



We Don't Need that Anymore, Exploring the Realities of the Impact of Digitization on Print Usage

Tom Teper and Vera Vasileva*

Librarians speculate that the digitization and delivery of items through the HathiTrust may reduce or eliminate demand for the corresponding print content. This belief feeds into a perception that monographs housed within academic libraries and delivered via such services are ripe for deduplication or outright withdrawal; yet, other institutions may remain dependent upon those holding titles to provide print-based access for their patrons. Embracing HathiTrust's emerging Shared Print Monograph Program, many member institutions committed to retain print monographs that correspond to those digitized from their collections. However, such commitments are not universal among the membership or universally displayed publicly. Moreover, such commitments may be utilized by other institutions to withdraw against these holdings without fully understanding the potential local impact. Developing an evidence-based understanding of how the availability of digital access to these items might impact both local circulation and the rate of ILL/DD lending for such items is a critical step in determining how institutions might approach the management of these collections in the future.

Introduction

For many years, librarians speculated that the digitization and delivery of items would reduce the demand for the corresponding print items. The belief furthered speculation that the reduced demand furthered the goals of preservation by reducing the wear and tear on items, the goals of collection managers by easing decision-making around relocating items to storage facilities, and the goals of those interested in developing new and innovating service needs for similar relocations.

It also fueled speculation that libraries could begin withdrawing collections based on the fact that they were, indeed, accessible to users—albeit via a new medium. In the meantime, elements of the scholarly community and our own profession remained skeptical, expressing their concerns in ways ranging from concern about the book as object, to the quality of the scanning, the accuracy of the metadata underlying discovery, to the uncertainty that remained about the availability of print copies through lending networks. Although these expressions of concern pre-dated contemporary mass digitization efforts, they assumed a new urgency in the last decade as digitization and deposit into services such as the HathiTrust ramped up, speculation about reductions in demand for corresponding print content once again made the rounds, and concern about the intentions of administrators crept into the conversation.

* Tom Teper, Associate University Librarian for Collections and Technical Services and Associate Dean of Libraries, Chair, Military Education Council (2014–2020), Associate Professor, University of Illinois at Urbana-Champaign tteper@illinois.edu. Vera Vasileva, Graduate Assistant, University of Illinois at Urbana-Champaign, verav2@illinois.edu.

Yet, there appears to be remarkably little published data on the actual impact of the digitization of these resources on their actual use, either locally or through borrowing networks. As a profession with a history of over 100-years of developing and maintaining resource sharing networks, the evidence exists that other institutions may remain dependent upon those holding titles to provide print-based access for their patrons. Knowing that this cross-institutional dependency exists, many HathiTrust member institutions committed to retain print monographs that correspond to those digitized from their collections. However, such commitments are not universal among the membership or universally displayed, leading to calls from within our professional community to publicly display such retention commitments. Moreover, such commitments may be utilized by other institutions to withdraw against these holdings without fully understanding the potential local impact.

Developing an evidence-based understanding of how the availability of digital access to items digitized and shared via the HathiTrust might impact both local circulation and the rate of ILL/DD lending for such items is a critical step in determining how our institutions might approach the management of these collections in the future. And, backing up our assertions with evidence is critical to both effectively managing our collections, sharpening our arguments about the need to locally retain collections, and supporting the communities that we serve.

Methodology & Problem Statement

In order to draw meaningful conclusions about the relative use of monographic titles after their digitization, the project lead developed a series of questions and utilized a team to gather and evaluate data from three sources in an effort to discern their answers. The primary challenge in accomplishing this work—aside from the voluminous size of the datasets involved—rested on the fact that the three types of datasets did not naturally speak to one another. In order to surmount this challenge, the research team pursued the following steps: (a) gather datasets, (b) import datasets into MS SQL Server database, (c) perform data cleaning and manipulation, and (d) write and run SQL queries that sought to ascertain answers to the questions involved. The three types of datasets initially imported included the following: (1) a 10.7-million record set of every physical item within the University of Illinois at Urbana-Champaign's Voyager catalog as of January 2018, (2a) an 8,246,410 item record set from the University of Illinois at Urbana-Champaign's *'archive transactions table'* that detailed original circulations (checked out and returned items)—not renewals—of all physical collection items from the library during the period 2002–October 2018, (2b) *'current transactions table'* that logged the 93,076 items currently checked out, and (3) a record set of the 751,522 items digitized from the University of Illinois at Urbana-Champaign's collections that are available via the HathiTrust as downloaded from the HathiTrust's Hathifiles repository as of October 2018. Among other things, one of the more challenging problems in bringing these three types of datasets together included the fact that all three of the datasets did not possess a single corresponding identifier, requiring the team to cross-walk bibliographic identifiers with item identifiers across the datasets. Consequently, this meant that the resulting data and results needed to be limited to multi-volume monographic items with exact matches to the digitized volumes and single-volume monographic titles. In the end, we narrowed the 10.7-million item dataset to focus on 5,305,508 physical monograph item records.

An additional challenge in examining the conclusions is that the records associated with a particular date of digitization are not so precise as to permit conclusions about how any dates of circulation and the date of digitization lined up within a particular year. For example, with a circulation record covering complete years running from 2002–2017, data about an item digitized in 2010 is reported from the years 2002 to 2010 (to count circulations before digitization) and from 2011 through 2017 (to count circulations after digitization).

The project also sought to incorporate ILL lending transaction data into the database, but time did not permit this portion of the research to be completed. Using the three types of datasets gathered into the MS SQL

Server database described, the research team could explore the local circulation for monographs from the “large, research university’s” collection that are digitized and available via the HathiTrust. Among other things, this project sought to explore:

- Were there subject-based differences in the ongoing demand for the original print resources?
- Was there a measurable difference in demand for these print resources from the periods before and after an item was digitized?
- Was there a difference in demand after digitization for those items that are freely available as full text (most being pre-1923 through the period of the study) when compared to those in which copyright or other restrictions limited the digital access?
- Was there a difference in local demand (local circ) versus external demand (ILL/DD) for the items? i.e., does one go up while the other goes down?

Other questions that were considered for eventual evaluation included:

- Was there a difference in the demand on these items from the local collection that corresponds in any way to how commonly an item is held per holdings registered in OCLC?
- Was there a difference in the circulation/ILL data for those items sourced from the “large, research university’s” collection as opposed to those sourced elsewhere with the same OCLC numbers?
- How did the usage of commercially digitized journal content/backfiles influence our assumptions about use of this monographic content?
- Should evidence for user preferences for newly published ebooks inform our decision-making on the management and/or retention of print copies?

Literature Review

While there is an extensive body of literature on the development, underlying premise, and perceived flaws inherent in print retention agreements for both serial and monographic literature; the overlap of collections and holdings within regionally defined areas; and image quality of both commercially digitized content and content digitized and delivered via the HathiTrust, there appear to be no published assessments that specifically examines the potential impact of digitization on the usage of corresponding print resources save for a limited study conducted by IFLA/UNESCO that generalizes about the use of original special collection items post-digitization.

A voluminous literature currently surrounds the development of print retention agreements and the possible flaws that undermine cross-institutional deduplication efforts. Most of the publications about these are relatively recent, although the earliest calls for a “national lending center” specifically aimed at avoiding needless duplication date to the late 1800s, and some of the earliest calls to develop a National Periodicals Center date to the 1973-1980 when Rolland E. Steven’s proposed a national serials repository. Although that effort failed, in part due to the political climate and lack of Federal funding to support such a program, it set the groundwork for further discussions.¹ In recent history, the Center for Research Libraries (CRL) assumed a leadership role in trying to coordinate print retention efforts associated with serial literature. When CRL convened the 2004 conference entitled “Preserving America’s Printed Resources”, CRL embarked on a series of discussions and iterative developments that resulted in their assuming a central role in the development of a serials print registry and their engagement in discussions with the serials retention programs that are increasingly a part of our contemporary professional fabric. In recent years, CRL sponsored the 2015 “Preserving America’s Print Resources II: A North American Summit” and published outcomes from that meeting in *Print Archiving and Shared Print in North America: A Preliminary Analysis and Status Report*.²

Monographic print retention presents different challenges due to higher instances of perceived bibliographic uniqueness, and due to the lower instance of duplication among titles, it did not garner the initial attention of those advocating deduplication for purposes of space savings. Yet, discussions about the transformative value, framework underlying, benefits and weaknesses of monographic print retention schemes are not new. While the notion of nation-wide monographic print retention schemes was common enough in European libraries, the notion took longer to catch on in the United States as the complicated patchwork of political, consortial, and educational bodies magnified the challenges faced by the more homogeneous nation-states of Western Europe and Scandinavia. Among the earliest meaningful works focused on the United States are Kieft and Payne's 2010 "A Nation-Wide Planning Framework for Large-Scale Collaboration on Legacy Print Monograph Collections," Nadal and Peterson's 2011 "Scarce and Endangered Works: Using Network-Level Holdings Data in Preservation Decision-Making and Stewardship of the Print Record," and Constance Malpas' *Cloud-Sourcing Research Collections: Managing Print in the Mass-Digitized Library Environment*.³ These works influenced the potential for such programs, their value as mechanisms to preserve our cultural heritage, how they might be built, and the potential for overlapping holdings to be viewed as expendable. And, they influenced discussions around the subsequent development of monographic print retention programs. The most prominent of these—the HathiTrust Print Monograph Archive—resulted from a ballot initiative developed for the 2011 HathiTrust Constitutional Convention. This ballot initiative put a stake in the ground for the HathiTrust to assume the mantle of leadership in developing the closest extant model to a national print retention program. While this program did not explicitly call for any institution to withdraw content, it was built under the assumption that some institutions would withdraw content based upon the presence of digital surrogates in the HathiTrust. It sought to create a base-line framework for ensuring continued retention and access to print titles that corresponded to the digital items in the HathiTrust.⁴ What this and other programs lacked was and remains the presence of a concerted national framework, a point highlighted by the 2016 report "Concerted Thought, Collaborative Action, and the Future of the Print Record."⁵

While no national model yet exists, the developing monographic print retention models have their strengths and weaknesses. Among their weaknesses as tools to manage local collections remain the two most prominent issues—concerns about the quality of the digitized content and its metadata and concerns about how the retention commitments made by other institutions may be used to guide the deduplication of local holdings. Although both focused on commercially digitized content, the challenges inherent in making collection management decisions and withdrawing print titles based on the availability of digital surrogates featured prominently in Lura Joseph's 2006 "Image and figure quality: A study of Elsevier's earth and planetary sciences electronic journal back file package" and her 2012 follow-up study.⁶ With respect to the HathiTrust, image quality featured prominently in the recent work of Paul Conway. In "Preserving Imperfection: Assessing the Incidence of Digital Imaging Error in HathiTrust," Conway reported on a study of image quality for titles digitized and delivered via the HathiTrust, seeking to quantify the prevalence of errors in pre-1923 items.⁷

The other concern regarding the utilization of digital availability via HathiTrust as a tool for driving local print retention decisions centers on the challenge of accurately determining the actual duplicate status or condition of materials held locally or across multiple institutions. Andrew Stauffer tackled this challenge in his 2016 article "My *Old Sweethearts*: On Digitization and the Future of the Print Record" and Jennifer Hain Teper sought to further explore this topic with her 2019 article "Considering 'Sameness' of Monographic Holdings in Shared Print Retention Decisions."⁸ Stauffer's work expressed concerns over the high level of variance among the items in his sample set, and Teper's work appears to have verified many of the conclusions drawn by Stauffer.

The one study that appears to draw a correlation between print usage and online availability is a 1999 publication jointly issued by the International Federation of Library Associations (IFLA) and UNESCO. Among many questions associated with digitization practices, the survey inquired about post-digitization access to original items. Focusing on the use of special collections materials from a number of national libraries after their digitization, the study included a note indicating that evidence exists that demonstrates that post-digitization demand for items can increase. Again, this study focused on special collections, but it indicated that discovery could spur a higher interest in the original items and a higher instance of use.⁹ That said, there appear to be no studies that directly compare pre- and post-digitization use of general collections materials.

Preliminary Results

Based on the aggregation of datasets covering bibliographic and item level data representing 10.7-million items (10,601,294 when deduplicated) at the University of Illinois at Urbana-Champaign, circulation data for the same items dating from 2002 through the end of 2017, and the digitization and availability of these items via the HathiTrust, the research team conducted a preliminary analysis of the aggregated data. The items included the following: 3,185,040 items for serial volumes; 6,909,723 records for monographic volumes; and, 506,531 items for other media such as computer files, maps, mixed materials, scores, sound recordings, and visual materials. Like many institutions, Illinois utilizes a number of classification schemes. Approximately, 1,178,936 of the records were classified with the Library of Congress classification system, and 321,612 were government publications, including many classified with the SuDoc scheme. The bulk, totaling 5,603,032 items, were classified with the locally developed “Exceptional Dewey,” and approximately 20%, or 1,950,745 records, of the original dataset of 10.6-million records were not classified at the time of writing. The remaining items were classified with other, locally developed schemes employed for a multitude of specialized collections, records for withdrawn items, and records that contained errors in call numbers or other critical identifying metadata.

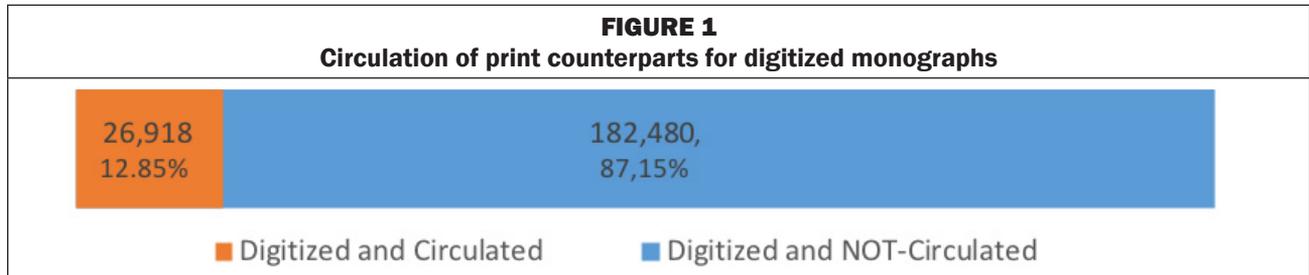
With respect to the specifics of this study, the research team sought to quantify whether there were changes in the usage of printed resources after digitization and delivery via the HathiTrust compared to the period prior to digitization. In order to accomplish this, it became necessary to link three datasets that shared no single common point of intersection and to identify the usage of individual items.

To overcome that challenge, the team came up with the following solution. In our 10.6-million deduplicated dataset of the Library's print collection, a unique item identifier for each physical item record is *Item_ID*. In ‘archive’ and ‘current’ transactions datasets each record stands for a single circulation (not a single item); thus, to count how many times a particular item circulated, we would need to count the number of records in which that *Item_ID* appears. If an item never circulated, no records appear in ‘archive’ or ‘current’ transactions datasets. As for dataset of digitized items, each digitized item record contains a unique item identifier indicating its contribution to the HathiTrust (*htid*), and the dataset does not have our Library's item identifier (*Item_ID*). Thus, it makes it difficult to match the dataset of digitized items with the Library's print collection dataset since they do not have unique identifiers in common. However, the HathiTrust dataset provides a bibliographic identifier (*source_bib_num*) and volume information (*description_h*) for each digitized item that can be used to uniquely identify an item. Therefore, matching the HathiTrust dataset with the Library's print collection dataset by bibliographic identifier and volume information, we were able to detect the *Item_ID* for the digitized items. Then, knowing digitized items' *Item_ID*, we matched the HathiTrust dataset with ‘archive’ and ‘current’ transactions datasets by *Item_ID* and retrieved information about circulations of digitized items.

The primary pitfall encountered when trying to detect the digitized item's *Item_ID* remained that not all records for multi-volume monographs in the HathiTrust dataset contain volume information. At the same time,

where volume information is present it does not necessarily match with volume information in the Library print collection dataset ('ENUM' field). There are several reasons and among them is that the HathiTrust dataset does not have separate fields for an item's publication date; therefore, in the 'description_h' field one may find both volume information and publication date. Due to this, typos, and other inconsistencies in records, it is hard to match items from both datasets by volume information field to precisely determine the usage of particular serial volumes. In much the same way that it is challenging to determine which particular volumes are utilized from available ILL/DD data, tying the usage of a particular serial volume (rather than to the entire bibliographic set) to the digitization status required restricting our study to monographic literature. The same problem existed for multi-volume monographic sets or series.

Thereby, the authors' narrowed the study to single-volume monographs as well as multi-volume monographs with exact matches to the digitized volumes. This means that our final dataset of the Library's print collection consisted of 4,123,726 single-volume monographs and 1,181,782 multi-volume monographs, which totals 5,305,508 out of 6,909,723 monographs in that collection. As for dataset of items digitized from our collection during the 2010-2016 period, it contained 265,202 monographic items out 751,522 digitized items (monographic and non-monographic). For 209,398 out 265,202 monographs (that is 79%), the authors determined *Item_ID* based on *Bib_ID* and volume information with exact matches. Of these, 12.8% of the digitized monographs, or 26,918, displayed evidence of use for their print components between 2002 and 2017 (Figure 1), and they circulated a total of 42,689 times during that period.



Are there subject-based differences in the ongoing demand for print resources?

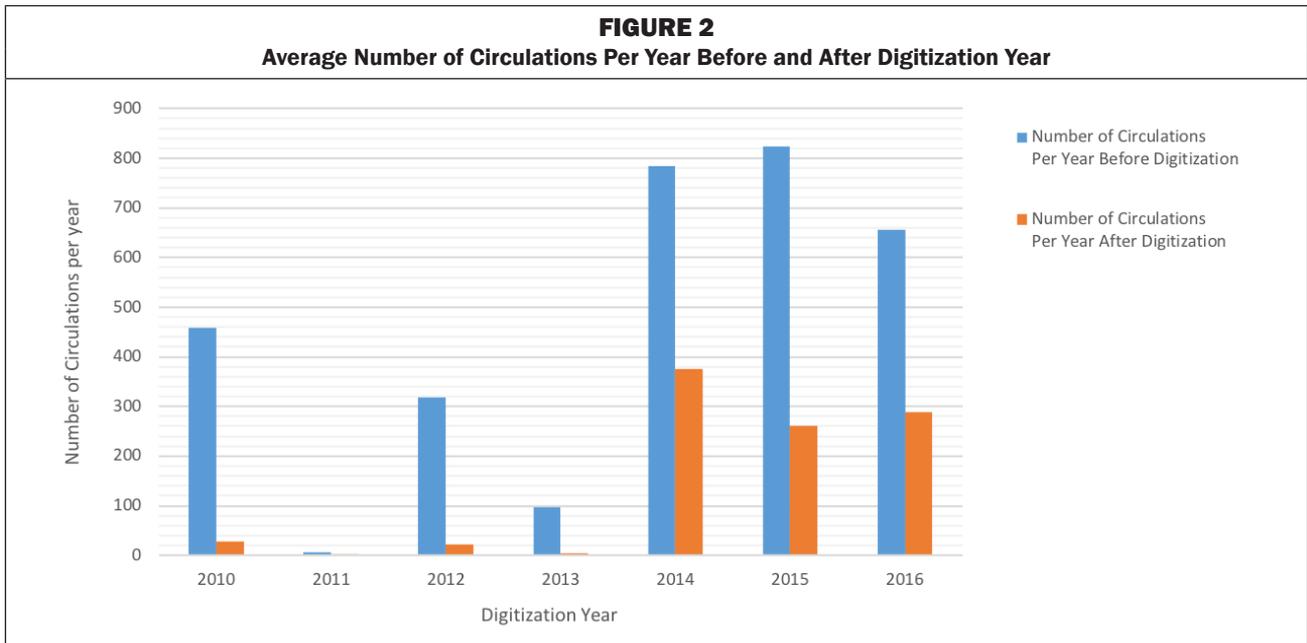
Results indicate that there are measurable differences in the usage of print resources based on their classifications. Total number of items from the Library's print collection dataset used in the subject-based analysis is 6,781,968, where 1,178,936 of the records had the Library of Congress call number, and 5,603,032 items—the locally developed "Exceptional Dewey." Overall, 23.67% of the items in all formats represented in the dataset circulated between 2002–2017. Total number of circulations for those items is 5,243,857 times. On average, each item circulated 3.3 times. When reviewed by classification range in both the Library's Dewey and Library of Congress call numbers, the percent of circulated titles per subject area ranged as low as 7.0% (LC Classification A–General Works) and as high as 63.97% (LC Classification E–History of the Americas). An assessment of the average circulation per title by call number range yields a significant difference as well, with an average of 1.8 circulations per item for LC Classification A–General Works and 4.5 circulations per item for LC Classifications R–Medicine, Q–Science, M–Music and Books on Music, and E–History of the Americas.

Is there a measurable difference in demand for these print resources from the periods before and after an item was digitized?

Preliminary results indicate that, when average annual usage is calculated, a measurable difference in demand

appears for these print resources in the periods before and after their digitization. The decrease is evident when reviewing the average circulation per year for the pre- and post-digitization periods. For the pre-digitization period, the average annual circulation for the print counterparts of the digitized items stands at 449.09. When reviewing the post-digitization period, the corresponding annual usage data is 139.93.

By examining the 2010 Digitization Year, one can view data for digitized items with a relatively balanced number of years before (nine years) and after (seven years) digitization. In that case, the average number of initial circulations per year declined from 458.22 times per year to 28.57 times per year (Figure 2).



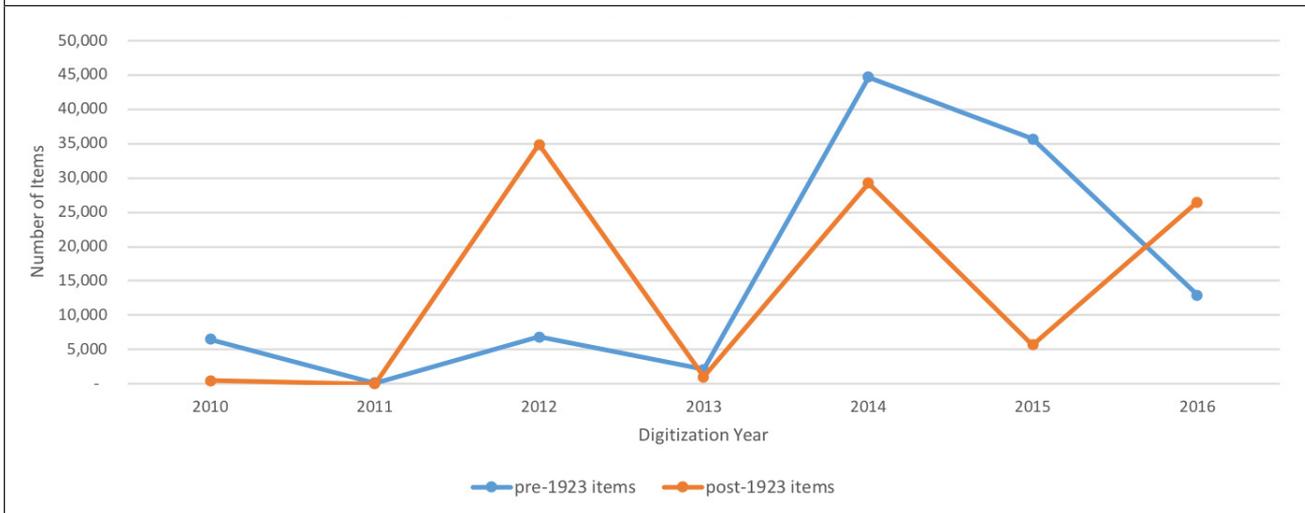
Is there a difference in demand after digitization for those items that are freely available as full text (most being pre-1923) when compared to those in which copyright or other restrictions limit the digital access?

Due to copyright limitations, most items published in 1923 and later are not available as full text via the HathiTrust. The results indicate that there is a difference in the demand for those items that are freely available as full-text (as defined by pre-1923 date of publication) when compared to the ongoing demand for those published in 1923 and after. The results, however, appear to contradict speculation that the availability of full-text access decreases demand on the original item. As noted above, the overall circulation rate appears to decline after digitization. Yet, the average circulation per item for those published after 1923 was actually lower than that for the pre-1923 publications.

In our dataset, the library held 209,398 monographs digitized between 2010 and 2016. Correcting for those items with a bad publication date such as 192u, 19uu, or even 1uuu, reduced the sample pool by 2,839 items. Of that final body of 206,559 items, 52.7%, or 108,836, carried pre-1923 publication dates, and 47.3%, or 97,723, carried dates equal to or later than 1923 (Figure 3). Out of the total body of monographs, 26,918 circulated between 2002 and 2017. Correcting for those with uncertain publication dates reduced the sample to 26,482. For the 108,836 published before 1923, 16.08% circulated between 2002 and 2017, and for the 97,723 with publication dates of 1923 or later, 9.19% circulated during the same period. Thus, for digitized monographs, pre-1923

titles circulated almost twice as many times as their post-1923 counterparts between 2002 and 2017. As for frequency of use, both pre- and post-1923 titles had a frequency of use equaling 1.5 circulations per title.

FIGURE 3
Number of Digitized Monographs for pre- and post-1923 Items by Year of Digitization



Comparing rates of circulation for pre- and post-1923 publications after digitization leads the authors' to speculate about the impact of full-text access. Out of 108,836 pre-1923 digitized items, 17,500 titles circulated a total of 27,477 times from 2002-2017. For the 97,723 post-1923 digitized items, total circulation equaled 14,513 for 8,982 circulated items. Circulations after digitization for pre-1923 items equaled 1,552 times; the circulation for post-1923 items after digitization totaled 677. In terms of relative circulation for the pre-digitization periods, the authors' determined that per item circulation for pre-1923 items equaled only 0.238 times. By comparison, circulation for post-1923 items equaled 0.142 times. Thus, before digitization, pre-1923 publications circulated more frequently than post-1923 items. When the authors reviewed the post-digitization limited dataset, pre-1923 publications also circulated more frequently—despite their full text being available via the HathiTrust. Per volume, pre-1923 items circulated an average of 0.014 times and post-1923 items circulated an average of 0.0069 times per item. All in all, there is a decline in usage for both pre- and post-1923 titles after digitization. Reviewing the ratio of the usage before digitization to after digitization for pre- and post-1923 titles yields a higher ratio for post-1923 items. That means that the decline in usage for post-1923 items is more than for pre-1923 items after digitization.

An analysis of usage by subject area provided interesting results. To avoid skewing the results, the authors limited their analysis to only those subject areas in which over 100 items were digitized. For pre-1923 titles, the four most used subject areas included LC P—Language and literature (36.7%), Dewey 100—Philosophy & psychology (25.0%), Dewey 900—History & geography (22.6%), and Dewey 700—Arts & recreation (22.4%). For those items published in 1923 or later, the four most used subject areas included Dewey 900—History & geography (48.2%), Dewey 200—Religion (35.7%), Dewey 100—Philosophy & psychology (30.2%), and Dewey 400—Language (28.5%).

Is there a difference in local demand (local circ) versus external demand (ILL/DD) for the items?

The initial proposal sought to also ascertain whether the ongoing demand for the print resources differed with respect to local demand and external demand via ILL/DD. Unfortunately, our project team was not able to incorporate the dataset of ILL transactions into the MS SQL Server database prior to publication.

Conclusions

To complete a study of the impact of digitization on the circulation of printed items in a research library's collection, one needs to compile information on the items in the collection and their digitization status and their recorded circulation information. Many of the systems that libraries utilize to maintain or gather these sets of data do not directly interface with one another. In this study, the research team needed to compile four different sets of data that included not only the identifying information for over 10-million items, but digitization histories for over 751,522 items and circulation transaction logs that tracked 8,246,410 individual transactions over an eighteen year period. At the time of writing, ILL/DD transaction data had not yet been included.

With respect to the questions about the impact of digitization on the circulation of printed items in a research library's collection, the conclusion from the data provided seems to indicate that there is a diminished amount of annual average usage for items in the periods after their digitization. With respect to differences in the demand for pre-1923 and post-1923 publications after digitization, the initial evidence points to a greater demand on the older items, most of which it is reasonable to presume are available via the public domain. Overall, while there are significant differences in the demand on print resources by subject area, attempting to ascertain whether the results from an initial period mark a change in the usage of these materials over a sustained period of time is impossible at this point.

What is not impossible is to look at overall trends. The evidence thus far points to a marked decline in usage for print counterparts of the digitized monographs—a presumed confirmation of much speculation from years past. Among items that cannot be factored into this data are changes in the scholarly demand for particular resources or subjects, the impact of the digital availability from other, commercial sources such as ebook backfile packages, or how the users of the digital surrogates were interacting with the particular resources (using online, printed and reading, etc...). However, the evidence does point to a decline in usage.

What this means for libraries and scholars is unclear. Some will look at this selective set of data and assume that collections can be managed more aggressively, lending credence to those concerned in the scholarly community that libraries are not stewarding our cultural heritage. Others will view the data as incomplete or flawed in some way, stone-walling efforts to rationally manage low-use collections that occupy significant portions of campus buildings where students and scholars may benefit from direct access to other services. In the end, the findings can be used to point us in directions, to encourage the scholarly community to sharpen its arguments about the value of preserving elements of our shared cultural heritage, to support collection stewards as they seek to manage their collections with the wisdom that they deserve, and to further the discourse around how we curate these resources.

Endnotes

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