HOW ARE URBAN PLANNING ACADEMICS USING TWITTER?
[DRAFT – Not for citation]

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ABSTRACT

Twitter has increasingly become a resource used by academics to share scholarship within professional networks, and beyond. As with other professionals, academics use Twitter to exchange information and to engage with a broader audience. Some academics use Twitter to expand "learning opportunities beyond the confines of the classroom" (Veletsianos, 2001, p.342). This lends insights on the potential usefulness of Twitter for academic discussion and scholarly communications. Less than one-third of urban planning academics are active Twitter users, and as of yet, there have been no empirical analyses of how and why they use Twitter. This paper presents a descriptive analysis of Twitter use by urban planning faculty, reporting characteristics of users, the topics of Tweets, and looking at indicators of Twitter influence among urban planning faculty as well as those outside academic circles. The analysis uses Twitter data from active accounts for urban planning faculties in the U.S. and Canada. Only accounts identified as being used for professional purposes are included. The results of this analysis characterize the nature and extent of planning academic's use of the platform. Given the rapidly evolving state of social media and limited participation by planning academics, the future utility of Twitter difficult to predict.

Introduction

The business of modern universities is to generate knowledge. Institutional missions are continually evolving as the role of higher education is publicly debated (Roth 2014). A traditional notion is that faculty concentrate on discovery through research, teaching, and outreach. These three areas are not independent of one another, since research informs classroom content and outreach activities to the broader community. At the same time, service activities can be viewed as opportunities for subsequent research. Ideally, a faculty would integrate and leverage these aspects of their institutional missions, but this is dependent on the specific discipline and faculty orientation. A faculty's research orientation and outlook is determined by the process leading to promotion and tenure positions, and that emphasize research productivity and academic reputation. Whilst productivity and reputation are

important, the reliance on what are often seen as outmoded means for their evaluation, undermine processes to identify meritorious performance and therefore knowledge generation in service to society (Schimanski and Alperin 2018).

Universities grew out of organizational models that were highly insulated and internally focused, without effective means to share knowledge beyond individual campuses. Eventually, scholarly publications started to play a gatekeeping role, where it was assumed that through peer-review processes, the commitment to publish signified a standard of academic rigor, quality, and demand. Printing and distribution were costly, whereas currently electronic publication (i.e., blogs and websites) facilitates the quick and easy access to a wide range of scholarship. While books, book chapters, and journal articles remain respected forms of academic output, information and communication technologies are changing the academic landscape. Higher education has been slow to evolve in comparison with other industries that recognize that content (i.e., ideas and knowledge), can be communicated immediately at scale at far less a cost than traditional books or journal articles. University libraries have acknowledged this for some time, and are taking on the challenges of adapting to change - while the rest of their institutions are slowly realizing the implications for how they do business.

The purpose of this paper is to examine a way that university faculty are using online platforms as part of their scholarly communications. Publishers and faculty are increasingly utilizing social media to disseminate scholarly work, increase their visibility and as a method for market infiltration.

Social media use by academics is evolving rapidly in unanticipated ways. As with the internet, some scholars predicted a revolution in information sharing with far reaching benefits to society (Hilbert and Lopez 2011; Nie and Erbring 2002), while others warned of an increase in conformity through social influence (Bargh and McKenna 2004; Creeber and Martin 2008). It is commonly assumed that wider access to information increases awareness and overall knowledge, either generally or in specific areas of interest. On the other hand, social media platforms are also prone to prioritizing some voices over others, increasing their influence by default. Recent evidence also points to the intersection of influence and persuasion on social media in propagating "fake news" and other unreliable information (Alcott and Gentzkow 2017)

along with trolling and inappropriate language common to online commentary (Schweitzer 2014). Nonetheless, social media has provided an added dimension to academic visibility and scholarly communication over the past decade, with academics being encouraged to develop their individual reputations as a way to gain increased visibility in their respective fields. Not only are academics expected to publish, teach, and perform service and outreach, but now more than ever, they must promote these activities both within and beyond their institutions.

This paper explores one such form of social media activity by urban planning academics. The focus is specifically on how Twitter is being used by academics in urban planning, along with some general characteristics about the urban planning discourse on Twitter. The flow of information in this context, was expected to be between urban planning professionals, urban planning academics and others with urban planning interests, since Twitter is structured on and around social networks. Following a review of key literature dealing with academics' use of Twitter, this paper analyses who among urban planning academics is using Twitter and how they are using it, in a bid to determine why urban planning academics are using Twitter.

While there are many ways that Twitter usage can be explored, this paper also explores whether, and in what ways, urban planning academics use the platform to communicate with other non-academics, planning practitioners, and more broadly within Twitter. The analysis of subject matter is somewhat challenging since it is subject to the constraints of Twitter protocols, such as the 140 character limit which affects the language used in terms of grammar, spelling, and punctuation. Tweets can be original content or forwarded information and can include images, web links, hashtags, and mentions of other Twitter users. While the combination of these elements provides richness beyond that of natural language, assessing all of these types together is quite complex (Kireyev, Palen, and Anderson 2017).

Inherent to this analysis is the identification of voices receiving most attention or influence. In scholarly publication, attention or influence is commonly measured by the number of citations. It is widely accepted that citation counts are not completely reliable measures of positive influence, since several factors contribute to publications' citation rates, not all of which are positive (Bornmann and Daniel 2008). And yet, total publication or author citation counts are regarded favorably, and are considered the best suited available metrics for

measuring influence within a particular discipline. A more in-depth analysis of citations examines who is citing, where, and why to better reflect the nature of influence or impact (see Sanchez 2017). The same can be said for Twitter where influence cannot be measured simply by the volume of followers or Tweets, an aspect that is discussed in greater detail later in the paper.

Literature Review

There is a growing literature on how and why academics use Twitter. Since Twitter is still relatively new, few of the existing analyses are empirical, many with sparse sampling. This is also due to the slow and somewhat low levels of social media adoption by academics and the publication lag for articles to appear in peer-reviewed journals. It can take an article a minimum of a year between the time of submission and when it appears in print or as a pre-print online version. Papers (such as this one) must rely on snapshots of Twitter activity that may not be seen as reflecting current activity and therefore be explicit about timeframe and purpose. Nonetheless, some of the early literature provides a useful foundation with regards to how and why academics use Twitter, but none to date on how urban planning academics specifically use it.

Academics' engagement with Twitter falls into two general categories. The first is self-promotion through building a "public profile" (Hall 2014) and engaging in "digital identity and impression management" (Veletsianos and Kimmons 2013, p.44). These activities are not too different from how academics build identities through different publications, conference presentations, and other activities outside of their own institutions. These efforts are closely aligned with promotion and tenure criteria that emphasize external visibility, despite the lack of evidence linking the benefits of individual scholarly notoriety to an academic unit or university. Some universities, through their promotion and tenure guidelines, are placing value on faculty social media participation, primarily for the purposes of university public relations. It is clear that these activities (e.g. engagement via Twitter, Facebook, and Instagram) have little or no scholarly value in themselves. Blogging on the other hand is emerging as a form of scholarly communication, but not perhaps scholarship (Kirkup 2010).

Other social media platforms used by academics include LinkedIn, ResearchGate, Academic.edu, and Mendeley. LinkedIn's primary purpose is to promote a public profile and to "network". While LinkedIn has communications capabilities, it is not used for this purpose with the same frequency that Twitter is used by urban planning academics. Although the platform is also used for information sharing, contrary to Twitter, this type of communication is oriented to professionals (Skeels and Grudin 2009). Other sites, such as ResearchGate, Academia.edu, Mendeley, and Social Science Research Network (SSRN), are mainly used to post and share publications with relatively limited accompanying "social" engagement. Users can network with others with similar interests to share information. Google Scholar and Microsoft Academic are primarily public profiles sites with search capabilities for publications and author metrics. These sites generally serve the least social function among those mentioned above but are increasingly becoming more widely used among academic disciplines (Martín-Martín, Orduña-Malea, and López-Cózar 2016).

Twitter provides opportunities for engagement between urban planning academics and practitioners. It is likely that academic-to-academic communications focus on topics that are different from academic-to-practitioner communications. Due to absence of empirical studies on urban planning academics' Twitter usage, this study does not explore trends or changes over time. By contrast with other social media platforms cited earlier, Twitter seems to be the social media platform most suited for connecting academics with practitioners, aside from LinkedIn. Web sites that focus on scholarship are probably not used by practitioners given the different types of information needs or interests of academics and practitioners. One objective of the descriptive analysis presented here is to characterize the flow of communications between academics and other academics as well as between academics and urban planning practitioners.

At the most general level, it is assumed that Twitter is used by urban planning academics and practitioners in somewhat similar ways. Urban planning practitioners are more likely to use Twitter in practical planning activities such as gathering data about resident's perceptions, gathering geo-tagged data about location or movement patterns, and decision-support (Hollander, et al. 2016; Shelton, et al. 2015). Applications that integrate social media

and urban planning are likely to continue to grow as planners become more familiar with accessing social media data, conducting analyses, and communicating their results in applied ways. The same was true when GIS came on the scene in the early 1980s (see Drummond and French, 2008). There was an evident adoption phase that was followed by pervasive use by planning organizations.

Methodology

To examine Twitter usage by planning academics, data for this analysis were obtained from two primary sources. A list of urban planning faculty from over 100 universities across the U.S. and Canada maintained by Sanchez (see Sanchez 2016), were searched in Twitter and manually validated for name disambiguation and also to determine if the account was used for professional or personal purposes. Accounts were assumed to be used for professional purposes if the user profile contained their professional title (e.g. professor), mention of an area of urban planning expertise (e.g. transportation, housing, environment), or employer's name (i.e. university name or department). In some cases, accounts were included when these criteria were not met but the content discussed in tweets was deemed to be related to urban planning. While Twitter accounts often contain a mix of professional and personal content, the focus of this analysis is on professional topics whilst also taking into account the blurred boundaries between professional and personal opinions.

A total of 324 Twitter accounts were identified from the over 1,100 urban planning faculty. Lists of profiles, Twitter activity, followers, and friends were obtained through the Global Event and Trend Archive Research project (GETAR) at Virginia Tech[1]. Lists of Tweets, followers, and friends resulted in individual files, which were then merged for all selected users. The first part of the analysis focuses on basic characteristics of the selected Twitter users such as: age of the account, frequency of participation, and user-engagement levels. These types of characteristics were also considered relative to professional status (i.e. academic rank). The study also considered the types of Twitter content being shared by urban planning academics primarily by the topic of Tweets. Text analyses of Tweet content were used to identify popular

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[1] National Science Foundation projects IIS-1619028 and 1619371

topics being posted. The analysis focuses primarily on hashtags and text within Tweets. It should be noted that Tweets often include abbreviations, slang, and jargon, with abbreviations being commonly used due to the 140 character limit on Tweets. Twitter accounts mentioned by planning academics include other planning academics as well as non-academics. Frequently mentioned non-academics were expected to be "outside" influencers, who may be practicing planners and others who share planning-related news items and discussion.

The next part of the data analysis examines the network aspects of Twitter users. Network analysis characterizes users relative to their connections to other Twitter users. Users at the center of the network are assumed to have more influence because they have more extensive network connections or are connected to more nodes within a network. Since Twitter data for this analysis were obtained at a single point in time, the results represent a snapshot of an otherwise dynamic set of relationships. Users continually add and remove followers and friends meaning that patterns of activity also change over time Network statistics and visualizations are used to understand the structure of these connections, especially for highly connected users.

Results

As noted earlier, 324 of the 1,104 selected urban planning faculty had Twitter accounts. Of those 324, 20 had not yet Tweeted, so their presence on Twitter is assumed to be passive even though nearly all of them had followers and friends (accounts they were following). It appears that Twitter adoption by urban planning faculty peaked in 2012, with 55 faculty joining that year, down to an estimated 10 to 15 that will join in 2019 (see Figure 1)[2].

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[2] The earliest Twitter adopter among planning faculty was Alan Lew, who joined approximately one year after Jack Dorsey's first Tweet of, "Just setting up my twttr" ("Twttr" was the original name of Twitter) on March 21, 2006. Lew's first Tweet was, "trying to stay awake and get some work done on my computer—I think I will take a nap" (3-24-07).

Figure 1. Year urban planning faculty joined Twitter
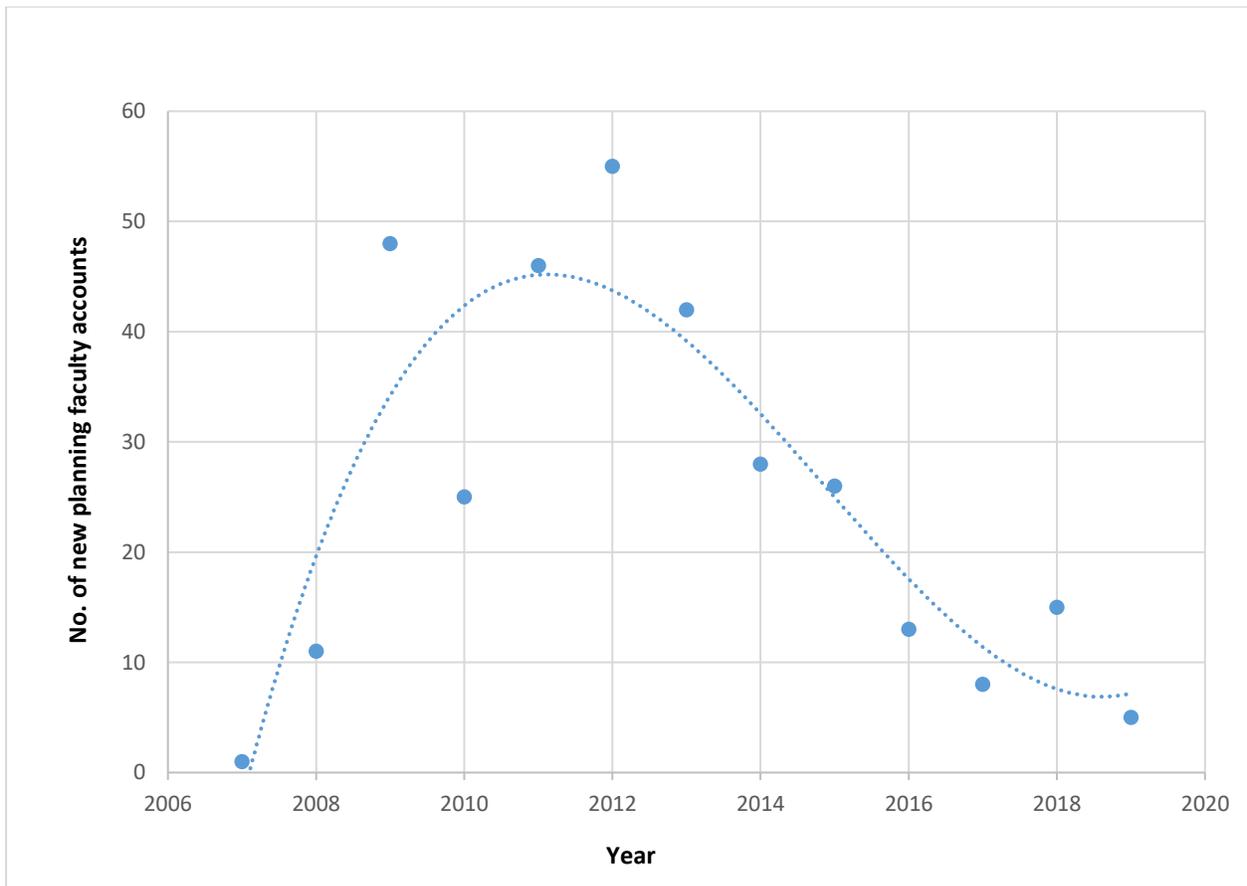
Currently the average academic urban planning Twitter user has been on the platform for 6.5 years, Tweets on average 20 times per month and has over 1,000 followers and 465 friends (accounts they follow) (see Table 1). One account is a significant outlier with over 128,000 followers which, when excluded from the sample, lowers the mean number of followers to 655. The account with the next highest number of followers has over 20,000 and only one other account has more than 10,000 followers. In terms of rank, faculty engagement on Twitter is relatively similar, with just over 100 assistant, associate, and full professors. On average, full professors Tweet more often and have higher numbers of followers, irrespective of whether the outlier was included in the sample or not. In terms of influence, the Followers to Friends ratio is also highest for full professors. This indicator is discussed later in the section (see Table 2).

Table 1. Descriptive statistics of planning faculty user accounts

	N	Minimum	Maximum	Mean	Std. Deviation
Account age (mos.)	323	1	145	78.2	32.5
No. of Tweets	323	0	102,360	1,809.4	6,920.9
No. of Followers	323	0	128,418	1,051.0	7,322.2
No. of Friends	323	0	10,066	465.1	903.9
Followers to friends ratio	319	0	171	3.2	11.8
Tweets per month	323	0	1,045	20.5	69.8

Table 2. Descriptive statistics by academic rank

Position		N	Minimum	Maximum	Mean	Std. Deviation
Assistant Professor	Account age (mos.)	116	3	134	77.8	30.7
	No. of Tweets	116	0	23,026	1,299.9	3,117.2
	No. of Followers	116	1	2,782	405.7	549.9
	No. of Friends	116	0	5,001	491.9	767.1
	Followers to friends ratio	115	0.1	12.9	1.2	1.46
	Tweets per month	116	0.00	212.8	14.6	30.36
Associate Professor	Account age (mos.)	105	1.02	133	73.9	36.1
	No. of Tweets	105	0	35,122	1,493.8	4,313.0
	No. of Followers	105	0	20,408	642.8	2,081.5
	No. of Friends	105	0	5,397	435.4	786.6
	Followers to friends ratio	102	0.00	74.5	2.3	7.4
	Tweets per month	105	0.00	272.4	18.9	44.3
Professor	Account age (mos.)	102	5.75	145	83.0	29.9
	No. of Tweets	102	0	102,360	2,714.0	11,011.7
	No. of Followers	102	0	128,418	2,205.0	12,811.2
	No. of Friends	102	1	10,066	465.2	1,138.3
	Followers to friends ratio	102	0.00	171.0	6.5	19.1
	Tweets per month	102	0.00	1,045.6	28.5	111.2

Twitter Engagement

Tweet content can take on multiple forms based on the user's intention. Twitter classifies individual Tweets as "Original", "Quote", "Reply", and "Retweet". Original Tweets are composed by the author using their own words together with links, hashtags, or images. Quotes are Tweets that are comprised of text from someone else and referenced within a Tweet. Replies are Tweets directed at other Twitter users, who are identified by their Twitter handle or user name. Retweets are Tweets previously posted that are then shared in a user's Twitter feed. Of the 258, 872 Tweets from urban planning faculties being analyzed here, nearly half are retweets with 7 of 10 being retweets, quotes, and replies. In other words, most of Twitter activity is not original material.

Figure 2. Tweet types
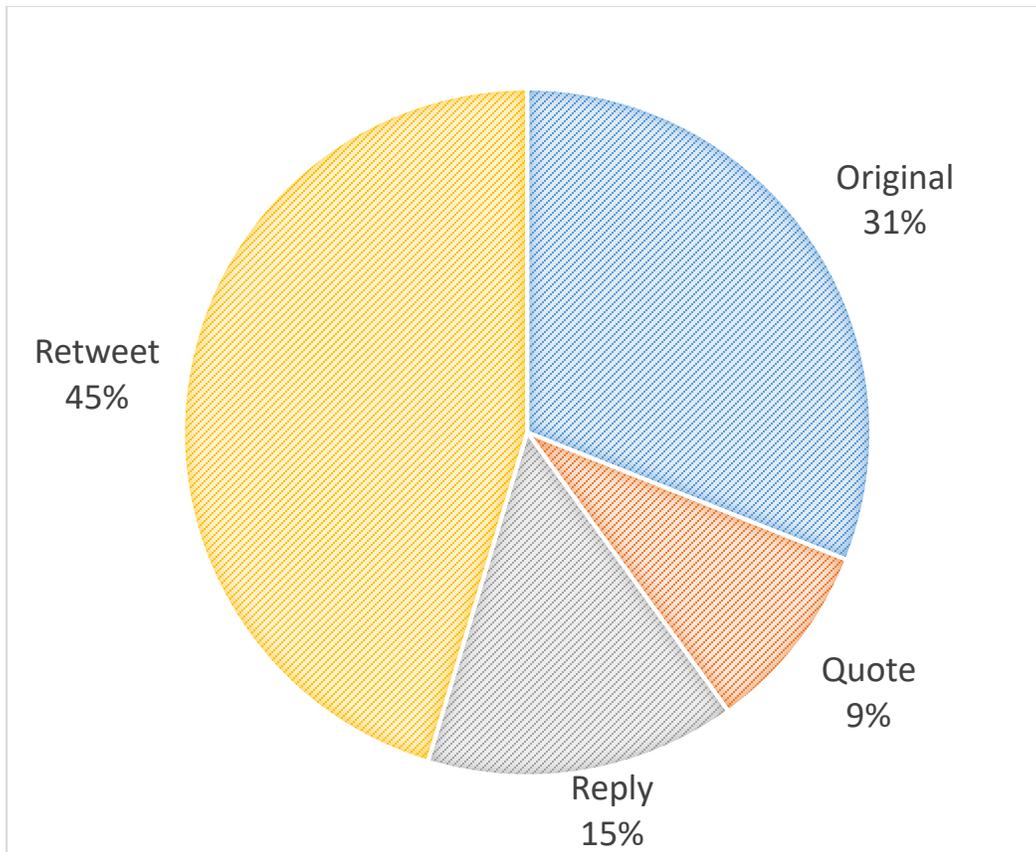
So what are all of these Tweets about? Hashtags represent useful indicators and keywords for categorizing tweets thematically. Of the 258,872 total tweets, nearly 75% (192,693) lacked hashtags. Of the 66,179 that used hashtags, 100,569 used hashtags. Using hashtags is intended to identify relevant topics so that other Twitter users can locate conversations of potential interest. There were 27,354 unique hashtags used by urban planning academics with 9,330 of those being used more than once. The most frequently used hashtag was #climatechange, followed by #planning, #cities, #urbanplanning, and #smartcities (see Table 3 for the top 20 hashtags). The hashtag frequencies are only for individual appearances and do not account for hashtags used in combinations, so while #urbanplanning was the fourth most frequently used hashtag, #planning (724 appearances) and #urban (442 appearances) may have been used in combination. However, it is difficult to determine the author's intention when using single or combined hashtags. As a result they are analyzed separately in this study.

Table 3. 20 most popular hashtags

Hashtag	Frequency	Percent
climatechange	727	0.7
planning	724	0.7
Cities	707	0.7
urbanplanning	661	0.7
smartcities	616	0.6
technicity	526	0.5
Bigdata	482	0.5
Urban	442	0.4
opendata	417	0.4
Climate	413	0.4
Data	410	0.4
resilience	396	0.4
Trbam	374	0.4
sustainability	347	0.3
justsustainabilities	342	0.3
Housing	335	0.3
Nyc	323	0.3
aspa2019	310	0.3
Toronto	289	0.3
gentrification	284	0.3

The hashtags in Table 3 appeared across a relatively small proportion of Tweets, with none exceeding 1% and the top 20 representing less than 9% of all Tweets. Of these 20, 15 were planning-related topics, 2 conferences, 2 places, and 1 online class.

Hashtags *versus* Text

Whilst hashtags represent a useful way to identify the topic of a Tweet, nearly all Tweets contain text. Hashtags are labels for classification added by authors, where the natural language within texts has to be analyzed to extract keywords and frequently occurring terms. In this regard, a thematic analysis was conducted to classify Tweet topics from text. This process analyzed the most frequent unigrams and bigrams to create topic labels. Over 35,000 topics or themes were associated with 95% of the Tweets.

Labels

A multi-label classification process resulted in 24,315 total unique combinations using 34 individual labels. The most frequent was "other" which captures most of the non-planning related and personal tweets (see Table 4). These tweets contained none of the frequent terms (unigrams or bigrams) or keywords identified using text mining. The next most frequent labels were for "place" (3.5%), "social" (3.0%), "scholarship" (2.3%), and "economic" (2.0%) resulting in a total of 28,110 tweets or about 11%.

Table 4. Most frequent Tweet topics (labels)

Labels	Frequency	Percent
Other	54,014	20.9
Place/	9,066	3.5
Social/	7,820	3
Scholarship/	5,999	2.3
Economic/	5,225	2
Education/	4,893	1.9
Environment/	4,752	1.8
Government/	2,995	1.2
Place/Social/	2,339	0.9
Planning/	2,201	0.9
Environment/Scholarship/	2,078	0.8
Environment/Place/	2,028	0.8
City/	1,776	0.7
Land/	1,708	0.7
Transportation/	1,498	0.6
Economic/Social/	1,454	0.6
Housing/	1,382	0.5
Urban/	1,338	0.5
Economic/Place/	1,323	0.5
Scholarship/Social/	1,308	0.5

In terms of the overall frequency of individual labels, the top 20 represented most of those appearing in the multiple label categories illustrated in Table 4. The most frequent single term was "place", followed by "other", "social", "scholarship", and "environment". As discussed earlier, these terms represent clusters of related unigrams and bigrams. For instance "place" includes terms like America, Canada, Toronto, California, and New York City. The label "social" includes terms like people, women, kids, children, and family.

The most popular topics derived from faculty interests, scholarly citations, and twitter conversations turn out to be very similar despite differences in the methods producing each list. Self-reported faculty interests represent potentially broader planning topics that reflect faculty research and teaching interests within urban planning programs (see Sanchez and Afzalan 2017). In the case of citations, there are both supply and demand factors that impact the popularity of certain topics (see Sanchez 2018). For instance, "global" issues potentially have a larger audience than other more geographically specific topics. While Twitter topics

closely resemble faculty interests and scholarly citations, the focus on "places" and "scholarship" often link to current events like planning related occurrences in certain locations, as well as recently released urban planning scholarship. Due to the nature of the Twitter platform, personal and professional topics are likely to be combined, "other" could only appear on Twitter and not among the topics for faculty interests or citations. The fourth column, an unweighted list of the most prominent urban planning related themes, is the result of averaging the ranks across the 3 lists (see Table 5).

Table 5. Topic ranking across research interests, citations, and Twitter topics

Topic	Research	Citations	Twitter	Rank
Urban	2	2	11	5.0
Environmental	7	9	5	7.0
Planning	1	20	8	9.7
Social	18	10	3	10.3
Land-use	9	15	9	11.0
Policy	4	17	16	12.3
Transportation	11	13	14	12.7
Development	3	21	15	13.0
Economic	12	21	6	13.0
Management	10	19	10	13.0
Regional	16	4	21	13.7
Community	5	21	21	15.7
Design	6	21	21	16.0
Analysis	14	16	18	16.0
Housing	15	21	13	16.3
Sustainable	17	11	21	16.3
Public	8	21	21	16.7
Theory	13	21	21	18.3
Methods	19	21	21	20.3
International	20	21	21	20.7

Note: A rank of 21 signifies indicates the topic was not in the top 20 for that particular list. This is used for weighting purposes.

Networks and Influencers

In addition to topics of interest being shared on Twitter, this study also considers the network of users and their connections. The primary set of users are urban planning faculties, however, all of them have followers and friends. These connections produce a social network that can be analyzed. Drawing on graph theory, network analysis methods are used to examine how urban planning faculties are associated and clustered. The analysis is performed using the available lists of urban planning faculties' users, followers and friends. Graph theory informs network analysis by exploring parameters that influence network connectivity, including the number of nodes and links between them in the network, the density of sub-networks (clusters), and the distance between the nodes and clusters (Linehan et al. 1995).

Gephi, an open source network analysis and visualization tool, was used to analyze faculty Twitter connections. A relationship exists between users who follow one another and creates a "directed" network. One account following another creates an "in-degree" connection for the first (a follower). When the first account follows a second (a friend), an "out-degree" connection results. When users follow each other, both in- and out-degree connections result. Following or friending creates an "edge" or connection between nodes or users. The more times a user is followed, the higher their "degree" or prominence in the network. "Betweenness centrality" is a measure of the role a node plays in network connectivity. This differs from "degree centrality" because a node with a high level of connectivity may not have a large number of edges, but may serve as a bridge that otherwise connects dispersed nodes or clusters in the network. In the case of this analysis, nodes with high betweenness centrality are users that span or connect users, for example by areas of interest. Users with high betweenness centrality may also have interdisciplinary interests.

Figure 3 illustrates a simplified network to illustrate the metrics mentioned above. Node 1 has the most followers as indicated by in-degree connections. There are five total nodes (or Twitter users) and users do not follow themselves, so Node 1 has four followers. The other four nodes each have one follower. In theory, Node 1 has the highest relative level of influence because more nodes (i.e., Twitter accounts) are connected to their content, although we cannot be sure that the content (i.e., Tweets) are viewed by or are of interest to these

followers. While Nodes 2-5 only have one follower each, both Node 1 and Node 2 have the same betweenness centrality measure. This indicates that Node 2 is potentially just as important as Node 1 in terms of relaying Twitter content to other users in the network. Node 2 serves as a conduit for information to flow from Nodes 3, 4, or 5 to Node 1.

Figure 3. Example network
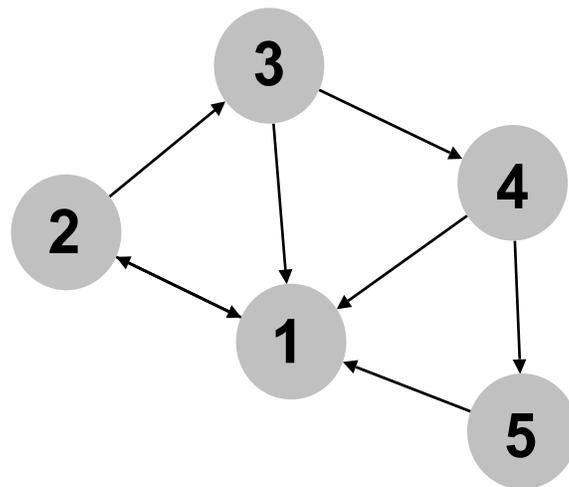
The network analysis illustrates levels of influence based on the number of connections and centrality of users. This is a dimension of Twitter influence along with the attention that a Twitter account's activity (tweets and retweets) receives in terms of shares and mentions. The attention can be in the form of quotes or retweeting user content or through mentions by user name.

Overall, the 324 urban planning faculties with Twitter accounts have a total of 336,822 followers. These are accounts from outside the group of selected faculties. Table 6 illustrates the top 10 non-faculty followers. The followers are composed of 3 organizations, 3 outside professors/instructors, 3 students, and one academic planning publication.

Table 6. Top 10 urban planning faculty Twitter non-faculty followers

Username	Frequency
The_ACSP	92
Erualdo	65
soplacers	63
nlamontagne	62
WrayAJ	56
DanImmergluck	55
amariearbis	54
JPER7	53
huyenkle	52
UCBDisplacement	51

Planning faculties follow (aka friend) 148,310 other user accounts, some of which are other urban planning faculties. The list of the top 20 Twitter accounts being followed is comprised of 11 planning related research organizations, 2 news organizations, 2 politicians, 2 outside professors, 1 academic planning department, 1 publication, and 1 account of general academic interest (see Table 7).

Table 7. Top 20 urban planning faculty Twitter friends

Friend	Frequency
planetizen	150
CityLab	149
BarackObama	125
APA_Planning	108
NextCityOrg	107
nytimes	107
The_ACSP	100
CitiesResearch	87
UrbanLandInst	87
urbaninstitute	78
AOC	75
DanImmergluck	75
urbandata	75
JPER7	73
Richard_Florida	73
NPR	70
MITdusp	65
NewUrbanism	64
PPS_Placemaking	64
AcademicsSay	63

Network Results

The network analysis using Gephi provides some additional metrics to assess Twitter users' relative influence according to their position in the network. The Twitter data used here results in a "directed network" because we know the direction of the connections for each urban planning faculty member. The number of followers a user has is referred to as the "in-degree" and the number of friends is the "out-degree". The "weighted degree" incorporates ties that are shared between nodes or users. The top 20 users by weighted degree are illustrated in Table 8. These only include urban planning faculties because the full data on their followers and friends were not included. In other words, the original data were based on a single degree of separation between urban planning faculties and their followers and friends. Assuming an average of 500 followers and friends, this would have meant an additional 168,000,000 nodes in the network.

Table 8. Top 20 weighted degree

Label	Weighted Degree
DrBobBullard	27,782
DarrickHamilton	23,950
Drschweitzer	10,672
ananyaUCLA	10,151
FreeBlackTX	7,721
pittman17	7,015
Rkeil	6,738
Julianagyeman	6,612
Pjrplan	6,089
Tomwsanchez	5,269
Markus_Moos	5,149
MarkJaccard	5,066
TimBeatley	4,752
Kiangoh	4,566
Alew	4,559
cschively	4,296
JohnGMcNutt	4,235
GoddardTara	3,859
eklopfer	3,792
BenClarkPhD	3,703

Another network metric that indicates the relative level of influence is "betweenness centrality". While the number of total connections (degree) implies network connectivity, the location in the network relative to the connectedness of followers and friends indicates that nodes or users with high measures of betweenness centrality serve as hubs or bridges between regions and are critical to the flow of information. Betweenness centrality is calculated as the number of shortest paths between all nodes on the network of selected users (337,000[2] or 1.1 x 10^{11}). Given the vastness of the network, even the top user with the highest betweenness centrality (drschweitzer) is on the shortest path between only 0.006% of users. This creates a level of influence that is not directly related to content generation, but is instead related to the role they play in connecting other users.

Table 9. Top 20 betweenness centrality

Label	Betweenness Centrality
drschweitzer	6,688,325
tomwsanchez	6,662,607
DrBobBullard	5,848,058
DarrickHamilton	4,964,018
ananyaUCLA	3,930,584
pittman17	2,627,553
cschively	2,510,091
AlexKarner	2,158,646
Rkeil	2,101,148
rgoodspeed	2,073,364
JonnAxsen	1,844,381
Markus_Moos	1,737,166
julianagyeman	1,726,943
FreeBlackTX	1,587,160
Marlon_Boarnet	1,586,819
arielbphd	1,495,310
TimBeatley	1,400,753
MarkJaccard	1,261,501
nmlister	1,203,753
drlungamam	1,187,439

<u>Mentions</u>

An analysis of user mentions in tweets is a potential indicator of influence. Whenever a user name (preceded by an @ symbol) is used in a tweet, it acknowledges a user or is used to draw attention to another user, in most cases with reference to something they tweeted. We can assume that accounts that are mentioned frequently, gain attention as a result of the content and frequency of their tweets. Examining the top 20 most frequently mentioned accounts indicates 9 professors (7 from planning), 7 organizations (planning or news), 2 planning programs, 1 planner (consultant), and 1 doctoral student (see Table 10). While @CityLab had the most mentions (1,549), these, whilst still noteworthy, represent only a very small fraction of the 328,568 total mentions.

Table 10. Top mentions

Hashtag	Frequency	Percent
CityLab	1,549	0.5
drschweitzer	1,411	0.4
frankjamespopep	1,387	0.4
DarrickHamilton	1,195	0.4
nytimes	1,122	0.3
RYSURP	956	0.3
julianagyeman	861	0.3
USCPrice	830	0.3
FJPopper	814	0.2
SandyDarity	739	0.2
surlyurbanist	702	0.2
BrentToderian	695	0.2
NextCityOrg	683	0.2
planetizen	680	0.2
TheEconomist	678	0.2
ananyaUCLA	666	0.2
DanImmergluck	649	0.2
rkeil	649	0.2
The_ACSP	620	0.2
APA_Planning	588	0.2

Summary

 Urban planning is a small discipline with only about 1,100 faculties and about 100 academic programs in the U.S. and Canada. While there are no other empirical analyses of disciplines allied with planning (public administration, urban studies, public policy, etc.), a core group of about 300 urban planning faculty on Twitter is a miniscule proportion of overall Twitter membership of 330,000,000[3]. Beyond the 300 faculty considered here, the data suggest that another 300,000 users are interested in what urban planning faculties share on Twitter about planning-related topics. It can be assumed that the Twitter network attached to these users extends beyond these 300,000 when considering followers and friends not accounted for in this analysis. A rough estimate may be in the range of 1,000,000 Twitter users take interest in some aspect of urban places and planning topics on the social network within 2 degrees of separation from the most popular accounts like NextCity, Planetizen, CityLab, and APA.

Although the rate of Twitter adoption by urban planning academics is declining and approaching a plateau, this is not necessarily indicative of engagement with this topic since faculties represent a small segment of the landscape. In terms of content, only one third of Tweets from urban planning faculties are original with the majority being recycled Tweets. It appears that hashtags are not a reliable way to track the topics of Tweets because they are not used regularly and there are no standards or conventions for hashtagging. Only about 25% of Tweets had hashtags, and of these, the popular themes were related to climate change, cities, planning, technology, and data. However, nearly all Tweets contain text that can be analyzed. The labels and topics resulting from the text analysis are far more wide-ranging and align with topics identified in other analyses (see Table 5). Excluding non-professional topics, Tweets about places, social dynamics, economy, and environment are more frequent, along with topics related to scholarship and education, which appear relatively infrequently. Self-promotion related to scholarship and publications appears to be a somewhat significant proportion of urban planning faculty Tweets relative to all other topics.

The core network for urban planning faculty Twitter users is small, but as noted earlier, but becomes more extensive when considering second and 3rd degree connections. The

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[3] https://www.statista.com/statistics/282087/number-of-monthly-active-twitter-users/

network analysis results do not indicate that any of the faculties are particularly influential. However, in this regard the focus on the connections of the 324 urban planning faculty, as opposed to the network as a whole, represents a limitation of this study. Drawing on an analysis of connections, influential non-academics include Planetizen (73,000 followers), CityLab (216,000 followers), APA (53,000 followers), and NextCity (114,000 followers), as the most significant influencers in urban planning related Twitter discussions.

In reality, any measure of influence based on Twitter connections or other network metrics is based on potential because there is no way to know whether information shared had any tangible impact. However, it is not entirely clear what a tangible impact would be on social media.

Conclusions

This paper began by broadly establishing the context for faculties' use of social media platforms such as Twitter. While Twitter posts are clearly not a research activity, they have been incorporated as part of teaching efforts, and not clearly used for academic service activities. The results of the analysis suggest Twitter posts may support each of these three roles. The evidence indicates that urban planning faculties using Twitter are engaging in conversations about urban planning-oriented scholarship and education, but less so when related service activities. Drawing on the key characteristics and structure of the Twitter platform, it is assumed that planning academics use Twitter to exchange ideas and opinions about a range of topics, but also to increase their visibility in the Twittersphere, and among colleagues and laypersons interested in planning topics. But, to what end?

As noted earlier, the urban planning academic presence on Twitter represents a microcosm of the urban planning landscape, a small outlet for academics to exchange ideas. Due to Twitter's status as a public platform, an underlying expectation was that there would be a greater presence of planning practitioners, and that their participation would be evident. However, this was not the case, and this is likely due to these connections occurring indirectly through information sharing by organizations such as CityLab, NextCity, APA, and Planetizen. Whilst speculative, this perspective is worthy of further research in order to identify whether

Twitter facilitates planning academic and planning practitioner dialogue. Such interaction may be concentrated on other social media platforms such as Facebook and LinkedIn. Both Facebook and LinkedIn include interest groups that engage academics and professionals, such as those with interests focused on urban design, transportation, new urbanism, etc. The activity across these platforms and other social media sites would also be an interesting topic of future research.

Finally, the analysis reported here is limited by the nature of Twitter communications. The character limit on Tweets make the context and motivation difficult to discern. This may be addressed by analyzing Twitter discussion threads rather than individual Tweets. Context is a lingering challenge for natural language processing techniques. Additionally, this study's narrow focus on the core group of planning faculty users, could be expanded to include the full constellation of connections, Tweets, and characteristics of all 337,000 users connected to urban planning faculties.

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