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Reading Chicago Reading: Quantitative Analysis of a Repeating Literary Program

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Abstract

This essay presents quantitative capture and predictive modeling for one of the largest and longest running mass reading programs of the past two decades: “One Book One Chicago” (OBOC) sponsored by the Chicago Public Library (CPL). The Reading Chicago Reading project uses data associated with OBOC as a probe into city-scale library usage and, by extension, as a window onto contemporary reading behavior. The first half of the essay explains why CPL’s OBOC program is conducive for modeling purposes, and the second half documents the creation of our models, their underlying data, and the results.

Introduction

In *The Library Beyond the Book*, Jeffrey T. Schnapp and Matthew Battles note the variety of data generated in contemporary libraries this way: “Every time a book is taken off the shelf, a file is downloaded, or a computer workstation is booted up, a story is told, and cataloged, and filed away in a database. In this way, each act of reading in the library broadcasts a handful of seeds, from which new growths of data will either spring — or disappear into a forest of statistical noise” [Schnapp and Battles 2014, 126]. Schnapp and Battles highlight how public libraries, like many institutions, are data-rich but information-poor; they remind us that much of the content in library databases is left fallow from lack of tools or budget or both; in turn, they challenge us to imagine new architectures and algorithms for libraries when, in the age of search, we find both literally and figuratively that “there is no shelf” [Shirky 2005].[1] 1

What follows is a report on one attempt to describe, and remedy, some aspects of this condition. This essay is about one of the largest and longest running mass reading programs of the past two decades, “One Book One Chicago” (OBOC), sponsored by the 80-branch Chicago Public Library (CPL) system since the fall of 2001. Our project works with anonymized CPL circulation data from this program and data of several other types to ask with tools of data science, can we capture and model some of the salient relationships of texts, readers, and their environment, particularly when a city assigns itself mass-mediated public interactions with literary works? The Chicago Public Library’s goals with OBOC are civic as well as cultural, and capturing the effects of the program at metropolitan scale might even show how DH tools and methods might inform social policy. “Can cities save the world?” political scientist Benjamin R. Barber asked (and answered affirmatively) in his 2013 study of city-scale planning experiments, *If Mayors Ruled the World*. Because of their more manageable scale and integrated governance structures, Barber argues that in both developed and developing nations cities have become “democracy's best hope” [Barber 2013, 3]. OBOC is a complex city-scale cultural phenomenon and study of it offers a means of capturing and quantifying how broad-spectrum civic programs have differential impact upon a heterogeneous population. 2

A major goal of the Reading Chicago Reading project (RCR) is to create open source tools so that public librarians and digital humanists can experiment with the kinds of predictive insight presently being generated by proprietary software in the film and music industries and for mass market book sales [Hit Song Science] [Archer and Jockers 2016] [Alharthi et 3 al. 2018] [Piper and Portelance 2016] [Alter and Russell 2016].[2] We have created the first instance of such a predictive model, and in what follows we will report about how it works. We also discuss findings and limitations of our data and methods to date. The first half of the essay explains why CPL's OBOC program is notable in itself and conducive for modeling purposes, and the second half documents creation of our models, their underlying data, and the results. To anticipate a bit, we chose Chicago Public Library's "One Book One Chicago" program because its prior seasons constitute useful training data and its current and future programs (i.e. different book selections) provide new data for the model which can be tested for the same areas in the same city. Our model predicts the annual circulation of a chosen book for every CPL branch; it is, as far as we know, the first attempt to combine tools of literary sociology and data science for city-scale prediction of this kind. Matthew Jockers noted with regret just a few years ago that "[t]he conclusions we reach as literary scholars are rarely 'testable' in the way that scientific conclusions are testable. And the conclusions we reach as literary scholars are rarely 'repeatable' in the way that scientific experiments are repeatable" [Jockers 2013, 6]. But the Reading Chicago Reading project captures the repeating traces of literary readership across a city by means of public library data and several other forms of information. In this way, our project offers an opportunity to formulate repeatable, testable, hypotheses about real-world reading culture at city-scale.

The Reading Chicago Reading project is also creating a growing archive about a notable large-scale program of elective reading and related social media, reminding us at the same time of the importance of documenting internet-mediated cultural programs. The stakes are high: if born-digital and mixed digital/analog phenomena such as the "One Book One Chicago" program are not captured in a timely manner they are likely to pass beyond any practical means of recovery by future researchers. Since reconstruction of internet-mediated culture requires hardware and software beyond the means of all but the most attentive and well-resourced archivers, "[t]he first few decades of the online revolution are already set to be a dark ages of sorts" [Weber 2016, 55]. This essay is one of several forthcoming from project researchers and presents initial results of our practice of combining multiple forms of investigation — time-series analysis, social media analytics, location extraction from texts and maps, sentiment analysis, and text measures — to analyze an ongoing program in one of the United States' largest public library systems. While "One Book One Chicago" forms an opportune starting point, we expect that our models and techniques can be applied to library holdings generally.[3] 4

And finally, as a pioneering "city of big data", Chicago offers particular advantages for the study of mass-mediated uptake of cultural forms. A rich history of quantitative sociological work on its highly-stratified urban fabric has long made Chicago "an excellent laboratory for testing theoretically-derived hypotheses" [Sampson 2012, viii].[4] Our study of some CPL book checkout data is, admittedly, small by the standards of Robert J. Sampson's Project on Human Development in Chicago Neighborhoods (PHCDN), but it is informed by a similar desire to understand how individual actions and perceptions are embedded in "neighborhood effects" that structure people's understanding of their place and possibilities in the city and the world [Sampson 2012]. 5

Research questions

The "Reading Chicago Reading" project is animated by a number of research questions: 6

- *When a large public library system "sponsors" a city-wide collective reading event — and makes the book selection part of a larger ensemble of multimedia programming — what can we learn about the different processes that shape cultural perception across a metropolitan region?*

- *How does one live in a city differently after reading about that same city, and perhaps in association with others?* Cultural programming often serves as a form of imagined community, and we can use network effects to understand these communities in the city.

- *What are the measurable effects of sponsored book culture where spillover effects of library programming (neighborhood to neighborhood, branch to branch, and online) may be identified?* Because in addition to reading and group discussion, Chicago's "One Book" programming has also featured, for example, guided city tours, "maker" events, film screenings, dances, and community gardening, novel forms of belonging and citizenship are presumably created by means of recommended reading.

- And importantly, *how does the above vary by neighborhood, and library branch, in a city so identified by neighborhoods?*

While we cannot in a single paper answer all of these questions, given our circulation data from CPL, census and other publicly-accessible city-wide data (demographics in this study, but police reports, shared bike usage, FOIA requests, and the like are also possible), social media data (gathered via API), and quantitative measures from selected books, it is possible by bundling them to document changes in Chicago's attention economy, and we will do so in part in what follows. Our project's aim is to capture and, to a degree quantify, how Chicago's public script about itself changed during year-long library programming around books on the theme of, for example, "Music: The Beat of the City" (the 2017-18 OBOC season) or "Food" (the 2016-17 season). Can the cultural pulse of a large city be captured quantitatively and modeled by way of public library circulation data? Our project proceeds from the premise that it can. 7

Project description

The "Reading Chicago Reading" project began in discussions about the possibility of capturing and predicting library-sponsored readership across Chicago by means of the OBOC program. It was apparent to the project's founders that the program resembled a repeating and repeatable experiment – that is, each chosen OBOC book season represented a data probe into library usage and, by extension, a window onto the elective reading behavior of the patrons of a major American library system. The project's motivating hypothesis was that book checkouts per branch, combined with library branch demographics, promotional activities, and chosen text characteristics would constitute variables that could be used to predict patron response to future OBOC books, and one of our key tasks has been to encode these variables into a predictive model and use the modeling process to discover relationships between them. A "one book" program is a repeating mixture of personal and collective experience with some slow-changing variables (e.g. number of library branches and general neighborhood demographics) as well as periodically-changing input such as text features of the annual book selection (e.g. reading difficulty and total word count) and publicity around the book, all of which drives patron interest and potentially library branch checkout numbers. 8

The "One Book One Chicago" (OBOC) program is also a useful optic for observing how readers engage with texts in different ways across quite variegated social space. Reading of course happens in a number of modes, from silent reading of printed books in armchairs (a diminishing practice, we suspect) to partially-solitary reading via electronic devices on public transit or in coffee shops, to fully public reading and associated "engagement" via blogging, posting on Goodreads and Amazon, and participation in book clubs. People who read also like to talk about what and how and why they read; they document books both good and bad, next choices, reflections, recommendations, and the like.[5] And heterogeneous social spaces bleed over into complex media spaces. For example, uptake of narrative through audio rather than sight is a rapidly growing phenomenon, and the explosion of transmedia fanfiction and other forms of "post-press" literature extend the reading and writing process ever farther.[6] "Texts," Matthew Kirschenbaum notes, "are increasingly networks of transmedia properties. … [T]he bigger the book, the more extended its network of transmedia relations becomes" [Kirschenbaum 2010].[7] As reading interfaces continue their shift from documents to performances (as Lev Manovich has nicely summarized it), those of us who seek to understand reading in the present and future will benefit from the tools of data science [Manovich 2013, 33–9]. Social media platforms in particular facilitate new kinds of capture and visualization of cultural phenomena at the scale of the city, and we have been inspired by many exciting projects and studies.[8] 9

"The Book is Just the Beginning"

Community-based mass reading events like "One Book One Chicago" have exploded in popularity around the United States so quickly that we ought to take a moment to grasp the implications of the mainstreaming of such programs. Book clubs have existed for decades, of course, with roots in the United States reaching back to the first circulating libraries and to public lecture circuits. [9] The contemporary mass-mediated book club, however, marked its public 10 success with Oprah Winfrey's TV "Book Club" which began in the fall of 1996 and ran for fifteen years.[10] Book club culture has been the subject of many studies, each noting the different forms of intellectual and social bonds created, and sometimes challenged, when people meet to talk about fiction and nonfiction with others like and unlike themselves.[11]

Study of a large contemporary metropolitan "one book" program is useful given growing attention to the scope and effects of social media filter bubbles from micro-targeted advertising and ad-supported news [Pariser 2011] [Helmond 2013] [Tufekci 2017] [Singer and Brooking 2018] [Mina 2019].[12] In asking residents to read and discuss a literary work as a public, a book program seeks to create a virtual, temporary, community for mass, but not similar, responses among people who might not otherwise become entangled together in real (or virtual) life. Many CPL patrons might read Saul Bellow's *Adventures of Augie March* (fall 2011 OBOC season) or Jane Austen's *Pride and Prejudice* (spring 2005 OBOC season); perhaps a notable fraction of the city's population will take up the selected work in some manner over the city's season. But the result of this programming is not, and indeed cannot be, the diffusion of a single opinion or the creation of consensus as if participants were linked by a newsfeed or social media account pointed to the same content. A city-scale book club, this is to say, fosters a different brand of imagined community: a sponsored, and collective, experience moving together in shared time but in the service not of homogeneity of intellectual outcome but rather an improvisatory and unpredictable detachment from parochialism. In this way, the community fostered by a library system's one book program both preserves, and departs from, what Anderson described as the normative uses of print capitalism [Anderson 1991]. 11

Mass reading events like OBOC are also one more component of a broad trend since the early 1990s in which civic leaders commission iconic buildings, programs, and public artworks to signal status as a "global city" to local residents and to the world.[13] Community book clubs are open-ended in format and have ranged from print-only to all-digital; to date, they have focused largely on literary fiction and nonfiction, but there are other possible reading assignments that might not even be reading in a traditional sense — witness "Open Data Book Clubs" in Canada, for example, for which city data sets are assigned monthly; still other kinds of collective library experience are indeed possible.[14] Perhaps not surprisingly, literary fiction has formed the bulk of reading selections for programs such as OBOC. Literary fiction was the standard against which other forms of reading was measured in several NEA studies since the early 2000s [NEA 2004] [NEA 2007] [NEA 2009] [NEA 2017]. A much-cited 2013 article in *Science* found that literary fiction, with its requirement of attentive engagement with subjective states, unpredictable events, and complex characters, revealed statistically significant benefits in measures of "theory of mind" (ToM), arguing that because "readers take an active writerly role to form representations of characters' subjective states, literary fiction recruits ToM" [Kidd and Costano 2013, 380]. In addition, literary fiction requires readers "to expand our knowledge of others' lives, helping us recognize our similarity to them" [Kidd and Costano 2013, 380].[15] The predominance of literary fiction in One Book One Community programs around the U.S. bears this out. Helpfully, the Library of Congress has documented hundreds of programs and their book choices across the U.S. as part of its "Big Read" initiative. While the data is incomplete in at least one major case (stopping at the 2007 season for Chicago's OBOC, for example), it lists over 2000 community programs and just over 860 book choices stretching from Seattle in 1998 to Santa Monica in 2016. The most popular book choices include predictable popular titles such as *To Kill a Mockingbird* (90 times), Bradbury's *Fahrenheit 451* (50 times), Hosseini's *The Kite Runner* (48 times), and Homer Hickam's *Rocket Boys* (38 times). A second tier of popular choices includes canonical classics such as *Moby Dick*, *Pride and Prejudice*, *A Doll's House*, *A Long Day's Journey into Night*, and *Frankenstein*, but also a great deal of middlebrow fiction and nonfiction by the likes of Barbara Kingsolver, Mitch Albom, Mark Haddon, Eric Schlosser, and Barbara Ehrenreich. There is a marked presence of genre fiction, particularly science fiction and thrillers; some unexpected choices might include Loudon County Virginia's selection of Nikki Giovanni's poetry (2010), Richard Dawkin's *The Selfish Gene* (by Kansas City, MO in 2008), and Hannah Crafts' *The Bondwoman's Narrative* (Indianapolis in 2004).[16] 12

We should also note, however, that the forms of difference readers may encounter in the OBOC's selected books' represented worlds — social, ethnic, racial, sexual, and the like — do not of course guarantee additional or positive encounters with such difference in life. Chicago is a highly segregated city, as it has been for generations, and this is 13 reflected in the hard facts of branch-area demography around the city. We are also aware of the notable fact, quantified in Robert J. Sampson's PHDCN research, that Chicago neighborhoods with a higher density of community organizations tend to maintain that density over time, in effect enabling residents in some parts of the city to wield outsize influence in cultural impact (though spillover effects into contiguous neighborhoods were also notable) [see Sampson 2012, 179-233]. And reading for pleasure has a history; it is not a practice evenly distributed across spaces and publics. As Elizabeth Long noted in her study of book clubs in Houston, Texas, "American popular culture marks leisure reading by both class and gender" [Long 2003, xvii]. In a number of important studies, Wendy Griswold has shown how the U.S. has been fragmenting into a differentially empowered "reading class" and other, less print-centered, parts of the population who are, paradoxically, literate but not readers [Griswold 2008, 68] [Griswold et al. 2014] [Griswold and Wohl 2015].

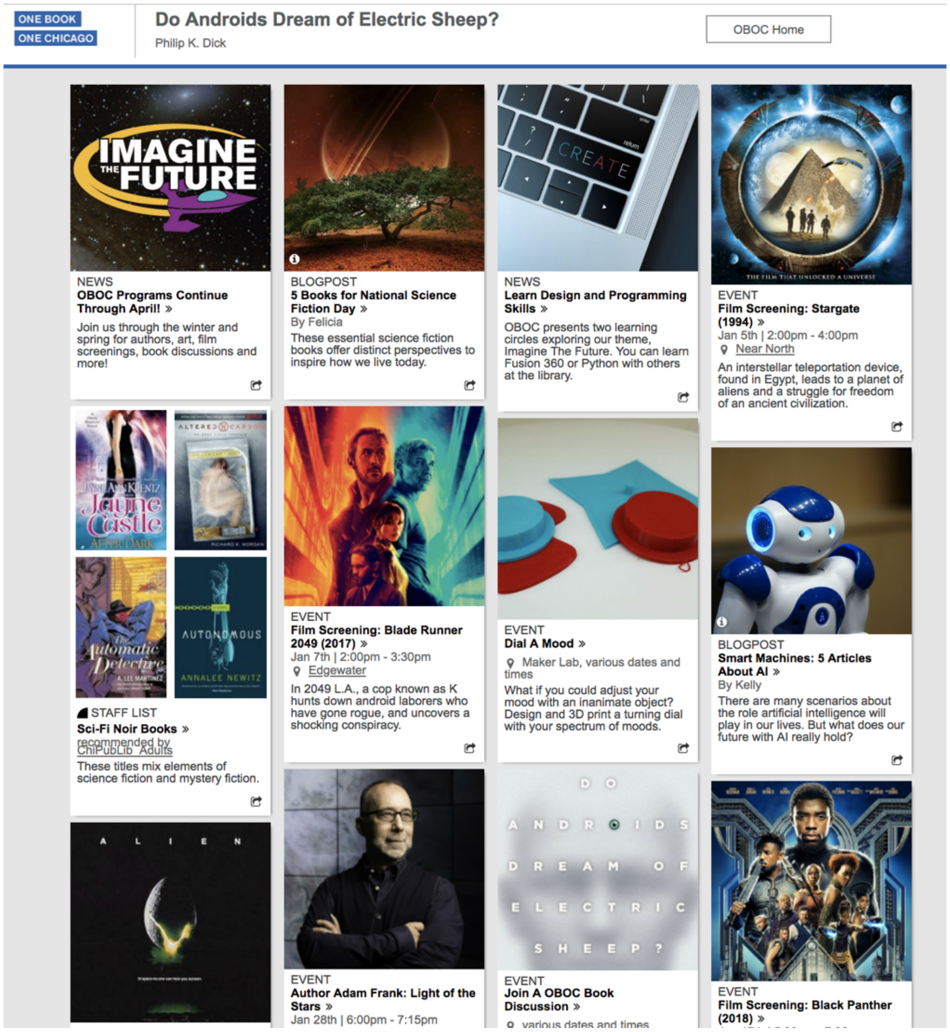
Why Chicago?

The origin of the city-wide "one book" program appears to be in 1998, when librarians Nancy Pearl and Chris Higashi at the Seattle Public Library sought ways harness the collective energy of the many small book clubs scattered around the city. They formulated their initial program as a question — "What if all Seattle read the same book?" — and chose Russell Banks' *The Sweet Hereafter* as the object of citywide discussion groups in libraries and private homes. Pearl and Higashi reported the idea at a meeting of the American Library Association, and by 2002 the ALA distributed "how to" packets for library systems willing to try the new idea. Nan Alleman at the Chicago Public Library read a *Chicago Tribune* article about Seattle's program and quickly launched "One Book One Chicago" in the fall of 2001 with the city assigned to read together Harper Lee's novel *To Kill A Mockingbird*. CPL branches stocked hundreds of additional copies of the book and discussions were scheduled throughout the fall in branches across the city. The Chicago Public Library received extended press coverage that enabled the idea to scale quickly.[17] 14

Chicago city government was immediately committed to the program. Initiated with fanfare by Mayor Richard M. Daley in the fall of 2001, and evolving in concert with other major public projects like Millenium Park (completed in 2004), the OBOC program is now a central node in cultural programming in Chicago. In the wake of the first season, Mayor Richard M. Daley called Chicago's public library system a "community anchor" and the "heartbeat" of its neighborhoods [Putnam and Feldstein 2003, 38]. Daley's comments in the program guide for Willa Cather's *My Antonia* (the OBOC choice for fall 2002) announced lofty civic goals: "One Book, One Chicago cultivates a culture of reading and discussion by bringing our diverse city together around one great book. Reading great literature inspires us to think about ourselves, our environment and our relationships. Talking about great literature with friends, family and neighbors can add richness and depth to the experience of reading." OBOC seasons created a dramatic impact in the city. In 2001-2, Harper Lee's *To Kill a Mockingbird* "was checked out of branch libraries more than eight thousand times over the course of a few months. Bookstores sold thousands more copies — *To Kill a Mockingbird* was on the Barnes & Noble top ten list for two months" [Putnam and Feldstein 2003, 51]. 15

The program seemed to fulfill its mission of bringing new engagement into metropolitan cultural events in the aftermath of the 9/11/01 terrorist attacks and the inauguration of new conversations about citizenship and cultural difference. Taking part in a shared narrative took on new meaning and amplified a sense of collective purpose. When asked about the "One Book" program, a 15-year-old African-American student in Chicago told interviewers "[i]t makes me feel good to be part of a city that is all reading the same book" [Fuller and Sedo 2013, 231]. Chicago's program has been successful close to twenty years now and continues, at the time of writing, with Elizabeth Kolbert's nonfiction book *The Sixth Extinction* and a city-wide theme of "Climate Change." One Book programs have many benefits and few liabilities for all involved: book publishers sell more books (since not all city residents will wait to check it out from a branch library); public libraries receive additional foot traffic and community relevance; citizens become active in a civic experience with cultural capital. In a publicity statement for the 2016-17 program centered on Barbara Kingsolver's *Animal Vegetable Miracle: A Year of Food Life*, Mayor Rahm Emanuel and CPL Commissioner Brian Bannon noted that the choice was intended as a catalyst for city-wide conversations about food, politics, heritage, and the environment. "From October through May 2017, One Book, One Chicago will explore a central theme — 'Eat Think Grow' — with citywide programming focused on cultural cuisine, cooking, eating, sustainability and urban farming. From seed, to 16 grocery, to cookbook, to table — we’re discussing all the ways we relate to and celebrate food. … Branch libraries host highlighted programs such as culinary walking tours, urban gardening discussions, and food talks about beer, bees, coffee and the Slow Food Chicago movement.”

17 As elective literary reading and related events, OBOC participation is cast as a means toward better historical and personal insight into the lives of others. The ideal of a program like OBOC is collective practices of learning and world-widening through mediated discussion of that reading as well as participation in live events. The OBOC’s annual repetition makes it resemble a city art biennial, and its overall experience is not unlike a fusion of book clubs, continuing ed classes, social media updates, and TED talks. People participate in a number of ways, not all centered on reading. In fact, the CPL slogan that “the book is just the beginning” is apt. OBOC programming itself has changed over the past 15-plus years, shifting from three-month programs centered on print book discussion “clubs” at physical CPL branches to nine-month seasons for which the assigned book is just one element, a teaser or “loss leader” as it were, for other civic initiatives, many of them digital. Figure 1 shows just some of the dozens of events around the city created in association with the 2018/19 OBOC book choice, Philip K. Dick’s *Do Androids Dream of Electric Sheep?* and season theme “Imagine the Future.”



Do Androids Dream of Electric Sheep?
Philip K. Dick

NEWS
OBOC Programs Continue Through April! »
Join us through the winter and spring for authors, art, film screenings, book discussions and more!

STAFF LIST
Sci-Fi Noir Books »
recommended by ChiPubLib_Adults
These titles mix elements of science fiction and mystery fiction.

BLOGPOST
5 Books for National Science Fiction Day »
By Felicia
These essential science fiction books offer distinct perspectives to inspire how we live today.

EVENT
Film Screening: Blade Runner 2049 (2017) »
Jan 7th | 2:00pm - 3:30pm
Edgewater
In 2049 L.A., a cop known as K hunts down android laborers who have gone rogue, and uncovers a shocking conspiracy.

EVENT
Author Adam Frank: Light of the Stars »
Jan 28th | 6:00pm - 7:15pm

NEWS
Learn Design and Programming Skills »
OBOC presents two learning circles exploring our theme, Imagine The Future. You can learn Fusion 360 or Python with others at the library.

EVENT
Dial A Mood »
Maker Lab, various dates and times
What if you could adjust your mood with an inanimate object? Design and 3D print a turning dial with your spectrum of moods.

EVENT
Join A OBOC Book Discussion »
various dates and times

EVENT
Film Screening: Stargate (1994) »
Jan 5th | 2:00pm - 4:00pm
Near North
An interstellar teleportation device, found in Egypt, leads to a planet of aliens and a struggle for freedom of an ancient civilization.

BLOGPOST
Smart Machines: 5 Articles About AI »
By Kelly
There are many scenarios about the role artificial intelligence will play in our lives. But what does our future with AI really hold?

EVENT
Film Screening: Black Panther (2018) »

Figure 1. Screen capture of a segment of CPL's OBOC programming. Accessed 3 Jan. 2019.

18 The variety of activities and media shown in Figure 1 also reveals why a large city-wide “One Book” program requires dedicated sponsors and culture workers. In *Making Literature Now*, Amy Hungerford calls for attention to the non-profit organization employees and public library staff who plan and implement experiences with contemporary literature. These “evangelists of culture”, as [Griswold and Wohl 2015] describe them, include Jennifer Lizak, CPL’s OBOC director, and around her the wider set of Chicago Public Library community outreach staff who create and facilitate

programming across the city. Hungerford writes that these “‘neglected agents’ of cultural formation not only play a crucial role in the cultural field but also constitute a set of actors for whom literary or artistic production matters beyond the moment of ordinary consumption” [Hungerford 2016, 38]. Culture brokers play a shaping role in the formation of the imagined community of a One Book program; but their choices of texts, as Griswold and Wohl show, tend to be based on hunches about demographic representativity (of authors, of branch behavior, of book topics) and reports about past book group success elsewhere. Tools of data science have not been an option. The decision-making process to make a Chicago Public Library OBOC selection requires several months of meetings, involves multiple parts of the library and the city bureaucracy, and is opaque to outsiders. As might be suspected, choice of a One Book One Chicago text is not based on generalizable criteria of sales, text length, genre, canonicity, or publication date. As we saw above (and see Appendix 1), CPL OBOC choices since 2001 have been quite varied — and yet a few tendencies can be discerned in most One Book programs nationwide: a tendency to favor living authors, especially those able to present their work at public readings, and a tendency, when possible, to select books with a tie to Chicago. Given the importance of social media outreach, authors with social media savvy are particularly appealing in the selection process.[18]

Data Sources

19 One of the challenges of digital humanities research is the assembly of appropriate data sources. “Reading Chicago Reading” combines data about people, about books, and about their interactions through a public library system and associated social media. We bring together a diverse set of data sources, each with its own history, complexities, and caveats. While we can be sensitive to these nuances, algorithms by their nature cannot, and consequently treat all data as equally valid and reflective of some real-world quantity or property. Such limitations of our CPL data are therefore limitations of our conclusions as well and need to be fully unpacked. We will be using the terminology in Table 1 in this discussion and in the analysis below.

Season	The time period between the announcement of one OBOC selection and the next.
Book/Text	An OBOC selection, a particular literary work.
Volume	A physical manifestation of a book, an item in the library’s inventory.
Transaction	Any action related to a volume recorded in the CPL system.
Circulation	Total count of “checkout” transactions of physical volumes from a given branch (or branches) over a particular period.

Table 1. Terminology

OBOC selections (2011-2016)

20 Since fall 2001, the One Book One Chicago program has selected over two dozen books. (See the full list of titles in Appendix 1.) Roughly half are novels, but the set also includes several short story collections (O’Brien, Lahiri, Li), two novellas (Solzhenitsyn, Cisneros) and two plays (Hansberry, Miller). Non-fiction and historical works, especially those with a connection to Chicago, play a notable part in the list (Dybek, Smith, Dyja, Wilkerson, and Kot). Most of the works date from after World War II, and just under half from the past two decades. Several OBOC book choices reflect the multiple communities in Chicago, White, Black, Latino, and Asian; 18 of 29 (62%) authors are male. Our data set encompasses books from seasons running 2011 to 2016 — the years for which we have CPL circulation data. [19] From the fall 2011 to the 2016-17 OBOC season we have seven central, but heterogeneous, texts: Saul Bellow’s sprawling 1953 *bildungsroman* (and National Book Award winner) *The Adventures of Augie March*; a 2010 short story collection by Chinese-American author Yiyun Li, *Gold Boy, Emerald Girl*; Markus Zusak’s popular novel set in Hitler’s Germany, *The Book Thief* (2005); Isabel Wilkerson’s *The Warmth of Other Suns* (2010) about African American migration from the southern U.S. over the 20th century; Michael Chabon’s comic epic *The Amazing Adventures of Kavalier and Clay* (2000); a 2013 study of post-World War II Chicago (*The Third Coast* by Thomas Dyja), and Barbara Kingsolver’s 2007 meditation on food and ecology, *Animal Vegetable Miracle: A Year of Food Life*. Table 2 lists these books and the abbreviations that we will use to refer to them throughout the rest of this discussion.

Year	Title	Abbreviation
2011 (Fall)	Saul Bellow, *The Adventures of Augie March*	AM
2012 (Spring)	Yiyun Li, *Gold Boy, Emerald Girl*	GB
2012 (Fall)	Markus Zusak, *The Book Thief*	BT
2013	Isabel Wilkerson, *The Warmth of Other Suns*	WS
2014	Michael Chabon, *The Amazing Adventures of Kavalier and Clay*	KC
2015	Thomas Dyja, *The Third Coast*	TC
2016	Barbara Kingsolver, *Animal, Vegetable, Miracle*	AV

Table 2. Seasons and selections covered by our data set

Definition of an OBOC season

As noted earlier, CPL's management of OBOC events has evolved over its nearly 20-year history. For the purposes of our project, the biggest discontinuity appears at the very beginning of our data set. 2012 was the last year that two seasons were held in one calendar year (i.e. fall and spring). *Gold Boy, Emerald Girl* in spring 2012 followed directly on the heels of the *Augie March* fall 2011 season. *The Book Thief* was then featured in the fall of 2012. The next selection, *The Warmth of Other Suns*, was launched one full year later in the fall of 2013 as CPL moved to a one-book-per-year schedule. In this case, at least, we were presented with a problem of how to define an OBOC "season." Our data showed, for example, that the fall 2011 selection *Augie March* was still being checked out at a significantly higher rate at many branches more than one year after its selection compared to the months prior to its announcement as an OBOC selection — and all despite the fact that another OBOC season and book had been launched in the meantime. This finding suggested that a 12-month span was a reasonable choice for a season length, even for the books chosen bi-annually. We therefore use library transaction data over the 12 months following a book's selection. As a baseline for the circulation of a book prior to its OBOC selection, we use the six months of city-wide transactions prior to the book's launch. The reason for this choice is again contingent on circumstances beyond our control: due to CPL's data migration in mid-2011, we only have data for six months prior to the launch of *Augie March*. For consistency, we define prior circulation for all the books in the same manner. 21

The next question is how to define the season duration for each book. For almost all seasons, the identity of the book remained secret until a defined "launch" day, where a public announcement would be made by the Chicago Public Library and (sometimes) the Mayor's office. However, the identity of the fall 2012 selection, *The Book Thief*, was leaked in newspaper reporting and then subsequently confirmed by the Chicago Public Library in the spring of that year, making the choice known for many months prior to the official launch. In this case, we were confronted with a number of choices, none entirely satisfactory. *The Book Thief* data could have been discarded. However, we were reluctant to do this as our set of seasons was already limited by CPL data availability – losing 1/7th of the total circulation data would have made our analytic tasks and modeling more difficult and uncertain. We could have stuck with the "official" launch date, and in fact, some of our early analyses were conducted in this mode. Doing so, however, creates an uncharacteristic early "bump" in what would be considered prior circulation for this title. In Chicago, *The Book Thief* became a popular summer reading title well before its fall launch, a phenomenon that denied us a clean demarcation of "before" and "after launch" circulation. By elimination, then, we have chosen to use April 30, 2012 (the date the *Chicago Sun-Times* inadvertently "announced" the next book) although its official launch by CPL was in September. A consequence of this complexity is that this book has remained a stubborn outlier in many of our analyses. One can see in Figure 2 below how *The Book Thief*'s circulation (label BT, blue line) differs from the other six in its delay from our x-axis zero "launch" point: 22

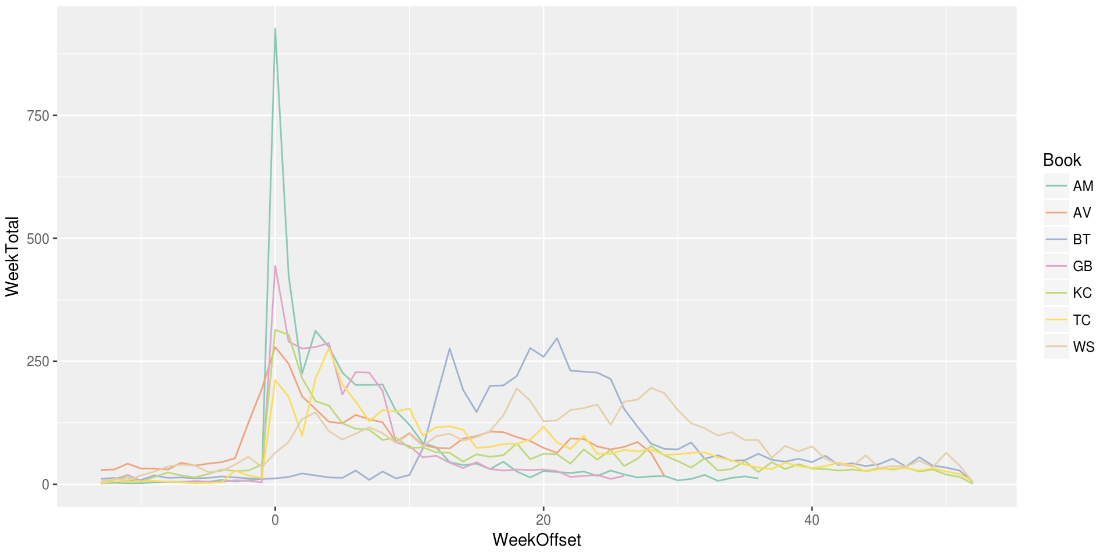


Figure 2. Book circulation (all branches) for seven seasons of OBOC (2011-2017) superimposed with the official launch date set to zero on the x axis.

The time series shown in Figure 2 allows us to grasp the effects of promotion by CPL. One can see that in most cases after an initial burst of interest (i.e. checkouts) created by the launch date, the checkout totals decline sharply, for instance see *Augie March* (green line) and *Animal Vegetable Miracle* (orange line). Other books present different results in their city-wide checkout totals: Dyja's *Third Coast* (yellow line) has notable swings up and down, as does *The Book Thief*. Isabel Wilkerson's *Warmth of Other Suns* (beige line) has no major launch-date "bump," but intriguingly keeps a steady background level of checkouts while also increasing in circulation over the following year. (By contrast, OBOC books typically witness overall declines in circulation after the launch date.) 23

In future work we will examine in detail the meaning of these checkout numbers, here totaled for all branches but capable of being disaggregated and plotted for each CPL branch. We are interested in the differences in checkouts over time per branch, of course, but one can see even with city-wide totals that after official CPL launches, different OBOC titles have different spikes of secondary or tertiary interest. What drives the later increases in checkouts of these titles? Live programming and social media, we suspect, are crucial factors: an author reads the book at a library event or posts about it (Kingsolver for instance has a large social media footprint), or other City of Chicago tie-in events note the book and/or the season's theme. In a forthcoming paper about the 2015-16 season (Dyja's *The Third Coast*), we have correlated records of CPL-sponsored events, checkout data, and social media about the OBOC program (via Twitter API) to show in detail and at branch-level how the social word of reading culture does and does not drive book circulation totals throughout the city. 24

Library checkout data

We obtained two types of library data from CPL.[20] As indicated above, we were able to obtain CPL transaction data — a history of how individual volumes were processed in the library system. Because of inconsistencies in how the data was queried, and a second data migration occurring more recently, we have all transactions data for some books and only checkouts for others. (The larger set of CPL transaction types includes, in addition to checkouts and returns, inter-branch transfers, renewals, book losses, and holds.) In our preliminary examination of this data we found that all types of branch-level transactions were heavily correlated with branch checkouts, and therefore we have used only checkouts in our analysis below. Our circulation modeling is limited to paperback, hardcover, audio CD copies as well as "book club in a bag" kits (see explanation below), and these constitute the vast majority of patron transactions. Although we did have e-book checkouts available, given that we are interested in analyzing differences in checkouts between branches and given that virtual checkouts cannot be associated with one branch, the analysis of e-book transactions is outside of the scope of this paper. Data that would have been helpful to have available is the information about readers 25 participating in OBOC events after purchasing their own copies of the books. We do know from early coverage of the program[21] that OBOC selection does drive metro area bookstore sales of the title to some extent, but a study of book purchasing behavior is beyond the scope of the present study.

Library holdings data

The second type of data is holdings data recording the number of OBOC books available at each branch library. This data is a series of transactions indicating when each OBOC volume was added to the inventory of a branch library, or accessioned: volume ID, branch, and date. In theory, from this data we would know how many books were on the shelf at each branch at the moment that the OBOC book was launched. However, the holdings data that we have indicates only when a book was added to the collection at a particular branch. In some but not all OBOC events, branches assembled “book club in a bag” kits containing eight copies of the chosen text for convenient single checkout. In some branches, these were treated as a single unit and not accessioned until broken out of the bags at the end of the OBOC season. In other cases, the books in the bag were available for separate checkout. The inconsistent treatment of these club bags meant that “holdings at the date of launch” is not a consistent representation of how many books a patron might have seen at a given branch during the season. Our compromise has been to count every copy accessioned by a CPL branch, regardless of date, under the assumption that the moment of the “One Book” event would by necessity be the moment of peak holdings for the chosen title. This way, the “broken out” books are treated uniformly for purposes of holdings calculations. 26

Demographic data

The Chicago Public Library has eighty branches scattered throughout a large and diverse metropolis well known for its history of segregation. To understand how different groups are participating in OBOC events, we need to associate demographics with the branch transactions that form our core data. For important privacy reasons, CPL – like other public libraries – does not retain patron information associated with book circulation after a book has been returned. The transaction data is therefore fully anonymous and there are not even “pseudonymous identifiers” that could be used, for example, to identify accounts that have participated in multiple OBOC events. In the absence of more detailed information about branch library users, we use data from the U.S. Census American Community Survey (ACS) for the area surrounding each branch. Census data is aggregated by tracts containing approximately 4,000 individuals. We used a simple geographical rule to associate tracts with branch libraries. 27

Each of Chicago's 866 census tract was associated with the branch library in closest geographical proximity, recognizing that this simple approach is only an approximation of complex patron usage patterns. Technically, this rule was realized through the construction of Voronoi polygons defined by the locations of each branch. A Voronoi polygon is defined by n points {p1, .. p n} and consists of n polygons {P1, …, Pn} where the points interior to polygon Pk are closer to point pk than to any other point. Census tracts fully contained in a particular polygon were assigned to the closest branch. Those that spanned multiple polygons were assigned to all intersecting polygons on the assumption that users equidistant from multiple branches might spread their visits across these branches. 28

Figure 3 shows these branches and their associated polygons. (Branch codes and names are given in Appendix 2.) 29

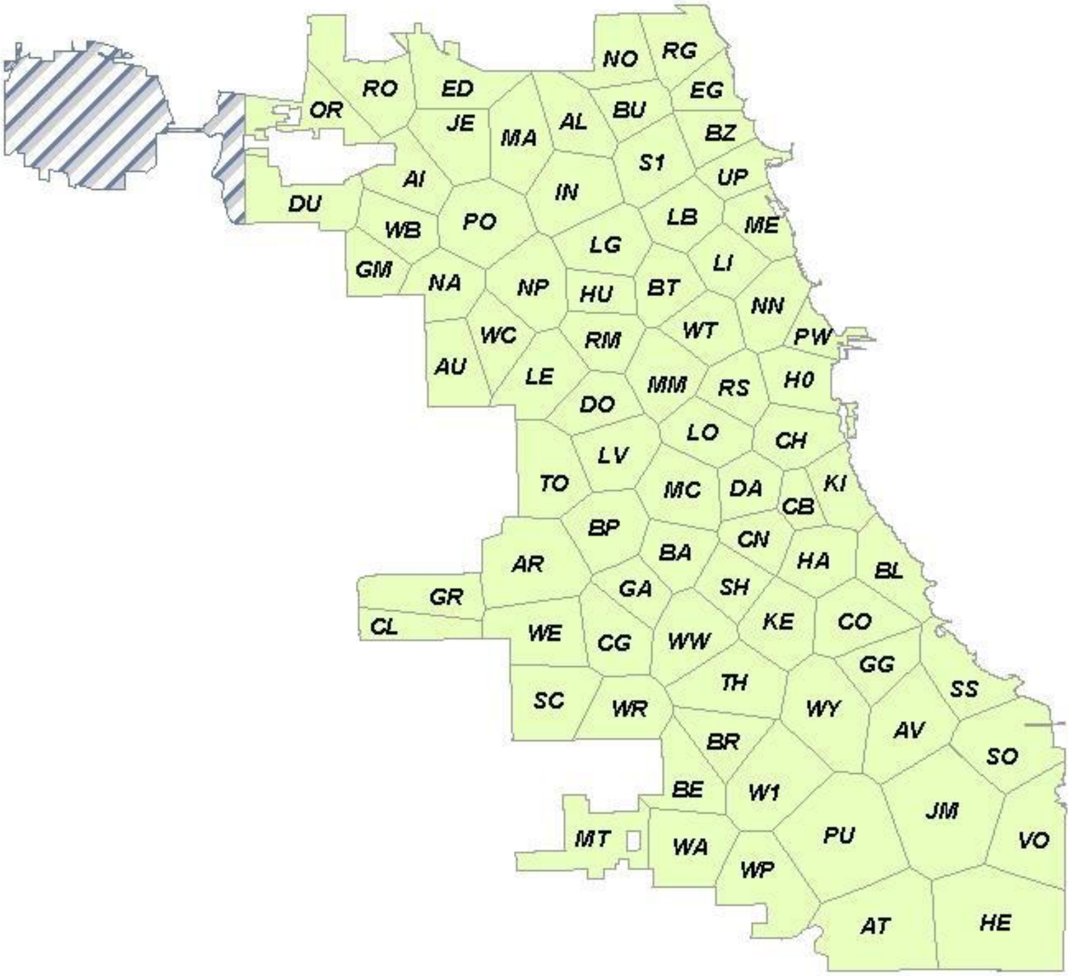


Figure 3. Chicago Public Library branches and associated Voronoi polygon regions.The shaded region at the top left is O'Hare Airport, which has no associated library branch.

30 Our analysis was complicated by the special status of three branches. One is CPL's iconic central downtown Harold Washington Library Center (branch code H0), which is intended to serve the entire city and not just a single local neighborhood (i.e. the Loop). Harold Washington Library Center is also host to dozens of OBOC events every season, and always the highest profile ones (i.e. author readings). The CPL system also has two "regional" library centers: Woodson (branch code W1) and Sulzer (branch code S1), located on the city's south and north sides, respectively. As with Harold Washington, these regional branches are intended to serve large segments of the city and not just an immediate neighborhood area. We considered various methods of handling these larger branches, including treating them on par with neighborhood branches, thereby ignoring their special status and greater geographic reach. In the end, however, we chose to treat these branches as having service areas overlapping with the neighborhood system. Harold Washington is represented by city-wide aggregate demographics and the two regional branches are represented as a separate "system" of two polygons for the halves of the city that they cover.

31 With the assignment of tracts to branches complete, we could then calculate aggregate demographics for each branch. The American Community Survey contains approximately 180 variables reflecting a wide variety of social indicators, including race, age, type of employment, average rent paid, commuting patterns, and many others.[22] To capture large-scale demographic variation across branches, we used principal component analysis (PCA) to create a set of projected dimensions capturing the largest proportion of variance in the ACS data over our polygonal regions. The core concept behind PCA is that a high-dimensional data set may have internal regularities that make some dimensions essentially redundant. For example, it may be that property values and rent are highly correlated. The data set needs only to retain one of these features to capture information about the relative wealth of different regions. PCA takes this concept one

step further by creating new dimensions that are linear combinations of the existing ones. Such projected dimensions can be difficult to interpret, but they have the benefit of being mutually orthogonal, meaning that they have no overlap in the aspects of the data that they represent. From our PCA decomposition of the census, we identified seven factors that account for 85% of the variation in the demographic data. Of these, the first four account for 75%, meaning that if a neighborhood is represented by just these dimensions, rather than the original 180, the demographic information will differ from the true value by no more than 25%.

32 To gain an understanding of the consequences of these features for the library regions, we performed unsupervised clustering of the branches based on their demographic characteristics. We used the Partitioning Around Medioids (PAM) algorithm [Kaufman 1990], which is known to be more robust to noise and outliers compared to the more widely-used k-means algorithm. PAM is more computationally-intensive than k-means, but for our small data set, this was not a significant drawback. We explored various combinations of cluster counts and selected features, using the silhouette metric to discriminate between the different choices. Our final set of five clusters was created using the top eight principal components and had an average silhouette width of 0.3. Figure 4 shows these clusters, and includes patterns perhaps familiar to students of the segregated history of Chicago. A number of “near-north” neighborhoods with higher property values are found in cluster 5. Surrounding them in cluster 2 are diverse neighborhoods with many rental property units. Majority African-American areas on the south and west sides of the city are grouped in cluster 4. Hispanic areas are found mostly in cluster 3. Cluster 1 is the so-called “bungalow belt” of historic ethnic neighborhoods, now occupied by a diverse mix of residents, distinguished from some of the other areas by a higher rate of home ownership — note the inclusion of Chicago’s Chinatown (CN branch) in this group. The three regional libraries are treated as a single separate cluster for analysis.

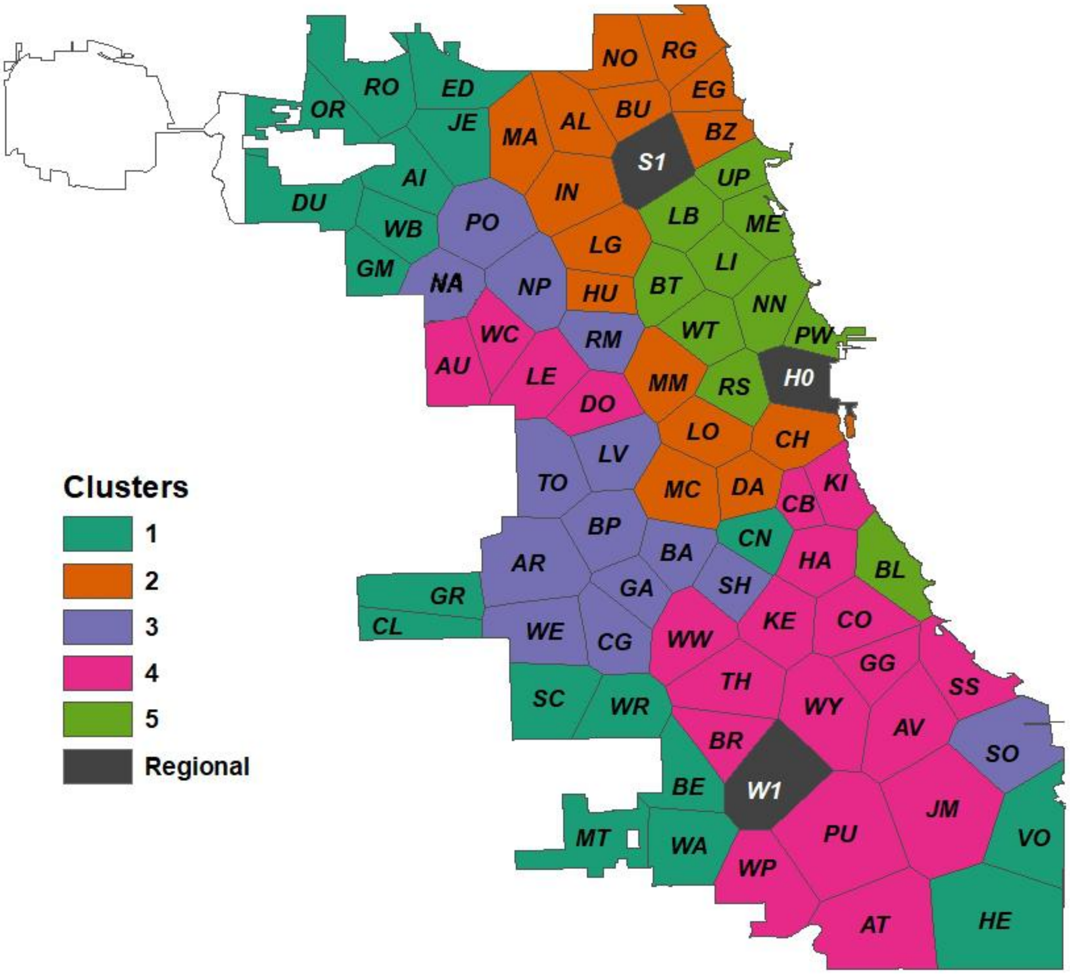


Figure 4. Branch library regions colored by cluster.

Textual measures data

Our last key data source is textual measures of the books themselves. In this, our project differs from much prior work using quantitative methods of full-text analysis in several ways. One major difference is the great heterogeneity of the texts in our corpus: our text set contains both fiction and non-fiction, and ranges from a modernist novel to short stories to a young adult title and (in the non-fiction) from a food memoir replete with actual recipes documenting a single year to the scholarly works of Wilkerson and Dyja covering decades of U.S. history. The books in our set also vary widely in length, from 70,000 words (*Gold Boy, Emerald Girl*) to about 260,000 words (*Augie March*), and in other stylistic measures such as type-token ratio and sentence length, as will be shown below. 33

We should also note that all of the recent OBOC works are in copyright — indeed, only Bellow's *Augie March* is more than 20 years old. Because of the small size of our collection, it was possible to use text extracted from ePub files. However, this would not be feasible at larger scale, and the only option for full-text processing at scale is the Data Capsule feature of the HathiTrust Research Center[23] which offers computational access to in-copyright texts. When we began our analysis, only four of our seven selections were available in the HathiTrust digital library data capsule: *Augie March* (AM), *Book Thief* (BT), *Kavalier and Clay* (KC), and *Gold Boy Emerald Girl* (GB). We added additional files to the data capsule to complete the set: *Warmth of Other Suns* (WS), *Third Coast* (TC), and *Animal, Vegetable, Miracle* (AV). With these additions, it was possible to apply non-consumptive analysis to all seven of works in Table 1 within the HathiTrust data capsule environment. 34

Analysis

There are many kinds of analysis we might undertake with these various data sources. In this article, we discuss our work to model normalized branch-level circulation. Such a model will ultimately enable predictive insight into correlations of city-wide book checkouts and city-wide OBOC book promotion.[24] Total circulation would seem an obvious, and straightforward choice as a measure of popularity. However, we noted that CPL OBOC book holdings varied widely across branches and a circulation value of 100 would have a very different meaning for a branch with 10 copies as opposed to a branch with 50 copies. Checkouts per holding would have been a logical alternative, but we found that some branches (typically smaller ones) had no copies of some OBOC titles, rendering this statistic meaningless. Our alternative normalization is to calculate circulation per thousand visitors. Because we found visitor count to be very closely correlated with OBOC holdings, this statistic closely tracks circulation per copy.[25] From the City of Chicago Data Portal we obtained the visitor "gate counts" for all CPL branches for the year containing the book's launch. Visitor counts typically change less than 10% from year to year, except when there is a major change to the physical plant such as new construction. 35

One plausible hypothesis regarding OBOC circulation might be that the book choice is irrelevant to patron participation. One could imagine a relatively-stable cadre of devoted readers with the time and inclination to pick up whatever text CPL chose to promote for each season. This would lead branches to have relatively stable OBOC checkouts over the seasons studied. We analyzed circulation patterns to determine whether this hypothesis might hold. Figure 5 shows a visualization of normalized circulation at each branch for each book. The seven columns are seven seasons of OBOC 2011-17 with the book title abbreviation at the foot of the column. The colors given to the two-letter branch codes in each column are the colors of the six clusters we described above, based on demography of neighborhoods. Note that the y axis is a logarithmic scale – so for example the lowest scoring branch (DO: Douglass, just west of the Loop) for the AV text has 1/100th the circulation per 1k visitors of the RO (Roden, in Norwood Park) branch at the top end of the scale. We see that the branches vary widely in their OBOC circulation. We also see that relative interest in the OBOC book is not consistent for a particular branch from season to season. For example, the DO branch is at the bottom for *Animal Vegetable Miracle* but closer to the middle of checkout totals for *Augie March* and *Warmth of Other Suns*. The AL branch (Albany Park, in the northwest of the city) has the most normalized circulation for *Kavalier and Clay* but is near the bottom for *Book Thief*. Clearly, the book choice matters, and different books appeal to different audiences at different branches. This is perhaps not surprising, but was important to establish at this phase of the study. 36

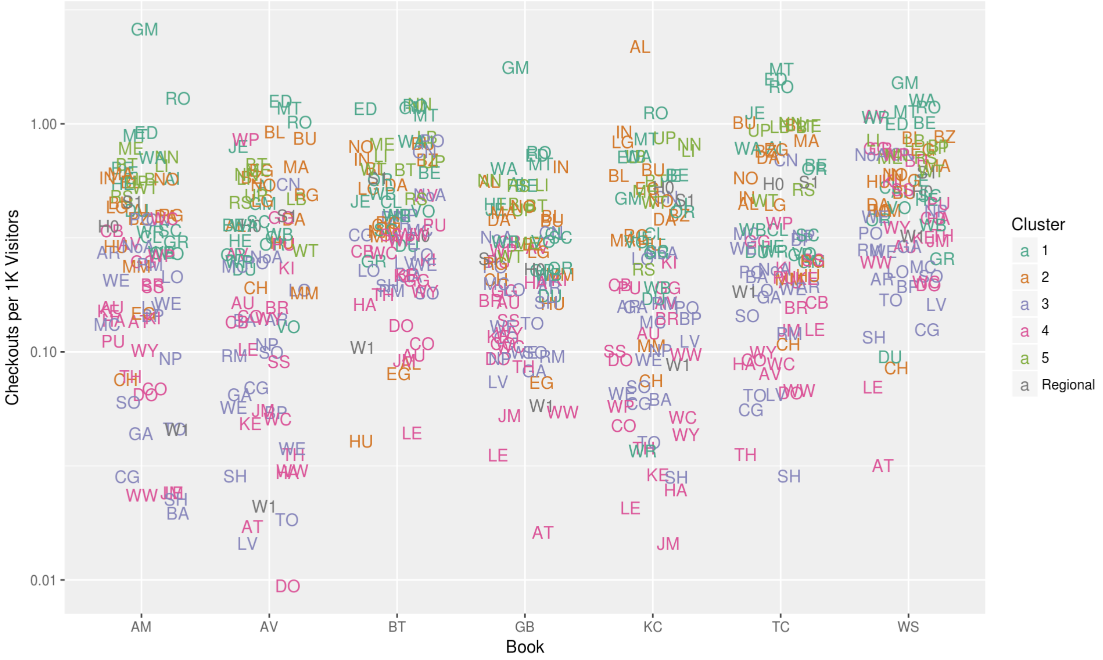


Figure 5. Normalized branch circulation by book, colored by cluster.

37 To understand the interaction between demography and circulation in greater detail, let’s examine a single book: Thomas Dyja’s *The Third Coast: When Chicago Built the American Dream* (2013) [TC, and the selection for the 2015/16 season] in relation to the first three components of our principal components decomposition. Figure 6 shows a scatter plot with these results. PC1 corresponds (roughly) to property value, with lower (more negative) values corresponding to wealthier neighborhoods. We see a linear trend with some substantial outliers: for example, CH (Chinatown branch) below the trend line — i.e. wealthier (and abutting the rapidly gentrifying south loop) but with lower circulation, and ED (Edgebrook) above the trend, i.e. median wealth but with higher circulation. Readers familiar with Chicago neighborhoods might hazard guesses about this output: despite similar wealth figures, Chinatown residents near the center of Chicago were less likely to read *The Third Coast* — a book centered primarily on north and south areas of the city — than far-north residents in Edgebrook. Because of the limited amount of data available we cannot trim these outliers, but instead must recognize that any kind of linear model will be an inexact fit. A similar observation can be made for PC3, which corresponds to a combination of the renter/home-owner axis and age, with lower (more negative) values corresponding to more owner-occupied housing and more residents above age 35.

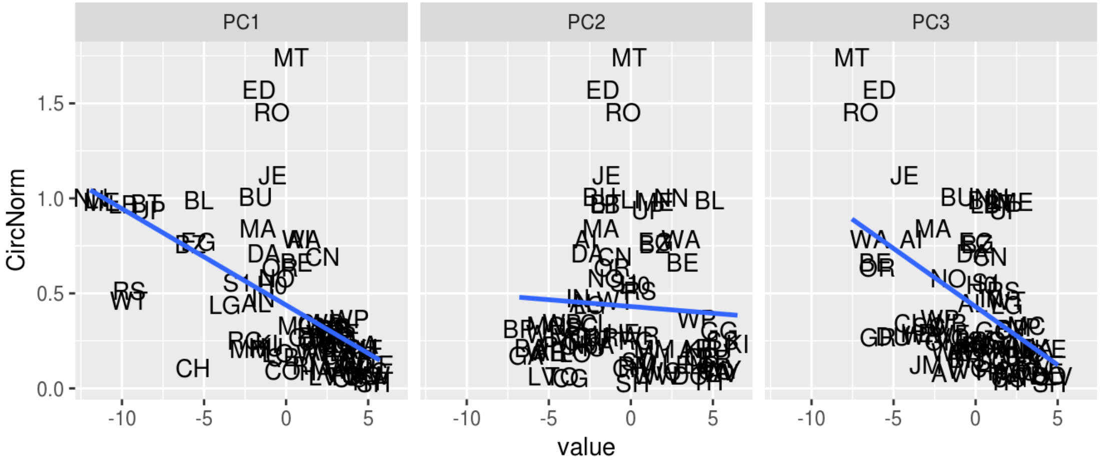


Figure 6. Trends for circulation vs branch demographics

38 However, PC2 is different. With this feature, we do not see an overall linear trend. Rather the extremes of negative and positive are lower, and peak circulation occurs at values around zero. This component corresponds to a race/ethnicity spectrum with Latinx communities on the negative end of the scale and African-American ones at the positive end. We experimented with various transformations of the PC2 variable and ended up with the following square transform:

39 $$C_{2X} = (C_2 {*} C_2)/5$$

40 The ⅕ factor was added to scale the value to a range similar to the other principal components. A comparison between the original PC2 and the transformed PC2X variables is shown in Figure 7.

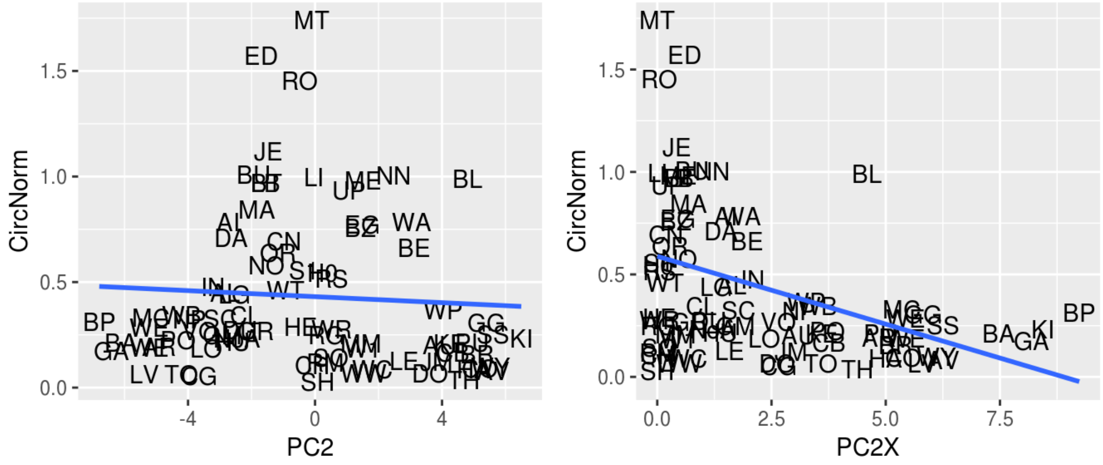


Figure 7. Circulation trend with principal component 2 and transformed version.

41 Although the analysis above examines only the data for a single book, other OBOC seasons show similar patterns. A complete analysis of the circulation data for all of the seasons can be found in the “Results” page of our project website (see endnote 3).

Circulation Modeling, Part I

42 To understand the magnitude of the impact attributable to book choice, we constructed a multi-level linear regression model of the aggregate branch-level circulation. A regression model has the form: $y{=}\beta_0{+}\beta_1 x_1 + \beta_2 x_2{+}...{+}\beta_k x_k$ where the x_i values are features being used for prediction (for example, a demographic characteristic of a neighborhood) and the β_i values are coefficients fit to the model to maximize its predictive accuracy. A multi-level model adds an additional set of terms to this predictor that are book-specific. For example, the model for the circulation of Saul Bellow’s *Augie March* (AM) has the following form:

43 $$y^{AM}{=}\beta_0{+}\beta_1 x_1 + \beta_2 x_2{+}...{+}\beta_k x_k{+}\gamma_0^{AM}{+}\gamma_1^{AM} x_1{+}\gamma_2^{AM} x_2{+}...{+}\gamma_k^{AM} x_k$$

44 where the γ_i^{AM} are book-specific coefficients. In this type of model, the β_i coefficients are known as the fixed effects and the γ_i^{AM} coefficients as the random effects. A different set of γ values is fit for each book, enabling us to determine how the relationship between neighborhood demographics and circulation varies by book.

45 A range of different models was constructed with different subsets of the demographic principal components. These models were evaluated on their ability to account for the existing patterns in the data, yielding the closest fit to the observed data. The best fitting model is described here and included four independent variables: the branch-level holdings (“Holds” in the figures), principal components 1 and 3 (PC1 and PC3) and the transformed version of principal component 2 as described above (PC2X).[26] Coefficients in the fitted model provide a quantitative measure of the relationship between the independent variables and the circulation, as impacted by the choice of book.

46 What we learn from this model fits well with intuition gleaned from the analyses above, but sharpens it to identify

specific aspects of the data. Figure 8 shows the coefficients learned for the demographic attributes for each OBOC book — both the β_i and the γ_i values from the equation above where i > 0. Because the coefficient values are small, they are scaled here by 1000, in effect undoing the per-thousand-visitors transformation applied to the circulation data. The fixed effect (β_i) coefficients for the three demographic parameters show a very large general effect associated with dimensions 1 and 3 and much smaller one for the (transformed) second component. In general, then, greater wealth and greater homeownership and age are correlated with OBOC participation and the particular book has a smaller effect. Interestingly, this wealth effect is enhanced most substantially for TC, but diluted for GB and to a lesser extent, BT.

The second demographic component, which in its transformed state corresponds more or less to a white+other (at zero) vs black+hispanic axis, shows more dramatic variation. The overall impact of this PC2X axis is not large compared to the other components (7 checkouts per season vs 30-40), but the variation relative to the book choice is more significant. Note Figure 8, and the PC2X results (middle third of the figure): the between-book variation follows patterns that we anticipated. As might be expected for a book about the Great Migration in which Chicago's African-American community plays a large part, WS reverses the otherwise largely downward trend of the axis: that is, more copies of *Warmth of Other Suns* were checked out in libraries with larger black+hispanic patrons. (To a lesser extent, *The Book Thief* also shows this phenomenon.) 47

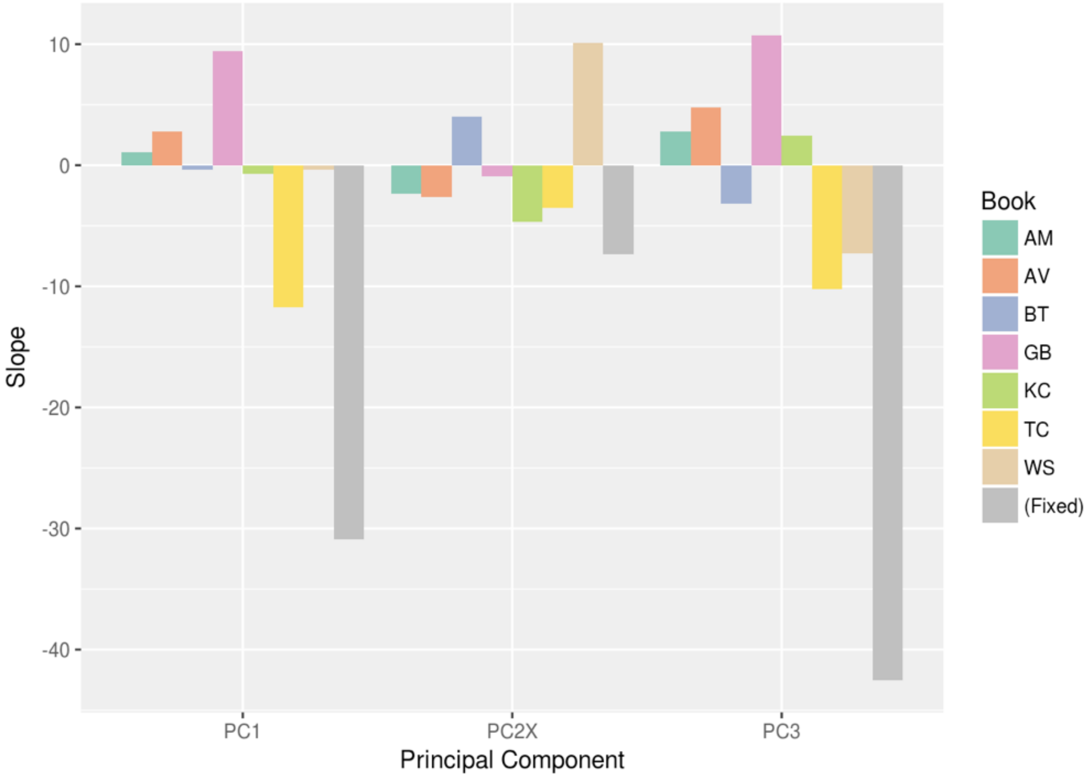


Figure 8. Fitted coefficients demographic variables in the multi-level model.

Figure 9 looks at the coefficients for the CPL Holdings variable — that is, the number of books assigned to a particular library branch. As expected, there is a strong general effect of approximately 3 checkouts per book: it is a more involved process for a patron to check out a book not currently on the shelf at the branch. Some books, however, show greater "shelf appeal", and for some, like WS, this effect is negative, suggesting that patrons were sufficiently interested in this title that lack of branch copies was not much of a deterrent. 48

Finally, Figure 10 shows the "intercepts" for the model, that is the β_0 and γ_0 values from the equation. These are not multiplied by any of the model features and therefore serve as a baseline level of popularity for the program overall and for each OBOC title. We see here that the baseline effect is strong. Choosing a book for the OBOC program will 49 typically add more than 300 checkouts for a typical CPL branch over the season. Different books have, of course, different levels of general interest as shown in the book-specific intercepts: BT, TC, and WS were more popular than average; GB had the lowest general appeal.

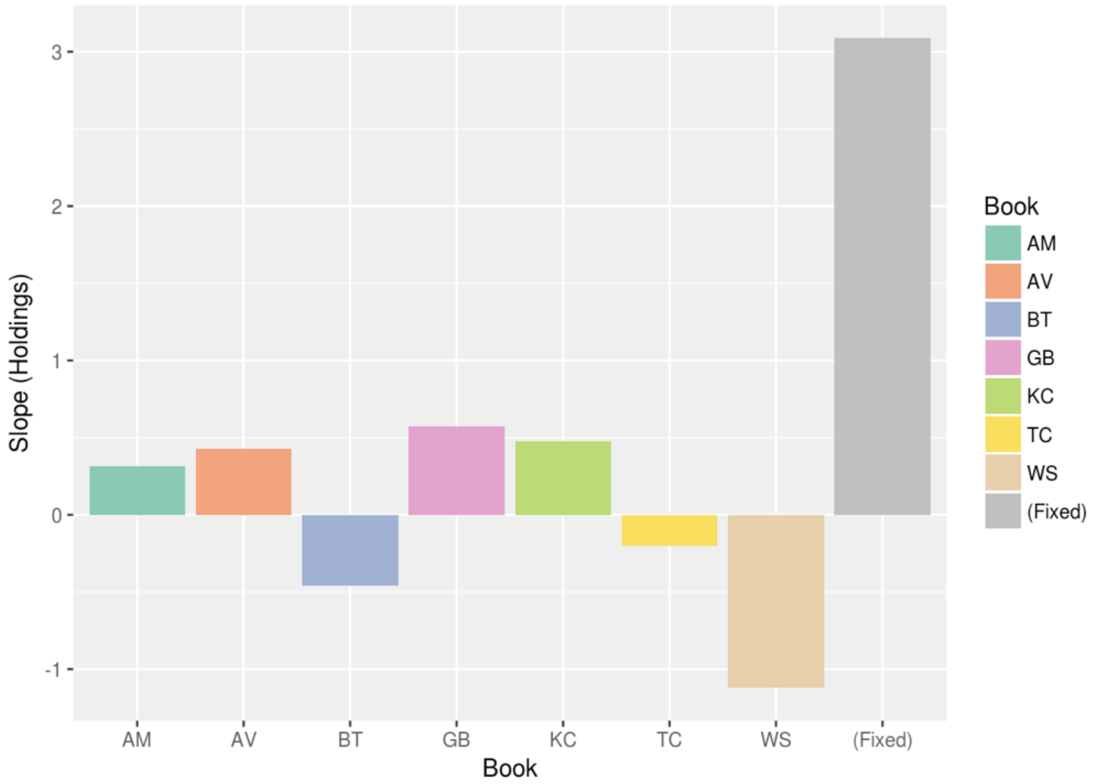


Figure 9. Fitted coefficients for branch library holdings

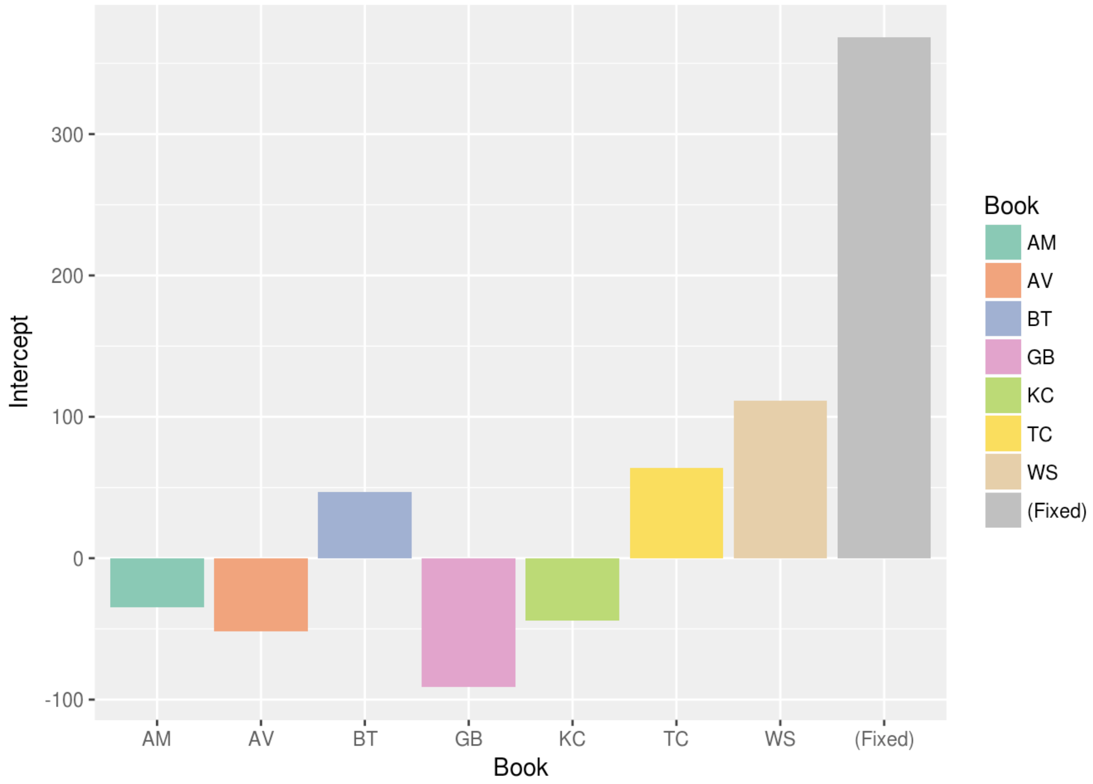


Figure 10. Fitted intercepts

Circulation Modeling, Part II

This first stage of modeling highlighted the heterogeneity of the book choices and of the OBOC patron audience. Books have clear differences in their overall appeal and in their specific appeal to different patron groups. However, this finding raises the question of what features of books cause them to appeal to different audiences within the city. From the start, a motive of the project has been to capture quantitatively, branch by branch and over time, the differential appeal and impact of literary works. We considered various types of textual features that might be extracted from our texts. However, we were confronted repeatedly with the challenge of the differences between the texts such as length, reading level, genre, and still other traits. We needed to identify features sufficiently generic that they could be extracted from any text in our set — but also for any future book — in order to begin modeling "unannounced" books for city-wide checkout predictions. Based on our discussions with CPL staff, we hypothesized that reading "difficulty" and text length would be important indicators, with some patrons less likely to pick up OBOC selections that overtly present greater reading challenges. 50

Text characteristics

There are many ways to calculate a "reading level" or degree of difficulty for a text or set of texts. Conventional indices of difficulty cannot tell the whole story, however, as they do not take into account the subject matter or the organization of the text but rely on the surface characteristics such as the occurrence or absence of "difficult" words or measures of sentence length [Dawkins 1956]. Numbers do not automatically align with the actual reading experience. For example, in our first efforts in modeling we noticed that the dense and allusive *Adventures of Augie March* scored lower on some measures than the relatively simple prose of Li's *Gold Boy Emerald Girl*. Such numerical findings in isolation did not, we felt, make sense of the quite different reading experiences involved. To address this, rather than rely on any single text measure we created a combined measure using the following four text attributes: 51

- Average sentence length
- Dale-Chall reading difficulty[27]

- Type-token ratio
- Total number of words

52 Our text measures were obtained by running a Python-based readability program on scanned volumes of OBOC selections in the HathiTrust secure data capsule.[28] We extracted the main text of each work and then tokenized it into sentences. We then extracted ten samples containing approximately 10,000 words each and computed the reading measures above (except for total number of words) on each sample. Then we averaged over the samples to produce the reading measures shown in Table 3 and Figure 11.

Title abbreviation	Number of words (punctuation excluded)	Average sentence length (punctuation excluded)	Dale-Chall Index	Type-token ratio	Combined difficulty
AM	263,427	16.17	8.03	8.61	0.43
GB	71,138	21.40	8.27	9.90	0.38
BT	127,838	10.58	8.08	7.34	0.08
WS	212,613	19.02	8.53	9.60	0.53
KC	240,216	16.89	8.89	9.20	0.54
TC	150,166	24.10	10.47	11.50	0.85
AV	125,849	18.67	9.50	11.11	0.60

Table 3. OBOC text measures

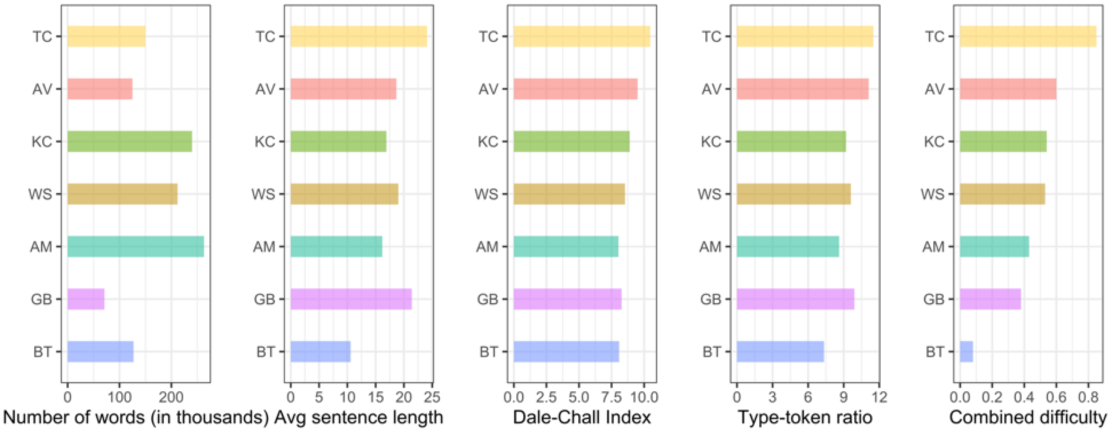


Figure 11. OBOC text measures visualization

53 The final column of Figure 11, “Combined difficulty”, is a normalized aggregate of the other four measures. We first normalized each measure so that the highest-scoring book has a value of 1 and the lowest a value of 0. Although still based on surface level analysis of the text, we believe that this combined measure captures more accurately a book’s difficulty. Figure 11 indicates that *The Third Coast* shows the highest average sentence length, Dale-Chall Index score, and Type-token ratio, and has the highest combined difficulty score. Both non-fiction works in our set, *The Third Coast* (TC) *and Animal, Vegetable, Miracle* (AV), score higher in reading difficulty and therefore stand apart from novels such as *The Book Thief*.

Locality features

54 The nature of place and locality in narrative has generated a lot of exciting research in (digital) humanities, from renewed attention to the concept of “chronotopes” to feature extraction and mapping work for corpora large and small.[29] For our purposes, locality can serve as a way to identify the “Chicago-ness” of a title and its geographical

connection to the city and its readers. Early analyses suggested that some clusters of residents had stronger interest in local titles than others, and this suggested to us the value of this feature. Forthcoming papers will document our mapping work. In the meantime, some visualizations can be found at the project website.[30]

Because of the aforementioned findings about the importance of location in book selection decisions, we were most interested in extracting places names from the texts and establishing each book's geographic locus. But disambiguating named entities of any type, including place name references, is challenging, as [Evans and Wilkins 2018] and others have noted. Our approach was to use the output of the Stanford Named Entity Recognizer (NER) 3.9.1 version [Finkel et al. 2005], using the default model for location extraction included in the parser. Although we were working with a scanned version of the text included in a digital library, we found the accuracy of this parser to be acceptable for this purpose [Rodriquez et al. 2012] [Atdağ and Labatut 2013]. Problems arose, however, when we tried to associate toponyms extracted from the text with their geocoordinates. For example, "Odessa" and "Paris" can be cities in Texas or in Europe. Likewise, "Gold Coast" has a specific local meaning in Chicago, but is also the name of several other places around the world. Our workflow made use of the Google Maps API to resolve toponyms to latitude and longitude coordinates and, as might be expected, without knowledge of the literary context of each toponym, the system could not resolve such ambiguities correctly in many cases. A particularly evocative example we encountered was the numerous references in *The Third Coast* to the once-famous "Mecca" apartment building on the south side of Chicago (immortalized in Gwendolyn Brooks's 1968 book of poetry *In the Mecca*). The Mecca building was demolished decades ago to make room for the expanding campus of Illinois Tech on Chicago's south side, but Google Maps unsurprisingly locates the place name in Saudi Arabia. Ultimately, this problem was solved by the manual examination and correction of each extracted toponym in its textual context together with the computed geolocation. [31] 55

A further problem with toponyms is how they occur in a hierarchy of specificity, with higher levels of the hierarchy resolved by the mapping API as centroids of a region. For example, the place name "Russia" yields a latitude and longitude pair placed in the middle of Siberia, which is geographically correct in an abstract sense, but unlikely to be the part of Russia to which any particular author is referring — and certainly not Chabon in *Kavalier and Clay* [KC], from which this example is taken. This problem does not admit of an easy all-purpose solution. Our simple expedient was to eliminate all place names with greater than "city" extent. Our rationale here is that a text gains its geographical purchase from the accumulated mention of specific locations, not from references to large abstract entities. To produce our locality measures, we computed the distance from each location to a zero-point centered in the Loop in downtown Chicago and averaged these distances. So that local national distances are not swamped by transcontinental ones, we took the logarithm of the value and used this as our measure of the "distance" of the text from the city. We also experimented with a version of the model in which this continuous distance value was replaced with a simpler binary distinction between local (that is, Chicago-centered) texts (AM, TC, WS) and non-local ones (AV, BT, GB, KC), also computed using the same toponyms. 56

Predictive Model

Historical circulation models offer a great deal of insight into the patterns of OBOC participation, as we have seen. To ask "what if" questions about books that might be chosen in the future, however, we need a different kind of model. This predictive modeling task builds on the work above, which allowed us to identify the most important demographic variables and get a sense of their predictive utility. In effect, we are seeking to replace the discrete individual books in the prior model with descriptive variables that capture some aspects of the books' contents as discussed above. 57

As with our prior methodology, the model serves multiple purposes. The ability to predict with some degree of precision indicates that the variables we have chosen for the model do, in fact, capture regularities associated with branch circulation outcomes. This helps us have confidence that the model is in the right form and has the right variables in it. The predictions coming from such a model may be useful to library staff in anticipating how different book choices might engage different patrons across the city. Finally, and most importantly for a digital humanities audience, the importance that the model assigns to different features gives us a sense of the impact of different variables on the final outcome. 58

As above, the dependent feature of our predictive circulation models is normalized circulation value: that is, checkouts 59 at a given branch per 1000 visitors. As we have described above, the new independent variables are: combined reading difficulty score, degree of promotion (i.e. number of events at branches), and locality. The values are combined with the variables from the earlier analyses: three demographic variables and the number of holdings. For the first model, MPrior, we added the book's prior circulation (previous 90 days) at that branch. With prior circulation as an input variable, we are enabling MPrior to predict the impact of the library's selection of a particular book. What, in other words, is the change in circulation pattern induced by a book's selection? This is interesting to the library, since it may make less sense to pick as a "One Book" selection a text that many people would have read anyway. But it is also interesting for our purposes since it reflects the impact of the "civic" motivation of the act of book selection. The model without prior circulation (MCirc) is interesting to us for a different reason: with this model, we predict *de novo* what the match between demographic and book characteristics might say about a book's popularity at a given branch given a particular level of investment by the library system (in promotions and book holdings).

The model type we chose is a boosted regression tree, an appropriate model for learning the relationship between a numeric output variable and a diverse set of input variables.[32] Regression tree learning is a form of decision tree learning, where the system builds a complex set of decision rules, each of which is a test against the values of a particular feature. For example, the top level of a decision tree might ask if the value of the PC1 variable is greater than 0.5, and if so, the rules on one side of the tree are applied, otherwise a different set. The power of the gradient boosting algorithm is that the system iteratively determines which cases in the input data generate the most error and focuses additional learning on getting these predictions correct. A typical boosted regression tree model might contain hundreds of such rules, knitted together in a complex pattern of choices. 60

Our model was trained and evaluated using a cross-validation technique. In each step of evaluation, one OBOC season was omitted and the model was trained on the other six seasons. Then the model was used to predict the missing year and the error calculated. This was repeated across all seven years, and averages computed across all years. The average mean absolute error for MPrior was 0.017. (Recall that all values were normalized between 0 and 1, including the circulation.) This average of 1.7% corresponds to about 7-8 checkouts in a given branch. The corresponding value for MCirc is 6%, or about 3.5 times as high. This is not surprising as this model has much less information to work with. However, it is still within 10% of the actual checkout total. 61

As noted above, our primary interest in this paper is not in predictions per se, but rather what the model tells us about the features under study. Figure 12 below shows the feature importance for different input features in MPrior. As noted above, the tree itself consists of hundreds of choices in complex combination; the feature importance is a statistic that reflects the overall utility of a particular variable across all the predictions the system makes. It does not offer any insight into the structure of the tree itself. The feature importance values shown here are averages across all seven learned models, and were relatively consistent across the different model runs. 62

Figure 12 also shows that the importance of prior circulation is very high, which is not surprising since it reflects the pre-existing interest of a particular set of patrons in a particular text. The other variables in descending order of importance are Holdings, Difficulty, PC1, PC3, PC2X, Promotion, and Proximity. (Note that feature importance values are not probabilities and do not sum to 100%.) The "shelf effect" noted above (see Figure 9) is substantiated here. The number of books allocated to a branch does indeed have an impact on patron behavior over and above the prior interest indicated by patrons. Also, we see that our combined reading difficulty measure contributes to the predictions. Feature importance does not indicate the direction of influence, but from other data we know that this influence is negative — i.e. the more difficult the book by this measure, the fewer patrons will check it out. It is also worth noting that, in general, reading difficulty measures track the fiction/non-fiction genre divide, with non-fiction books generally scoring higher. At this point, we do not have enough data to firmly disentangle the effects of reading difficulty for this fiction/nonfiction distinction. Finally, we have the demographic variables, especially the PC1 (property value) and PC3 (owner/renter) axes. At lower levels of importance are the number of OBOC outreach events held and the locality measure ("proximity") of the text. 63

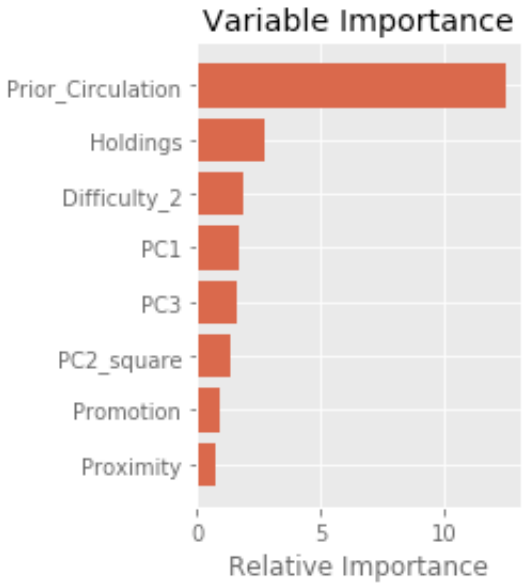


Figure 12. Average feature importance for MPrior circulation models.

Figure 13 contains similar importance values for MCirc, but now prior CPL circulation is not considered. Here we see that the roles are reversed between the set of demographic variables and the holdings/reading difficulty measure. The prior circulation variable in MPrior is, to some extent, building in the baseline appeal of the book to the patrons of a particular branch, and when this variable is removed the demographic factors become a stronger element. In some ways, this brings us back to one of our original research questions – namely, the relationship between demography and OBOC participation. Here we see effects of PC1, PC3 and PC2X similar to those found in the multi-level model. Once we get past these effects, we have a consistent pattern relating holdings, reading difficulty, promotional events, and proximity. 64

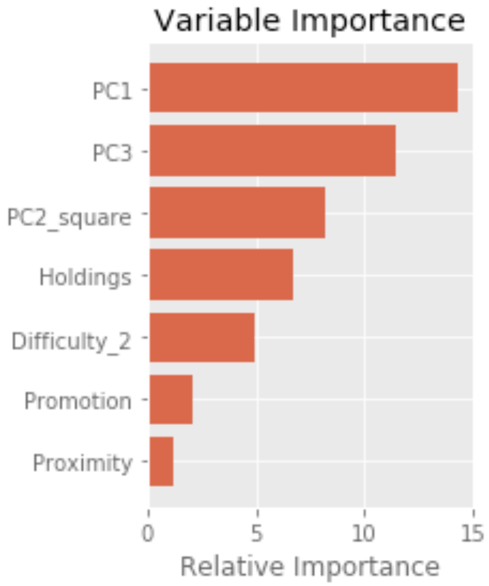


Figure 13. Average feature importance for MCirc models

Our final model examined the impact of using a binary Chicago/non-Chicago feature as our representation of a text's locality rather than the quantitative proximity values used in the other models. We call this model MBinary. Interestingly, the average mean absolute error on this model was approximately 0.018, which is slightly but not significantly improved over the MPrior model. Figure 14 shows the average error for the three models expressed in terms of normalized 65 circulation.

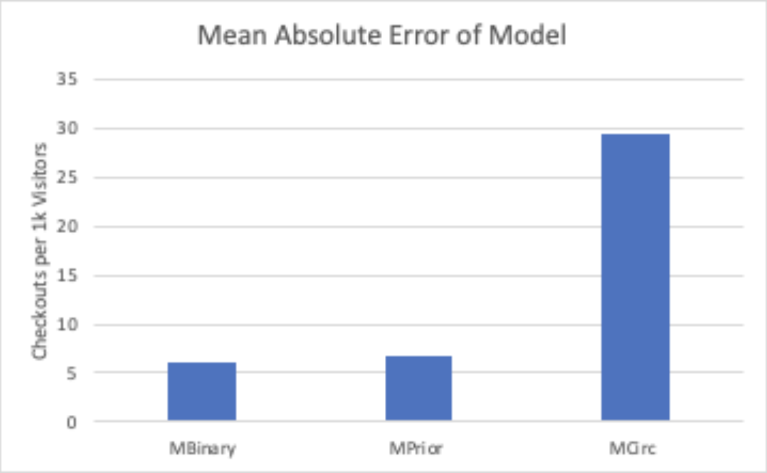


Figure 14. Average model MAE

Figure 15 shows the average feature importance for the MBinary model. The values are very similar to those found in Figure 12, with the binary feature showing a small, but non-negligible contribution to the model performance. The results for MBinary are quite important as they demonstrate that high accuracy in toponym attribution is not essential to making use of locality in circulation modeling. It is sufficient to label a book simply as Chicago-connected or not, and we expect that this will be possible without the manual effort required to achieve high accuracy for each geographic label. 66

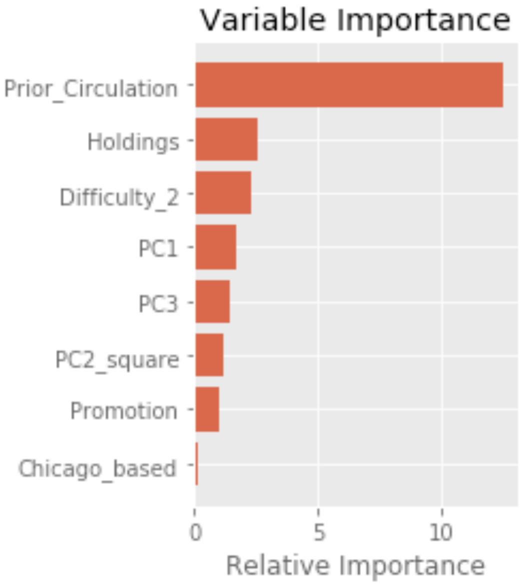


Figure 15. Average feature importance for MBinary models

Limitations

The analyses above have some gaps that we hope to address in future research. For instance, although the period in question has seen greater use of e-books by CPL patrons, we have not yet included e-book checkouts in our analysis. (Because e-book checkouts are not associated with particular branches, we would not have been able to build them into branch-level circulation models.) However, e-book usage is almost certainly correlated with neighborhood demographics and therefore represents “missing” checkouts in certain areas. A similar point could be made about book purchases. Chicagoans with the resources to purchase a copy of the selected OBOC text rather than read a library copy are 67 obviously not represented in the CPL circulation data. Thus, we expect that our models underestimate total OBOC participation, particularly in more affluent areas of the city.

A limitation in our analysis is the limited number of texts we were able to use. 80 branches and seven books constitute less than 600 circulation data points. The texture of the model can be enhanced in several ways, however. One way would be to obtain year-by-year demographic data for each branch rather than using a single year's census data to stand in for the whole time period. As it is now, only 80 combinations of the demographic factors can appear, and therefore interrelations between the factors are difficult to discern. In general, we would not expect this to change the results much, but in neighborhoods experiencing rapid or marked demographic change it would provide a more accurate representation. 68

Richer data can also be obtained by looking at additional books. We have obtained the branch-level circulation data for 309 books chosen by CPL as recommendations associated with each of the seven recent OBOC seasons (the "if you liked this book, you might also like ..." feature that appears regularly on the CPL website, on program flyers, and in branch libraries). These books were selected by CPL for thematic or other similarities to the OBOC choices and therefore provide an interesting, if idiosyncratic, control group: books that did not receive the full promotional boost of the official OBOC selected texts but were brought to the attention of patrons nonetheless. With these 300+ additional texts, it would be possible to extend MCirc by adding a binary variable distinguishing the "selected" vs "recommended" texts. 69

Another limitation is working exclusively with in-copyright texts. Both the set of seven recent OBOC selections and the extended corpus of recommended texts contains many in-copyright works and therefore our text processing can only occur, painstakingly, through the non-consumptive text processing capabilities of the HathiTrust Digital Library. We have also found that many of the texts in this extended data set are not held in the HathiTrust collection. For the works that are present, working from scanned OCR-ed text entails significant difficulties in calculating some of the text properties that we have relied on in this analysis to date. We have discovered significant biases in the calculation of reading difficulty. Most challenging is the determination of the location/proximity variable, which in the end required manual checking — a process that does not scale up to a larger corpus. This is one reason that the MBinary model is of interest: we expect that assessing a simple Chicago/non-Chicago placement of a text will be less error-prone than the calculation of distances for each toponym, although the case of the "Mecca" building is an important cautionary tale. 70

As in other disciplinary contexts, merging data from heterogeneous sources is a difficult task with no easy or standardized solutions. Each type of data — branch demographics, library circulation (both checkouts and book holdings), and book content — poses its own challenge for data curation, normalization, and integration, many of which have been discussed above. One distinguishing feature of this work has been our reliance largely on a relatively small number of heterogeneous in-copyright texts. Thus, we do not have the advantage of large-scale "distant" text processing where small errors in the transformation pipeline can be expected to cancel each other out. 71

Conclusion

Our project has identified several challenges that will be of interest to scholars in the digital humanities, particularly those working at the intersection of text analysis, geography, and public data sets. Our original goal to capture and predict mass literary events has largely been met. As "capture", we have created an archive of nearly a decade of multiple media forms (and metrics for them) associated with a cultural program that has engaged many thousands of people across a major American city for years. In pursuit of "prediction", we have produced a novel predictive model integrating demographics, book content, and branch data to produce branch-level predictions of book circulation. With this tool, we plan to generate branch-level circulation predictions for book titles (OBOC program or not) beginning in summer 2020. This will be reported in a future paper. 72

While we expect this predictive model to be of use to CPL staff, it is important to note that it has not been our intent (nor theirs) to optimize against such a model in choosing books. One does not need data-intensive modeling to identify books that circulate highly; for example, a good bet at any time would be current best-sellers by authors with name recognition who have been highly promoted by publishers. *But maximizing circulation alone has never been the primary* 73 *goal of “One Book, One Chicago”.* We expect that library staff will continue to make OBOC text and theme choices as they always have, through an in-depth process that considers an entire constellation of cultural and socio-political factors. However, they will now be able to do so with the help of an additional data source: for any given book, they will also be able to calculate “what-if” scenarios for all CPL branches and consider different levels and kinds of promotional activity.[33]

One of the key findings of our predictive model is that prior circulation makes the largest predictive contribution for the circulation of OBOC selected works. This is a measure, however, that will be unavailable for new books and little-known or first-time authors. It is possible, as we have shown, to do similar types of predictions without prior circulation data, but with significantly lower accuracy. This is not a surprising finding, but our ability to quantify the effect will enable library staff to reason about the tradeoffs inherent in choosing works already circulating well in the local library-system as opposed to “importing” choices from outside the system in the name of expanding readers’ horizons. 74

Additional work remains. One key question of interest to us is the interaction between kinds of promotional events surrounding a given OBOC season, the sharing and re-sharing of these events via social media, and subsequent specific branch circulation outcomes. As shown in Figure 2, the time course of each book’s circulation shows a variety of different patterns and temporal structures. Preliminary analysis suggests that, as might be expected, there is a close association between bumps in checkout numbers and branch events and social media activity hosted by the library — but there are notable differences by branch and type of event. However, analysis of this association for each of the eighty branches remains to be done. We do not know, for example, how different types of events impact circulation or whether an event at one library branch impacts circulation at others. We are interested in linking the circulation and event time-series data to the timeline of OBOC Twitter posts, many but not all of which are related to specific OBOC events. We have already collected associated Twitter and Goodreads data for several OBOC seasons and have developed supervised text classification algorithms to isolate the OBOC-specific tweets from unrelated content. This relationship between social media activity and circulation is yet to be quantified, but will be the subject of a future paper. 75

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Appendix 1

“One Book One Chicago” Program book selections, 2001-2019

- 2019/20 Elizabeth Kolbert, *The Sixth Extinction: An Unnatural History*
- 2018/19 Philip K. Dick, *Do Androids Dream of Electric Sheep?*
- 2017/18 Greg Kot, *I’ll Take You There*
- 2016/17 Barbara Kingsolver, *Animal, Vegetable, Miracle*
- 2015/16 Thomas Dyja, *The Third Coast*
- 2014/15 Michael Chabon, *The Amazing Adventures of Kavalier and Clay*
- 2013/14 Isabel Wilkerson, *The Warmth of Other Suns*
- 2012 (Fall) Marcus Zusak, *The Book Thief*
- 2012 (Spring) Yiyun Li, *Gold Boy, Emerald Girl*

- 2011 (Fall) Saul Bellow, *The Adventures of Augie March*
- 2011 (Spring) Neil Gaiman, *Neverwhere*
- 2010 (Fall) Toni Morrison, *A Mercy*
- 2010 (Spring) Colm Toibin, *Brooklyn*
- 2009 (Fall) Carl S. Smith, *The Plan of Chicago*
- 2009 (Spring) Sandra Cisneros, *The House on Mango Street*
- 2008 (Fall) Tobias Wolfe, *The Right Stuff*
- 2008 (Spring) Raymond Chandler, *The Long Goodbye*
- 2007 (Fall) Arthur Miller, *The Crucible*
- 2007 (Spring) James Baldwin, *Go Tell It on the Mountain*
- 2006 (Fall) Jhumpa Lahiri, *The Interpreter of Maladies*
- 2006 (Spring) Aleksandr Solzhenitsyn, *A Day in the Life of Ivan Denisovitch*
- 2005 (Fall) Jane Austen, *Pride and Prejudice*
- 2005 (Spring) Walter Van Tilburg Clark, *The Ox-Bow Incident*
- 2004 (Fall) Julia Alvarez, *In the Time of Butterflies*
- 2004 (Spring) Stuart Dybek, *The Coast of Chicago*
- 2003 (Fall) Tim O’Brien, *The Things They Carried*
- 2003 (Spring) Lorraine Hansberry, *A Raisin in the Sun*
- 2002 (Fall) Willa Cather, *My Antonia*
- 2002 (Spring) Elie Wiesel, *Night*
- 2001 (Fall) Harper Lee, *To Kill a Mockingbird*

Appendix 2

Branch Code and Branch Name
AI - Austin-Irving
AL - Albany Park
AR - Archer Heights
AT - Altgeld
AU - Austin
AV - Avalon
BA - Back of the Yards
BE - Beverly
BL - Blackstone
BP - Brighton Park
BR - Brainerd
BT - Bucktown-Wicker Park
BU - Budlong Woods
BZ - Bezazian
CB - Chicago Bee
CG - Chicago Lawn
CH - Chinatown
CL - Clearing
CN - Canaryville
CO - Coleman
DA - Daley, Richard P.-Bridgeport
DO - Douglass

DU - Dunning
ED - Edgebrook
EG - Edgewater
GA - Gage Park
GG - Greater Grand Crossing
GM - Galewood-Mont Clare
GR - Garfield Ridge
H0 - Harold Washington Library Center (Main)
HA - Hall
HE - Hegewisch
HU - Humboldt Park
IN - Independence
JE - Jefferson Park
JM - Jeffrey Manor
KE - Kelly
KI - King
LB - Lincoln Belmont
LE - Legler
LG - Lincoln Square
LI - Lincoln Park
LO - Lozano
LV - Little Village
MA - Mayfair
MC - McKinley Park
ME - Merlo
MM - Manning
MT - Mount Greenwood
NA - North Austin
NN - Near North
NO - Northtown
NP - North Pulaski
OR - Oriole Park
PO - Portage-Cragin
PU - Pullman
PW - Water Works
RG - Rogers Park
RM - Daley, Richard M-West Humboldt
RO - Roden
RS - Roosevelt
S1 - Sulzer (Regional)
SC- Scottsdale
SH - Sherman Park
SO - South Chicago
SS - South Shore

TH - Thurgood Marshall
TO - Toman
UP - Uptown
VO - Vodak-East Side
W1 - Woodson (Regional)
WA - Walker
WB - West Belmont
WC - West Chicago Avenue
WE - West lawn
WP - West Pullman
WR - Wrightwood-Ashburn
WT - West Town
WW - West Englewood
WY - Whitney M. Young, Jr.

Table 4. Chicago Public Library Branches and Branch Codes

Notes

[1] The phrase grounds Clay Shirky's influential account of the distinction between browsing and search and the latter's success: "One reason Google was adopted so quickly when it came along is that Google understood there is no shelf, and that there is no file system" [Shirky 2005]. On the role of data in design decisions for libraries, in addition to [Schnapp and Battles 2014] see [Palfrey 2016].

[2] For historically-informed analysis of the data of contemporary literary production and reception, see [McGurl 2016] [Hungerford 2016] [Lynch 2017]. On the importance of "comps", a marketing tool still largely unknown to literary scholars, see [McGrath 2019]. On the privacy implications of increased for-profit reading platform use, even in public library environments, see [Ard 2013/14].

[3] Visualizations, code notebooks, and some data sets are available at the RCR project website: https://dh.depaul.press/reading-chicago/

[4] The City of Chicago Data Portal, containing downloadable data sets ranging from shared bike journeys to crime statistics, makes "Cook County ... one of the best places in the nation for thinking creatively about the role of government in people's lives" [Dukmasova 2018]. However, an important examination of smart city hype that imagines "cities as spreadsheets waiting for the right formulas" can be found in [Bratton 2015, 160]. On the temporality of data of "smart" cities, see [Olmstead 2019]. Trenchant critiques of plans to "imagine cities from the internet up" can be found in [Mattern 2017] and [Graham et al. 2019].

[5] And importantly, on Goodreads, LibraryThing, and shared Zotero groups, people publicize taste in ways that make their reading visible to social media analysis methods. As Nakamura points out, "Goodreads invites readers to navigate not in books but in its catalog, to create new catalogs, and to enjoy other people's collections" since the "site's main purpose [is] to provide users with familiar tools that encourage them to perform their identities as readers in a public and networked forum" [Nakamura 2013, 4, 5]. An early attempt at using LibraryThing data for book recommendations is [Pera et al. 2010]. For quantitative analysis of differences in reviews on Goodreads and Amazon, see [Dimitrov et al. 2015]; for a more recent use of Goodreads for literary sociology, see [Porter 2018].

[6] On audiobooks, see [Rubery 2016] and [Kozlowski 2018]. On fanfiction, [Thomas 2011], [Hellekson and Busse 2014], and [Vadde 2017]. On "post-press literature", see [Levey 2016] and [Laquintano 2016]. An influential account of transmedia storytelling is [Jenkins 2007]. The contemporary literary field is dominated by a few large publishers and Amazon.com — the latter on its own facilitating one-half of all U.S. print book purchases and 70% of all e-book purchases [McGurl 2016, 448]. See also [Striphas 2009] and [Sinykin 2017].

[7] See also [Collins 2013]. Bob Stein, founder of the Institute for the Future of the Book claims: "in the future … we'll think of a book less as a physical object than as a 'place to congregate'" (qtd. in Nunberg 2013).

[8] In addition to work mentioned above (note 7), see Lev Manovich's "SelfieCity" (http://selfiecity.net/) and "On Broadway" (http://www.on-broadway.nyc/). See also [Cranshaw et al. 2012] [Boy and Uitermark 2016] [Pinder 2012].

[9] For overviews, see [Davidson 1989] and [Amory et al. 2007-14].

[10] On Oprah's book club, see [Rooney 2005] and [Striphas 2009, 111–40].

[11] [Long 2003] [Taylor 2012, 142–58] [Radway 1997]. On demographic difference in book clubs, see [Davis 2008, 155–86]. Of book group reading choices, Burwell notes that encounters with demographic differences are "more likely to occur through textual engagement than through encounters with other members" (qtd. in Griswold et al. 2014, 27).

[12] And see this trenchant reminder that "filter effects" have a long, non-digital, history: "[Eli] Pariser is certainly right that personalization disguises one of today's key processes for substituting a narrower world for the world tout court. But in this, the personalization of Web 2.0 may simply be a subset of a larger and longer recommender system that has gone by many names: race, gender, sex, sexuality, ethnicity, class, ability — the original filter bubbles" [Cohen 2019, 176].

[13] On the so-called "Bilbao effect" and its endurance, see [Moore 2018]. On the growing use of people as a distinct medium in contemporary art, see [Bishop 2012]; see also for Chicago specifically [Grams 2008]. On people as a "last mile" technology in city infrastructure, see [Mattern 2015, 94–112, 106] and [Barber 2013].

[14] http://opendatabook.club/. We owe this reference to [Mattern 2016]. As public libraries increasingly think of themselves as "platforms", in David Weinberger's influential phrase [Weinberger 2012], we should also note the growing variety of materials circulated to patrons. Seattle Public Library, for example, created a wifi hotspot checkout program in 2014 [Risley 2015].

[15] But note caveats about [Kidd and Costano 2013] and others in [Mumper and Gerrig 2019].

[16] Library of Congress Read.gov list: http://www.read.gov/resources/index.php. [Griswold and Wohl 2015, 99] note creation of their own private database of One Book programs nationwide. They list 567 programs in all 50 states, covering the years 2000 to 2012, numbering 3110 book selections (1506 unique books and 1193 unique authors).

[17] [Fuller and Sedo 2013, 20–1] [Grams 2008, 195] quotes Seattle Public Library's Higashi: "it wasn't until Chicago chose *To Kill a Mockingbird* for their One Book One City project that they got national press, a big article in the *New York Times*. That's the point at which the project really went boom all over the country and indeed the world."

[18] See [Griswold and Wohl 2015]. The social media circuit is changing literary production. Embedding herself at *McSweeney's* and other publishing houses, Hungerford finds the cutting edge of publishing now is housed at presses and companies that embed interactive sociality at the core of the reading experience. English departments and establishment publishing houses are improvising ways to respond to these "productionist" tendencies; in the twenty-first century, she asks, "What if literary culture is a culture of making rather than a culture of reading?" [Hungerford 2016, 9]. See also [McGurl 2016].

[19] Circulation data prior to 2011 was lost in a CPL software migration and is unrecoverable.

[20] Note that these data sets are subject to non-disclosure agreements, and we are not able to distribute them.

[21] See [Putnam and Feldstein 2003, 51].

[22] Our OBOC seasons span seven years in the history of Chicago, 2011-2017, and the demographics of the city were certainly not constant during that time. The ACS data we used is from 2015. Yearly fluctuations in demographic composition of different neighborhoods before and after that time are not reflected in our analysis.

[23] https://www.hathitrust.org/htrc.

[24] We have conducted some analysis of other aspects of our data such as the time-varying patterns of circulation and the interaction between promotion events and circulation, but we will not discuss these results here.

[25] Indeed, library staff confirmed that branch activity was a key factor in the distribution of OBOC volumes across branches.

[26] The model was fit using the lmer method from the lme4 package in R. Full model output can be found on the project website at http://cwi.cdm.depaul.edu/~rburke/circ/multi-level-norm.html

[27] See Chall and Dale 1995.

[28] https://pypi.org/project/readability/

[29] See for instance [Moretti 1997] [Bakhtin 1983] [Stanford Literary Lab 2016] [Cordell 2015] [Evans and Wilkins 2018].

[30] See our sample “geographical centers” for recent OBOC selections: http://cwi.cdm.depaul.edu/~rburke/location/geo_center.html.

[31] We have begun work on processes to automate Chicago location checking. Reference works such as [Kaser 2011] makes this, for our subject city at least, a bit easier.

[32] The GradientBoostingRegressor class in Python’s scikit.learn package was used with parameters optimized by grid search.

[33] We are in the process of constructing a dashboard with interactive visualizations to support such exploration.

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