An Effect of Rumor and Anti-rumor in Social Media

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Abstract. Social media platforms are one of the fastest ways to disseminate information but they have also been used as a means to spread rumors. If left unchecked, rumors have serious consequences. Counter-rumors, messages used to refute rumors, are an important means of rumor curtailment. The objectiveof this paper is to examine the types of rumor and counter-rumor messages gen- erated in Twitter in response to the falsely reported death of a politician, Lee Kuan Yew, who was Singapore's first Prime Minister. Our content analysis of 4321Twitter tweets about Lee's death revealed six categories of rumor mes- sages, four categories of counter-rumor messages and two categories belonging to neither type. Interestingly, there were more counter-rumor messages than rumor messages. Our results thus suggest that, at least in the context of our study, online users do make an attempt to stop the spread of false rumors throughcounter-rumors.
Keywords: Rumor correction · Counter rumor · Social media · Death hoax · Content analysis · Twitter

1 Introduction

Social media platforms such as Twitter are one of the fastest waystodisseminateinformation. Unfortunately, they have also been used as a means to spreadrumors andother forms of misinformation. For example, following the June 2017terroristattacksin London, rumors began circulating online that London mayor SadiqKhandefendedSeptember11thterrorists.Suchaclaimwasofcoursefalse,andoriginatedfromanunrelated video of the mayor. In Asia, rumors swirled in social media thatthe ill-fatedMalaysiaAirlinesflightMH370fromKualaLumpurtoBeijingactuallymadeasafeemergencylandingsomewhereinChina,bringfalsehopetofamiliesandlovedones.Online rumors, if left unchecked, have serious consequences especially iftheyturr rmsofdis-seminating accurate information. They may damage the reputations of individualsand organizations. Finally, they may harm social cohesion. Rumor correction is hence of utmost importance to control the negative effects from the spread of misinformation. One way to do this is through counter-rumors. In this paper, counter-rumors refer to messages used to refute rumors and spread the truth. Prior work suggests that counter-rumors are effective in combating rumors on the Internet [1]. This is because exposure to such messages reduces people's belief in the rumor in question, hence lowering their propensity to share that rumor [2].Traditionally, rumors have been tackled by governments, affected organizations and mainstream news media [3]. However, on social media, the community of users play this role as well, although results have been mixed. On the one hand, some work has suggested that online communities are capable of self-correction and self-policing when presented with dubious information [4, 5], and that counter-rumors may be effective [2]. On the other hand, some research suggests that counter-rumors could reinforce misperceptions [6, 7].

One gap that motivates the current research is the relative lack of attention paid to the content generated by the online community in response to a rumor. For example, what types of messages do the community spread in a rumor situation? Importantly, what types of counter-rumor messages do

the community create in response? Such questionsarenotaddressedinexistingwork.Wearguethatunderstandingthenatureof such messages created by online communities would translate into useful insights that will not only advance research but also benefit individuals and organizations in rebuttingrumors.
Hence, the objective of this study is to examine the types of rumor and counter-rumor messages generated in Twitter in response to the falsely reported death of a politician, Lee Kuan Yew, who was Singapore's first Prime Minister. The rest of the paper is organized as follows. Literature on rumor and rumor correction is reviewed. Data collection and analysis methods are next described, and the types of messages created are then presented. Thereafter the findings are discussed, together with implications of the work.

2 RelatedWork

Rumor may be defined as "unverified and instrumentally relevant information statements in circulation that arise in contexts of ambiguity, danger or potential threat, and that function to help people make sense and manage risk" [8]. It may also be defined as "a collective and collaborative transaction in which community members offer, evaluate and interpret information to reach a common understanding of uncertain situations, to alle- viate social tension and to solve collective crisis problems" [9]. Put differently, rumors may be seen as a form of collective sense-making to a community attempting to understand ambiguous or uncertain situations when official information is lacking [8]. Nevertheless, rumors may negatively impact individuals, groups of people and even entire nations, depending on the topic, its content and the will of those that disseminate it. There are a number of methods to neutralize rumors, including ignoring, confir- mation of the truth, and denial. Ignoring a rumor is considered the weakest method of all and is used only if the rumor is highly implausible. However, rumors tend to take alife of their own and may spread uncontrollably. Thus, deliberate correction mecha- nisms, also known as counter-rumors, may be required [10, 11]. Rumors often carry some truth and counter-rumors confirming that part of the rumor that is true may be sufficient to neutralize its impact. Denial is a popular counter-rumor used to refute rumors [12] but its effectiveness has been questioned [13]. Other rumor coping tactics includeprovidingtheinformationthatisindemandandenhancingtrustandcredibility byengaginginpublicrelations[14,15].
The increased use of social media and other online platforms to share informationmeans that as an unfortunate side-effect, people have also used them to spread rumorsand other forms of misinformation. This phenomenon has correspondingly attractedresearch attention. One stream of work deals with identifying rumors in online mes-sages. Here, [16] developed and compared classifiers to predict whether images onTwitter about Hurricane Sandy were real or doctored. In so doing, they demonstratedthat machine learning techniques could be used to identify fake images that may fuelrumors. Likewise, [17] investigated factors in online social networks that influencedjudgments of information credibility. Using these results, they developed an automatedmethod to identify and rank credible information sources and users for any given topic.Another stream of work concerns the effectiveness of counter-rumors to curtail thedissemination of rumors. For example, [18] examined the effect of exposure tocounter-rumors on people's decision to spread rumors in social media. They found thatwhen people were exposed to counter-rumors before rumors, they were more likely tostop the spread of rumors than when the converse was true. Next, [2] showed thatappropriate message design could reduce the spread of health-related rumors on socialmedia. This included the use of warnings that the content has appeared in rumor
websites and presenting counter-rumors generated by other users and sources.
While such research advances knowledge, one gap present is the relative lack of work done in analyzing the actual content of rumor and counter-rumors. We arguethat understanding the nature of such content would lead to a better ways of curtailing the spread of falseinformation.

3 Methodology

Background:TheRumoredDeathofLeeKuanYew

The death of an important political leader can significantly impact a country's social fabric and its economy. Unsurprisingly, there have been may instances where false rumorsofthedeathsofleadershavespreadquickly,includingBarackObamaandKim Jong-Un.Ifleftuncorrected,suchrumorsmayhavenegativeeffects.
In this paper, we study the rumored death of Singapore's first Prime Minister, Lee Kuan Yew. In February 2015, Lee was admitted to Singapore General Hospital for treatment for severe pneumonia. Rumors of his passing began circulating on social media as his conditioned worsened. Things came to a head on 18 March 2015, when a doctored screen capture of an official announcement of his death, purportedly issued from the Prime Minister's Office (PMO), went viral on social media. The fake announcement stated that Lee, aged 91, had passed away at the Singapore General.

Hospital on 5.30 pm that day. As the screen capture resembled official press released from the PMO, it misled many, including the foreign news media, who prematurely reported Lee's passing. Soon after this incident, the PMO responded that the press release was fake. Subsequent police investigations revealed the culprit of the doctored screen capture to be a 16 year old student.

DataCollection

The dataset for this study was drawn from Twitter, the popular microblogging website for disseminating information and increasingly, for scholarly inquiry into commu- nicativebehaviour [19] such as rumor research. Tweets from 17 March 2015 to 20 March 2015 (inclusive) were harvested using customized software. Specifically, those with the hashtags #LeeKuanYew and #LKY were downloaded, leading to a sample of 4321 tweets distributed across the four days as depicted in Table 1.

Table 1. Distribution of tweets used in the study.

Date	Quantity	Percentage
17 March 2015	20	0.46
18 March 2015	3135	72.55
19 March 2015	829	19.19
20 March 2015	337	7.80

Therationaleforselectingthefourdaysareasfollows:AsnewsofLee'sworsening health condition was publicized in the news, people began sharing their concerns, well-wishes, and rumors on Twitter. This online expression reached its peak on 18 March 2015 [20]. On that same day, the fake announcement of Lee's death was released at 2000 h, which led to further spikes in tweets. Soon, a local news channel (ChannelNewsAsia) announced that it had verified that the image was fakeand debunked the rumor. Other correction tweets sent out by the local newspaper (The Straits Times) were retweeted widely too. The rumor messages eventually began subsiding around 2300 h on the same day, and eventually tailed off a few days after. We hence selected 18 March to collect the

tweets, as well as 17 March and 19–20 March,whicherethedaysbeforeandafterthemainrumoreventrespectively.

Coding andAnalysis

All tweets were analyzed and coded via an iterative procedure common in content analysis [21]. The unit of analysis was a tweet. First, each comment was classified based on categories derived from earlier rumor studies including [22, 23]. Second, for those not classifiable into these categories, we inductively constructed new categories by identifying similarities across entries and coding them into logical groupings [24]. This addition of new categories required that entries that were previously categorized bereviewedtocheckiftheyneededtobereclassified.Thisprocesswasrepeatedtillall commentscouldbeconsistentlycategorized.Categoriesandtheirdefinitionswererecorded in a codebook where they were fully explained to coders. The final set of categories and their definitions are presented in Table 2.

In the present study, three coders were independently involved in the content analysis procedure, and the final intercoder reliability using Cohen's kappa was found to be 0.96. This value is above the recommended average [21].

Table 2. Categories of tweets (n = 4321).

Category	Description	Frequency (%)
Rumor oriented statements		
Belief	Expressing one's belief in the rumor	868 (20.1)
Providing Information	Including information relevant to the rumor	219 (5.9)
Personal Involvement	Describing one's experiences in the context of the rumor	208 (4.8)
Apprehensive	Expressions of fear, anxiety, dread or apprehension	53 (1.2)
Prudent	Cautionary statements used to qualify "hearsay"	21 (0.5)
Counter-rumor oriented statements		
Refutation	Providing evidence to refute the rumor	1009 (23.3)
Disbelief	Expressing one's disbelief in the rumor	612 (14.2)
Guide	Suggesting a course of action to refute rumor	267 (6.2)
Sarcastic	Ridiculing others' beliefs or comments that support the rumor	140 (3.2)
Interrogatory	Asking questions about the rumor	9 (0.2)
Others		
Uncodable	Content that is not related to the rumor or spam	454 (10.5)
Appreciation	Giving appreciation	427 (9.9)

4 Results

Table 2divides the categories uncovered into three groups: those that fuelled the rumor, those that attempted to counter the rumor, and those that did not belong to the former two. In addition, Table 3

shows the distribution of categories within the rumor group while Table 4 shows the distribution for the counter-rumor group. A description of these categories is presented in the following paragraphs, together with excerpts from relevant tweets.

Within the categories that were rumor oriented statements, it was unsurprising that thelargestnumberoftweetsbelongedtotheBeliefcategory.Thiscomprised20.1%of all tweets in our analyzed dataset as well as 63% among all rumor tweets. Essentially, these tweets indicated the person's belief that the rumor was true, that indeed, Lee Kuan Yew had passed away. It would appear therefore that those who generated such tweets believed that the doctored image was from the PMO. These tweets contained prayers, well-wishes or hope for Lee. Examples include "

Table 3. Distribution of rumor tweets (n = 1369).

Category	Description	Frequency (%)
Belief	Expressing one's belief in the rumor	868 (63.4)
Providing Information	Including information relevant to the rumor	219 (15.9)
Personal Involvement	Describing one's experiences in the context of the rumor	208 (15.2)
Apprehensive	Expressions of fear, anxiety, dread or apprehension	53 (3.9)
Prudent	Cautionary statements used to qualify "hearsay"	21 (1.5)

Table 4. Distribution of counter-rumor tweets (n = 2037).

Category	Description	Frequency (%)
Refutation	Providing evidence to refute the rumor	1009 (49.5)
Disbelief	Expressing one's disbelief in the rumor	612 (30.0)
Guide	Suggesting a course of action to refute rumor	267 (13.1)
Sarcastic	Ridiculing others' beliefs or comments that support the rumor	140 (6.9)
Interrogatory	Asking questions about the rumor	9 (0.4)

removed] (-: #LeeKuanYew", "*praying really hard for #LeeKuanYew am really wor- ried. hear that his condition has worsened*", "*Our thoughts go out to #LeeKuanYew and his family. #LKY. #GetWellSoonMrLee*", and "*May you RIP, and you will be missed. #LeeKuanYew*").

The next two largest categories in this group were Providing Information (5.9% of all tweets; 15.2% of rumor tweets) and Personal Involvement (4.8%; 15.2%). The former refers to tweets that include information relevant or in support of the rumor. Here, the majority of tweets quoted from various sources including traditional media outlets and non-traditional ones such as blogs and other online platforms. Inparticular, to support the notion that Lee had passed away, the tweets focused on verified infor- mation that he had been ill preceding the death announcement. Examples include a retweet from another user "*MM Lee's condition has deteriorated further*" and aretweet fromanewsource"*Formerprimeminister#LeeKuanYewiscriticallyill,conditionhas deteriorated*". The Personal Involvement category refers to tweets that describe the person's involvement with the

rumor. Unlike Providing Information, this category contained information from an individual's perspective, leading to a more personal touch. For example, a user tweeted a photo of people keeping vigil at the hospital (Singapore General Hospital - SGH) where Lee was, "*The surreal scene at SGH tonight.Eating.Drinking.Waiting.Repeat.#LeeKuanYew[linkremoved]*".The remaining categories in this group of rumor oriented statements were small in number, with each comprising about 1% or less of the entire analyzed dataset:

- Apprehensive tweets (1.2%; 3.9%) expressed a range of negative emotions such as fear,dreadandanxietyoverthedeathofLee.Inparticular,concernswereabout thefuture of Singapore, as Lee had been instrumental in building the country ("*without him, I'm scared for our future*").
- Prudenttweets(0.5%;1.5%)werethosethatexpressedcautionwhileproviding

information related to the rumor. This sense of hesitancy was probably appropriate given the momentous event in the country's history. For example, a user claimed that there was an announcement from the PMO's office about Lee's death, but was unsure about its existence "*There is a photo being circulated on the PMO website about #LKY. Until I see it up on the site, I'm unable to verify if photo is real*".

In terms of counter-rumor oriented statements, the largest category belonged to Refutation tweets and it was also the largest among all our uncovered categories at 23.3% of the dataset as well as 49.5% of all counter-rumor tweets. Essentially, these tweets attempted to debunk the rumor of Lee's death by providing various forms of evidence, such as retweeting content from various traditional and new media sources. Examples include "*RT @STcom: PMO lodging police report about fake website announcing death of Mr Lee Kuan Yew [link removed] #LeeKuanYew*" and "*#Lee- KuanYew is dead according to this #PMO website screengrab sent to Redwire. Hoax? Yes says the PMO. Cops notified. [link removed]*". Closely related to Refutation was the Disbelief category which comprised tweets expressing skepticism about therumor. This was the second largest counter-rumor category at 14.2% of the entire dataset and 30% of counter-rumors. However, unlike the former category, the tweets here did not provide evidence from other sources but were more personal in terms of expression. One example would be: "*1. LKY is not dead yet. 2. Stop saying he is dead. 3. If you havenothingbettertosayabouthim,don'tsay.#LeeKuanYew*".

Next, the Guide category (6.2%; 13.1%) referred to tweets which provided instructions or advice to others about refuting the rumor of Lee's death. Put differently, such tweets went beyond providing evidence of the false rumor and included a call to action for stopping its dissemination. An example of this category is a plea from a user "*Kindly do not spread rumours about Mr #LeeKuanYew. The image that is spreading is edited from that of Mrs #LKY. [link removed]*" while another tweeted "*He's a person. The media does not pronounce him dead, a doctor does. Until then, stop jumping the gun.#LKY*".

TheSarcasticcategory(3.2%;6.9%)containedtweetsthatridiculedotherusersand tweets that supported the rumor of Lee's death. Perhaps users were frustrated or concerned about the spread of the false rumor and poured scorn on those that believed it. Examples include "*Fail. @[name removed] falls for a hoax. #LeeKuanYew*" and "*This is how rumors get around. Blind leading the blind.Ugh.*". Finally, Interrogatory tweets (0.2%; 0.4%) were questions seeking more information about the rumor. A typical example included "Serious, did #LeeKuanYew die?" Given the uncertainty surroundingLee'sdeath,thenumberofquestionsaskedwassurprisinglysmall.

There were also two categories that did not belong to either the rumor or counter-rumor category that were uncovered during our analysis. First, the Apprecia- tion category comprised tweets that were thankful of Lee's sacrifices and contributions towards nation-building such as "Thankful for Mr #LeeKuanYew. Some people devote a specific period to doing something, this man devoted his life" and even a simple hash tag "#ThankYouLKY". It should be noted that these tweets neither supported that Lee had passed away or not, but that this rumor reminded them of his work for the country. Second, the Uncodable category (10.5%) consisted of tweets that were spam, not meaningful, or not

related to the rumor. Examples include a context-less "#LKY", punctuation/special characters or links to irrelevant websites.

5 Discussion

The primary objective of the present study was to uncover the types content generated by the online community arising from a rumor. We used the rumored death of a Singapore politician, Lee Kuan Yew, as the context of our work and analyzed 4321 tweets harvested from Twitter. Our results yielded the following insights.First,ouranalysisshowedthattherewereremorecounter-rumormessagesthanrumor messages. The former comprised 47.14% of the dataset while the latter totaled 31.7%. Thiscorroborateswithpriorworkthatonlinecommunitieshavethepotentialtocorrect misinformation [5] through counter-rumors. Our dataset indicates that as rumor ori- ented messages started circulating on Twitter in response to the fake announcement of Lee's death, other users began posting tweets to stop the rumor. These counter-rumor messages were predominantly of the Refutation category where evidence from local news reports were quoted to dissuade those who wrongly believed in Lee's death. At the same time, users also posted tweets belonging to the Guide category, telling others that the rumor was false and that they should not circulate such content further (e.g. "*What's this fake news being circulated about Mr #LeeKuanYew passing away? Pls DONT post anything unless you're V V sure.*"). There were also other users who were frustrated with the rumor-mongering despite the evidence and resorted toposting tweets in the Sarcastic category to insult those who perpetuated the rumor (e.g. "So many dumb people that believe he's dead. #LeeKuanYew"). In sum, the fact that there Twitter users who actively posted various types of messages to debunk and stop the false rumor of Lee's death bodes well for the use of social media to disseminate counter-rumors.

Nextandonarelatednote,ourstudyhighlightstheimportanceofsourcecredibility in the use of counter-rumors [25]. In particular, Twitter users who posted messages to debunk Lee's rumored death extensively retweeted from local news outlets such as the Straits Times (newspaper) and ChannelNewsAsia (TV news channel), which are considered authoritative and credible in the Singapore context. It would seem that by doing so, the hope was that people's perceptions could be shaped to achieve corrective behavior, that is, the curtailment of the rumor. Ironically, it was the foreign news outletsthatwronglybelievedinthefakeannouncementandprematurelyreportedLee's demise. Unsurprisingly, a number of tweets belonging to the Sarcastic category were directed at them (e.g. "*Can't believe [news outlet name removed] is so dumb not to verify the source #Singapore #LKY*"). This finding also suggests that online users are able to distinguish between real and fake information even if the sources appear credible.

Lastly,ouranalysisrevealsaninterestingobservationthatcounter-rumormessages were largely evidence-based while rumor messages were mostly personal opinions. ThisisseeninTable2whereRefutationwasthebiggestcounter-rumorcategory,whileBelief was the biggest rumor category. As mentioned previously, Refutation messages provided evidence (e.g. "*RT @[name removed]: China's CCTV official weiboapolo- gises for unverified news update on #LeeKuanYew. [link removed]*") from credible sources while Belief messages contained expressions that indicated that the rumorwas true without any evidence (e.g. "*RIP…. You will be dearly missed. #LeeKuanYew*"). Put differently, counter-rumor messages were factually driven while rumor messages were emotionally driven. This finding lends support to prior work [26, 27] that emo- tions such as anxiety fuel rumor transmission, but also extends such work that counter-rumor transmission is primarilyevidence-based.

6 Conclusion

We contribute to the understanding of how online communities respond to a rumor by analyzing the content created on Twitter. In particular, we uncovered the various categories of rumor and counter-rumor messages that were posted, and show that online users do attempt to correct falsehoods with appropriate evidence from credible and authoritative sources. Stated differently, counter-rumor

messages were primarily factual in nature, in contrast to rumor messages which were driven by personal opin- ions, hearsay and emotions.

OnepracticalimplicationofourworkisthatsocialmediaplatformssuchasTwitter are viable outlets to disseminate counter-rumor messages. If organizations and indi- viduals involved in such activities make a concerted effort in releasing these messages on social media, other interested users will eventually retransmit them to their social networks. In so doing, the rumor may eventually be quelled. Further, our results also suggest that it would be helpful to identify social media users who are active contrib- utors, and who are inclined to assist debunking rumors. By tapping on their social networks, counter-rumor messages can be more easily disseminated. In addition, it wouldappearthatthoseuserswhoarelikelytoaidindiscreditingrumorsarediscerning intermsofthecontenttheyread.Therefore,itwouldbeappropriatethatcounter-rumor messages are factual and informative in nature, rather than emotionallycharged.

There are some shortcomings that could limit the generalizability of our findings. First, only one microblogging site, Twitter, was examined. Users of other microblogs mighthavedifferentusagepatternsrequiringseparateinvestigations.Onarelatednote, only one death hoax (albeit a significant one) was studied – that of Lee Kuan Yew. Other individuals or rumor events may yield different types of content generated. Further, our results are constrained by data (tweets) that is openly available on Twitter and without any clarifications with the tweet creators. For future research, our study could be extended by examining other events such as natural disasters, health crises, organizationalcrises,anddrawcomparisonsofrumorsandcounter-rumorsacrosseach type. Further, extending this study to other types of social media platforms such as Facebookwouldbehelpful.Next,itwouldbeworthwhiletoinvestigatehowtherumor and counter-rumor messages actually spread across individuals' social networks. Finally, while we studied rumor and counter-rumor messages from the perspective of the content creators, it would also be useful to study the perspective of the content consumers,andunderstandtheimpactofsuchmessagesonopinionandbehavior.

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