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Audience Gatekeeping in the Twitter Service: An Investigation of Tweets about the 2009 Gaza Conflict

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Abstract

Twitter is a social news service in which information is selected and distributed by individual members of the tweet audience. While communication literature has studied traditional news media and the propagation of information, to our knowledge there have been no studies of the new social media and their impacts on the propagation of news during extreme event situations. This exploration attempts to build an understanding of how preexisting hyperlink structures on the Web and different types of information channels affect Twitter audiences' information selection. The study analyzes the concentration of user-selected information sources in Twitter about the 2009 Israel-Gaza conflict. There are three findings. First, a statistical test of a power-law structure revealed that, while a wide range of information was selected and redistributed by Twitter users, the aggregation of these selections over-represented a small number of prominent websites. Second, binomial regression analyses showed that Twitter user selections were not constituted randomly but were affected by the number of hyperlinks received and the types of information channels. Third, temporal analyses revealed that sources via social media channels were more prominently selected especially in the later stages of the news information lifespan.

Keywords: Twitter service, social media, audience gatekeeping, online journalism, information concentration, Israel-Gaza conflict

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INTRODUCTION

The rise of social media in general and Twitter in particular has allowed the online public to actively participate in processes of news creation and circulation. Launched in 2006, Twitter is an online information sharing service accessible through various digital and mobile devices (Mills et al., 2009; Li and Lao, 2010). Users can easily exchange short messages called "tweets" that are limited to a maximum of 140 characters. Twitter is composed of constellations of users' personal networks in which the users play a dual role of both audience and broadcaster. In the audience role, users receive information from within their Twitter personal network as well as from external sources outside Twitter. As broadcasters, they create or relay information to their own follower networks. Consequently, user-originated tweets include not just self-produced texts but also works of others that are redistributed either by manual posting or by using "retweet" (or RT)[1] or sharing "plug-ins" embedded in the designated websites.

The current study explores what kinds of web sources Twitter audiences adopt to understand a news event. A news event is narrated differently according not only to the storyteller's preferences but also to the characteristics of the media channel that conveys the story. Therefore, a Twitter audience's understanding of an event is partly affected by which delivery channels are widely adopted. This inquiry is important especially given the elevated status of Twitter audiences in constructing and disseminating public information. The influence of social media users, including Twitter users, upon the conventional methods of news creation and dissemination is also acknowledged by traditional mass media sectors. For instance, according to Tony Maddox, the executive vice president of CNN International, CNN has been strategically "covering reports on social media networks such as Twitter and Facebook" as a means to provide audiences with a "sense of involvement and putting them right in the moment" (Shin and Yim, 2011, n.p.).

While recent Twitter studies have primarily looked at how the textual messages produced within Twitter contribute to self-promotion and audience management (e.g., Marwick and Boyd, 2011) and collaborative works (e.g., Oh et al., 2010), few studies have explored the dynamics of how already available online news items are re-circulated in Twitter. User engagement in re-circulation of existing web content is a widespread practice; Smith and Boyle (2012) reported that a majority of mobile phone users are constantly connected online to watch, verify, comment, and disseminate information. Shoemaker and Vos (2009) called the practice "audience gatekeeping," in which users "pass along already available news items and comment on them" based on the user's own set of criteria about the newsworthiness (p. 113). Twitter is one of the popular channels through which audiences engage in such a gatekeeping process.

Understanding Twitter as an audience gatekeeping channel helps to clarify the status of an audience in the contemporary social media environment. Journalism scholars in the past conceptualized the word-of-mouth among audiences as small-scale interpersonal conversations subsequent to the reception of mass-mediated information products (Southwell and Yzer, 2007). The role of audience communication, therefore, used to be considered to have little influence on determining newsworthiness. In a social media environment, however, user-to-user communication is acknowledged not just as a consequential behavior of news reception but as an additional step in a chain of news gatekeeping. According to a survey, the increased role of the online public is so evident that more than one third of users have contributed to the process of news creation and dissemination via social media sites (Purcell et al., 2010).

The contributions of this paper are twofold: First, theoretically, we adapt the theory of audience gatekeeping (Shoemaker and Vos, 2009; Shoemaker et al., 2011) to envisage personal Twitter users as agents who re-distribute information items based on their own criteria. Second, among possible elements that comprise an audience's selection criteria, we study two media centric factors that might affect selection routines and analyze the subsequent configuration of media concentration pattern. One of the two factors is the existing web structure, particularly the hyperlink networks. The other is the type of online channel through which information or news is acquired.

To explore the effects of these two factors, we analyze Twitter use in the context of one of the most persistent international news stories, that of the relationship between Israel and Palestine. Specifically, we focus on the Gaza conflict of 2009 and examine a short-window event that covers the time period of the active conflict. We chose the Gaza conflict of 2009 for three reasons: One, this conflict is known as one of the signposts regarding the evidence of utility of micro-blogging as an information delivery system during extreme incidents (Israel, 2009). Two, the relationship between Israel and Palestine is a significant international political issue which various information providers, not to mention mainstream news organizations, find newsworthy. Three, although the conflict itself begins as an instantaneous event, the complicated geopolitics in this region lead the related news coverage to take "thematic news frames," which focus not just on snapshots of concrete instances but general conditions and long-term implications of the issue (Iyengar, 1994, p.14). Thematic news frames involve multifaceted and recurrent elements that are likely to be covered for a longer period of time than any instantaneous or episodic news such as a natural disaster, car accident, or violence crime. Given the thematic nature of the topic, the Gaza conflict is a good fit to investigate the over-time pattern of audience news selection.

TWITTER AND AUDIENCE GATEKEEPING

Participatory social media embrace amateur online users as information co-creators by harnessing the users' self-authoring, sharing, and collective intelligence (O'Reilly, 2005). Bruns (2007) describes social media users with his own term "producers," i.e., users who are simultaneously consumers and producers. In this view, producers are the online public who are empowered by web 2.0 technologies that enable practices of searching, linking, authoring, tagging, recommending, disseminating, and updating in an easier way and at minimal cost (Brynjolfsson and McAfee, 2007).

Online participation in the process of news diffusion is generally understood in two ways. First, users play the role of alternative news producers. A representative example is the bottom-up journalism at sites such as Moveon.org or Ohmynews.com, in which citizens seek an event to construct their own reporting. Often, the narratives in citizen journalism reveal discrepancies between ordinary citizens' versions and elite media versions of events (Kwon and Moon, 2009), triggering public allegations of bias in corporate media (Chang, 2005). Although one of the important tasks of news media has been to set up the criteria of news worthiness and to frame newsworthy issues, the legitimacy of such criteria is no longer taken for granted in the decentralized online environment which "negates the role of a central news gatekeeper" (Meraz, 2009, p.684). Indeed, in recent years several extraordinary political and social issues have occurred that have been exposed to the public primarily through social reporting. For example, information about the recent multiple protests in Arabic countries was transmitted largely via wikileaks.ch, ushahidi.com, Twitter, and Facebook. Cases such as this reflect the fact that traditional mainstream media have been experiencing weakened power to control information flow, while the citizens who used to be conceived as mere recipients have emerged as alternative information producers.

Another way online participation in the process of news diffusion may be understood is through the practice of "audience gatekeeping" (Shoemaker et al., 2011). As an audience gatekeeper, the user's role is not to create news items but to filter and deliver existing content to other audiences. As defined by McQuail (1994), gatekeeping traditionally refers to "the process by which selections are made in media work, especially decisions regarding whether or not to admit a particular news story to pass through the 'gates' of a news medium" (p. 213). Various gatekeeping theories have commonly assumed that news is differentiated from raw information because news is storytelling constructed by professional journalists who reorganize pieces of information selected from different sources (Shoemaker and Vos, 2009).

Therefore, gatekeeping begins when a journalist becomes aware of the existence of an event (Halloran et al., 1970). Based on that awareness, professional journalists gather raw information from their own experiences, private enquiries, government resources, newswire or other media organizations, etc. Traditionally, most of the raw sources are not likely to reach audiences until they are reconstructed as news by news organizations. Accordingly, understanding how raw information is processed into a news story has been a critical inquiry that assesses the quality of social representation in media. Research on the daily editorial process in a newsroom suggests that multilevel factors should be considered in their decision making, ranging from the editorial staff′s personal preferences, media or channel characteristics, institutional and economic infrastructures, and ideological orientation of the community of which the news organization is a part (Clayman and Reisner, 1998; Shoemaker and Reese, 1996).

The traditional gatekeeping models exclusively focus on the role of professional media workers as gatekeepers and the factors that affect their decision-making. Therefore, audiences have been excluded from the theoretical conceptualization. Barzilai-Nahon (2008) insightfully pointed out that the absence of vocabulary that refers to the message recipients subjected to the gatekeeping effect reflects the relative negligence toward this entity in the traditional gatekeeping literature. She calls the recipients of the processed information the "gated" (p.1496). In her view, although the gated are the message receivers, they are not the last stop. Instead, they do intervene in the gatekeeping process to varied degrees depending on their level of "political power,″ ability of "information production," "relationship" with traditional gatekeepers, and ability to find and choose "alternatives" as substitutes for elite news content (pp.1500-1501).

Shoemaker and Vos (2009) also pointed out the unassigned role of audiences in traditional models. They call for one more mechanism: "audience's gatekeeping, referring to audience members providing information to each other about their favored news items" (Shoemaker et al., 2011, p.61). Audience gatekeeping emerges as an important process particularly on the Internet where user sharing has an even greater impact on determining the importance of news agendas than conventional forms of interpersonal communication. The audience gets involved in gatekeeping by emailing news items that they select, or by sharing them through social media channels such as digg.com, reddit.com, newsvine.com, and twitter.com (Shoemaker and Vos, 2009). According to Goode (2009), audience gatekeeping is a form of "metajournalism" with the primary purpose of expanding the circulation of already existing information by leveraging aggregation algorithms of web 2.0 and public participation (p. 1290).

Once audience gatekeeping is included in the bigger picture of news production and distribution, content made by media professionals should not be regarded simply as a finalized product anymore. Rather, professional news sites becomes one option for users to select along with other channels that used to be raw information providers accessible only to media professionals in the past (Goode, 2009; Southwell and Yzer, 2007). In the contemporary online environment, therefore, the audience is exposed to various information options such as news articles processed by media professionals, social reporting by citizen journalists, and raw sources directly accessible from the respective online databases. Audience gatekeeping is similar to what Bruns (2005) called "gatewatching" which refers to the practice of information gathering rather than creating, analogous to "the specialist librarian, who constantly surveys what information becomes available in a variety of media and serves as a guide to the most relevant sources when approached by information seekers" (p.7).

In Twitter, audience gatekeeping occurs by posting the URL (i.e., hyperlinking) of the selected external content, or by re-tweeting within Twitter. Dimitrova, et al. (2003) argued that hyperlinking to other webpages is a part of gatekeeping that influences readers' information choice. While their study is based solely on professional journalism sites, their discussion is expandable to social news sites in which users' hyperlinking influences other users' information choices. During audience gatekeeping in Twitter, professional news contents compete for user attention with other online sources, some of which used to be merely raw materials available to the public only after being processed by media professionals. Also, a growing amount of user-generated content is added to the pool of selections. Once selected, the content is often reconstructed by the addition of the user's own comments. The reconstructed content is tweeted to other users who were yet unspoken, with the potential of reproduction within the Twitter community via re-tweeting (Figure 1).

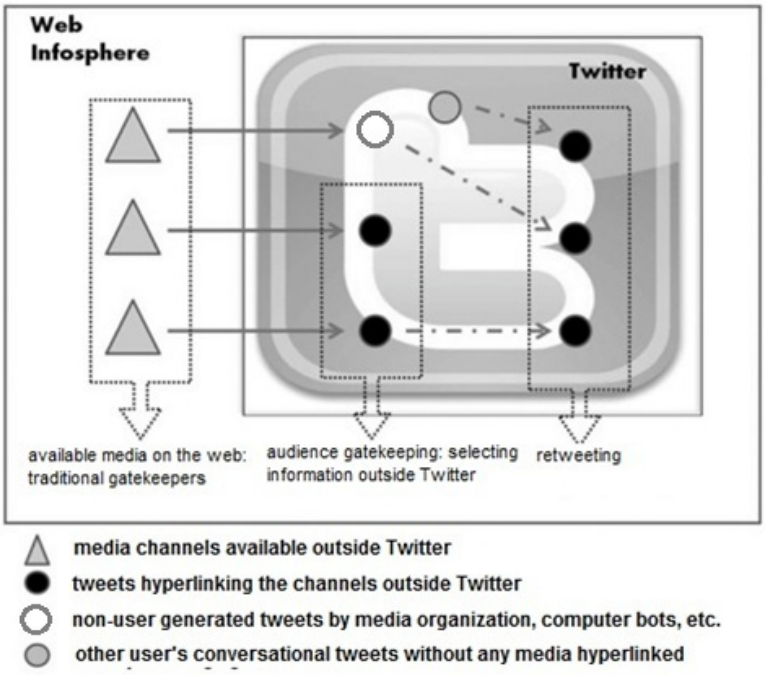


Figure 1: Twitter Audience Gatekeeping

RESEARCH BACKGROUND AND HYPOTHESES

Shoemaker et al. (2011) studied the popularity of news events among audiences and concluded that news items' popularity, represented by rank order based on the frequency at which audiences share each item, is a collective indicator of newsworthiness according to audiences. While these researchers focused on each news event as the unit of analysis, another important line of inquiry into the dynamic of audience gatekeeping is the popularity of information channels, given that storytelling of the same issue can differ depending on the characteristics of the medium that delivers the issue.

Despite vastly fragmented channels available online, the majority of the audience has a penchant for accessing content delivered through broadly appealing or already popular channels rather than selecting channels based on specific topical or content interest (Webster and Ksiazek, 2012). In other words, audiences' criteria for channel

selection are not free from media-centric factors. While various factors can potentially be considered to define users' criteria, few studies have investigated those factors and how they impact the audience gatekeeping process. As an early attempt in this line of research, this paper is specifically focused on two factors of interest: the type of media channel and web hyperlink structure.

The Impact of Channel Types on Twitter Gatekeeping

A potential factor behind audience gatekeeping is the nature of channels through which the audience receives information. For example, users may be more likely to select major news organizational websites than other alternative providers even though all of them are easily accessible online. According to Webster and Lin's (2002) study on audiences' cable channel selections, the majority of audiences tend to insist on consuming familiar mainstream channels rather than taking a risk by adopting novel alternatives due to the passivity inherent in audience behaviors and the presumption that the high production budgets of mainstream media are the "manifestation of information quality" (Napoli, 2008, p. 58). Yim's (2003) study on cable channels also found that "item diversity" does not necessarily lead to "exposure diversity" (p.126). In contrast, the abundance of choices actually results in an even greater audience concentration on a handful of channels, because an individual's channel repertoire – a subset of items that an individual regularly visits – is not randomly constructed (Yim, 2003). For example, the major broadcasting network channels are almost always included in an individual's cable channel repertoire.

However, Twitter can facilitate searching through obscure information sources by amortizing search costs among a large number of users. The reputation of a Twitter user is likely to be increased by the user's ability to highlight interesting but previously unknown information. This therefore motivates users to search for interesting information in obscure channels and bring it to the attention of the wider audience. We therefore posit a research question:

- RQ1: Will Twitter users' channel selection be concentrated more on the traditional media-based websites than other alternative types of websites?

The Impact of Web Hyperlink Structure on Twitter Gatekeeping

On an individual level, hyperlinking is simply a referencing practice that "automatically brings the user to a particular point in a cited work" (Halavais, 2008, p.39). On a collective level however, the hyperlink network is a form of media measurement and the most fundamental mechanism of online gatekeeping (Webster and Ksiazek, 2012; Zittrain, 2006). Sundar and Nass (2001) pointed out that collective user behavior is an important component in the evaluation of the credibility of an online source, given that it is partly "responsible for the content floating around in any given media vehicle" (p. 59).

A majority of the online audience agrees that the vastness of online content is an overwhelming experience (Purcell et al., 2010). Subsequently, audiences often inevitably rely on search engine results to select a manageable amount of content from the clutter. Considering that many search engines de facto operate under the algorithms ruled by hyperlink traffic, for instance Google's PageRank system (Finkelstein, 2008) which gives higher ranking to pages with a higher count of inlinks, the link structure configured in the Web is likely to affect Twitter users' information selection. Therefore, we hypothesize that:

- H1: The number of hyperlinks received by a certain web channel will be positively associated with the popularity of the channel among Twitter audiences.

The Interaction Effect of Hyperlinks and Channel Types on Twitter Gatekeeping

Hyperlink structure and channel type are likely to interact with each other to influence audience gatekeeping in Twitter. For example, while mass media-based websites are likely to be culturally familiar channels to many users, only a few of them may be preferred to other types. Users might prefer certain mass media channels when they also receive enough link traffic to be ranked high from the search results. Likewise, even though the search results position a certain website high up in the order of presentation, users may not consider it the most relevant if they have never heard of the source site previously. In these cases, there is an interaction between the content provider types and the hyperlinks. Therefore, we hypothesize that:

- H2: The interaction between the degree of hyperlinks received by a channel and the channel type will be associated with the popularity of the channel among Twitter users.

Temporal Differences in Audience Gatekeeping

Timeliness is an important news value considered in the process of gatekeeping. Even when treating the same event, the editorial board evaluates news sources differently over a period of time because the attributes to be highlighted

vary depending on the phase of the event's progress (Chyi and McCombs, 2004). In a similar vein, audience gatekeepers are likely to find different information channels interesting during different phases of the development of the event. For instance, audiences might consider local information avenues to be useful in the early phase when instantaneous updates of specific events could be the main news agenda. On the other hand, channels that offer in-depth reports and experts' interpretations can become more meaningful as the event is developed into an investigative theme. In other words, audiences' channel selection can change over time. We suggest that the temporal aspect will result in differences in Twitter users' choice of information channels.

- H3: Popular information channels among Twitter audiences will differ depending on the developmental stage of the news event.

The Macro-Pattern of Channel Popularity among Twitter Audiences

As mentioned earlier, our investigation is on a macro scope. We are questioning what kind of selection pattern will be configured as a collective result of audience gatekeeping. One possibility is a power-law distribution, which is a commonly found pattern on the web (Barabasi et al., 2000). A power-law distribution is characterized as being composed of a few highly popular selections and a large number of peripherals. This distribution pattern is also called the 'preferential attachment tendency,' indicating that people make choices preferably based on preexisting popularity. Subsequently, the pattern follows a "rich-get-richer mechanism," resulting in severe inequality in attention distribution (Easly and Kleinberg, 2010, p.566).

The power-law distribution pattern has been found in many subsets of online communities. In her study on the blogosphere, Meraz (2009) found that despite the technological affordance of decentralization, the emergent structure shows inequality with the celebrity status of so-called "A-list" bloggers and the marginalization of everyone else. Hindman (2008) also noted that the political use of the Internet shows uneven traffic among the relevant websites. We ask whether audience gatekeeping in Twitter, as a sub-practice in Websphere, will reveal a similar pattern:

- RQ2: Will Twitter users' selection of information channels collectively produce a power-law distribution?

ISRAEL-GAZA CONFLICT AND TWITTER

This study analyzes Twitter data pertaining to the Israel-Gaza conflict over a short event window (December 27th, 2008 to January 18th, 2009). The topic was selected because the Israel-Palestine discord has been one of the most long-lasting and recurring international news topics for decades. Therefore, even though one particular disaster may be breakout news, the issue is situated in a complex geo-political conflict, making the temporal analysis meaningful. The hostile relations between Israel and Palestine have been widely reported in online media as well. According to Kang and Choi (1999), Israel was ranked second among the investigated 45 countries in terms of international news coverage via online news groups, with Palestine and Israel frequently mentioned concurrently in news articles. This topic is also relevant since research on Twitter use in the context of manmade extreme events is sparse (Oh et al., 2011; Prentice et al., 2011), although prior research has studied tweets in the context of natural extreme events (Mills et al., 2009 such as the Haiti earthquake (Oh et al., 2010) and the China earthquake (Li and Rao, 2010).

The Israel-Gaza conflict in 2009 started with Israel's major military attack against Hamas in the Gaza Strip with the claim of suppressing rocket fire into the southern Israel territory from the Gaza Strip (Zanotti et al., 2009). Due to the sensitive political nature of those areas, the Israel-Gaza conflict has drawn global attention from both mainstream and social media. Despite a Supreme Court ruling, Israel coordinated a media campaign in response to this attack to prevent foreign journalists from accessing the Gaza strip area[2], and Israeli soldiers were prohibited from carrying mobile phones which could unintentionally leak embarrassing information to the world (Ward, 2009). Ironically, such media control forced outsiders to rely on the public driven social media (i.e., blogs, Twitter, Facebook, YouTube, etc.) even more (Ward, 2009). Given the diversity of online information sources produced during the course of the event, the Israel-Gaza conflict can be a good case in which to study the online public's source selection behavior as a means to produce, share, and consume related news.

METHODS

Data Collection and Cleaning

Using Twitter's search engine (http://search.Twitter.com), we first collected a total of 6,839 Twitter messages that were sent during the Israel-Gaza conflict. To collect comprehensive but relevant sample data, we monitored and searched for news about the conflict using Google's search engine. Through the search, we identified that various

news media used different terms to describe the conflict. We used those terms to perform real-time searches via Twitter's search engine. The final search keywords that we used for data collection and the resulting number of tweets for each term are as follows: Gaza Air Strike (98), Gaza Attack (840), Gaza Ceasefire (1146), Gaza Clash (62), Gaza Conflict (954), Gaza Emergency (164), Gaza Massacre (480), Gaza Violence (648), and Gaza War (2447). We intentionally did not contain the country names 'Israel' and 'Palestine' in any search keyword, and we excluded any local language such as Hebrew or Arabic to prevent the dataset from any systematic bias that could result in over-representation of either a pro-Israel or pro-Palestine view.

Considering that our primary interest is the impact of audience gatekeeping on the popularity of information channels, the unit of analysis is discrete media channels. Therefore, we first extracted tweets that included references to external online websites, resulting in a total of 2,297 tweets retained. External websites are often posted to tweets in tiny URL form. For this study, each tiny URL[3] was translated into the original full URL. Then, the URL was cleaned, leaving only the registered and the top one or two-level domain names (http://www.zzz.zzz/ or http://www.zzz.zzz.zzz/), deleting characters that followed the first slash (/). There were 115 tweets that included unidentifiable URLs, and we removed them from the sample.

Among these tweets, we additionally separated the tweets posted by personal Twitter users. First, we removed unidentifiable profile accounts. We did not consider accounts as "personal" if they represented any organizational or media entity or a computer-automated bot. However, to discuss the distinctive aspect of ordinary users' gatekeeping, these non-personal accounts were additionally analyzed and compared to the personal user-based data. As a result, 860 tweets were considered as personal users' tweets.

To conduct temporal analyses, the data set was split into two halves. Given that a large number of news stories were circulated during the few days immediately following the incident, a time-based split would have been imbalanced, making the temporal comparison hard to interpret. Therefore, we divided the data into the two chronologically ordered groups which contained an equivalent amount of tweets. The first half was considered to be the early stage of news dissemination (from December 27th, 2008 to January 6th, 2009) and the rest as the later stage (from January 7th, 2009 to January 18th, 2009).

Variables

The unit of analysis is each information channel, or selected content website. Therefore, we created a list of websites based on their domain names from the tweets collected. A total of 256 unique websites were identified and each variable associated with the websites is described below.

Dependent variable

The dependent variable in this study is channel popularity, indicated as the frequency of each website tweeted. For example, if a website is tweeted 40 times, the website is understood to be a more popular channel among Twitter users than another website which is tweeted only 20 times. As mentioned above, each website was identified based on its domain name taken from the full URL of the tweeted web page.

Independent variable

There are two independent variables in this study.

1) Hyperlinks: To measure this variable, we retrieved the numeric data indicating the number of hyperlinks that a particular website received from other websites from Alexa.com, a web information company. This data contains global traffic. Given the severe skewness and heterogeneity of variances, we log-transformed the data to fit into the analysis (before transformation, M = 35609.53, SD = 1.16330E5, and after transformation, M = 7.69, SD = 2.75)

2) The types of channels tweeted[4]: In order to determine types of tweeted websites, we analyzed their formats and self-descriptions and categorized them heuristically into five types. Two graduate students were trained to code data based on the five categories. The inter-coder reliability was satisfactory, Cohen's Kappa k = .890, p < .001. Table 1 provides brief descriptions of and exemplary websites in each category.

(a) Traditional News Organizations (both broadcasting and print): This category subsumes conventional mass media-affiliated websites, including newswire, broadcasting, and print, whose headquarters are located offline and run by media corporations or public broadcasting networks. Print media was required to have an offline edition. The websites under this category target mass audiences by presenting a broad range of topics such as politics, culture, society, travel, technology, entertainment etc.

(b) Commercial Social Media: Certain formats were identified by domain names whose websites offered space for user-generated content, such as social networking, visual/audio updating, blogging, micro-blogging, and/or content

aggregate services. Examples are youtube.com, facebook.com, yahoo.com, digg.com, reddit.com etc. Twitter also falls into this category.

(c) Online Journalism: Chang (2005) identifies three different types of online journalism: first, traditional media that use electronic means to transmit messages; second, online newspapers that adhere to journalistic writing and formatting, but do not have an offline edition (which Chang calls "genuine online journalism"); and third, informal online communities where ordinary users participate in information exchanges such as newsgroup and bulletin boards (p. 926). In our study, the first type is categorized as "traditional media" and the third type overlaps with other categories. Therefore, the category "online journalism" as we have conceptualized it only includes the second type that Chang defined. Most websites in this category only had online editions. However, in a few occasions, websites did not clearly specify whether they were exclusively online or whether they had offline editions. In these cases we included websites in this third category if the content revealed a sub-cultural audience taste despite the journalistic writing style.

(d) Personal Reports: This type of channel has its own domain name and is run by either an individual or a small number of people. These websites are informal and do not show formal organizational characteristics.

(e) Other Organizational/Institutional/Community Websites: This type includes government, non-government, education, research, advocacy organization, and community websites. Some advocacy websites play a dual function as citizen journalism and movement organizers. In this case, the role presented on the front page was used to determine which category should be assigned to the website. If a primarily journalistic writing style was presented on the front page, it was coded as online journalism. If mobilization efforts such as petition, protest information, or donation were more prominent on the front page, the website was categorized as "other."

Table 1: Descriptions of Channel Categories

Channel Type	Description	Examples
Traditional News Organizations	• Newswire, broadcasting, and print mass media. • Must have offline presence (e.g. offline-based headquarters, offline edition of newspapers). • Should target mass audiences and include a broad range of topics on the websites.	cnn.com aljazeera.com guardian.co.uk
Commercial Social Media	• Offers a space for users to easily create and share contents. • Sometimes have an automatic function that aggregates user-generated contents or external information and/or facilitates sharing processes.	youtube.com reddit.com facebook.com
Online journalism	• Journalistic writing style yet no offline edition. • Have independent domain names.	alternet.org huffingtonpost.com allvoices.com
Personal Reports	• Informal websites run by either an individual or a small number of people. • Have independent domain name. • Do not have formal organizational structure.	polizero.com andycarvin.com buzzsuggest.com
Other Organizational/ Institutional Websites	• Any organizational / institutional / community websites not categorized above. • For example, governmental, corporate, educational, research, advocacy organizational websites.	gazatalk.com un.org arabmediasociety.com

RESULTS

Data Description

The frequency analysis revealed that 256 unique websites were identified from personal users' tweets. Interestingly, fewer than 30% of the total tweets referred to traditional news organization websites. Specifically, 76 (29.7%) out of 256 were traditional media, 40 (15.6%) were social media sites, 43 (16.8%) online journalism, 39 (15.2%) were personal content providers, and 58 (22.7%) were other organizational websites. On the other hand, we found that

when examining all tweets, traditional channels accounted for a much larger proportion: 43.18% of the total selections. This suggests that whereas mass media entities aggressively use Twitter as another broadcasting venue, personal users' selection process is not necessarily mass-media dominant but more inclusive of diverse types of sources.

When the two time periods of news dissemination defined above were compared, "social media" had the highest mean frequency in both periods, and the frequency sharply increased as time passed: in the early stage, the mean frequency of social media was 3.43, while it was 5.75 in the later stage: $t(49) = 20.31$, $p < .001$. Also, the mean frequency increased for "organizational, institutional, and community websites" from 1.88 to 2.45 as the news evolved: $t(67) = 24.81$, $p < .001$. Overall, the most frequently tweeted websites included: youtube.com (41 times), blogspot.com (40 times), bbc.com (37 times), and friendfeed.com (35 times), three of which were categorized as "social media sites."

Table 2: Mean Frequencies and Hyperlink counts for Each Content Type in Different Time Stages

Content Types	Time 1			Time 2		
	Mean FRQ	Mean Hyperlink	N	Mean FRQ	Mean Hyperlink	N
Traditional Media	2.92	9.34	48	2.64	9.27	55
Commercial Social Media	3.43	10.74	28	5.75	9.30	22
Online Journalism	1.84	8.12	25	1.43	8.42	23
Personal	1.05	5.12	21	1.10	5.88	22
Org/Inst /Community	1.88	6.66	33	2.47	8.21	35
Total	2.36	8.27	155	2.45	8.14	157

The majority of providers, (68.8%), were tweeted only once. Appendix A lists the top 20 most tweeted websites along with hyperlink scores and channel types.

The Effects of Hyperlinks and Channel types on Channel Popularity

To examine the effects of hyperlinks and channel types, we ran negative binomial regression models based on the two time periods. When a dependent variable is a count variable, as presented in our data, ordinary least squares regression cannot be performed due to the violation of normality in residuals. Instead, Poisson regression modeling is a common statistical approach. However, Poisson regression requires strict adherence to the assumption of dispersion by which the expected mean value should be approximately equal to the observed variance. To quantify the equality of variance to the expected mean, it should be approximately equal to one when the residual deviation is divided by the degrees of freedom. If the result is greater than one, the data fail to fit the Poisson distribution assumption due to over-dispersion (Berk and MacDonald, 2008). Our dataset was over-dispersed; the ratio of residual deviance (767.76) to degrees of freedom (238) was 3.23. In this case, the use of a negative binomial regression model is recommended.

Therefore, a negative binomial regression for the two time periods was conducted, with hyperlinks and types as the independent variables and channel popularity as the dependent variable. The variable "channel types" is a categorical variable, requiring a reference level for comparison. We chose "traditional news organization" and "social media" as references for interpretations, because (1) audiences' familiarity might lead "traditional news organization" to be tweeted more than other types and (2) "social media" showed the highest mean frequency among all. The omnibus tests showed a good fit for all models: for the early stage, the likelihood ratio χ^2 (9) = 27.97, $p < .001$; for the later stage, the likelihood ratio χ^2 (9) = 42.86, $p < .001$.

RQ1 asked whether the "traditional news organization" would be more often selected than other types of websites. The results revealed that the channel type alone was not a significant factor in either stage, indicating that in this case, "traditional news organizations" were not necessarily more popular than other channel types. H1 hypothesized that there would be a significant effect of hyperlinks on a website's tweet frequency. The results supported H1 during both temporal stages. For the early stage, Wald χ^2 (1) = 7.30, $p < .01$; for the later stage, Wald χ^2 (1) = 5.09, $p < .05$. In other words, the preexisting hyperlink structure determined Twitter users' selection of information sources. H2 hypothesized that there would be a significant interaction effect between channel types and hyperlinks. H2 was supported only during the later stage, Wald χ^2 (4) = 10.50, $p < .05$. A significant interaction effect was not found during the early stage. These results also supported H3, which predicted significant differences between the two time stages.

Table 3: Tests of Model Effects of Channel Selection and Distribution in Twitter: Two-Time Period Comparison

Sources	Time 1			Time 2		
	Wald	df	Sig.	Wald	df	Sig.
Intercept	2.13	1	0.144	0.01	1	0.959
Hyperlinks	7.3**	1	0.007	5.09*	1	0.024
CT	2.06	4	0.725	3.79	4	0.436
CTx Hyperlinks	3.01	4	0.556	10.49*	4	0.033

Note: CT = Channel Types, * p <.05, **p < .01.

Table 4 presents parameter estimates for the conditional effects of channel types and hyperlinks and their interaction effects on the later time period. When "traditional news organization" was a reference, only the parameter estimates of hyperlinks were significant. This indicates that traditional journalism websites were not the most prominent channel through which the Twitter audience consumed information during this event. When 'social media' was used as a reference, some parameters appeared significant, suggesting a significant influence of social media channels on the Twitter users' gatekeeping. Accordingly, the results in Table 4 are reported using 'social media' as the reference level. The form of model equation for parameter estimates is as follows:

$$log(\text{Tweet Frequency}) = Intercept + b_1(CT=traditional) + b_2(CT=online\ journalism) + b_3(CT = personal) + b_4(CT = org/inst/community) + b_5 Hyperlinks + b_6\ (CT=traditional)*Hyperlinks + b_7 CT=(online\ journalism)*Hyperlinks + b_8(CT=personal)*Hyperlinks + b_9(CT=org/inst/community)*Hyperlinks.$$

Table 4: Parameter Estimates on Time 2 (Social Media as a Reference Level)

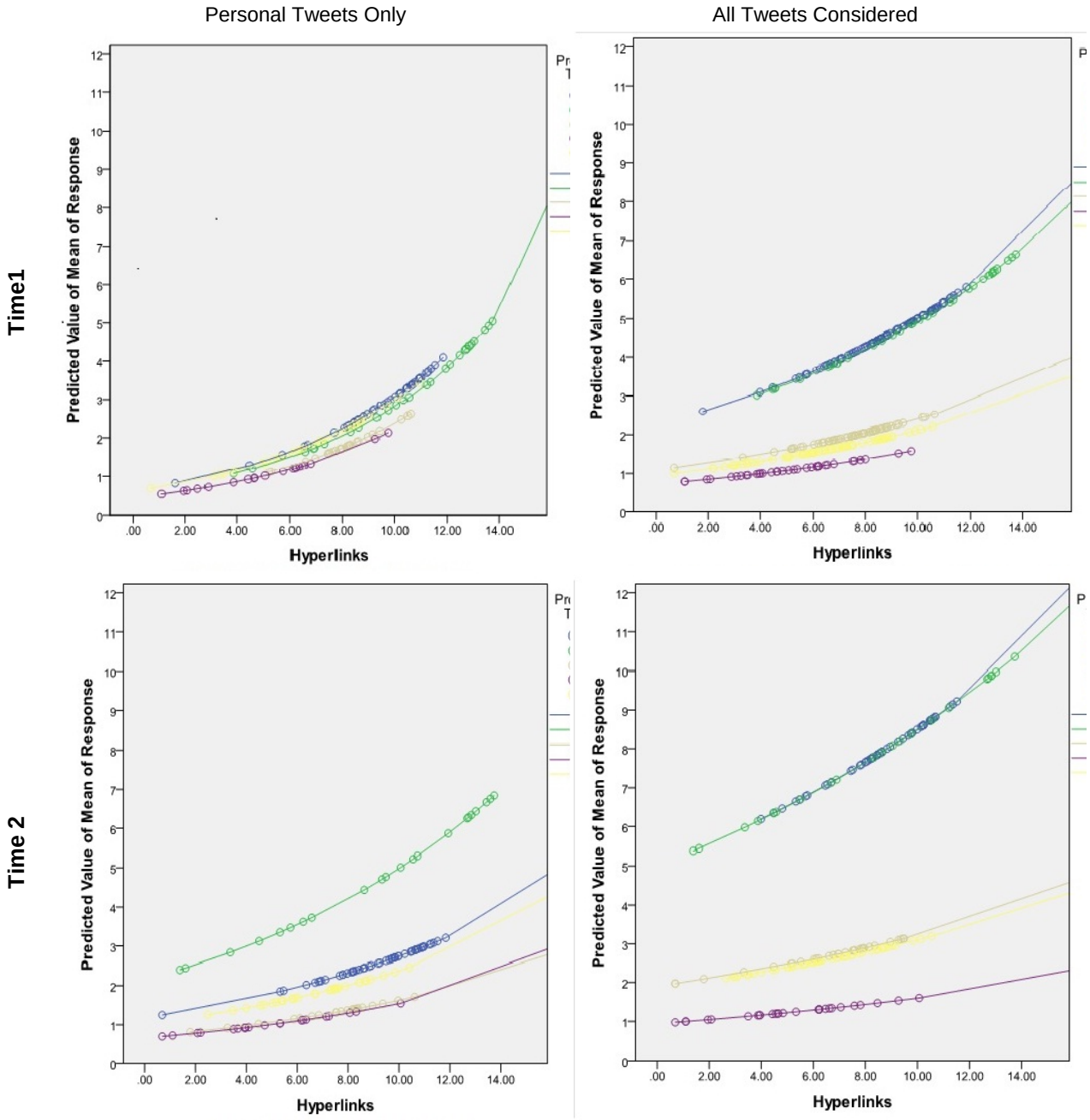
Parameter	Hypothesis Test						C.I.	
	β	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
(Intercept) **	-0.96	0.74	1.69	1	0.193	0.38	0.09	1.63
(CT =Traditional)	0.68	1.01	0.45	1	0.503	1.97	0.27	14.38
(CT =Online Journalism)	1.26	1.01	1.56	1	0.211	3.53	0.49	25.58
(CT =Personal Contents)	1.04	0.89	1.38	1	0.241	2.83	0.50	16.08
(CT =Org /Inst /Community)	1.74	0.94	3.41	1	0.065	5.70	0.90	36.15
Hyperlinks ***	0.25	0.07	12.84	1	0.000	1.28	1.12	1.47
(CT =Traditional) x Hyperlinks	-0.12	0.10	1.39	1	0.238	0.89	0.73	1.08
(CT = Online Journalism) x Hyperlinks *	-0.24	0.10	5.60	1	0.018	0.79	0.64	0.96
(CT = Personal) x Hyperlnks *	-0.25	0.10	6.50	1	0.011	0.78	0.65	0.94
(CT = Org /Inst /Community) x Hyperlinks **	-0.27	0.10	6.85	1	0.009	0.76	0.62	0.93

Note: CT = Channel Types, * p < .05, ** p < .01, *** p < .001.

As shown in Table 4, the interaction effect results suggest that when hyperlinks moderated the relationship between channel types and tweet frequency, "online journalism," "personal reports," and "organizational/institutional/community websites" were tweeted significantly less frequently than "social media." The increase in tweet frequency of "online journalism" was 0.79 times compared to social media, β= -.24, $Exp(\beta)$ = .79, p < .05; 0.78 times for "personal reports," β = -.25, $Exp(\beta)$ = .78, p < .05; and 0.79 times for "organizational/ institutional/ community websites," β = -.27, $Exp(\beta)$ = .76, p <.01. On the other hand, there was no significant difference between "traditional news organization" and "social media."

Figure 2 visually represents how the two independent variables interact with each other to determine channel popularity. To gain more information, we compared the selection pattern observed from personal users' practices (the left column) to the comprehensive data that includes data from not only personal users but also media and other organizations and computer-automated bots (the right column). When all tweets were taken into consideration, "traditional news organization" and "social media" were the most prominently distributed types right from the beginning. Moreover, the discrepancy between these types and the rest of the content increased over time. However, when only personal users' tweets were considered, Twitter users' selections were not very concentrated to

a particular media type during the early stage of news breakout. Instead, their choices were largely determined by the extent to which a website received in-links from the general online public. This observed pattern changed as the news lifespan increased, however. In the later stage, personal users' selections were concentrated to social media-based contents, followed by the traditional news outlets.



Note: blue = Traditional, green = Social Media, basie = Online Journalism, purple = Personal, yellow = Org/Insti/Community Sites.

Figure 2: Interactions of Hyperlink Intensity and Channel Types: Comparison between 'Personal Tweets Only' and 'All Tweets Considered'

Testing a Power-law Structure in Twitter Users' Selections of News Contents

RQ 2 asks if Twitter users' selections collectively produce an unequal representation among the accessible information channels. To statistically examine the distribution structure, we tested the model of a "power-law

distribution" following Barabasi et al.'s (2000) formalization. That is,

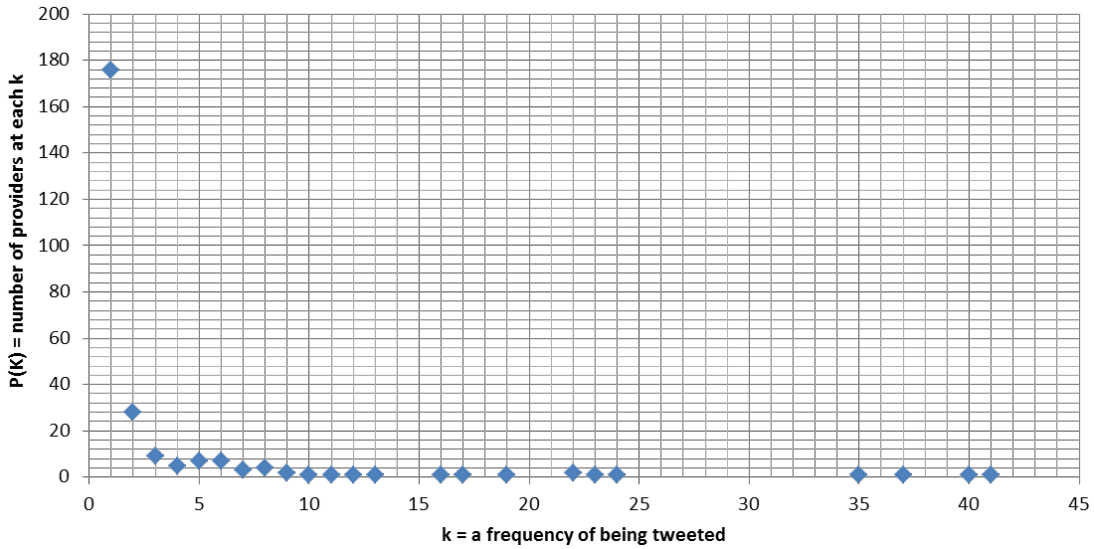
$$P(k) \sim k^{-r},$$

in which the probability that a website is tweeted k times follows a power law with the exponent r (Barabasi and Alberto, 1999). If there is the power-law distribution, the distribution must be represented as a negative linear relationship when plotted using log-transformed scales, which makes statistical testing possible (Moody and White, 2003);

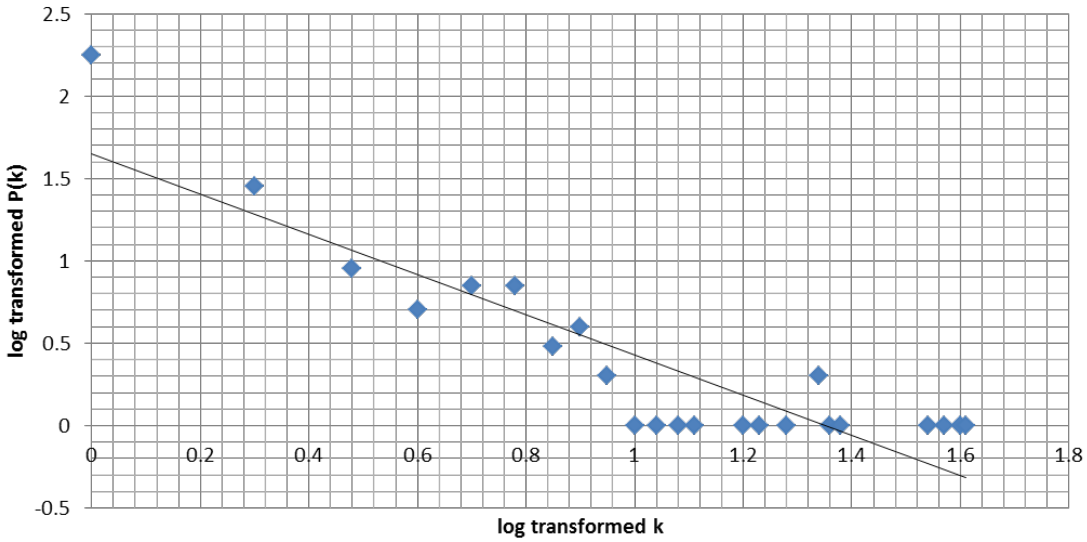
$$P(k) = ak^{-r} \rightarrow lnP(k) = ln(a) - r\,ln(k).$$

A negative linear relationship is tested between the log-transformed value of tweet frequencies, k, and the log-transformed value of the number of websites at each k, which is *P(k)*.

Our results revealed a significant negative relationship with R2 = .80, F(1, 21) = 82.25, p < .001. In other words, the collective outcome of Twitter users' channel selection shows an uneven distribution, suggesting the existence of a list of dominant websites. Figure 3 visualizes the imbalanced distribution of information channels.



(a) A power-law distribution of the number of content websites at each tweet frequency



(b) A negative linear relationship represented on a log-log plot

Figure 3: Distribution of Twitter Users' Selection of News Contents

DISCUSSION AND CONCLUSION

Scholars have attempted to theorize the role of audiences in the gatekeeping process (Barzilai-Nahon, 2008 Shoemaker and Vos, 2009) and have found that audiences play an important role in setting public agendas that is distinctly from the role played by professional journalists (Shoemaker et al., 2011). As an early attempt to apply the audience gatekeeping model to the social media context, this study investigated how Twitter audiences select information channels. An abundance of online channels can construct a news event in a variety of manners depending on the channel characteristics. Therefore, the selection of channels through which to receive and spread information can influence how the audience interprets the issue. Given that Twitter has become a popular information system that facilitates user participation for information sharing and collaboration (Honeycutt and Herring, 2009), knowing what kinds of channels are prominently selected by Twitter audiences to understand and respond to news events provides important insights. As gatekeepers, Twitter users not only consume incoming information from within their own Twitter network and/or outside of the system, but also broadcast the consumed information to their own networks of followers.

We questioned how Twitter audience gatekeeping was affected by two media-centric variables: hyperlink structure and channel type. Our results revealed that while hyperlink structure largely determined users' selections, channel type was also influential in that an interaction effect between hyperlink and channel type was present. This effect was more prominent during the later stage of news lifespan. Interestingly, the most prominent channels were social media sites, such as youtube.com, blostpot.com, and wordpress.com, rather than traditional media actors. These sites offer spaces in which the high budget products made by traditional media entities and user-generated contents intermingle. Our results suggest that the wide adoption of social media sites is a distinctive characteristic of audience gatekeeping in comparison to the whole Twitter-sphere, where traditional media actors aggressively adopt the tool as broadcasting venue. Thus, despite the prevalence of traditional mass media organizations in Twitter, audiences do not necessarily depend on them but may rather tend to find the emergent, user-empowering channels more interesting.

This finding should reignite discussions about the status of mass media situated in the Web 2.0 technology era. On the one hand, proponents of citizen journalism have advocated that the participatory media would eventually challenge the "priesthood" or "punditocracy" of corporate media organizations in public information production (Chaffee and Metzger, 2001). On the other hand, a competing view has defended the professionalism of traditional news organizations regarding their investigative and global nature in contrast to the snippets and hyperlocalized stories in user-generated content (Lemann, 2006). In this study, we conclude that Twitter users' gatekeeping process may diminish the authority of traditional organizations at least as a primary information delivery system.

However, that does not mean that the audience gatekeeping in Twitter is free from existing systems. On the contrary, our results suggest that audience gatekeeping is largely determined by search results attributed to the preexisting link structure. Also, highly selected social media sites turned out to be the institutionalized commercial services. In fact, the prominent selection of a few dominant social media sites in the later stage may even be an indicator that the new media channels might continuously recycle and reconstruct the content made by big media organizations. While the popular perception is that social reporting through new technologies such as Twitter may lead to media fragmentation, our results suggest that audience gatekeeping may in fact lead to media concentration, resonant with the position of Webster and Ksiazek (2012).

Meanwhile, the extent to which alternative channels are selected through audience gatekeeping should be interpreted in a mixed way. On one hand, the descriptive analysis showed that a non-trivial portion of selected channels was from alternative journalism, non-institutionalized websites, governmental, research, or non-governmental organizational databases. This result suggests that Twitter audiences utilize information alternatives to traditional news items, implying that traditional news actors may not be the predominant agenda-setters at least in the Twitter community. Also, the results showed that social media channels were as popular as traditional news channels, indicating that Twitter users adapt the items reconstructed by other social media users as much as the original news products from professional journalists.

On a collective level, however, the selection pattern indicated high imbalance. The distribution revealed that Twitter was structured with a few prominent content providers – particularly the established dominant social media sites – and a large number of less visible alternative actors. The result reflects that outwardly contradictory trends coexist: one is the content concentration predisposed to a few highly prominent providers, and the other is the diversification of the news market by harnessing the long-tail part composed of less powerful actors (Anderson, 2006). The power-law distribution found in the current study reaffirms the recent decade's theoretical contention between the proponents of a rich-get-richer mechanism of the Internet (e.g., Barabasi, et al., 2000; Hindman, 2008) and of the collective empowerment of newly emerging yet less visible content providers (e.g., Anderson, 2006; Barsky and Purdon, 2006; Fortunato et al., 2006).

One limitation of our study is the generalizability of our data. The short-term collection of data with content pertaining to a long-lasting political conflict may cause history-dependent bias on user gatekeeping. In addition, the strongly political context of our data sample does not guarantee the generalizability of our findings in other social contexts, such as business. We also note that our results do not suggest any causal implications. The data could not tell us which factors preceded others in influencing user gatekeeping. For instance, preexisting reputation of traditional media may have been a significant determinant of being hyperlinked extensively.

Our study exclusively focused on the pattern of channel selection, and did not delve into the reconstruction process. As gatekeepers, however, users not only distribute information but also reconstruct it with their own interpretations. Accordingly, future research needs to explore how users edit and reinterpret the existing information through their own commentary, and how the reconstruction impacts news gatekeeping in general. To construct a better understanding of audience gatekeeping, another factor that requires further investigation is preexisting channel loyalty depending on ideological predisposition, demographic, and personal attributes.

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[1] A one-click function embedded in Twitter that allows a user to conveniently copy a preexisting tweet and share it via the user's own Twitter profile.

[2] http://cyberwanderer.wordpress.com/2009/01/03/summary-2009-israel-gaza/ (Retrieved February 12th, 2011).

[3] As Twitter allows only 140 characters in a message to post, lengthy URLs cannot be properly posed as a linked message. To avoid this problem, many websites are providing the service of shortening the lengthy URL into a "tiny URL" format. One exemplary website is: http://tinyurl.com/.

[4] The representative search engines, Yahoo.com and Google.com were removed from the analysis.

APPENDIX

The 20 Most Tweeted Web Sites in Different Time Stages

Time1			
Channel Name	**Tweet FRQ**	**Channel Types**	**Hyperlinks**
bbc.co.uk	67	Traditional	11.52
reuters.com	57	Traditional	10.94
cnn.com	36	Traditional	11.36
blogspot.com	32	Social Media	12.84
alertnet.org	32	Traditional	8.83
friendfeed.com	31	Social Media	10.55
twitter.com	29	Social Media	13.59
nytimes.com	24	Traditional	11.84
youtube.com	21	Traditional	13.44
guardian.co.uk	19	Traditional	11.26
dw-world.de	19	Traditional	9.74
aljazeera.net	19	Traditional	8.64
gazatalk.com	13	Advocacy	3.99
wordpress.com	11	Social Media	11.94
haaretz.com	11	Traditional	9.18
globalvoicesonline.org	11	Advocacy	8.66
israelnationalnews.com	11	Traditional	8.07
telegraph.co.uk	10	Traditional	10.95
huffingtonpost.com	10	Online Journalism	10.62
gmanews.tv	10	Online Journalism	7.85
Time 2			
Channel Name	**Tweet FRQ**	**Channel Types**	**Hyperlinks**
bbc.co.uk	118	Traditional	11.52
friendfeed.com	71	Social Media	10.55
blogspot.com	59	Social Media	12.84
alertnet.org	52	Traditional	8.83
cnn.com	49	Traditional	11.36
dw-world.de	41	Traditional	9.74
aljazeera.net	35	Traditional	8.64
guardian.co.uk	33	Traditional	11.26
gazatalk.com	19	Advocacy	3.99
digg.com	17	Social Media	12.73
gmanews.tv	16	Online journalism	7.85
globalvoicesonline.org	16	Advocacy	8.66
allvoices.com	15	Online journalism	0.69
facebook.com	14	Social Media	13.74
abc.net.au	14	Traditional	10.19
dailyme.com	13	Online journalism	6.19
freealzaidi.com	11	Advocacy	3.09
foxnews.com	11	Traditional	10.47
feedburner.com	10	Social Media	11.2
enduringamerica.com	9	Advocacy	6

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