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Abstract

In August 2014, Toledo, Ohio, experienced a dangerous algae bloom that led to a citywide water ban. News media coverage of the incident was widespread, as was social media conversation. Opinion leadership has been linked to news media agenda setting, and social media users are capable of generating considerable social influence within the sphere of their social networks. To better understand the dynamics of the conversation—especially as it pertained to agriculture—both during and after the water ban, the researchers used a social media analysis platform to identify high-influence Twitter users who participated in water-quality discussions about the Toledo water ban. Narrowing the search to agriculture-related discussion, the researchers revealed a dearth of agriculture-related content and also identified three categories of Twitter users in the conversation, including news sources, activists, and agriculture advocates. The researchers also found that Ohio users in post-ban discussions tended to be more influential than those who participated during the water ban. Identifying these users allows practitioners to monitor influential accounts for emerging issues and to engage with authoritative users in their geographic regions. The researchers also recommend that agriculture advocates exercise restraint in publicly speaking out about the industry’s involvement in environmental issues.

Keywords

Opinion Leadership, Social Influence, Social Media, Water Quality

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RESEARCH

Tweeting with Authority: Identifying Influential Participants in Agriculture-Related Water Quality Twitter Conversations

Ashlan E. Wickstrom and Annie R. Specht

ABSTRACT

In August 2014, Toledo, Ohio, experienced a dangerous algae bloom that led to a citywide water ban. News media coverage of the incident was widespread, as was social media conversation. Opinion leadership has been linked to news media agenda setting, and social media users are capable of generating considerable social influence within the sphere of their social networks. To better understand the dynamics of the conversation—especially as it pertained to agriculture—both during and after the water ban, the researchers used a social media analysis platform to identify high-influence Twitter users who participated in water-quality discussions about the Toledo water ban. Narrowing the search to agriculture-related discussion, the researchers revealed a dearth of agriculture-related content and also identified three categories of Twitter users in the conversation, including news sources, activists, and agriculture advocates. The researchers also found that Ohio users in post-ban discussions tended to be more influential than those who participated during the water ban. Identifying these users allows practitioners to monitor influential accounts for emerging issues and to engage with authoritative users in their geographic regions. The researchers also recommend that agriculture advocates exercise restraint in publicly speaking out about the industry's involvement in environmental issues.

KEY WORDS

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INTRODUCTION

In the summer of 2014, news spread like wildfire through the city of Toledo, Ohio that quality tests indicated that large amounts of an algae known as *microcystis* were found in the water of Lake Erie (Henry, 2014a). A citywide ban was placed on the water supply, and residents were without drinking water for two days, relying upon donated and store-bought bottled water after a state of emergency was declared by Ohio's governor (Dungjen, 2014; *The Blade*, 2014). In the aftermath of the water ban, a series of community caucuses were arranged, and the city faced a great deal of vitriol from citizens and officials who blamed "agriculture, sewage plants, lawn fertilizers, runoff from our millions of miles of streets and parking lots" for the city's water-quality failings (Henry, 2014b, para. 60). Similar conversations continued beyond these gatherings as individuals sought answers and a place to express their concerns.

During the ban and in the weeks and months following, community leaders used the social media platform Twitter to communicate with affected stakeholders, legislators, and other interested parties. Regional news stations and political

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figures provided up-to-date information and details about the events; the local newspaper, the *Toledo Blade*, even utilized a hashtag (#EmptyGlassCity) to encourage readers to discuss the water ban online (*The Blade*, 2014). As time passed, many conversations took a cause-and-effect angle, addressing possible reasons for the spike in dangerous toxins. Again, agriculture became a topic of hot debate among the online audiences following news surrounding the water ban. Given the importance of social media in crisis situations (Graham, Avery, & Park, 2015), our research team believed that identifying how and when individuals bring agriculture to the forefront of online conversation is perhaps just as important as who engages in this discussion. This study was undertaken to demonstrate that not all social media participants carry equal influence during crisis events and that size of followership and message timing are of great importance.

CONCEPTUAL FRAMEWORK

Opinion Leadership and Agenda Setting

Within social networks, whether online or in-person, opinion leaders serve as the primary means through which information, innovation, and ideas spread. "Opinion leadership is earned and maintained by the individual's technical competence, social accessibility, and conformity to the system's norms" (Rogers, 2003, p. 27). Opinion leaders have typically been described as individuals who are more interested in particular issues than their peers, who offer their opinions more readily, who are sought after by others who value their points of view, and who are socially embedded (Shafer & Taddicken, 2015; Katz & Lazarsfeld, 1955).

Opinion leaders are not a demographically homogenous group: Shafer and Taddicken (2015) described what they dubbed "mediatized opinion leaders," individuals who augment or replace interpersonal communication with online conversation and whose characteristics differ from "traditional" opinion leaders. Mediatized opinion leaders still demonstrate higher-than-average investment in issues but have more online friends than traditional opinion leaders, tend to be younger (under 29 years of age), and are more likely to be female than traditional media opinion leaders.

Opinion leadership within traditional media has long been considered the primary means through which opinion and awareness of events pass to citizens with influential outlets setting the media agenda by telling readers and viewers "what to think about" (Neuman, Guggenheim, Jang, & Bae, 2014, p. 193; McCombs & Shaw, 1972; Cohen, 1963). In today's changing media climate, however, digital influencers are beginning to counterweigh traditional agenda-setters (Neuman et al., 2014; Shafer & Taddicken, 2015). For example, Meraz (2009) found that "the independent blog platform is redistributing power between traditional media and citizen media" (p. 701). Micro-blogging platforms like Twitter "allow citizens more influence and power in setting news agendas" (Meraz, 2009, pg. 701). In a comparison of online and traditional news agendas, Neuman et al. (2014) found that social media users "spend a lot more time discussing social issues such as birth control, abortion, and same-sex marriage and public order issues such as drugs and guns than the traditional media" (p. 210). Activist thought is encouraged online than in traditional news outlets.

Influence in Social Media

The role social media networks play goes far beyond users conveying personal opinions and experiences. Individuals have the ability to share and interact with others who may share or oppose viewpoints. Some draw only a few followers, while some have access to thousands (or even millions). With greater networks and stronger connections, almost any user of Twitter today can gain influence and authority on the platform. An influential "uses his or her visible position in a large network to spread messages widely" (Dubois & Gaffney, 2014, p. 1261). Twitter users of high influence can effectively draw attention to certain ideas and issues by bringing them to the attention of users within their networks. "Influencers not only have the ability to reach a large number of people, but also have their audience's attention, and in some cases, their participation" (Goldsmith, 2015, p. 135).

Researchers use a number of metrics to determine users' influence within social networks, including knowledge and interaction. User authority is another way to measure an individual's activity and presence on Twitter. This measure is based on "retweets," or when an original tweet is shared on another user's profile, allowing the second user's network to view the

original post. The number of retweets are measured along with consideration of profile statistics and number of followers (Bray, 2013). The Sysomos MAP online data gathering system used in this study classifies users based on authority with levels ranging from 0 (no authority) to 10 (highest authority).

Twitter Characteristics and Uses

Twitter, a microblogging platform that limits users to 140-character “tweets,” was selected as the social medium of investigation for this study. Twitter was selected for several reasons. First, Sysomos Media Analysis Platform (MAP), the online social media analytics program used to gather data (described further in Methods, below), has a high level of access to Twitter data through the Twitter Firehose, which gives license holders access to all tweets in real time (“Sipping,” 2011). Twitter is a social media platform that has the ability to produce a large amount of data in a relatively short amount of time (in this case, three months). Its format is simplistic yet dynamic in that users are given restraints in which to craft their tweets, but the single message can rapidly draw attention through retweets, shares, or likes if a user has acquired a high number of followers and has established a profile of high authority.

Another contributing factor in the decision to use Twitter as the target platform was a study released by Pew Research Center outlining the demographic makeup of Twitter users. Their 2015 *Mobile Messaging and Social Media* report found that a large percentage of users had at least a college degree, lived in urban areas, and made above \$50,000 per year (Duggan, 2015). Usage by men and women as well as usage across ethnic backgrounds tended to be evenly distributed, with a majority of users being between the ages of 18-29 or 30-49. These characteristics are traditionally associated with opinion leaders within both online and geographic communities, who tend to be socioeconomic, educational, or political elites (Dubois & Gaffney, 2014).

These things—opinion leadership status paired with a strong influence over a large following—allow for quick development of a single group or individual agenda. Many users have the ability to instantly provide a large amount of content to a very engaged population. Understanding the dynamics at play within prevalent conversations on Twitter provides greater insight into how topics like agriculture are brought to the forefront during water-related crises.

PURPOSE AND OBJECTIVES

For crisis communicators, knowing which users are playing the largest role in shaping or driving the Twitter conversation allows for close monitoring of the people introducing and leading conversations on topics of interest. In the context of this study, interest lies in the prominent users who focused on agricultural causes in the months following the Toledo water ban. To this end, the purpose of this study was to identify the most-followed and–shared Twitter users during the Toledo water ban and to compare them with those during the three months following the water ban. The researchers developed the following objectives to guide this study:

- RO1: To identify high-authority Twitter accounts in Ohio that engaged in water-quality conversations surrounding the Toledo water crisis, both during and after the ban;
- RO2: To describe the agriculture-related Twitter conversations surrounding the Toledo water crisis, both during and after the water ban;
- RO3: To categorize high-authority Twitter users who engaged in conversations surrounding agriculture and Toledo water quality; and
- RO4: To compare Ohio Twitter accounts’ authority in agriculture discussions during and after the water ban.

METHODS

Sampling

Tweets related to the Toledo water ban were gathered using Sysomos Media Analysis Platform (MAP). Sysomos MAP allows users to collect both social and traditional media conversations and creates detailed reports on conversation sentiment, demographics, geography, and key influencers on platforms ranging from Twitter and Facebook to Instagram and YouTube (PR Newswire, 2009). Using Sysomos MAP, the researchers created a Boolean search query to isolate tweets related to water quality in the Lake Erie Basin region of Ohio: "(water OR "water quality") AND (Ohio OR Toledo)." Two searches were conducted to limit content to two different time frames. The first search was limited to the dates of the water ban (August 2, 2014 – August 4, 2014). The second search included the three months following the water ban (August 5, 2014 – November 5, 2014). Both searches generated over 10,000 tweets each. To make the data more manageable, the researchers downloaded Microsoft Excel spreadsheets containing a random sample of 3,000 tweets per search. These tweets were then sorted in Excel according to Sysomos's proprietary user authority levels—with a score of 1 indicating little authority and a score of 10, highest authority—and filtered by geographic location, limiting the users to those in Ohio.

Data Analysis

One researcher—the primary coder—undertook a quantitative content analysis of the resulting data. The coder analyzed both data sets for tweets that included agriculture-related words, such as *agriculture*, *farm* or *farming*, *fertilizer*, or *runoff*, using the "Find" feature in Excel. These terms were identified as those that often appeared in state, local, and national news coverage of the Toledo crisis. Both researchers reviewed the data set and agreed upon the inclusion or exclusion of tweets based on agriculture-related content. In total, 259 tweets were included in the data set: 49 posted during the ban and 210 posted afterward.

After the Twitter data set was finalized, discrete users who took an active role in producing these agriculture-related tweets were then identified and categorized. The primary coder coded each user according to their perceived association or occupation based primarily on previous content produced and their Twitter profile biography. This analysis resulted in the emergence of three categories of users: activism-centered users, information sources, and agriculture affiliates. Both researchers came to agreement upon the identification and categorization of Twitter users involved in agriculture-related content during and following the water ban, and spot checks were used throughout the process to ensure coder reliability.

FINDINGS

RO1: Influential Twitter Accounts in Ohio During and After the Water Ban

Most definitions of "opinion leadership" identify proximity, or social embeddedness, as a key component of influence. Therefore, the researchers sought to identify Twitter users or accounts within Ohio that engaged in water-quality discussions about the Toledo water ban. The results for during the ban (Table 1) and post-ban (Table 2) are displayed below. News organizations rated highly in both searches, with local television and radio stations and newspapers appearing most often. Other influential individuals included politicians, writers, and journalists. Ohio Farm Bureau was the only agriculture-related Twitter account to appear either pre- or post-crisis before the data was filtered for agriculture-related keywords.

Table 1

High-Authority Twitter Accounts and Users in Ohio that Engaged in Water Quality Discussions During the Toledo Water Ban

NAME	TWITTER HANDLE	LOCATION	TYPE	AUTH
Clevelanddotcom	@Clevelanddotcom	Cleveland, OH	News	9
Rob Portman	@senrobportman	Columbus, OH	Politician (Sen-R)	9
The Toledo Blade	@Toledonews	Toledo, OH	News	9
WDTN	@wdtn	Dayton, OH	News	9
WSYZ ABC 6	@wsyx6	Columbus, OH	News	9
Brittany Gibbons	@brittanyherself	n/a, OH	Internet Personality	8
David Pepper	@davidpepper	Cincinnati, OH	Politician (Rep-D)	8
Garden Chat w/Bren	@bg_garden	n/a, OH	Blogger	8
News Radio 610 WTVN	@610wtvn news	News/Politics	News	8
Ohio_Politics	@Ohio_politics	n/a, OH	News/Politics	8
Ryan Wichman	@ryan_wichman	Toledo, OH	News/Meteorologist	8
Toledo Tweets	@Toledo_tweets	Toledo, OH	News	8
WHIO Radio	@whioradio	Dayton, OH	Radio	8
Amy Taylor	@nomeatballs	Columbus, OH	Writer	7
Henrietta (top that)	@nonnydee	n/a, OH	Personal	7
Jill Miller Zimon	@jillmillerzimon	n/a, OH	Writer	7
Mike Brandyberry	@didtribewin	Cleveland, OH	Sports Writer	7
News Radio 1370WSPD	@1370wspd	Toledo, OH	News Radio	7
Ohio_EMA	@Ohio_ema	n/a, OH	Gov. Organization	7
Ohmi News	@Ohminews	Toledo, OH	News	7
Patricia	@porcelain10	Cleveland, OH	Personal	7
Rusnivek	@rusnivek	n/a, OH	Personal	7
Sara Hegarty	@sarahegarty	Toledo, OH	Personal	7
Social In Toledo	@socialtoledo	Toledo, OH	Toledo News	7
The Sound of Ideas	@soundofideas	Cleveland, OH	Radio Show	7
Todd Finnerty, Psy.D.	@drfinnerty	Cleveland, OH	Psychologist	7
Greeds World	@greedsworld	Columbus, OH	Music Producer	6
Aaron Shafer	@shafedaddyfresh	Columbus, OH	Student	6
Adam Hansen	@adamhansen	Toledo, OH	Blogger, Entrepreneur	6
Amanda Rabinowitz	@a_rabinowitz	Cleveland, OH	Radio Host	6

Table 2

High-Authority Twitter Accounts and Users in Ohio that Engaged in Water Quality Discussions After the Toledo Water Ban

NAME	TWITTER HANDLE	LOCATION	TYPE	AUTH
10tv	@10tv	Columbus, OH	News	10
wkyc	@wkyc	Cleveland, OH	News	10
dispatchalerts	@dispatchalerts	Columbus, OH	News	10
13abc	@13abc	Toledo, OH	News	9
Toledonews	@toledonews	Toledo, OH	News	9
wsyx6	@wsyx6	Columbus, OH	News	9
Ohio_digital	@ohio_digital	Cincinnati, OH	Business	9
[City]dailynews	@daytondailynews	Dayton, OH	News	9
Wlwt	@wlwt	Cincinnati, OH	News	9
Ohio_tourism	@ohio_tourism	n/a, OH	Government	9
Ohio98babe	@ohio98babe	n/a, OH	Personal	8
kittyfitz50	@kittyfitz50	n/a, OH	Personal	8
1800hurtnow	@1800hurtnow	n/a, OH	Personal	8
wkycweather	@wkycweather	Cleveland, OH	News	8
philominax	@philominax	n/a, OH	Personal	8
toledodaily	@toledodaily	Toledo, OH	News	8
thetrivshow	@thetrivshow	Independence, OH	Radio	8
Toledo_tweets	@toledo_tweets	Toledo, OH	Parody	8
City of Dayton	@cityofdayton	Dayton, OH	Government	8
Ohio Politics	@ohio_politics	n/a, OH	News/Politics	8
Ohio Farm Bureau	@ohiofarmbureau	Columbus, OH	Ag Non-Profit	8
Toledo Zoo	@toledozoo	Toledo, OH	Zoo	8
Ryan Wichman	@ryan_wichman	Toledo, OH	TV Meteorologist	8
Vindicator	@vindicator	Youngstown, OH	News	8
Joe Cimperman	@joecimperman	Cleveland, OH	Politician	8
917wvxu	@917wvxu	Cincinnati, OH	Radio	8
Ohiodotcom	@ohiodotcom	Akron, OH	News	8
Portia Boulger	@portiaboulger	Chillicothe, OH	Personal	8
Wcpn	@wcpn	Cleveland, OH	News Radio	7
Wally Water Drop	@wallywaterdrop	Cleveland, OH	Water Masco	6

RO2: Agriculture-Centered Twitter Conversations During and After the Water Ban

From the data set during the water ban (August 2-4, 2014), 49 tweets, or less than 2%, were focused on agriculture's contribution to the spike in levels of microcystis found in Lake Erie. Following the ban, this number increased fourfold with 210 tweets focusing on agriculture's role in the lake's contamination. (Examples of these Tweets can be found in Table 3.) A cursory review of the non-agriculture tweets generated during the water ban revealed that Twitter users were less interested in the antecedents of the emergency than in finding access to clean water, resulting in the relatively small number of agriculture-related tweets.

Table 3

Prevalence and Examples of Agriculture-Focused Tweets Before and After the Toledo Water Ban

Agriculture-focused tweets during crisis (n=49)	Agriculture-focused tweets post-crisis (n=210)
@jillmillerzimon: "RT @guardianeco Farming practices and climate change at root of Toledo water pollution http://t.co/09htFIKHK5 "	@chadlivengood: "Farms are focus of studies on drinking water toxin from blue-green algae blooms on #LakeErie http://t.co/FNh510okgX #GreatLakes #Toledo"
@gingerspice44: "RT @Mind_Of_Peace Should we just keep ignoring that agricultural chemicals have left the 500 00 people in Toledo without water?"	@newsongreen: "Toledo Loses Drinking Water to Algal Bloom From Farm Runoff http://t.co/f29XnAoZU6 "
@kevinkimmich: "RT @tickerguy http://t.co/cJLlBjGah4 And Now The Farm Pollution Gets You #water #Ohio"	@art_news: "The truth you're not being told about the Toledo water crisis in Ohio: Chemical agriculture poisoned the water http://t.co/UhWmur1Tpq "

RO2: Types of Twitter Accounts Involved in Agriculture-Related Water Quality

Conversations

Three user categories emerged upon further analysis of the data (Table 4).

Table 4

Users of High Authority or Influence Categorized by Primary Content Focus

Category	Twitter Handle	Name	Cause/Specialty	Additional Resources	Location
Activism-Centered	@mbarlondsmith	Michelle Barlund	Environmental	Facebook	Battle Creek, MI
	@thesqueezezy	The Squeeze food truck/catering	Anti-production agriculture, vegan lifestyle	thesqueezejuice.com	New York, NY
	@soldier_777	ἰῶη "Joseph"	Animal Rights	n/a	n/a
Information Source	@davidkesmodel	David Kesmodel	Bureau Chief of WSJ ag, commodity, and food	LinkedIn	Chicago, IL
	@chadlivengood	Chad Livengood	Detroit news reporter, provides coverage on water/EPA issues	Facebook , Staff Page	Lansing, MI
	@goirish1951	Patrick McDonough	Cornell Vet Medicine, zoonotic disease, animal health		Cornell, NY
Agriculture Affiliate	@fit2farm	Rebecca Davis	Hog farmer and blogger	Blog	Michigan
	@newburgequip	Newburg Equipment	Farm Equipment sales	Facebook , Website	Melbourne, AR
	@adambrent1	Adam Brent	CEO/founder of Cocoa Corp., recycling, sustainable AG	Website	Chicago, IL

The first category of users—*activism-centered*—consisted of those who consistently produced content seeking to engage in conversations to promote their stance. *Information sources* were those users who provided newsworthy or scientific information, and whose network viewed them as knowledgeable or informed in a certain area of focus. *Agriculture affiliates* were the individuals who spoke from experience in agriculture or agriculture-based organizations and businesses.

RO4: Ohio Twitter Accounts' Authority in Agriculture Discussions Before and After the Water Ban

The researchers examined the authority scores of Ohio Twitter users who participated in agricultural conversations during and after the water ban (Table 5). Within Ohio, the user authority level fell from 50% of users at Level 5 authority during the crisis to 33% post-crisis. Far more authority Level 6 users were engaged post-crisis than during. Overall, the percentage of tweets by users of authority levels 6-9 increased across the board; the percentage of Level 5 users was the only category to decrease.

Table 5

Prevalence and Examples of Agriculture-Focused Tweets Before and After the Toledo Water Ban

Authority Level	# of Tweets During Crisis	%	# of Tweets Post-Crisis	%
5	120	50.63	109	33.75
6	74	31.22	122	37.77
7	23	9.70	39	12.07
8	13	5.49	33	10.22
9	7	2.90	20	6.19
Total	237	100.00	323	100.00

CONCLUSIONS

In a time of growing social media use around the world, the ability for individuals to gain influence within their social media networks grows as well. One tweet in the wake of a crisis may take hold in the influx or be carried away by the stream of breaking news and updates. Understanding interactions and conversation in a network can help provide insight into who influences topics and how they arise. In the case of the water crisis in Toledo, Ohio, during the two-day water ban, the most influential users from the primary search set were providing critical news updates and information. As time went on, however, the focus shifted to causes and effects of the algal blooms in the lake. Mentions of agricultural causes became more common as individuals began to speculate in the aftermath when the issue became less immediately pressing.

Based on the analyses of these users and their affiliations, the researchers concluded that individuals who were involved in activist-type organizations or groups were among the most outspoken against agriculture and the most likely to post information implicating the industry. Being able to identify these users provides access to networks that can be monitored for emerging issues and that should be involved in the communication process as those issues arise.

The rise in higher authority users within the post-ban data set for the state of Ohio compared to during the ban could be attributed to awareness and growing media coverage in the months following, drawing a larger number of users and increased discussion following the Toledo water ban. The decrease in authority Level 5 users may also indicate that these lower-authority users produce less content related to the same topic over time. An alternate theory is that the growth in

publicity drew more individuals of higher authority to become engaged in conversations surrounding the issue. Another possibility is that lower authority users during the crisis may have been retweeting health and safety content regularly to stay up to date with changes, rather than producing their own content as many were after the crisis.

IMPLICATIONS AND RECOMMENDATIONS

Perhaps the most intriguing finding of this study is the dearth of agriculture-related content generated by Twitter users during and after the Toledo water ban. The lower-than-expected number of agriculture-related tweets suggests that the general public was less focused on the environmental antecedents of the water ban than ways to prevent it from happening again. The lack of content also suggests that agricultural advocates may do more harm than good when publicly disclaiming sole responsibility for the algae blooms—they may actually be raising more awareness of the industry's role in the *microcystis* outbreaks than existed prior to the water ban. Though industry proponents want to avoid appearing reactive, waiting to respond increases the likelihood of affected parties negatively perceiving the industry's role and reduces opportunities for positive engagement (Houston et al., 2014).

The results of this study suggest many other practical uses. Agricultural communicators could use the results of this study to engage with high-authority social media users to prevent information gaps from forming in the event of future water-quality issues in the Lake Erie basin. They should also monitor activist accounts to identify emerging issues before they become full-fledged crises. This proactivity could improve public perceptions of agriculture. Implementing listening software like Sysomos to aid this process would also be beneficial. Extension practitioners can utilize information gained through finding and monitoring influential users to better identify those who should be involved in the conversation on social media platforms like Twitter. Having the ability to identify these users of high authority in their territories provides a means to influence through the sharing of information within and beyond their networks.

Areas for further research include a deeper analysis of the movement of information through networks during crises such as these. In doing so, researchers could identify secondary users beyond the opinion leaders to gain a broader map of networks related to specific causes or events. Another area that can be further investigated is the reason for a decrease in Level 5 or mid-authority users, perhaps to better understand the fluctuations that each authority level experiences throughout the timeline of crisis events. This may help with identifying the best timing and target audience for professionals utilizing Twitter to generate as many views and interactions as possible.

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