# When We Went Online: Library Conference Twitter in the COVID-19 Pandemic

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**ABSTRACT**

**Introduction:** For over a decade, Twitter (now known as X) provided a platform for invisible colleges of professional and academic networks to form, allowing conference attendees to share information with their wider communities of practice. With the move to virtual conferences during the COVID-19 pandemic, the authors examined how library conference-related Twitter use changed.
**Method:** Tweet data from five major library conferences over the course of 10 years were collected, cleaned, and analyzed to look for statistically significant differences in the volume of original tweets and retweets during in-person (2011 to 2019) and online conferences (2020 and 2021).
**Results:** Original tweets, retweets, and unique authors using library conference hashtags on Twitter decreased when conferences met virtually during the COVID-19 pandemic.
**Discussion:** The decrease in informal library conference communication does not correlate with conference attendance or overall Twitter use. The dramatic reduction in retweets signifies that librarians were engaging less with tweets by their colleagues during virtual conferences.
**Conclusion:** Twitter served as a central public place for library professionals to find and engage in topical conversations, but use of Twitter shrank during the COVID-19 pandemic, diminishing the reach of professional library discourse.

**Keywords:** Invisible colleges, library conferences, virtual conferences, Twitter, social media, professional communication, scholarly communication

## IMPLICATIONS FOR PRACTICE

1. The displacement of public discourse from Twitter represents a shift in informal professional communication and may represent a loss to library and information science (LIS) communities.

2. Library conference organizers may want to consider how the discourse surrounding their conference may reach a wider professional community. Committees have spent over a decade deciding on conference Twitter hashtags, and now they need to consider the functionality of various platforms—for example, the immediate but fleeting nature of virtual conference messaging platforms, focused but closed communities on Slack channels or Discord servers, and the ability to search and find these conversations.

3. Research examining academic and professional discourse on Twitter has been studied for many years. However, dramatic recent changes made by Twitter leadership, including a rebranding of the platform to X, limitations to access, and changes to application programming interfaces (APIs), may stymie future research in this area. These changes may reduce its role as a public square and make it harder to study.

## INTRODUCTION

Professional conferences are an important venue for disseminating research results, making connections with others in the same discipline, and sharing news. At in-person conferences, casual communication between participants happens in conference center hallways, between sessions, and at meals and social events. Online communication such as email lists and social media has magnified the network and reach of informal interaction within professional or disciplinary communities. Price and Beaver (1966) and Crane (1972) pioneered the contemporary conception of invisible colleges, i.e., unofficial networks of academic research collaboration and communication among people who are not necessarily bound by formal institutional relationships. Although previously hidden in interpersonal communication through in-person meetings, letters, or other correspondence, these informal scholarly networks are increasingly able to encompass a wider group of participants and have become visible through public messages on platforms such as Twitter[1] (Algarni, 2014; Gao, 2021). The use of Twitter as a method to amplify conference-related communication by academic communities has been widely documented (Allen et al., 2018; Banerjee et al., 2021; Fekete & Haffner, 2019; Greenhow et al., 2019; Shetty et al., 2022). When conferences shifted en masse to virtual platforms in early 2020 with the rise of the COVID-19 pandemic, we wondered

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[1] Twitter was rebranded in 2023 as X. The data for the current study were collected prior to the rebranding; therefore, the company will be referred to as Twitter throughout this article.

what impact that would have on online invisible colleges within the library profession, as represented in library conference-related Twitter use. In this project, we use public tweets as a way to explore shifts in online communication surrounding library conferences during the pandemic. When conferences took place entirely online, did online communication on Twitter change? Did conference communication on Twitter increase, decrease, or stay the same?

Other library conference attendees shared this curiosity, as seen in this excerpted public Twitter thread from 2021 (AMsRuth [@AMsRuth], 2021; Matthew Noe [@NoetheMatt], 2021):

*@NoetheMatt: Anyone else finding that engagement on Twitter is lower than usual this conference? Or am I imagining it? #ALAAC21*

> *@AMsRuth: Replying to @NoetheMatt*
> *But it is not just #ALAAC21, I noticed it with #loex21 too. I wonder if people are too overwhelmed, not attending, or plan to watch recordings not during the "live" conference.*

> > *@NoetheMatt: Replying to @AMsRuth*
> > *Interesting… someone should study this…*

This study collects public tweets from five major LIS conferences over the course of 10 years, looking for statistically significant changes in the volume of tweets between the in-person conference years of 2011 to 2019 and the online conference years of 2020 and 2021. The results provide a window into the shifting nature of online scholarly conversation and professional networking during a time of rapid upheaval in conference modalities during the COVID-19 pandemic.

## LITERATURE REVIEW

### Invisible colleges

Historical references to the concept of the invisible college describe a precursor to the Royal Society of London in the seventeenth century, in which academics and scientists met periodically to exchange ideas and share research beyond the formal structure of their colleges (Webster, 1974; Zuccala, 2006). Price is credited with popularizing the modern concept in the 1960s to describe networks of scientists at the forefront of an area of study who meet at conferences, share letters and preprints, and are connected by common interests rather than location (Price, 1963; Price & Beaver, 1966), and Price's work in identifying these informal structures contributed to the development of bibliometrics. Crane explored the influence

of interconnected research collaborations in her book-length treatment of the concept of invisible colleges (Crane, 1972). Discussions of invisible colleges are also included in examinations of the concept of scholarly communication (Fleming-May, 2023; Welsh & Wright, 2010).

In attempts to make the invisible observable, in recent decades, researchers have been making efforts to map invisible colleges, typically through bibliometric analysis and studying citation networks of published research articles (Cronin, 1982; Gmür, 2003; Lamovšek & Černe, 2023; Vogel, 2012; Zuccala, 2006). Lievrouw (1989) points out a shortcoming of this type of analysis in that it examines the output (publications) of social networks of researchers as a proxy for studying the process of scientific communication, such as interpersonal contact.

Most of the investigations regarding social media use in connection to scholarly communication are focused on boosting viewership, readership, and citation through altmetrics (Basumatary et al., 2022; Shrivastava & Mahajan, 2021). One study showed the differences between scientific and social science communities of practice in terms of levels of Twitter use for sharing research, developing professional connections, and professional communication among peers generally (Holmberg & Thelwall, 2014). Little has been published regarding social media as a communication network platform for invisible colleges (Algarni, 2014; Gao, 2021). Although the contemporary understanding of invisible colleges is of informal networks, researchers have typically attempted to identify invisible colleges by analyzing the formal publication process. We propose that the informal nature of the Twitter platform aligns with the informal, nebulous, and changeable nature of invisible colleges.

**Twitter trends**

Among the myriad topics and types of content available on Twitter, academics use the platform to share research, promote findings, participate in debates and open discussion, amplify conference presentations, and more. A 2019 survey of reasons for Twitter usage found that 14% of users turn to Twitter "to strengthen [their] professional network," and academics are certainly part of that number (AudienceProject, 2019). According to Dickinson (2019), "as of 2010, just four years after Twitter launched, as many as 40 percent of academics were creating accounts" to "connect with people for the exchange of new ideas and analysis. On Twitter, scholars are effectively creating open and public scholarship" (Dickinson, 2019, para. 8). Priem et al. (2011) coded tweets from a sample of scholars at five universities in the United States and United Kingdom and found that academics were using Twitter as a "scholarly communication medium" to share and discuss research content, among other topics.

When governments around the world instituted COVID-19 lockdowns in early 2020, Twitter usage skyrocketed, as measured by daily tweet volume (GDELT Project, 2022). In October 2020, Twitter instituted efforts to combat misinformation surrounding the November 2020 US election (Gadde & Beykpour, 2020), which throttled back the surging tweet volume. Daily Twitter use has grown again since then but stabilized below the early pandemic peak (GDELT Project, 2022). The way that people have been using Twitter was shifting even before the usage effects from the COVID-19 pandemic. The volume of Twitter posts have been transitioning from original tweets to more retweeting, and Leetaru (2019) considers "the question of whether Twitter is becoming less of a place to share original content and more of a place to merely retweet the content of others" (Leetaru, 2019, paras. 25–26). "By late 2018, more than half of all tweets were retweets, as Twitter became an echo chamber of amplification" (GDELT Project, 2022).

### Librarianship, professional communication, and Twitter

In librarianship, little research has been published on the use of Twitter as an invisible college. April Hathcock (2017) has written on the use of #critlib and #libleadgender hashtags on Twitter, which facilitated communication among librarians from various institutions who were interested in these topics. Two studies (Coombs & Rhinesmith, 2018; Adams & Hanson, 2018) performed network analyses of similar topics on Twitter. Coombs and Rhinesmith (2018) mapped "edge perspectives" or emerging LIS scholars in the #critlib community. Adams and Hanson (2018) analyzed the hashtags #informationliteracy, #infolit, #infoliteracy, #informationlit, #informationfluency, #infofluency, #critlib, and #ACRLframework in order to identify the most prominent Twitter accounts posting and sharing with these hashtags, how those accounts were connected through retweets, and what were the most prevalent terms used in those tweets. Moreillon (2015) conducted a netnographic (i.e., "ethnography conducted online") study on Texas school librarians who were part of a community of practice. She found that participants found a deep sense of belonging connecting through scheduled Twitter chats. Shulman et al. (2015) and Yep et al. (2017) analyzed the influential followers of academic library Twitter accounts to leverage tailored social media outreach.

### Twitter use at academic conferences

"Tweeting the meeting" has been a popular activity at academic and professional conferences. Many studies have examined the use of Twitter at conferences, focusing on the use of Twitter as a conference backchannel, to involve and educate those who miss a conference or a session, for professional networking, or to understand how Twitter can be used to disseminate research findings and trending topics at the conference (Allen et al., 2018; Banerjee et al., 2021;

Fekete & Haffner, 2019; Greenhow et al., 2019; Shetty et al., 2022). Twitter data surrounding academic conferences can provide insight into the shifting topics and professional conversations taking place within a discipline over time (Hanson et al., 2021).

Studies have looked at the rates of conference tweeting over time at specific conferences. For example, Elkbuli et al. (2021) found that tweeting at their in-person surgical conferences from 2016 to 2018 grew significantly as measured by tweets and retweets. However, Twitter activity declined at their virtual 2020 conference from the 2019 in-person conference. Similarly, Beste et al. (2022) found that Twitter activity between 2011 and 2012 swelled by 30% at their medical conferences, but there was a 46% decrease in Twitter activity between their in-person 2019 and virtual 2020 conferences. On the other hand, Niner and Wassermann (2021) found that there was a 2% increase in Twitter activities from the in-person 2019 marine science conference to the virtual August 2020 conference. Shetty et al. (2022) also found an increase of tweets from their scientific conferences between 2019 and 2020. The 2020 virtual conference had 55% more tweets than the in-person 2019 conference.

Although there is a plethora of research on conference tweeting at academic conferences (predominantly medical and scientific conferences), there is very little research related to Twitter activity at library conferences. One study compared Twitter activity at three library conferences that took place in 2018 (Albertson, 2019); however, all three of these conferences took place in a single year and therefore did not reveal trends over time. Another study analyzed Twitter data at one academic library conference over 10 years, exploring the topics of conversation but not looking at changes in volume over time (Hanson et al., 2021).

**The shift to virtual conferences**

As early as March 20, 2020, 36% of technology conferences had moved online (Detwiler, 2020), with conferences in every field following suit. In the first week of the national US COVID-19 shut down, while conference planners were grappling with canceling or moving conferences online, many speculated that virtual conference formats could have long-lasting implications, and that this might be a good thing (Viglione, 2020). Several studies have shown that scholarly conferences had higher attendance at their virtual conferences than their in-person conferences (Niner & Wassermann, 2021; Raby & Madden, 2021; Skiles et al., 2022; Yates et al., 2022). One major benefit of virtual conferences is the lack of travel costs, making attendance more affordable (Peuler & McCallister, 2019; Skiles et al., 2022). Additionally, many conferences, whether their overall numbers increased or not, had more international participation, especially from developing countries. This is likely because virtual conferences do not require attendees to obtain visas, in addition to the absence of international travel costs (Alajmi & Said Ali, 2021; Chou & Camerlink, 2021; Köhler et al., 2022).

One study found that virtual conferences had a higher proportion of students, early career scientists, women scientists whose disproportionate caregiving roles may make conference travel difficult, and attendees from institutions that are not research intensive (Skiles et al., 2022). Köhler et al. (2022) and Viglione (2020) similarly reported that virtual conferences are easier for researchers with caregiving responsibilities to attend. Virtual conferences are also easier for people with mobility challenges to attend (Viglione, 2020).

Several studies found that virtual conferences had many benefits, and the online format did not detract from the quality of the conference (Alajmi & Said Ali, 2021; Kim et al., 2022; Niner & Wassermann, 2021; Raby & Madden, 2021). Alajmi & Said Ali (2021) reported that one benefit included the engaging features of virtual conference platforms. Many studies have emphasized the importance of virtual conferences having a reduced environmental impact because of the lack of travel (Chou & Camerlink, 2021; Köhler et al., 2022; Niner & Wassermann, 2021; Raby & Madden, 2021; Skiles et al., 2022; Tao et al., 2021; Yates et al., 2022). Several of these studies have mentioned that reducing the carbon footprint of academic conferences was something that their professional associations had been discussing for years prior to the COVID-19 pandemic.

On the other hand, several studies have noted disadvantages to virtual conferences. The main disadvantage highlighted was the difficulty of professional networking in the virtual space compared with in-person conferences that have receptions, meals, and hallway conversations facilitating networking (Niner & Wassermann, 2021; Raby & Madden, 2021; Skiles et al., 2022). One study emphasized how poorly two out of three virtual conference platforms worked for attendees with vision impairment (Arias-Flores et al., 2021).

## METHODS

In this study, the authors downloaded and analyzed tweets that included official conference hashtags for the following five major LIS conferences over the course of 10 years: American Library Association (ALA), American Association of Law Libraries (AALL), Medical Library Association, (MLA), Society of American Archivists (SAA), and Special Libraries Association (SLA). Library conferences that primarily meet in the United States were chosen to limit the geographic and linguistic range of tweet behaviors. The authors focused on conferences that appealed to broad subsets of the profession (e.g., public, academic, and special libraries). Conferences were not included if they focused on state or regional audiences (e.g., California Academic & Research Libraries) or were vendor-specific (e.g., Ex Libris User Group). Each conference needed to take place consistently throughout the time period of interest, i.e., 2011 to 2021, and a threshold of more than 2000 tweets per year needed to be met for the majority of the years to allow for statistically significant comparisons of the pre-pandemic

and pandemic-era conference years.[2] In addition, the conferences needed to convene virtually during 2020 and 2021. Although tweets were originally collected from several conferences that focused on specific functional areas within libraries (e.g., Electronic Resources & Libraries and the Charleston Conference), these were ultimately dropped due to the low volume of tweets from conference year to year. Tweets from the Association of College & Research Libraries and Public Library Association conferences were also dropped because they meet biannually and therefore would not allow for meaningful comparisons with annual conference trends. Finally, the authors needed to be able to identify the official hashtag or hashtags for each year—usually available on conference websites or programs—because variations on those hashtags were used to search for relevant tweets. The authors collected registration numbers for as many conferences as possible (Table 5), either through conference websites or by contacting conference organizers directly. Not all registration numbers were available, and, owing to variability in reporting from conferences, some numbers may include vendor registrations.

Tweets and associated metadata, including user data for those who tweeted, were collected on February 18 and 21, 2022, using Twitter's Academic Research API (Twitter, 2023). A search query was sent to Twitter for each conference year that included a few simple variations on the official conference hashtag, along with a date limiter to collect tweets from 2 days before the conference began to 2 days after it ended. The Internet Archive's snapshot of the 2011 ALA conference, for example, listed an official hashtag of #ala11 and the conference dates June 23 to 28, 2011 (American Library Association, 2011). From these details, we extended the query to retrieve tweets that included #ala11, #ala, or #ala2011 and had a *start_time* parameter of '2011-06-21T00:00:00Z' and an *end_time* parameter of '2011-06-30T00:00:00Z.' For conference years in which less obvious official hashtags were recommended, we extended the list of hashtags in our query. ALA's 2021 conference used #alaac21, for example, but because simpler versions were still common, our query looked for #alaac21, #alaac, #ala, #alaac2021, #ala2021, or #ala21.

A number of cleaning steps were taken to remove tweets that were not relevant to the conferences at hand. First, duplicate tweets—found when multiple hashtags (e.g., #ala and #ala2021) were present in the same tweet—were removed from the data. Next, to reduce the number of "false positives," all tweets that did not indicate in the metadata that they were in the English language were excluded. Although this certainly removed some non-English language tweets that were relevant to the conferences, it was more common that

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[2] However, the number of tweets per year fell below 2,000 for a number of conferences that are included during 2020 and 2021.

hashtags had different uses in other languages, adding too much noise to the data. The acronym SLA in Italian, for example, refers to amyotrophic lateral sclerosis and was present in 1073 Italian-language tweets, which were removed from the 69,796 tweets that were originally collected for the SLA conferences (1.54% of the SLA tweets overall). Additionally, 50 randomly sampled tweets were taken for each conference year, which were then manually examined by the authors to identify tweets that were clearly irrelevant, including spam. Keywords that were present in these irrelevant tweets and that corresponded with other common uses for the hashtag were identified, and then tweets containing those keywords were removed from the dataset. SAA, for example, was found to commonly refer to the Syrian Arab Army; therefore, tweets with commonly co-occurring keywords such as "Syria," "drone," "Assad," and "Aleppo" were removed. The percentage of tweets removed during the cleaning process varied from conference to conference, from 1.49% for AALL at the low end to 31.78% for SAA at the high end.

| Conference | Tweets collected | Tweets removed | Tweets analyzed[3] |
|---|---|---|---|
| AALL | 32,427 | 482 (1.49%) | 31,945 |
| ALA | 382,365 | 11,424 (2.99%) | 370,941 |
| MLA | 76,443 | 1641 (2.15%) | 74,802 |
| SAA | 137,112 | 43,578 (31.78%) | 93,534 |
| SLA | 69,796 | 4781 (6.85%) | 65,015 |

**Table 1.** Number of tweets collected and removed for each conference

To explore the impact of the transition from in-person to online conferences on the volume of Twitter traffic related to each conference, $t$ tests were run comparing the number of tweets per conference for in-person conferences (2011 to 2019) with the volume of tweets for online conferences (2020 and 2021). The $t$ tests compared two independent samples, i.e., the mean number of tweets per year for the ALA conference (for example) from 2011 to 2019 with the mean number of tweets for the same conference in 2020 and 2021. The null hypothesis is that the population means of the two samples are equal, and the test helps determine whether there is a statistically significant difference between

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[3] To share data in accordance with the Twitter API Terms of Service, identifiers (IDs) for all of the tweets that were collected and analyzed are available in Zenodo (https://doi.org/10.5281/zenodo.7757609). Tweets that were deleted after data collection, along with tweets from accounts that were deleted or made private, will no longer resolve using these tweet IDs, respecting individual users' rights to privacy. The underlying data might be particularly fragmented given the large number of accounts on "academic Twitter" that were deleted following Elon Musk's acquisition of Twitter on October 28, 2022 (D'Agostino, 2022).

the mean number of tweets during the in-person and online conference years for each conference. When those differences have a $p \leq 0.05$, one can reject the null hypothesis and interpret the difference in the mean volume of tweets as a meaningful difference between the independent samples, i.e., online and in-person (Laerd Statistics, 2015). *t* tests were also used to compare the number of unique authors of tweets for each conference year and, to better understand the shape of the underlying data, *t* tests were performed on subsets of the data reflecting the retweets and the original tweets for each conference year.[4] The Python SciPy package's statistics *ttest_ind* function was utilized to perform the *t* test analyses (Virtanen et al., 2020).

Conference attendance numbers were collected in a variety of ways. The authors found conference attendance on some conference websites, in post-conference press releases, blog posts, and on Twitter. In some cases, conference organizers provided attendance numbers to the authors. Unfortunately, there are some conferences and/or conference years in which the authors were unable to attain conference attendance.

## RESULTS

Looking at the overall number of tweets per conference in Table 2—which includes retweets—all five conferences showed a statistically significant drop in the mean number of tweets during the years in which conferences were held online (2020 and 2021) compared with the previous 8 years of in-person conferences (2011 to 2019). The AALL, ALA, MLA, SAA, and SLA conferences all saw vast and statistically significant decreases in the mean number of tweets during their online conferences in 2020 and 2021, where the degrees of freedom were calculated to be nine. The largest difference of means between in-person and online conferences identified was for SLA, in which the mean number of tweets dropped by 83.80%, closely followed by SAA, which decreased by 82.13%. The smallest significant change was for AALL, which still saw a 68.87% decrease in the mean number of tweets during online conference years. The range of the mean number of tweets during in-person conferences was from 39,280.00 on the high end (ALA) and 3319.78 on the low end (AALL), whereas the online era showed a range from 8710.50 (ALA) to 1033.50 (AALL). The effect size, as measured by Cohen's *d*, was larger than two standard deviations for all conferences, with a range from 2.22 (SAA) to 4.13 (ALA).

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[4] *t* tests were also run on equal length 2-year intervals to see whether more significant results would be found when comparing in-person (2018–2019) and online (2020–2021) conference tweets. More significant results were found for the longer timeline (2011–2021) when looking at all tweets and retweets, whereas subsets of the original tweets and the unique authors per conference had more significant results when focused on 2-year intervals (2018–2021). Given similarities in significance overall, the longer timeline was chosen to allow for a discussion of tweeting trends at library conferences over a longer time period.

| | Number of tweets | | | | |
| | In-person (2011–2019) | Online (2020–2021) | | | |
| Conference | Mean* | Mean* | Percentage change | p value** | Cohen's d |
|---|---|---|---|---|---|
| AALL | 3319.78 (872.56) | 1033.50 (405.17) | −68.87% | 0.007 | 2.74 |
| ALA | 39280.00 (7858.11) | 8710.50 (333.05) | −77.82% | 0.001 | 4.13 |
| MLA | 7794.22 (1993.37) | 2327.00 (824.49) | −70.14% | 0.005 | 2.88 |
| SAA | 9995.67 (3878.86) | 1786.50 (1597.35) | −82.13% | 0.019 | 2.22 |
| SLA | 6972.89 (2360.05) | 1129.50 (142.13) | −83.80% | 0.008 | 2.63 |

\* Standard deviations in parentheses.
\*\* A $p > 0.05$ is not statistically significant.

**Table 2.** Total tweets per conference; *t* tests comparing means of in-person and online conference years

A subset of "original" tweets also showed decreases in activity when comparing the two eras of conferences; however, these results were less commonly statistically significant. By removing retweets from the tweet data and performing *t* tests on the remaining subset of "original" tweets (see alternating rows in Table 3), statistically significant changes were found for the ALA and SLA conferences, again with nine degrees of freedom. Although original tweets from all conferences showed decreases of over 50% in the mean from in-person to online conference years, only ALA, with a 68.71% drop, and SLA, with an 81.42% drop, proved to be statistically significant. In cases in which the difference of means appears large but a high *p* value suggests that an effect is not statistically significant, the sample size is either too small (likely the case for AALL) or there is too much variability in the data (reflected by high standard deviations) for the *t* test to find the effect to be significant. The latter is likely the case for original tweets from MLA and SAA, in which the standard deviations are quite high relative to the means. The effect sizes (Cohen's *d*) for the original tweets were all greater by more than one standard deviation and fewer than two standard deviations.

The authors also looked at a subset of the data focused only on retweets. *t* tests on the subset of retweets from each conference showed similar results to the analysis of all tweets (see alternating rows in Table 3). Every conference showed large and statistically significant decreases in the mean number of retweets moving from the in-person to online conference era. SAA showed the largest drop in the mean number of retweets (89.98%), whereas AALL showed the smallest statistically significant drop (72.82%). The effect size (Cohen's *d*) for the retweets

was quite large, with all conferences having a difference of means greater than two standard deviations. The higher number of statistically significant results for retweets than original tweets suggests that the presence of retweets in the analysis of the full dataset (Table 2) contributed to the statistical significance of the overall downward trends that were observed there.

| Conference | In-person (2011–2019) Mean* | Online (2020–2021) Mean* | Percentage change | $p$ value** | Cohen's $d$ |
|---|---|---|---|---|---|
| AALL: Retweets | 1900.44 (401.45) | 516.50 (210.01) | −72.82% | 0.001 | 3.60 |
| AALL: Original tweets | 1419.33 (668.39) | 517.00 (195.16) | −63.57% | 0.102** | 1.42 |
| ALA: Retweets | 21,041.44 (4403.69) | 3004.50 (364.16) | −85.72% | <0.001 | 4.34 |
| ALA: Original tweets | 18,238.56 (7249.57) | 5706.00 (31.11) | −68.71% | 0.044 | 1.83 |
| MLA: Retweets | 4778.11 (882.01) | 840.50 (156.27) | −82.41% | <0.001 | 4.73 |
| MLA: Original tweets | 3016.11 (1533.77) | 1486.50 (668.22) | −50.71% | 0.214* | 1.05 |
| SAA: Retweets | 5232.33 (2215.46) | 524.50 (371.23) | −89.98% | 0.018 | 2.25 |
| SAA: Original tweets | 4763.33 (2444.61) | 1262.00 (1226.12) | −73.51% | 0.088** | 1.50 |
| SLA: Retweets | 3969.44 (1282.51) | 571.50 (48.79) | −85.60% | 0.006 | 2.81 |
| SLA: Original tweets | 3003.44 (1348.66) | 558.00 (190.92) | −81.42% | 0.036 | 1.92 |

* Standard deviations in parentheses.
** A $p > 0.05$ is not statistically significant.
**Table 3.** Retweets and original tweets per conference; $t$ tests comparing means of in-person and online conference years

To place the changes related to moving conferences online observed earlier into the broader context of tweeting trends at each conference from 2011 to 2021, stacked area charts were generated showing the volume of both the original tweets and retweets at each conference per year (Appendix A). Although there are year-to-year variations from conference to conference, every conference shows a general pattern in which the volume of tweets rose from

2011 to around 2014 to 2017 and then declined again through 2021. The SAA conference (Figure A4) shows the most consistent curve, with the volume of tweets rising every year from 2730 tweets in 2011 to 15,067 tweets in 2015 and then declining each preceding year until 2021, when only 657 tweets were found. Other conferences show specific spikes and dips that deviate slightly from the overall trend, with the volume of tweets from AALL and MLA both dipping briefly in 2014 after high marks in 2013, for example, and then rising even higher for the next several years. Some annual shifts can be partially attributed to the variations of the conference organizers' use and promotion of the official hashtags for a particular year: SLA, for example, shows a decline in the volume of overall tweets, with numbers dropping from 10,676 in 2011 to 5206 in 2012, followed by a return to 8,847 tweets in 2013, that seems to be due in part to the promotion of #SLAChicago as the official hashtag that year, deviating from the norm of promoting official hashtags using the conference year (e.g., #SLA2011 or #SLA2013).[5]

The ratio of original tweets to retweets is also fairly consistent from conference to conference, with retweets in all cases representing a higher proportion of the tweets overall. MLA showed the largest difference, with retweets accounting for 59.7% of the tweets across all conference years, whereas SAA showed the smallest gap, with retweets only accounting for 51.5% of tweets. The stacked area charts in Appendix A show that the ratio of original tweets to retweets, however, was often much lower in 2011 than in later conference years: for example, only 14.97% of the MLA tweets were original in 2011, rising to 58.14% of the tweets being original in 2021. Along similar lines, the percentage of original tweets at ALA rose from 23.71% in 2011 to 67.59% in 2021.

Finally, means of the number of unique tweet authors for each conference were compared using *t* tests looking at the in-person (2011 to 2019) and online years (2020 and 2021). Significant differences were found for AALL, ALA, and SLA, all of which saw a drop in unique tweet authors of over 60%. ALA saw the mean number of unique tweet authors fall from 8229.67 during the 2011 to 2019 conferences to 2431.00 during the online conferences in 2020 and 2021, whereas AALL dropped from 516.33 to 163.00 unique authors and SLA dropped from 833.78 to 312.00. Although the mean number of unique authors for MLA and SAA both decreased by over 50% when comparing in-person and online conference periods, the findings for those conferences were not statistically significant. The effect size (Cohen's *d*) for the number of unique authors showed a difference of means greater than 1.5 standard deviations for all conferences, with nine degrees of freedom.

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[5] Tweets from SLA 2012 were collected for all of the following hashtags: #sla2012, #sla, #sla12, or #slachicago.

| Conference | Unique authors | | Percentage change | p value** | Cohen's d |
| | In-person (2011–2019) | Online (2020–2021) | | | |
| | Mean* | Mean* | | | |
|---|---|---|---|---|---|
| AALL | 516.33 (174.05) | 163.00 (33.94) | −68.43% | 0.023 | 2.15 |
| ALA | 8229.67 (2443.45) | 2431.00 (301.23) | −70.46% | 0.011 | 2.51 |
| MLA | 559.00 (190.07) | 265.50 (7.78) | −52.50% | 0.066** | 1.64 |
| SAA | 1297.67 (533.54) | 482.00 (319.61) | −62.86% | 0.073** | 1.59 |
| SLA | 833.78 (264.85) | 312.00 (36.77) | −62.58% | 0.026 | 2.09 |

* Standard deviations in parentheses.
** A $p > 0.05$ is not statistically significant.

**Table 4.** Unique authors per conference; *t* tests comparing means of in-person and online conference years

Although it was not possible to collect conference attendance or registration data sufficiently for AALL or SLA, the registration numbers for ALA, MLA, and SAA provide some context for the changes observed in the volume of tweets. The large drop in the mean volume of tweets for ALA from the in-person to the online conference periods corresponds to a significant drop in attendance at the conference itself. Although the volume of ALA tweets dropped 77.82% from the in-person to online periods, attendance dropped by 57.23%, going from a mean of 20,399.12 registrants between 2011 and 2019 to a mean of 8724 registrants in 2020 and 2021. Although both saw significant decreases, the volume of tweets at ALA dropped even more steeply than registration itself. *t* tests for conference registration for MLA and SAA were not statistically significant, likely because registration held relatively steady for both conferences from the in-person to online periods of time. The mean number of registrants at MLA dropped by only 1.67%, and SAA registration actually increased by 21.89%. It is not possible in the case of these conferences, then, to correlate the significant drop in the volume of tweets (70.14% for MLA and 82.13% for SAA) with any corresponding drop in registration. From this small sample, there does not appear to be any correlation between changes in attendance and the volume of tweets. In fact, the three conferences with sufficient data show three completely different patterns: at ALA, both the attendance and tweets decreased; at MLA, attendance held steady, and tweets dropped; and, at SAA, attendance rose, and tweets dropped. These *t* tests had eight degrees of freedom, and the effect size (Cohen's *d*) varied widely from conference to conference.

| | Number of registrations | | | | |
| | In-person (2011–2019) | Online (2020–2021) | | | |
| Conference | Mean* | Mean* | Percentage change | *p* value** | Cohen's *d* |
|---|---|---|---|---|---|
| AALL | N/A (N/A) | N/A (N/A) | N/A | N/A | N/A |
| ALA | 20,399.12 (3452.58) | 8724.00 (1023.89) | −57.23% | 0.002 | 3.59 |
| MLA | 1174.62 (119.67) | 1155.00 (73.54) | −1.67% | 0.834** | 0.17 |
| SAA | 1914.00 (355.98) | 2333.00 (352.14) | 21.89% | 0.174** | −1.18 |
| SLA | N/A (N/A) | N/A (N/A) | N/A | N/A | N/A |

* Standard deviations in parentheses.
** A *p* > 0.05 is not statistically significant.
**Table 5.** Conference registration numbers; *t* tests comparing means of in-person and online conference years

## DISCUSSION

Pre-pandemic, professional library conference Twitter use was robust. Tweeting at professional library conferences declined significantly with the move to virtual conferences during the COVID-19 pandemic (Tables 2 and 3). Retweets, which consistently accounted for the majority of tweets from each organizational conference, also saw significant decreases over the same time period. Along similar lines, three conferences experienced large and statistically significant drops in the number of unique tweet authors during the transition from in-person to virtual conferences, with all conferences seeing declining numbers. Not only did the volume of tweets decline, but the number of people tweeting dropped significantly in the move to virtual conferences during the pandemic. However, these declines cannot necessarily be attributed to a decline in conference attendance. Some virtual conferences did experience fewer participant registrations (such as ALA), whereas others remained at similar levels to pre-pandemic in-person conference attendance (such as MLA), and yet another conference recorded higher registration numbers when they moved to virtual conferences (SAA). Neither can the decline in Twitter posts related to professional library conferences when they went virtual be attributed to a decline in overall Twitter use. Although Twitter volume has been variable over time, there is no correlation between Twitter use on the platform overall and the dramatic decline in Twitter use demonstrated by the findings of the current study (GDELT Project, 2022).

Our findings showed a statistically significant decline in retweets across all of the conferences in this study when they moved from in-person to virtual conferences. This trend is a contributing factor to the overall drop in Twitter volume in the current study, and it contradicts the broader trend of retweets increasing across the Twitter platform (GDELT Project, 2022). There could be several contributing factors to the decline in Twitter use. Twitter use at

conferences differs from Twitter communication in a number of ways. People tweet and re-tweet about research presented in conference sessions or where to get the best coffee and tote bags, for example. It is unclear, from the data collected here, to what extent (if any) conference attendees were less likely to retweet conference-related content based on the lack of physical proximity or in-person conversations. Tweets related to local events or venues, however, would certainly drop given the lack of in-person events (e.g., "rt …: exhibition hall at #sla-chicago in full effect. come by booth #120 for a free t-shirt and see why librarians love us! #sla12"). It is possible that sharing local content with other in-person attendees accounts for a significant portion of conference retweets, especially given the likelihood that conference attendees are likely to follow the official conference hashtag to learn more about these opportunities.

Overall, the greater decline in retweets implies that there were fewer incentives for attendees to reshare or boost conference-related content on Twitter during these virtual conferences. This shift also signifies that librarians were engaging less with tweets by their colleagues during virtual conferences, and that Twitter users who did not follow a specific user would therefore be less likely to encounter conference-related tweets that were not shared as widely. The decrease in retweets and engagement among users implies that the interconnected Twitter network of invisible colleges related to professional library discourse may have shrunk when conferences moved online.

One important difference between in-person and virtual conferences is that many virtual con-ferences leveraged platforms that included a variety of communication channels such as syn-chronous and asynchronous chat. These communication tools were sometimes features offered within the virtual conference software but also included dedicated spaces for confer-ence attendees on other platforms such as Discord. These communication features overlap with many of the social and parasocial communication functions that Twitter provides. Con-tributing to a synchronous online chat during a virtual conference presentation, for example, may fulfill some of the social and professional needs that tweeting about the session would have met during an in-person conference session. In addition, many online conferences re-corded presentations for later asynchronous consumption (Foramitti et al., 2021), which likely decreased the sense of the content's timeliness or an attendee's feeling of having a shared experience, both of which may contribute to the likelihood that one would find it less relevant to share on Twitter, where news cycles move quickly.

One aspect of communication on Twitter that virtual conference communication is less likely to provide, however, is the ability of Twitter users to cultivate a professional online persona or "brand" related to a publicly visible library discourse. When discussions are only visible to session attendees, the potential audience is limited. Because virtual conference session

discussions were often held on private conference platforms, the content was locked down to registrants and inaccessible to those who did not attend the conference. Even for session attendees, the chat feature in a virtual conference platform was usually fleeting because the chats were not available for future reference or continued discussion. Although some of the social online conference tools may have moved some conference traffic off of Twitter, it is clear from the data showing significant decreases in the number of unique tweet authors across all conferences that fewer Twitter users found online conferences a good fit for sharing professional discourse publicly. One purpose of conference tweeting has been to disseminate research findings and share conference content with those who are unable to attend (Allen et al., 2018; Banerjee et al., 2021; Fekete & Haffner, 2019; Greenhow et al., 2019; Shetty et al., 2022). Public conference discourse on Twitter has served for some as a virtual invisible college that was open to all, searchable, and available over time. This invisible college network seems to have significantly shrunk for many virtual library conferences that met during the pandemic.

Research has shown that virtual conferences do a poor job in creating the networking opportunities that in-person conferences provide (Niner & Wassermann, 2021; Raby & Madden, 2021; Skiles et al., 2022). The decreased activity on Twitter throughout these virtual conferences suggests that Twitter was not widely viewed as a viable platform for filling this networking gap. One would expect to see some increase (or at least stability) in the volume of tweets during virtual conferences as participants sought to socialize and connect with colleagues online, given the inability to meet in-person. It is possible that virtual conference platform features such as participant chat tools or dedicated online social sessions were better equipped to help participants network than Twitter. It is striking to note, however, given previous research on Twitter's role as an informal professional networking platform, that there is little evidence that the platform was widely utilized in this manner when conference in-person encounters with colleagues were not an option.

**Limitations and future research**

There are a number of scope limitations to bear in mind, based on the nature of the Twitter API and the use of hashtags to find conversations related to specific conferences over time. The media scholar Tufekci, for example, explains that using hashtags to find relevant tweets leads to self-selected samples (2014). In the case of library conferences, it is clear that there are many relevant conversations on Twitter that do not include official hashtags. The tweet dataset collected here does not include subtweets or other content when conference attendees neglected to include the conference hashtag; therefore, the findings should be considered solely in terms of those who opted to take part in conversations directed through the "official" conference channel. Along similar lines, conference organizers' lack of consistency in assigning and

communicating official hashtags to attendees has also likely led to a smaller and less fully representative dataset than is ideal. In investigating a lower tweet count than expected for SLA in 2012 in the initial query, for example, the authors discovered that the official hashtag did not follow the format of other conference years (#SLA2012) and instead was #SLAChicago. Although the API query was adjusted to include the official hashtag along with common variants such as #SLA2012, it is possible that the change confused or discouraged conference attendees from using a conference hashtag in tweets that year.

Although the study found that tweets and retweets decreased with the move to virtual conferences during the COVID-19 pandemic, identifying the reasons for these shifts is beyond the scope of this project. A number of factors could contribute to declines in conference tweeting, but further research would be necessary to understand the causes. It is clear that the COVID-19 pandemic has had major impacts on academic librarians and their engagement with professional obligations, including participation in conferences. Increased rates of stress, illness, death, bereavement, and responsibilities related to childcare are just a few of the life factors that may have contributed to changes in online engagement with library conferences.

Future research could illuminate to what extent Twitter engagement (e.g., via likes and replies) and the topics of tweets shifted over the course of this time period for conference goers. Although engagement data were collected via the Twitter API, the authors found that an analysis of engagement would pair better with a qualitative analysis of conference tweets and a network analysis of influential users. Both of these directions, although out of the scope of this quantitatively focused paper, could lend additional insight into the transformation of online professional library discourse. Additionally, further research could explore whether alternative social platforms were used more frequently during these conferences, eating into some of Twitter's user base. Many virtual conferences used third-party messaging platforms such as Discord, Slack, or Zoom chat, for example. Given the sudden and steep increase in other forms of online work during this period, such as Zoom meetings, it is also possible that screen fatigue and other forms of digital burnout led to decreases in engagement during virtual conferences.

Finally, although future studies might examine shifts in Twitter usage over a longer period of time, the shuttering of the Academic Research API in 2022 would make longitudinal analysis difficult. Recent changes in ownership and policies led to an exodus of academics from the platform, perhaps signaling an end to the platform's importance to professional communication.

## CONCLUSION

Invisible colleges have fostered informal networking among librarians, academics, and practitioners in a variety of communication settings. Our study captures a unique snapshot in time

when the landscape for informal online communication among invisible colleges was noticeably altered. The number of tweets, retweets, and unique authors using library conference hashtags all declined noticeably when conferences moved online due to the COVID-19 pandemic. Although the scope of our study is focused on library conference Twitter use between 2011 and 2021, the decline in information sharing indicated in this dataset could have wider implications for invisible colleges in other disciplines.

Online conference-related discourse changed during the COVID-19 pandemic and is still evolving. The platform formerly known as Twitter served as a forum for public sharing about topics related to professional conferences for many years. The user base of Twitter has changed and is continuing to change after it was rebranded as X in 2023, and conversations that were previously shared on Twitter may have moved to other platforms, may be hidden behind private accounts, or may have ceased entirely. The dispersal of Twitter users to alternative forums fractured the potential for information sharing to a broad audience that stretches beyond conference attendees, and reach may be dramatically reduced. Twitter served as a central public place for library professionals to find and engage in topical conversations, but use of the platform in that way appears to have undergone a major shift during the COVID-19 pandemic. How and where future online invisible colleges related to library discourse will emerge remains to be determined.

## ACKNOWLEDGMENTS

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Zuccala, A. (2006). Modeling the invisible college. *Journal of the American Society for Information Science and Technology*, *57*(2), 152–168. https://doi.org/10.1002/asi.20256

# APPENDIX A.
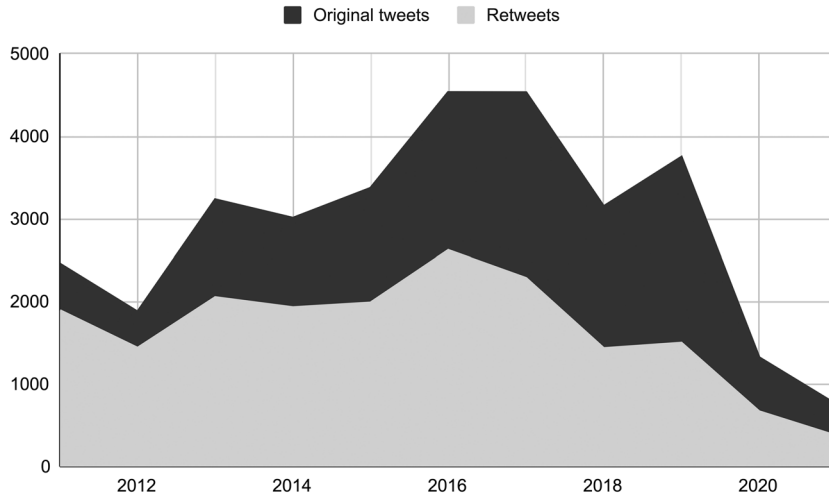## Retweets and original tweets per conference year



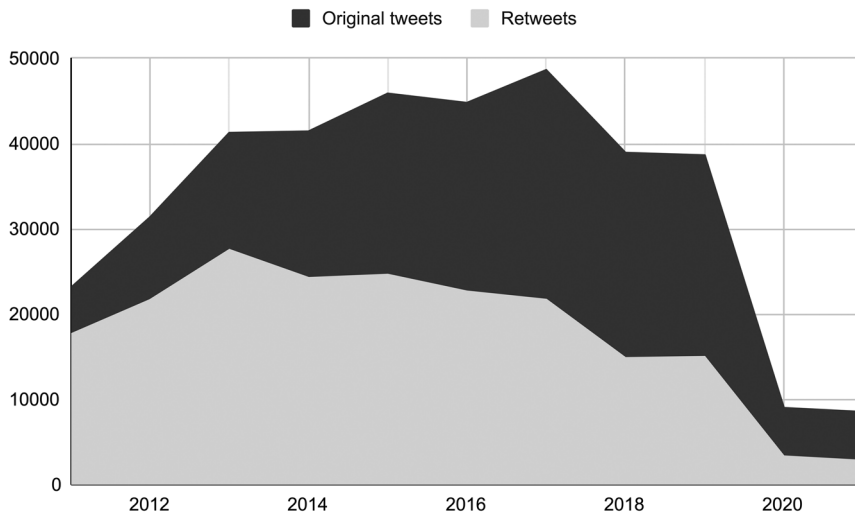**Figure A1.** AALL, Original tweets and Retweets over time



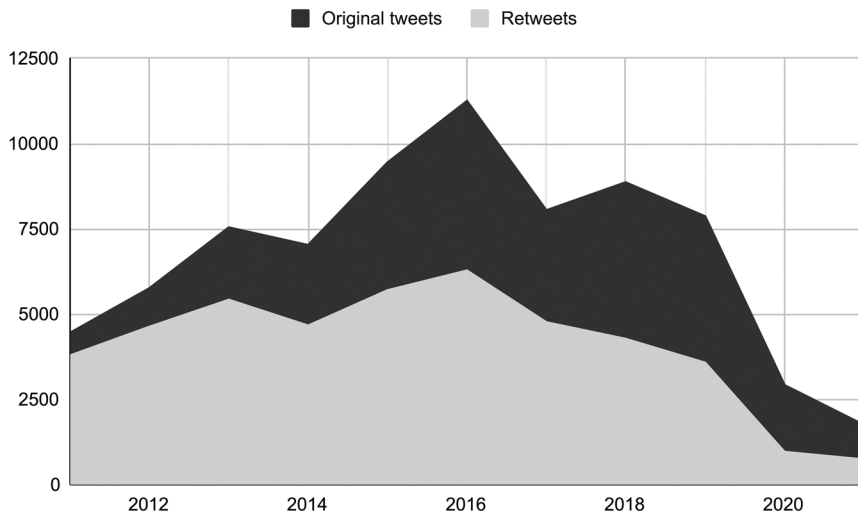**Figure A2.** ALA, Original tweets and Retweets over time

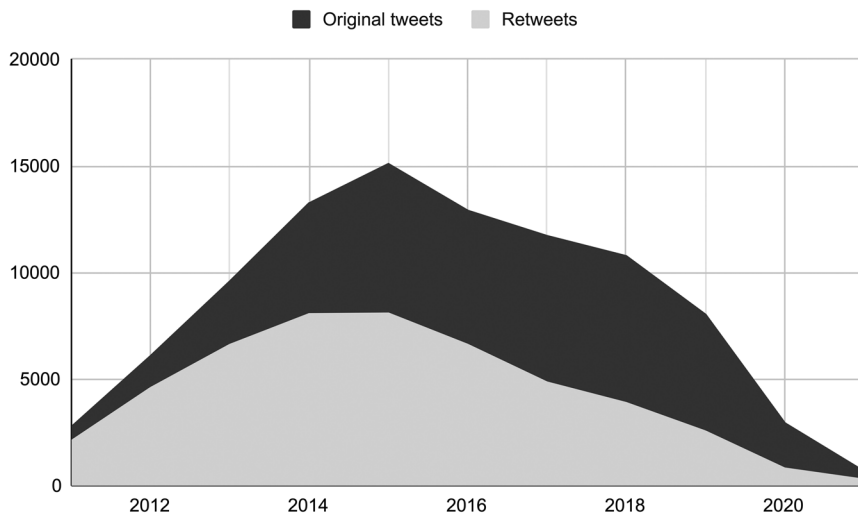**Figure A3.** MLA, Original tweets and Retweets over time
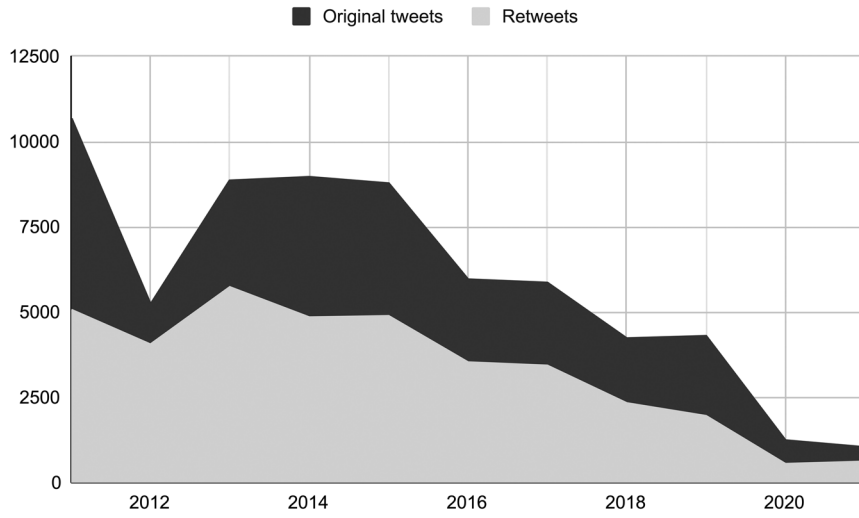


**Figure A4.** SAA, Original tweets and Retweets over time

**Figure A5.** SLA, Original tweets and Retweets over time