage in High-Density Shelving: Studying Item Sizing in Theoretical Shelving Configurations," *Technical Services Quarterly* 34, no. 2 (2017): 174–86.

TABLE 1
Types of Institutions

Type of institution	Respondents identifying as such	Number of size classes reported	Most common number of sizes
Archive	6	3, 5, 6	5 (three times)
Book supply institution	1	4	4 (once)
College	9	3, 4, 5, 7	4 (four times)
Law School	1	3	3 (once)
Library	17	2, 3, 4, 5, 8, 9, undefined	5 (six times)
Museum	2	4, 5	4 and 5 (once each)
Seminary	2	4, 9	4 and 9 (once each)
University	7	2, 3, 4, 5, 6	2 and 3 (twice each)
None given	7	2, 3, 4, 6	3 (three times)

much of the extant scholarship approaches shelving from an engineering perspective rather than from one informed by practical librarianship, it is difficult to gauge how special collections libraries are solving the problem. To help fill that gap and gain a contemporary picture of on-site shelving, I distributed an anonymous survey invitation via ExLibris. ExLibris is an email listserv heavily used by book historians, booksellers, and librarians. Subscribing to the listserv is free, which broadens its reach. I chose ExLibris because it combines a large and active membership with a focus on rare books.[20] The questions asked in the survey are included in appendix 1. Thirty-eight libraries, mostly in the United States, responded in the affirmative that they shelved materials based on size. Table 1 shows their responses as well as the sizes that each type of institution reported using.

While the number of responses is not large enough to be comprehensive (n = 38), the responses do suggest that shelving closed-stack material by size is not an outlier. Nineteen of the thirty-eight respondents identified themselves as being associated with higher education, whether as a college, university, seminary, or law school. Of the seventeen "libraries," eight identified purely as a "library" with no other institution associated with them.

Most institutions subdivided their collections into at least three size classes, with four being the most common number of sizes. Table 2 lists the number of size classes and how many institutions implemented them. Seven of the respondents noted that their collection was subdivided into named collections and/or themed

20. ExLibris. "exlibris-l – Rare book and manuscripts." 22 July 2022. https://list.indiana.edu/sympa/info/exlibris-l

TABLE 2
Number of Sizes

Number of Sizes	Institutions	Percentage
2	6	15.8%
3	7	18.4%
4	11	28.9%
5	7	18.4%
6	3	7.9%
7	1	2.6%
8	1	2.6%
9	1	2.6%
Undefined	1	2.6%

collections, which were each shelved separately and further subdivided by size, sometimes resulting in dozens of categories. A few institutions additionally retained old remnants of previous classification systems. One institution had implemented a five-size system but also kept legacy monographs that had previously been cataloged using the Dewey Decimal System as "octavo," "quarto," "standing folio," and "flat folio" and had not been reclassed. Another had previously had four size classes (regular, quarto, folio, and small) and although they had eliminated the quarto and small size classes, books that had originally been cataloged in those classes were not reclassed and reshelved. As a rule, only the very largest books were typically shelved flat, though for more heavily subdivided collections, sometimes the largest two categories were shelved flat.

Bibliographic terms are often (mis)applied as ways to describe oversize materials: fourteen of the responding institutions used "Folio" (or some variation thereof) to designate oversize materials, and eight of those also used "Quarto" and "Octavo" as size-related descriptors. One respondent specifically mentioned their frustration with the bibliographic error of using these formats as measurement. When asked in the final question of the survey if they had anything to add, they wrote:

> Only that I dislike our use of Quarto and Folio as designators of size since they are only really relevant descriptors of handpress era books. We have books shelved and designated as Quartos (due to size) that are actually Folios by format and I fear that can create confusion for people who are familiar with the bibliographic meanings of those terms.

Using "Octavo" as a shorthand for "regular-sized," and "Quarto" and/or "Folio" to refer to oversize materials seems to have been common practice since at least the 1930s: Van Hoesen and Kilpatrick write about "the dimensions distinguishing

octavos, or ordinary size books from oversize books (quartos and folios)," and Henderson uses the octavo as the basis for his *cubook* unit.[21] Both Ellsworth and Kaplan continued using *folio* and *quarto* as size terms in the 1960s without defining them.[22] According to the survey results, some librarians are renaming quarto and/or folio size classes, while others grit their teeth against the bibliographic inaccuracy and work around legacy naming conventions.

Just as the number of size classes recognized by a given library varied, the exact bounds of each category varied. The typical size for a "regular" or "standard" book tended to be between 27 and 29 cm (10.6" and 11.4"), and oversize book categories began above 29 cm (11.4"). This suggests that special collections shelving tends to assume that the typical book will be slightly larger than Kilpatrick and Van Hoesen reported, though it is unclear whether this arises out of empirical observations or simply from past librarians hedging their bets in terms of shelving. A conventional setting for shelves appears to be 33 cm (13.0") from the bottom of one shelf to the top of the next shelf, leaving a 31 cm (12.2") opening for the books.

Two separate respondents noted that size classes at their institution seemed to have been based on the height of the shelves at a specific point in the past. One of these two respondents added that "We had to re-class many items when we moved into a new building a few years ago." This observation highlights a potential risk of shelving by size, namely that it can be based on physical constraints rather than systematic principles, and therefore becomes problematic in a new physical context. A third respondent's memory of a shift at their institution offers another perspective on this issue:

> There had also been a lot of shelving adjusted to accommodate an oversize item here and there; maintaining these "adjustments" as [the] collection grew or changed, had become a royal pain. To create a little space, we removed items as necessary to reset shelving to absolute uniformity. As I recall we had to do this in stages, first working out regular sequence, moving stuff to folio, then moving large folios to their own sequence. This liberated something on the order of 750 linear feet and proved (1) far easier to maintain and (2) left the collection much better housed in preservation terms."

Here, ad hoc improvisations to shelving became the source of the trouble as the collection grew. Standardization led to a more efficient use of the space as well as a collection that could more flexibly grow.

21. Van Hoesen and Kilpatrick, "Heights of Books in Relation to Height of Stack Tiers," 353; Henderson, "The Cubook," 866–67.
22. Ellsworth, *Library Buildings*, 65; Kaplan, *Shelving*, 6–7.

These respondents' comments suggest that shelving size classes are revisited mainly during a relocation or during a shelving crisis. A fourth respondent noted, "We used to have more categories of sizes, but some were eliminated, because we were running out of shelf space in those sections." Their institution stopped classifying new items under these size classes in favor of integrating them within a simpler category system of just two size classes, but retained old records and their old shelving. This tendency to leave shelving systems in place makes practical sense, since large collections of materials—particularly oversize materials—are difficult to reorganize without a considerable time investment. At the same time, however, not bringing the entire collection into line with the new system makes storage solutions more complicated. I suggest that, if possible, special collections libraries that are relocating or renovating their stacks should take the opportunity to revisit their classification systems.

What does this mean for shelving in on-site closed stacks? A recurring theme throughout the last century is that shelving by size is mainly feasible in high-density storage, and that materials will be shelved upright. By keeping size-based shelving out of publicly accessible areas, libraries avoid patron confusion and minimize the risk of misshelving. Shelving by size introduces a second form of classification into the mix: it requires that a book be classified based on its dimensions in addition to—or instead of—its contents. On some level, this classification system requires the cataloger to literally judge a book by its cover. Classification by size competes with classification by topic, which in turn is designed as a browsing aid. Within high-density repositories, classification by size typically supplants classification by topic entirely as books are shelved exclusively by size and date of acquisition. This maximizes efficient space utilization though it also makes the system vulnerable to a catastrophic system failure if the shelf list is lost or if library staff is poorly trained. Within closed stacks, classifying and shelving materials by topic typically remains the norm, making it easier for librarians to quickly gather books on a given subject. While this facilitates paging materials, ease of use is gained at the cost of efficiency in shelf-volume density.

The going assumption also tends to be that all books will be shelved upright. Only Henderson mentions the prospect of shelving large materials flat, which he does with the assumption that "folios" make up 2 percent of a typical collection.[23] Concrete numbers for shelving efficiency based on size are mainly available in studies focused on high-density shelving, where the absence of browsing and the influence of the Harvard Depository have rendered size the main determining factor of where a book will be stored. As a result of these two assumptions — that

23. Henderson, "The Cubook," 867.

TABLE 3 Old and New Shelving Designations at MU Special Collections	
Old Designation	New Designation
Rare	Rare
Rare Folio	Rare-L Rare-XL
Rare XFolio	Rare-XXL

shelving by size is a feature of high-density depositories, and that all materials will be shelved upright — there is a gap in the literature comparing the volumetric costs gained or lost between shelving materials flat and shelving materials upright. For collections that are kept in stacks on-site rather than being stored off-site at a high-density depository, this kind of information is crucial for maximizing storage density.

The Rare-XL Project

In line with the literature and practical advice from the survey responses, MU Special Collections staff decided to subdivide our main oversize category (called Rare Folio) in a more nuanced way. The goal was to separate out those parts of Rare Folio that were too tall to fit on the regular shelves, but not so large that there would be structural concerns in storing them upright. By subdividing Rare Folio into materials that needed to be stored flat and materials that could be stored upright, we hoped to make more efficient use of the department's available space and to consolidate the oversize collections within a single room. To make materials easier to locate, MU Special Collections also renamed the size categories. Taking conventional American shirt sizes as a model, the new categories would be called Rare, Rare-L, Rare-XL, and Rare-XXL (table 3). With Rare acting as the "Medium" designation, a Rare-S category was later created for items under 15 cm in height.

Renaming the size designations serves three purposes: first, it makes the relationships between the size designations clearer, which in turn makes it easier to train the staff who do much of the paging and reshelving of materials. Second, it allows staff to better anticipate the size and relative location of materials they are paging, letting them know quickly whether they will require a cart to retrieve a given book (as is often the case with Rare-XL) or whether it is likely portable without a cart. Third, it eliminates the descriptive inaccuracy of using *folio* and *quarto* to refer to large books, which had long been a point of irritation.

As these new size designations were created, MU Special Collections staff additionally articulated clear parameters for each of these size designations. The new size parameters (presented in table 4) were based on a preservation course prepared by

TABLE 4
Shelving Designations by Size at MU Special Collections

Designation	Height	Width	Length	Shelving
Rare-S	up to 15 cm	below 8 cm	below 15 cm	Upright
Rare	up to 28 cm	below 8 cm	23 cm and below	Upright
Rare-L	above 28 cm and below 40 cm	below 8 cm	33 cm and below	Upright
Rare-XL	40 cm or above and below 62 cm	8 cm and above	33 cm and below	Flat
Rare-XXL	above 62 cm	8 cm and above	33 cm and below	Flat

the Northeast Document Conservation Center (NEDCC) with modifications to take into account the dimensions of available shelving. To allow for more precise measurements and to follow extant catalog records, measurements were done in metric rather than Imperial. These new size designations were then shared with cataloging staff so that future acquisitions, already measured as part of creating a catalog record, could be grouped with other books of the same size. Our catalogers have expressed their appreciation for the documentation of the project, since they no longer have to guess which size class to assign to each item.

At the time of the Rare-XL project, MU Special Collections had three full-time librarians on staff. One of these librarians set aside ten hours a week to go through the Rare Folio materials and individually identified those that needed to remain in Rare-XL and those that should be transferred to Rare-L or (very rarely) Rare. The COVID-19 pandemic both delayed and accelerated the project. When the pandemic began in early 2020, MU Special Collections transitioned to working remotely and the project was placed on hold, but when librarians began to work on campus (albeit in staggered shifts), the reading room remained closed to patrons. As a result, the librarian assigned to the project spent much of their on-site time working on transferring and reshelving materials. The changes in the amount of time when the librarian had access to the collection and could work on the project make it difficult to gauge the total amount of time needed, though we estimate it at between 80 and 100 hours for 4,620 items.

A major limiting factor in terms of implementing any reorganization project in a library is the need for overflow shelving to accommodate materials while they are being rearranged. Empty shelves are necessary to start any project, even if there is a net gain in shelf space by the end. Other, unrelated shifting projects within MU Special Collections had freed up 200 linear feet of shelving. Some of this shelving was adjusted to accommodate the larger Rare-L materials. Previously unincorporated oversize materials were integrated in their proper places on the Rare-XL

TABLE 5
Items Stored per Linear Foot at MU Special Collections

Designation	Items	Shelving in use (in linear feet)	Items per linear foot
Rare Folio	4,620	1,841	2.51 (flat)
Rare-L	3,440	393	8.75 (upright)
Rare-XL	1,660	1,171	1.42 (flat)

shelves, freeing up carts and shelving. The oversize comic collection (previously designated as "Comic Folio") was also merged into Rare-XL and Rare-L as part of a larger decision to consolidate the comic collection with the book collection. Rare-XXL was left largely untouched during the project due to the unusual size of the Rare-XXL items: most items in this classification require two people to move them.

At the end of the project in fall 2020, all of Rare-XL had been consolidated from three noncontiguous rooms to just one room, simplifying retrieval, since no shelving guide has to be consulted to identify the room where an item is shelved. Table 5 compares the number of items and shelving within Rare Folio (before the project began) with the items and shelving for Rare-L and Rare-XL. As the table indicates, the project resulted in a net gain of 277 linear feet (15 percent of the space used originally) due to the greater efficiency of shelving books upright. At the same time, the Rare-XL materials can be shelved less tightly than they had been in Rare Folio. Despite being consolidated into fewer shelves than Rare Folio occupied, Rare-XL seldom has more than two items in a stack and typically has only one on a given shelf. The looser shelving allows for easier and safer retrieval. The reshelving process resulted in freeing 188 linear feet of shelving within shelf space allotted to Rare-XL to accommodate future collection growth.

In addition to the shelving space gained, the project provided four indirect benefits. First, the librarian working on the project gained a broader exposure to the collection, as they handled nearly the entirety of the oversize materials held by MU Special Collections. Some items that had been in the collection for years without use received new attention and have since been used in departmental teaching. Second, manually going through the oversize collection doubled as an impromptu shelf-reading project. Several items that had been lost by being misshelved were found and reshelved properly. Third, the project provided an opportunity to give oversize materials a conservation assessment. Many items were given new enclosures before being reshelved. Finally, other stacks projects within Ellis Library had made some newer and more space-efficient shelving available. As the Rare-XL project moved forward, staff took the opportunity to replace some of the oversize shelving with this newer shelving. Replacing the old shelving units further improved the shelving conditions, adding 79 linear feet of available flat shelving that had not been available for Rare Folio.

Conclusions

Because special collections libraries continuously acquire new material and typically do not deaccession materials without replacing them, shelving efficiency is an important part of collections management. Oversize materials complicate the situation. There appear to be two major benefits to be gained from systematically reorganizing a closed-stack collection by size: the more efficient use of shelving space and less dense shelving for flat materials.

In terms of space usage, upright rather than flat shelving can represent an improvement of up to 600 percent. Because books have to fit on a single shelf in their entirety—it is impossible to shelve half an intact book on one shelf and half on another—shelving materials flat often results in lost space. Upright books have a smaller footprint and therefore there is less waste of space on any individual shelf. Just how much a specific collection will benefit by adopting this model depends on the number of oversize materials that can be safely shelved upright and the thickness of the materials. As a point of comparison, MU Special Collections discovered that only approximately 26 percent of the materials shelved as Rare Folio actually needed to be shelved flat for preservation purposes.

The space that is gained horizontally should be weighed against the space that is lost vertically. Taller books require more vertical height than regular-sized books. Allowing 1 cm for the shelf and 4 cm for easy retrieval, books that are 27–29 cm (10.6"–11.4") tall require shelves to be set at 32–34 cm (12.6"–13.4") intervals, whereas a 40-cm book (15.7") requires 45 cm (17.7") of space for its shelves. This means that shelves tall enough to accommodate all oversize books—assuming that a library follows the same height guidelines that MU Special Collections implemented—will be about 36 percent less vertically efficient. On the NISO-recommended shelving unit, which is 2.13-2.28 m tall, this means that five oversize shelves will take up the same space as seven regular-sized shelves. An institution with a sufficiently large collection of oversize materials might want to subdivide their upright oversize materials further to improve vertical efficiency. Ironically, for a smaller collection, the amount of labor involved might prove self-defeating since hours of work may only result in gaining one or two shelves.

Conversely, institutions with large collections of smaller books may want to consider setting shelves closer together to maximize vertical space usage. There is additionally a preservation-related benefit to doing so. In terms of upright shelving, books of similar sizes can better support one another on the shelves. Shelving a particularly short item between two taller items can cause the larger items to lean inwards, which presents a preservation concern for the larger items. Kilpatrick and Van Hoesen's assessment that the majority of books are below 25 cm (9.8") in

height[24] suggests that there can be additional space savings here. Shelves configured for books with a maximum height of 15 cm (5.9"), for instance, require only 18 cm (7.1") and can fit twelve shelves in the same amount of space as seven shelves set for regular-sized books.

Shelving by size also has implications for shelving density, especially in flat shelving. While shelving books too tightly is a concern regardless of whether books are shelved upright or flat, flat storage adds the problem of weight. Books that are so large that they merit being shelved flat also tend to be heavy. Heavy books stacked on top of one another make it difficult to retrieve materials from the bottom of the stack and also result in friction as library staff have to pull one book out from among the others. By shifting some of the oversize collections into upright shelving, items in flat storage can be shelved more loosely and can be retrieved more safely.

These potential benefits all come with the downside that as spatial efficiency improves, the library must pay a cost in terms of temporal efficiency. While subdividing books based on their size may make it easier to fit more materials into a smaller space, it also creates more opportunities for errors when staff goes to retrieve or return materials. Every new category creates another location where materials may be stored and thereby raises the risk of confusion among staff. Libraries can work to mitigate confusion with intensive training for staff, but confusion is an inherent weakness in complex systems. Especially for new staff, the increase in spatial efficiency may be accompanied by a decrease in temporal efficiency as staff spend more time to page each individual item and must take special care not to misshelve them in the wrong categories.

Overall, however, shelving by size offers one answer to the challenge of storing an ever-increasing number of books, which has bedeviled librarians at least since the development of the printing press if not beforehand. All buildings have a finite storage capacity. Barring generous university administrators interested in building expansions for their libraries or new storage repositories, libraries need to find ways to store more materials in the same amount of space. For special collections, the challenge of space is compounded by a tendency not to deaccession materials: special collections departments tend to be the last home for many books.

At the same time, however, special collections has an advantage over other libraries. Because special collections materials are stored in closed stacks, they can be arranged and organized without a concern for patrons needing to personally locate

24. Kilpatrick and Hoesen, "The Heights of Three Hundred and Fifty Thousand Volumes," 341–42.

materials. Reorganizing materials by size offers a way to effectively create new shelves without having to build new rooms to hold them. In this case, high-density repositories offer lessons that can be applied in on-site locations as well. Shelving by size is the most important of these lessons. For oversize books, it can be as much as 600 percent more effective to shelve upright than flat, though there may be potential for gaining space through a reorganization of smaller materials as well. Librarians preparing for a move or a renovation therefore have an opportunity, albeit a labor-intensive one: with the shelves already empty and therefore comparatively easy to reconfigure, shelving by size offers a chance to maximize the use of space and let the library grow without having to build extra space.

This photograph shows a row of Rare-XL shelving after the project was completed. The shelves at left are set with 19cm spacing and at right with 14cm intervals. Oversize books are are shelved with no more than two volumes on any shelf.

Appendixes

Appendix 1: Survey

1. Does your institution shelve any of its materials by size?
2. How many different size designations does your institution have? Please list them and give a quick description of each if possible.
3. Are there formal criteria for technical services and cataloguing staff in terms of which materials belong to different categories? If so, what are they?
4. How many items are included in each of your size designations?
5. How are different kinds of materials shelved (flat, upright, in drawers, or otherwise)?
6. How many linear and/or cubic feet are being used for each kind of shelving?
7. Are size designations listed in the library's (public-facing) catalogue? If only some of them are, which ones?
8. Do you know when your institution began to shelve materials by size?
9. Where do you work?
10. What kind of institution is your home institution? (Please select all that apply.)

- Library
- Archives
- Museum
- Historical society
- Other

11. How large is your collection? Do you have an estimate for how many items it contains and/or how many linear feet of shelving it uses?
12. How many undergraduate students attend your institution? How many graduate students?
13. Do you have anything else you would like to add?

Appendix 2: MU Special Collections Cataloging Guidelines

Rare-S

- **Height:** 15 cm and below
- **Width:** below 8 cm
- **Length:** 15 cm and below
- **Shelved:** Upright

Rare

- **Height:** 28 cm and below
- **Width:** below 8 cm
- **Length:** 23 cm and below
- **Shelving:** Upright

- **Notes:** The dimensions for Rare are determined based on shelving currently in use: the default height for our Rare shelves is 28 cm, and most Rare shelving is 18 cm deep. Factoring in an overhang of no more than 5 cm, this results in a maximum length of 23 cm.

Rare-L

- **Height:** above 28 cm and below 40 cm
- **Width:** below 8 cm
- **Length:** 33 cm and below
- **Shelving:** Upright

- **Notes:** The dimensions for Rare-L are determined based on shelving currently in use: the default height for our Rare shelves is 28 cm, and the deepest available shelves are 28 cm deep. Factoring in an overhang of no more than 5 cm, this results in a maximum length of 33 cm.

Rare-XL

- **Height:** 40 cm or above
- **Width:** 8 cm or above
- **Length:** 33 cm or above
- **Shelving:** Flat

- **Notes:** The dimensions for height and width for Rare-XL have been determined based on the NEDCC.

Rare-XXL

- **Height:** 62 cm or above
- **Width:** 8 cm or above
- **Length:** 45 cm or above
- **Shelving:** Flat

- **Notes:** Our current oversize shelves are 45 cm x 62 cm, bounded on the sides by metal posts. Items that exceed those dimensions cannot be stored safely on the shelves: 62 cm is the hard limit before the sides of the shelves cause problems and items cannot protrude off the shelves into the aisle without impeding the use of carts and running the risk of impact by library staff walking past them.