

Case Study**A Case Study: Shifting within a Curriculum Materials Center**CAITLIN STEWART¹

Assistant Professor / Teaching and Learning Librarian, Illinois State University, IL, USA

Abstract

This case study explores the strategies used to redistribute materials among available shelves in a curriculum materials center after deaccessioning and relocation projects. The librarian estimated imposed fill ratios based on collection segments which were then mapped onto a floor plan to efficiently shift materials. The estimated imposed fill ratio allowed for the consideration of variables that are often overlooked when using a strictly mathematical approach to calculate a fill ratio. Strategies to improve browsability of shifted collections such as call number range breaks on shelves and front-facing covers were key factors included in the project.

Keywords: collection management, children's collections, shifting, curriculum materials, fill ratio

¹ **Caitlin Stewart** is an Assistant Professor at Illinois State University where she serves as the liaison librarian to the School of Teaching and Learning within the College of Education as well as the university's laboratory schools. She also acts as the head of the Teaching Materials Center, which serves the teacher education programs across Illinois State University departments. She is the 2024 chair of the EBSS Curriculum Materials Committee. She is passionate about teacher preparation to thoughtfully evaluate and meaningfully implement resources in the classroom, especially as it relates to critical visual literacy as well as curriculum materials center management.

Background

A curriculum materials center (CMC) within Milner Library at Illinois State University underwent significant deaccessioning which necessitated the shifting of materials within the center in 2023. A curriculum materials center collects, educational resources that provide curriculum and instructional experiences for preschool through 12th grade (P-12) students. These materials are used by educators to develop curricula and lesson plans and may also be used in actual instructional situations with P-12 students. (American Library Association, 2017, para. 7)

This specific CMC has children's and young adult literature split between an Easy and Fiction section; juvenile informational resources as well as graphic novels, poetry, and fairytales in a Dewey section; professional teaching strategy books in a Professional section; curriculum and textbooks in a Textbook section; manipulatives, models, games, puppets, etc. in a Nonbook section; as well as leveled readers; magazines; and graphics in their own sections. The floor plan of the CMC prior to the shifting project is represented in Figure 1 in the appendix.

The CMC also had a Media section, which was reviewed in the Summer of 2023, and ultimately removed based on findings from a materials usage and formatting analysis. Findings suggested that most media materials had not been used in recent years and were often incompatible with the equipment and current preferences of library users. Those materials which were still occasionally used were too few to justify an entire section. As a result, the CMC deaccessioned or relocated all media, including DVDs, CDs, audiobooks, software computer files, and more, which previously made up the Media section. This allowed the leveled readers and magazines to take the shelves formerly occupied by media while moving the Professional section into the row those materials vacated. These changes, alongside deaccessioning in the Professional and Fiction sections, necessitated a shifting project to better distribute remaining Fiction and Dewey materials within the newly available shelf space.

The collection was left with one free row of shelving units closest to the Dewey section, as well as spacing inconsistencies in both the Dewey and Fiction sections which made certain shelves disproportionately full or empty. As a result, the CMC librarian sought to identify a thoughtful and efficient way to shift materials, specifically within the Fiction and Dewey sections to distribute items more consistently on the available shelves.

Literature Review

For clarity, some common library shelving terminology will first be defined:

- A shelf is a single board upon which books sit. Most library shelves tend to be 35.5" wide.
- A shelving unit is stacked shelves which utilize vertical space to hold more materials while occupying the same floor space.
- A row is a line of shelving units. Rows are often placed back-to-back, so that books face outward on either side with an aisle separating abutted rows. The number of shelving units in a row can vary.

- A section comprises materials which have shared call number naming practices based on material type.

Literature about shifting and relocation projects in libraries is robust, with scholarly works outlining the most efficient approaches to such projects spanning more than a century. However, these approaches are commonly focused on full libraries without guidance given to smaller collections such as CMCs. Researchers agree, however, that no matter why or how books shift in the library, it is best to know where every book will end up before any books are moved (Hammer, 1960; Lambert, 2016, 2022a; Tucker, 1999; W., 1930). This ensures that there is no wasted energy and time when shifting materials due to spacing mistakes. Early approaches that emerged in the 1930s mentioned estimating the number of shelves full of books, grouped by classification, and assigning these classification-based shelf counts to specific new shelving locations while leaving room for growth (W., 1930)

While the approach of estimating current holdings and anticipating necessary shelf space and book distribution has remained fairly consistent, specific processes vary significantly. Many reported approaches are mathematical and rely on data collection and analysis (see Hamburg, 1974; Kurkul, 1983; Leimkuhler, 1967; Leimkuhler & Cox, 1964; Tucker, 1999). Despite different approaches, a commonly used metric and easily understandable variable is *fill ratio*.

Fill Ratio

A key consideration when shifting and relocating library materials is the fill ratio of shelves. This is frequently calculated with the following formula.

$$\text{Fill Ratio} = \frac{\text{Shel space occupied by materials (in)}}{\text{Total available shelf space (in)}}$$

Fill ratios can be calculated by identifying the total amount of shelf space materials occupy and dividing that by the total amount of available shelf space both occupied and unoccupied (Lambert, 2016). This ratio can then be used when shifting to identify how full to make a given individual shelf before moving to the next shelf so that all shelves have roughly the same amount of occupied and unoccupied shelf space. If the entire width of a shelf were occupied by books, collection growth would not be possible and easy browsing would be restricted. Calculating a fill ratio allows one to determine how full each shelf should be, given the available space and collection. Some early scholars referred to this same idea as occupancy ratio (Kurth, 1966).

Occupied and total shelf space can be estimated or measured (Castro, 2011; Fortriede, 2009; Habich, 2010; Kurth, 1966; Tucker, 1999). Palermo (2016) clarifies that “[e]stimation methods often use a random sample of shelves to calculate a fill ratio or average number of volumes per shelf and then the length of the collection” (p. 26). While estimating can be a faster approach, approximating can lead to unintended consequences such as spacing errors (Palermo, 2016). Approaches which rely on estimation can also

look at all shelves but would likely be less exact than measuring. One such method involves estimating the collection by approximating how full each shelf is to the nearest 25% (Peacock, 1983).

Habich (2010) comments that, “[e]stimates are good when the collection is relatively small, for preliminary planning, or when the consequences of an error are relatively minor (for instance, the new stack location has considerable excess capacity)” (p. 5). These factors are more likely to be met by CMCs and are met by the collection in this case study. Most scholars recommend taking an exact physical measurement of linear space occupied by shifting materials and linear space of shelves available if at all possible when calculating fill ratio (Fortriede, 2009; Habich, 2010; Tucker, 1999). Fill ratios can also be calculated on different scales, ranging from a fill ratio for the entire shifting collection to highly precise segments in the collection which have been identified as having unique or different needs (Lambert, 2022a).

While measuring occupied space is more common in the literature, the opposite has also been used, i.e., measuring how much unoccupied space there is, and how many “empty shelves” there are in the area under review. This shows the room available for future expansion (Hammer, 1960). This ratio has also been converted to a percentage and referred to as an average *percent growth space* (Palermo, 2016).

How much space for future growth is needed, and how to calculate for it has been proposed by various scholars (Castro, 2011; Espinosa, 2015; Fortriede, 2009; Habich, 2010; Leighton, 1999). Shelves in libraries have a working capacity, or “the point at which a shelf is considered full” (Habich, 2010, p. 31). Leighton (1999) suggested a max working capacity of 86 percent for shelves to still function well for users. The working capacity of shelves needs to be considered when accounting for future growth. Espinosa (2015) recognizes that growth can be split into three discrete measurable variables: historic, projected, and available growth. A librarian’s knowledge of how quickly different call number ranges tend to grow can inform shelf-level organization, and fill ratio can be adjusted based on rates of expansion in different areas (Castro, 2011).

A simplified alternative to adjusting mathematical fill ratios based on projected growth is the use of *imposed fill ratios* in certain circumstances, defined as, “something library staff approximate in their mind based on best guesses, intuition, or other information. Library staff may do this because they know that one collection will grow faster than another” (Lambert, 2022a, p. 171). Rather than rigidly requiring that all shelves have a consistent fill ratio, *imposed fill ratios* allow for a smaller fill ratio on shelves containing fast-growing call number ranges and larger fill ratios for shelves which infrequently have additions. While Lambert names this phenomenon, it has long been recognized that mathematical guides must be adjusted in certain areas due to the differing rates of expansion across a collection (Hammer, 1960).

Waypoints

After identifying how full each shelf should be, scholars recommend identifying waypoints before beginning the physical shifting of materials (Fortriede, 2009; Lambert, 2016, 2022a). According to Fortriede (2009) “[a] waypoint is a defined spot in a collection designated by the call number of the book to be filed immediately after the waypoint... the basic concept is that you break up your collections into small segments

and calculate where each segment will fall on the shelves” (p. 35). Lambert (2022a) suggests, “doing so once every [row], for either the first book of that [row] or the last” (p. 175). In a later article, Lambert (2022b) explains that within these segments judgment-based tweaks are often necessary to avoid larger future problems. If a waypoint is not met, there is the ability to redistribute recently shifted materials. This freedom to redistribute ensures that the entire shift is not thrown off due to compounded errors. Waypoints also allow for multiple people to be shifting materials at the same time, starting from different waypoints, which allows the shifting process to be more efficient; Fortriede (2009) calls this “the skipahead” (p. 35).

Shifting Smaller Collections

Existing literature primarily addresses large-scale material shifting projects in academic and public libraries. However, there is a noticeable gap when it comes to applying recommended strategies to smaller-scale projects or those involving unique considerations, such as CMCs and school libraries. There is available, if outdated, literature on facilities planning for school libraries (Barron, 2001; Minter, 2007; Prozano, 1999), some of which details methods for shelf analysis, such as basic information on calculating how much shelf space needs to be available in a library (Baule, 2007; Hart, 2006; Klasing, 1991; *Maine School Library Facilities Handbook*, 1999). For example, one handbook recommends calculating space based on the assumption that sixty picture books or thirty standard books fit comfortably on an average shelf (*Maine School Library Facilities Handbook*, 1999). These numbers for shelf capacity by book type seem standard in the literature (Klasing, 1991). Research in school libraries is also consistent in suggesting that shelves be two-thirds full of materials for optimized browsing and future growth (Baule, 2007; Farmer, 2017; *Maine School Library Facilities Handbook*, 1999). Most existing research on shelf distribution for school libraries discusses planning future libraries or moving to a new building rather than redistributing an existing collection. There was no literature found specific to book distribution in CMCs.

Most of the literature which does touch on shifting materials in existing school libraries and CMCs rather than moving library facilities focuses on the reclassification of materials or changing of the larger organizational system, with little emphasis on how to functionally redistribute new materials on the shelf or re-allocate shelf space. Existing literature provides little evidence for how librarians should approach strategically moving items within their collection after a deaccessioning project or other space change. For example, scholars may mention genrefication of a collection, but do not detail the process of shifting materials thoroughly for these changes (Outhouse, 2017; Torres, 2021; Witteveen, 2019). Space considerations in articles specifically about CMCs also seem to focus on sub-section organization or shelf-list analysis (Cohn, 2022; Gelber & Uhl, 2013). Guidance on determining shelf distribution approaches for CMCs with a section-based material organization would be beneficial.

Shortcomings of Existing Methodologies

Strategies for shifting full libraries or large numbers of texts are well-documented in the literature, as are their shortcomings. Namely, as Bommer (1975) expressed in an opinion piece almost fifty years ago,

...[t]oo often, crucial variables are ‘assumed away’ or ignored in the quest to obtain an optimal solution to the model... [T]his precision tends to dominate and obscure the contribution of equally relevant and non-quantifiable behavioral, organizational and political considerations (pp. 137-138).

The combination of CMCs having fewer materials and unique needs for browsability and organization, means that mathematical precision in material redistribution need not be the sole focus. Librarians may prioritize variables which favor browsability such as call number range breaks.

Specific Approach

The specific approach used for this project overlaps with strategies recommended in the literature review and established as best practices but diverges in several ways due to the nature and size of the collection. Of note, the approach used relies on estimates, which work best when shelf space is not a primary constraint. The basic approach was to (1) identify shifting priorities; (2) determine segments and waypoints; (3) shift the collection.

Identify Shifting Priorities

A few things were identified that were expected to enhance the usability of the collection for patrons. These impacted distribution strategy choices. For example, the librarian wanted space on the right of every shelf to have a front-facing cover to improve the visual impact of the collection and highlight recommended titles (Farmer, 2017). Consequently, a goal was to have a fill ratio that would allow for this additional display space. Ultimately, it was decided that a fill ratio between 0.5 and 0.66 for each segment was preferable to allow for variation in cover-size for front-facing materials, while also maintaining alignment with best practices.

Another key consideration was what call number would start each new row, shelving unit, and shelf. To allow a good browsing experience for users, it is preferable that call number ranges have clean breaks when possible. Most importantly, the Dewey and Fiction sections needed to be clearly differentiated while encompassing full rows of shelves in two clear sections. Additionally, the CMC librarian wanted the graphic novels (shelved as 741.5 in Dewey) to have their own complete row. Baule (2007) states that, “...it is best if classification ranges are not split between areas. For instance, one would not want the fiction section to be almost completely shelved in one area, and then have the end of the section across the room” (p. 29). This meant that the sections had to be analyzed separately based on the space allotted to them, rather than as one whole collection, which could lead to a change of sections at an inopportune location.

Additionally, the CMC had a frequent problem in that over time, certain call number ranges had expanded in such a way that shelves and call number range progression were out of sync. This meant that sometimes authors or subject areas trailed along multiple

shelves with only a few titles separated from the rest. The librarian wanted to improve this, which meant that the call number ranges needed to be considered before calculating fill ratio. A strictly mathematical approach would compound existing barriers to browsability based on call number range distribution across shelves, shelving units, and rows. To better visualize the move, the librarian used a series of annotated floor plans and data tables during planning.

Determine Segments and Waypoints

The Fiction and Dewey sections were investigated to determine a shifting strategy which prioritized the upper-level organization of the call number ranges in each section. The Fiction section is organized alphabetically by the author's last name, so each call number range with a new first letter in Fiction was first analyzed as a unique segment. The Dewey section was segmented into the upper-most Dewey Decimal classes initially. The CMC librarian sought to approximate how many shelves a given segment would occupy and whether it would be possible to have a segment begin each row. The librarian counted how many shelves a segment currently filled, while looking at how call number ranges were split across shelves and the amount of available space. Due to the relatively small number of shelves in each segment, this review was done visually, with notes being taken with pen and paper. While this was a more involved approach than mathematically calculating a fill ratio with measurements, it allowed for the consideration of significantly more variables.

The librarian used imposed fill ratios based on knowledge of the collection and opted to look for clean breaks between shelves when possible. Slight variations in fill ratio across shelves was preferred if it allowed for clear call number range spacing. The number of shelves needed for a given segment given a fill ratio between 0.5 and 0.66 was estimated. This was done by visually reviewing each segment and identifying call number ranges within the segment which were approximately half to two-thirds of a shelf worth of titles from the beginning of the segment or the last call number range identified. For example, in the Fiction A segment the librarian would start by asking, what author is approximately at half to two-thirds of a shelf worth of materials from the start of the section? Within that range of half to two-thirds, is there a satisfactory break in call numbers? Given that identified point, what appropriate break in call numbers is approximately half to two-thirds of a shelf worth of materials away when continuing along the call numbers of that segment? This process was continued until all materials in a segment were spoken for. The process was iterative, so some segments had to be re-reviewed a few times before an estimate was arrived at which the librarian felt fulfilled the target fill ratio range for all shelves and the call number range changes. Fast-growing call number ranges such as those in the Fiction section near a prolific author were chunked smaller (closer to 0.5) to allow for more future room for growth. These estimations are outlined by segment in Table 1 for Fiction, and Table 2 for Dewey, based on recommended practice (Kurkul, 1983).

Table 1*Initial Fiction Segments & Estimated Number of Shelves Needed (for 0.5-0.66 fill ratio)*

Segment	# of Shelves Estimated	Segment	# of Shelves Estimated
Fiction A	12	Fiction N	6
Fiction B	28	Fiction O	5
Fiction C	22	Fiction P	17
Fiction D	12	Fiction Q	1
Fiction E	5	Fiction R	12
Fiction F	10	Fiction S	23
Fiction G	12	Fiction T	7
Fiction H	17	Fiction U	1
Fiction I	1	Fiction V	5
Fiction J	5	Fiction W	15
Fiction K	9	Fiction X	0
Fiction L	11	Fiction Y	3
Fiction M	19	Fiction Z	2

Table 2*Initial Dewey Segments & Estimated Number of Shelves Needed (for 0.5-0.66 fill ratio)*

Segment	# of Shelves Estimated	Segment	# of Shelves Estimated
000-099	2	500-599	49
100-199	3	600-699	24
200-299	5	700-799	53
300-399	84	800-899	47
400-499	5	900-999	91

Once the librarian had an estimate for the number of shelves each segment would ideally occupy, they needed to determine how this matched the actual physical layout of the shelves and rows of the CMC. To do this, the librarian looked at the number of shelves available in the various rows and ran different iterations of shelf distributions through mapping. This was complicated because the rows in the CMC were different lengths and the shelving units different heights, so the number of usable shelves per row was inconsistent. For example, the Fiction A segment automatically had to start in row one, but the estimated number of shelves (12) needed for that segment exceeded the number of shelves in row one (10). The librarian mapped different distribution possibilities onto the floor plan of available shelves based on the estimates and certain preferences they had (such as the graphic novels occupying their own row) in order to visualize the various options prior to shifting. Finally, the librarian identified the mapped strategy which seemed to best meet project priorities such as fill ratio and improved browsability. During this process, some segments were combined and final segments which filled a complete row or two were identified. The final segments and their corresponding rows would later be used as waypoints when shifting. The final segments, the row(s) they occupy, and the number of shelves in each row are outlined in Table 3.

Table 3*Final Segments Mapped onto CMC Rows with the Estimated Number of Shelves*

Collection Row	# Shelves in Row	Final Segments	# of Shelves Estimated
Row One & Two	45	Fiction A and B	40
Row Three	35	Fiction C and D	34
Row Four	14	Fiction E and F	15
Row Five	14	Fiction G	12
Row Six	35	Fiction H, I, J, and K	32
Row Seven	35	Fiction L and M	30
Row Eight & Nine	28	Fiction N, O, P, and Q	29
Row Ten	35	Fiction R and S	35
Row Eleven	35	Fiction T, U, V, W, X, Y, Z	33
Row Twelve	10	000-299	10
Row Thirteen	10	300-309	10
Row Fourteen	84	310-499	79
Row Fifteen	84	500-699	73
Row Sixteen & Seventeen	40	700-741.5	30
Row Eighteen	84	741.6-920	82
Row Nineteen	84	921-999	79

To see this mapped onto the CMC, view Figure 2 in the appendix.

While this method was not mathematically exact, it allowed the librarian to consider additional factors such as call number breaks between shelves, the width of front-facing books on each shelf, how many books were checked out, how many books tend to be added, and how thick the spines of those books are. A benefit to this approach is that it allows thoughtful consideration of user-experience-based variables, though it is not error-proof. Because there was excess shelving available from deaccessioning/relocation and front-facing display space was included on every shelf, slight discrepancies in future fill ratio were not problematic.

Shifting the Collection

Most rows had a slightly different number of shelves available than the estimated number of shelves needed for the segment assigned to that location. For example, Row Five had 14 shelves, and was assigned Fiction G that was estimated to take up 12 shelves (see Table 3). However, every shelf in each row was used. As a result, when shifting, two main techniques were employed to distribute materials thoughtfully within the segments and the row(s) they were assigned. These strategies helped mitigate the potential problems that come from estimating a fill ratio.

First, while each of the final segments identified in both the Fiction and Dewey sections acted as waypoints, shelving unit-based flexible waypoints were also identified. These were determined using the same estimation strategy of breaking segments according to call number into chunks containing titles which would occupy between 0.5

and 0.66 of a shelf. Only the call number range expected to be first on a new shelving unit was logged (see Figure 3 in the appendix). These flexible waypoints did not necessarily identify a specific book, just estimated a call number range that would start off the shelving unit, such as a Dewey Decimal class or the first letter of an author's last name. These acted as recommended or anticipated waypoints which could be ignored or altered based on the judgment of the shifter. If they were slightly off, this allowed for a course correction if a shelf or shelves looked overly full or overly empty without allowing the error to compound. Of the 161 shelving units involved in this shifting project, ultimately 26 did not begin with the flexible waypoint identified prior to shifting, but 135 did. This meant that while they were not perfect, they did serve as a fairly effective spacing checkpoint.

Second, and most importantly, the shifters used a technique they dubbed the “pincer technique”. Rather than shifting a row by moving directly through the call number ranges as they grew, the shifters moved one shelving unit in at a time from opposite ends of the row, pinching towards the middle of the row. This allowed for real-time adjustments when shifting and prevented large-scale re-shifting. This technique is a great supplement to estimate-based fill ratio calculation as it helps correct the margin of error in real time with limited re-shifting. This helps with what Lambert (2022a) noted as, the extra measure of books [which] will slowly grow and require a time-consuming correction at the end of a large shift. This is the reason libraries should use waypoints. Following the waypoint forces library staff to ‘reconcile’ their placement of books at smaller intervals (p. 175).

The pincer technique, when combined with waypoints, allows even smaller intervals of shifting and far less correction than would be necessary otherwise. Additionally, it yields good spacing at both ends of the rows, the areas most often seen by users.

Analyzing the Approach

To compare planning of the shifting project with its execution, precise measurements using a tape measure were taken after the collection had been shifted. These measurements allowed the actual fill ratios of the shelves to be calculated, and helped to determine how effective the estimates, mapping, and shifting process were in achieving the target fill ratio. Most importantly, it helped to determine if a semi-consistent fill ratio could be maintained alongside decisions which prioritized the spacing of books based on call number. Fill ratio for each final segment was determined using the following formula:

$$\text{Fill Ratio} = \frac{\text{Total inches of books in a given final segment}}{\text{Total inches of shelf space in a given final segment}}$$

Calculations were rounded to the nearest hundredth. The calculated fill ratio of final segments is presented in Table 4.

Table 4
Calculated Fill Ratio of Final Segments

Collection Row	Final Segments	Inches of Books	Inches of Shelf	Fill Ratio
Row One & Two	Fiction A and B	811.5"	1597.5"	0.51
Row Three	Fiction C and D	695.5"	1242.5"	0.56
Row Four	Fiction E and F	270"	497"	0.54
Row Five	Fiction G	252"	497"	0.51
Row Six	Fiction H- K	621"	1242.5"	0.50
Row Seven	Fiction L and M	670.5"	1242.5"	0.54
Row Eight & Nine	Fiction N-Q	547"	994"	0.55
Row Ten	Fiction R and S	732.5"	1242.5"	0.59
Row Eleven	Fiction T-Z	627.5"	1242.5"	0.51
Row Twelve	000-299	216.5"	355"	0.61
Row Thirteen	300-309	195"	355"	0.55
Row Fourteen	310-499	1843"	2982"	0.62
Row Fifteen	500-699	1472"	2982"	0.49
Row Sixteen & Seventeen	700-741.5	755.5"	1420"	0.53
Row Eighteen	741.6-920	1819.5"	2982"	0.61
Row Nineteen	921-999	1731"	2982"	0.58

The calculated fill ratios ranged from between 0.49 and 0.62 among the final segments. Only one segment fell outside of the target fill ratio of between 0.5 and 0.66 and even then, by only one one-hundredth. And it is likely that checked out materials contributed to this discrepancy. This suggests that when there is a range of possible fill ratios due to available space in a small collection, estimating, while prioritizing call number positioning, is absolutely an appropriate way to determine fill ratio. When considering the fill ratio on a section rather than segment level scale, the fill ratio of both the Dewey and Fiction sections combined was 0.56 (see Table 5). The fill ratio of the Fiction section was 0.53 and the fill ratio of the Dewey section was 0.57.

Table 5
Calculated Fill Ratio of Sections and Total Shifted Area

Section	Inches of Books	Inches of Shelf	Fill Ratio
Fiction Section	5227.5"	9798"	0.53
Dewey Section	8032.5"	14058"	0.57
Total Shifted Area	13260"	23856"	0.56

Recommendations

While the ultimate goal of thoughtfully shifting materials within the Dewey and Fiction Sections of the CMC was met, there was an additional question that the author hoped to answer. Namely, how effective is estimating fill ratio when shifting curriculum materials and determining waypoints for an actual move? Results suggest that estimating

based on call number segmenting can be effective for collections when an excess amount of shelf space is available. Calculating exact fill ratio based on precise measurements is an effective and necessary strategy for larger scale projects and those with real space constraints. For smaller projects with more available shelf space, a deeper level of analysis is possible since space maximization does not have to be the only guiding principle. This is a viable approach for collections which seek to center browsability and allows other features such as front-facing covers, tidier shelves, and shelving-unit call number separation to be prioritized. The author realizes that a mathematical approach might be a better option for some CMCs.

The approach used for this project was only possible due to the large-scale deaccessioning projects which pre-empted and necessitated shifting materials. It is highly advised that weeding always occur prior to shifting. This allows greater flexibility when shifting and helps one acquire better knowledge of the materials on the shelf, which can be paired with information about how they are acquired and used. It also prevents shifting materials which will shortly be removed and reduces future small-scale re-shifting that happens naturally after a weeding project.

The pincer technique, shifting materials simultaneously from both ends of a row to pinch towards the middle of a row, while using waypoints, is highly recommended to anyone seeking to shift a collection based on estimations. This approach allows much greater ease in visualizing the spacing and it supports recognizing when slight changes need to be made. Waypoints are, however, necessary when using the pincer technique.

Ultimately, CMCs and other smaller collections that have extra shelf space can use an estimated and imposed fill ratio when shifting materials. This approach allows greater consideration to be given to important variables which impact the user-experience when browsing. At the same time, it maintains precision, minimizing the need for re-shifting when moving or redistributing collection segments. To plan and visualize the move effectively, a combination of charts and floor plans is recommended. Multiple floor plans should be created, based on the collected data to determine segments and how they plot onto rows. By exploring various scenarios and options, librarians can strategically position each book on the shelf while taking into account various factors. The imposed fill ratio method proves effective for CMCs that are not overly constrained by space limitations.

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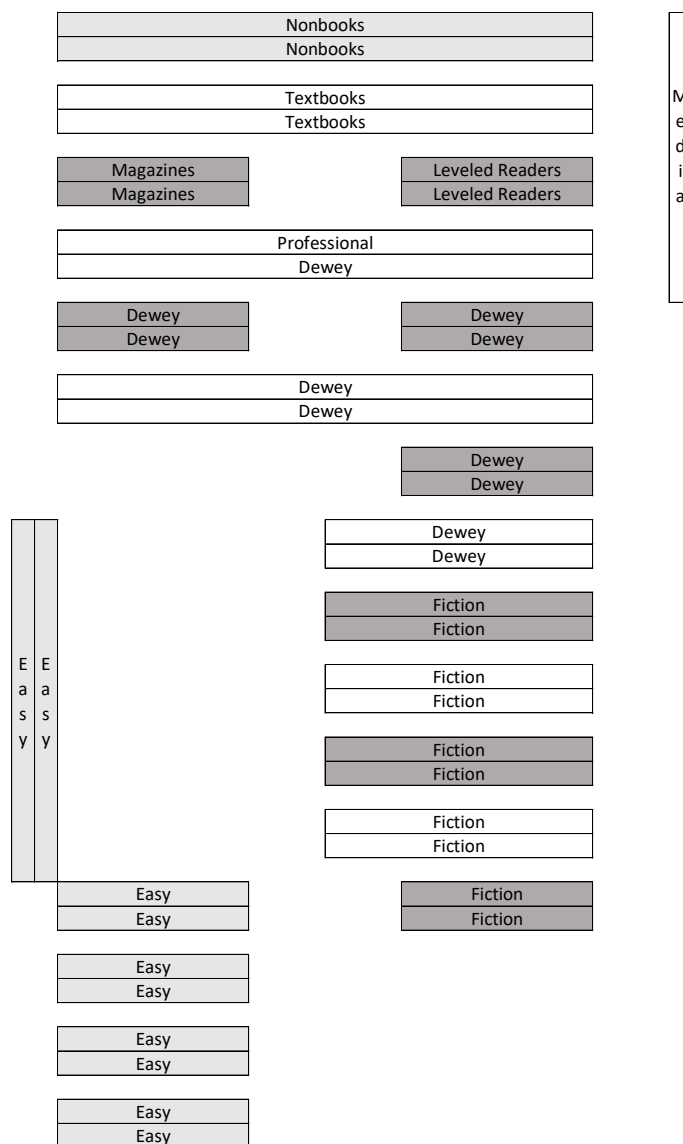
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Appendix

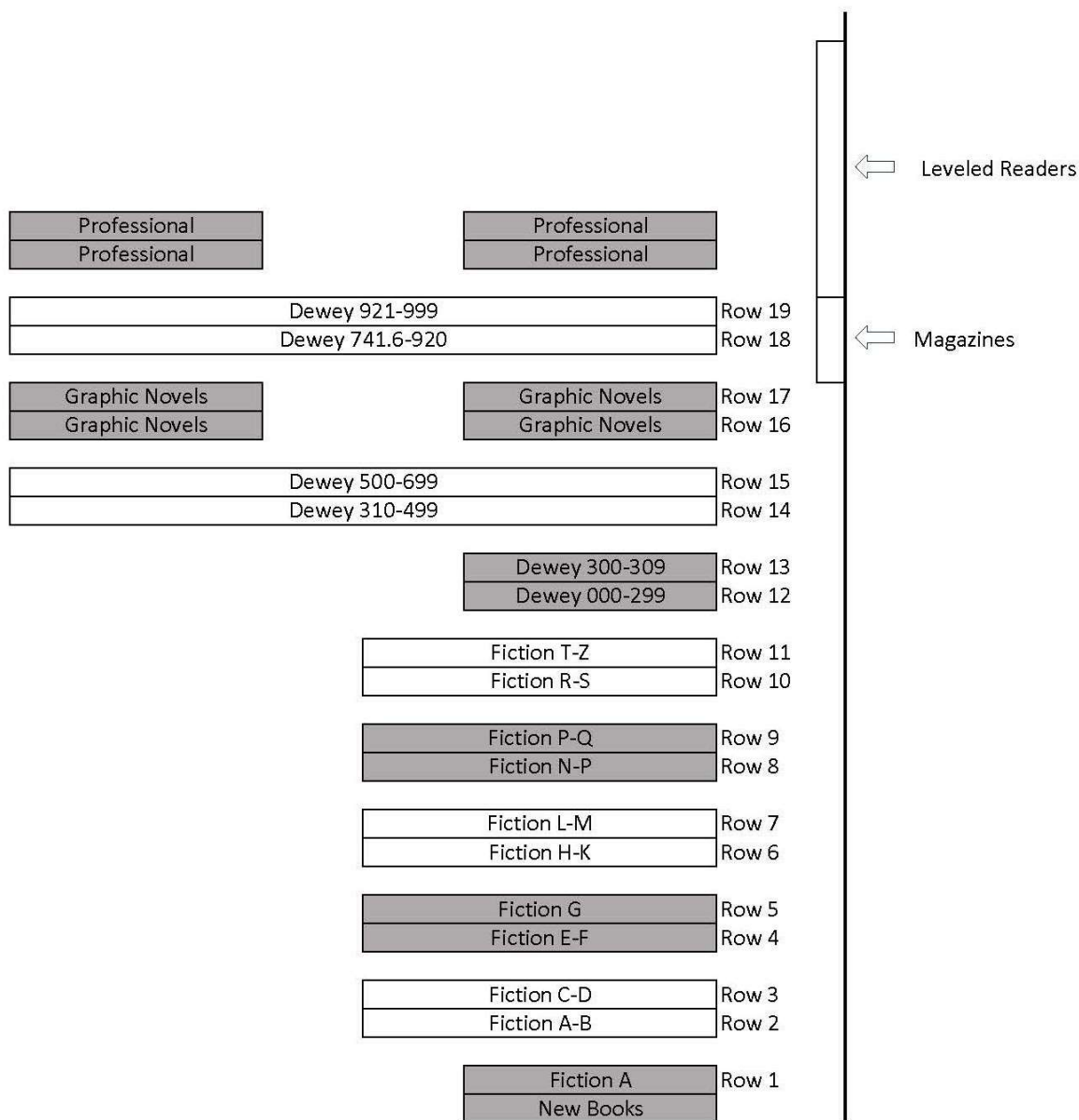
Figure 1

A floor plan of the CMC in early 2023, before shifting over summer 2023.



Note: Full height rows with five or six shelves do not have shading. Mid-height rows with three or four shelves are shaded light gray and short-height rows with two or three shelves are shaded dark gray.

Figure 2
Final Segments and Waypoints Mapped onto the CMC



Note: Sections of the CMC which were not included in this project have been omitted from the map.

