Improving Readers' Awareness of Divergent Viewpoints by Displaying Agendas of Comments in Online News Discussions

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Readers of online news articles often hold related discussions in social media, sharing comments with various news-relevant topics, which we denote as 'agendas'. Online discussions that span diverse agendas can help readers mitigate the biased influences from news media. However, displaying comments based on popular voting often fails to reveal such diversities to readers. In this paper, we designed a proof-of-concept *Hagendas* that aims to improve awareness of divergent agendas in online news discussions. It presents possible agendas automatically derived from news articles, and enables readers to view and filter the comments accordingly. We evaluated how Hagendas would affect users' online news discussion practices through a within-subjects experiment with 95 online participants from MTurk. While the *agenda tags* and *filtering* features did not significantly increase the number of distinct agendas people identified through reading comments, 77.9% of participants preferred having those features for exploring online news discussion.

CCS Concepts: • **Human-centered computing → Empirical studies in HCI**; *Empirical studies in collaborative and social computing*.

Additional Key Words and Phrases: Agendas; Divergent; Discussions; Online news discussions; Social media

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1 INTRODUCTION

Many readers of online news articles like to share their thoughts and opinions on social media (*e.g.,* Reddit), and the comments they post may vary in topics [14, 28]. In this paper, we denote such topics of comments as 'agendas'. However, the current ways of displaying news-related comments in social media are not supportive for users to stay aware of divergent agendas of comments shared by the public [13, 14]. The vast amount of comments under a thread are often presented in an ordered fashion such as recency or popularity (*e.g.,* 'Best', 'Top' sorting in Reddit). While such display methods could help screen out low-quality comments, it holds a drawback that comments with relatively less popular but valuable agendas would not be easily visible to the public [24]. In addition, those whose perspective is seemingly different from that of the majority as revealed in the popular comments may hesitate to speak out (a.k.a. the spiral of silence [22, 32]), which could further discourage sharing comments with divergent subjects.

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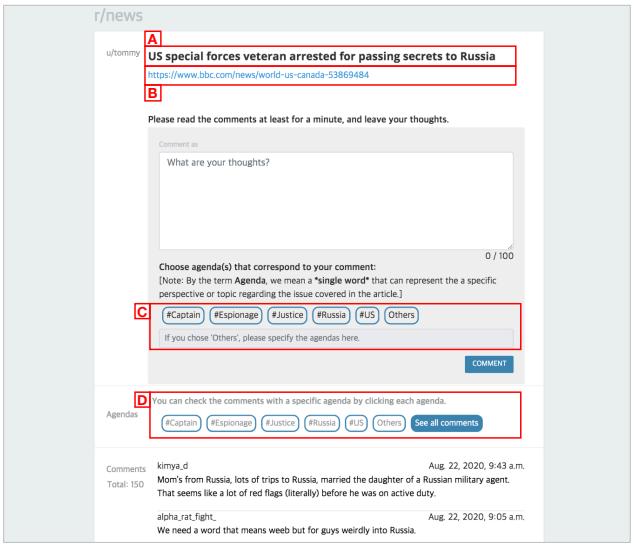

Fig. 1. The user interface of Hangendas. The headline of a news article is shown on **[A]**, while the original article link is on **[B]**. The possible agendas for discussion about the news article are displayed on **[C]**. Users can tag any corresponding tags among [C] for their comments. By clicking ones in **[D]**, users can check corresponding comments for the agenda.

Prior studies have explored various methods to increase readers' awareness of divergent opinions in online spaces. One stream of research focused on organizing comments by their contents in dichotomous settings [14, 17, 21]. This, however, is not sufficient in the context of news because not every discussion falls into a bilateral setting. Other work attempted to summarize the contents of large-scale threaded comments through a text analytic visualization (*e.g.,* Sankey diagram [15, 16]) to show their topic distributions. Although these tools are effective means to encapsulate existing subjects in the comments, they still leave out any related agendas that have never been voiced out in the discussion. Little work has studied how to let readers aware of unvoiced topics from comments in online news discussions.

In this regard, we designed *Hagendas* (**H**ashtag + **agendas**), a proof-of-concept for improving readers' awareness of divergent agendas in online news discussion. It derives five agendas from the headline and the first sentence of the news article as they usually cover the gist of the news [10, 25]. It displays these agendas in the form of hashtags above the threaded discussion (see Fig 1). Hagendas let users tag agendas when they leave comments. Also, it supports users to filter comments relevant to each of presented agenda. We conducted a within-subjects online experiment with 95 participants (57 male, 38 female). We counterbalanced three conditions: [*i*] the *Baseline*: mimicked the interface of a popular online forum (*i.e.,* r/news in Reddit), where the comments are displayed by popular votes of the crowd, [*ii*] *Agenda tags*: baseline interface + displaying agenda tags, and [*iii*] *Agendas & Filters*: Agenda tags interface + enabling comment filters by associated agenda tags. Participants found new agendas more with Agendas & Filters. They noted that filtering comments by agendas enabled them to search comments easier. In addition, they preferred having those two features significantly more than the baseline, especially for exploring comments and discussions online.

2 HAGENDAS: MANIFESTING POSSIBLE AGENDAS FOR DISCUSSIONS ONLINE

As illustrated in Fig. 1, we mimicked the essential features of *r/news* in Reddit, which is a popular place for sharing comments to discuss social issues with online news articles. Our proof-of-concept, *Hagendas*, generates five possible

#	Headlines of News Articles	Outputs – *Possible Agendas*
1	U.S. special forces veteran arrested for passing secrets to Russia [9]	*Espionage, Justice, Captain, Russia, US*
2	Iran plane crash: Western powers suggest missile downed jet [5]	*Plane, Tehran, Error, Leader, Evidence*
3	Colorado teenager was fatally shot while (...) [3]	*Officer, Report, Colorado, Teenager, Lawsuit*
4	Fox News publishes digitally altered and misleading (...) [4]	*CNN, Business, Demonstration, Image, Fox*
5	Police admit they arrested the wrong man (...) [6]	*Jail, Police, Victim, Felony, Charge*
6	Prison whistleblower (...) in Arizona facility found dead [7]	*Condition, Suicide, Whistleblower, Arizona, Facility*
7	Black disabled veteran sentenced (...) for medical marijuana [2]	*Prison, Attention, Veteran, Marijuana, Month*

Table 1. Table shows seven news articles that we used for the pipeline validation. It returns five possible agendas derived from a news article. The outputs (*i.e.,* agendas) of the NLP pipeline for each article are enumerated in the right column.

agendas for discussion threads, and display them on [C] as a form of hashtag to let commentators consider the provided agendas while leaving their comments, and [D] to improve the readers' awareness of diverse agendas from others' comments. We decided to present five agendas because we did not want to overwhelm readers by providing too many agendas, but still present a number of agendas that would spark divergent considerations on the issue. We described the details of how the agendas are derived in 2.1. Followings are the rationales for the key features of Hagendas:

- **Hashtag**: Hagendas extracts possible agendas from news headline and article contents. Then it presents the agendas as a form of tag, to resemble the prior use cases of hashtags for raising the public awareness [18, 19].
- **Word-level**: Hagendas provides word-level tags, neither a phrase-level nor clause-level, as they may impose a particular intention with a specific viewpoint (*e.g.,* #BlackLivesMatter). In such cases, readers often lose the motivation to read the contents of the post [27], which is against our intention.
- **Filtering**: Hagendas allows readers filtering to leave associated comments by the attached agendas. Once a user clicks one of the tags, the system shows the comments with the corresponding hashtag.

2.1 Identifying Possible Agendas

We implemented a natural language processing (NLP) pipeline to extract agendas from online news articles. First, the pipeline identifies nouns, using Stanford CoreNLP Part-of-Speech (POS) tagger [30, 31] and spaCy Named Entity Recognition (NER) model [8], from the headline and the first sentence of a news article where the important aspects of the article are presented [25, 26]. Then it clusters similar agendas using Google's word2vec pre-trained model [1] to avoid presenting agendas with similar or replaceable ones. Only one representative agenda from each cluster will be chosen. The pipeline utilizes *WordNet* [11, 20] and selects the agenda farthest from the core node (*i.e.,* 'entity') as the representative agenda of each cluster. Table 1 shows examples of the pipeline outputs for seven news articles.

3 ONLINE EXPERIMENT

We conducted an online study to evaluate the effects of Hagendas on readers' experiences in the online news discussion. We recruited 95 participants (57 male, 38 female) from Amazon MTurk. We recruited only U.S. residents to ensure the participants to have at least minimal background knowledge on the incidents covered in the articles. They are all with 97% or higher of acceptance rates to minimize recruiting trolling inputs. Their ages ranged from 21 to 68 (M = 37.96, SD = 10.81). The duration for the completion of the entire task was 55.4 minutes on average (SD = 29.7 minutes). The participants were compensated with 8 USD for participation. We set up a within-subjects experiment with three interface conditions ([i] Baseline, [ii] Agenda tags, and [iii] Agendas & Filters) to investigate and compare the effects of different features–*tags* and *filters*, respectively. We counterbalanced these three conditions to get rid of ordering

Conditions	**Wrong Arrest** [6]	**Lawsuit** [3]	**Espionage** [9]	**Total**	**Valid Participants**
[*i*] - Baseline	58 (1.45)	39 (1.5)	47 (1.62)	144 (1.52)	75.8% (72 out of 95)
[*ii*] - Agenda tags	67 (2.58)	47 (1.47)	49 (1.32)	163 (1.72)	67.4% (64 out of 95)
[*iii*]- Agendas & Filters	52 (1.82)	89 (2.41)	36 (1.24)	177 (1.86)	78.9% (75 out of 95)

Table 2. The # of agendas that participants found from others' comments (the average # of agendas per participant in the parentheses).

effects. The participants read one article per interface condition–(*Wrong Arrest*, *Lawsuit*, and *Espionage*). We fixed the sequence of news articles to mix the pairing between the articles and the interface conditions. On each article, we crawled the top-level comments from Reddit r/news and crowdsourced to label each comment with agendas.

- Wrong Arrest [6]: Police admit they arrested the wrong man, yet he still sits in jail. Even after the victim told police the suspect was not the man who assaulted her, they took him into custody on two felony charges.
- Lawsuit [3]: Colorado teenager was fatally shot while running away from off-duty officer, lawsuit says. The family of a Colorado teenager filed a lawsuit Thursday accusing an off-duty corrections officer of using deadly force "recklessly" and "without warning" when he fatally shot the teen in his backyard as a group of friends were fleeing the scene of a home break-in.
- Espionage [9]: U.S. special forces veteran arrested for passing secrets to Russia. A former U.S. special forces captain has been arrested on charges of espionage, the U.S. Department of Justice says.

3.1 Task & Procedure

Participants were first asked to fill out a pre-study survey on their basic demographics and familiarity on reading online news articles. Then they were provided a headline and the original link of the news article (see [A] and [B] on Fig 1). They were supposed to read the online news article and leave their initial thoughts about it. To prevent them from leaving comments without reading the article, they are only allowed to submit their initial comments at least one minute later from the moment they clicked the link to read the article. In this stage, the participants were not allowed to see the others' comments to avoid them to leave their thoughts influenced by others. After submitting the initial comment, the participants were allowed to see the comments on the news article with the experimental interface (Fig 1). They were asked to read other comments at least for a minute and leave their comments again, as if they were leaving a comment on the discussion in social media. They are also required to attach an appropriate agenda to their comment in Agenda tags and Agendas & Filters condition. After submitting a comment, they were asked to answer a short survey, including open-ended questions "From the comments, what agendas have you found?" and "Did you make any changes on your comment after looking at others' comments? Why did (or did not) change your comments?". The participants repeated the procedure for all three interfaces. After using all three interfaces, they were asked to tag their comments with the corresponding agendas. Finally, the participants were asked to respond to a final survey with questions "Among the three systems, in which one of them could you easily find various topics from comments?" and "Among three systems, in which one of them could you easily find some comments holding similar topics as yours?"

4 RESULTS AND DISCUSSION

We can see that overall participants identified more agendas in total after reading comments in the forum in *Agendas & Filters* than in *Agenda tags*, and both surpass *Baseline* (see the fifth column in Table 2). However, the Friedman test

Articles	Conditions	Ratio†	Max / Higher frequencies	Lower frequencies
Wrong Arrest	[*i*] - Baseline	29/40	5 / arrest(5), admit(3), brutality(3)	blm*(1), rights(1)
	[*ii*] - Agenda tags	20/26	4 / victim(4), felony(3), innocent(3), blm(3)	arrest(2), brutality(2)
	[*iii*]- Agendas & Filters	20/29	7 / police(7), victim(5), felony(3), blm(3)	arrest(1), brutality(1)
		69/95		
Lawsuit	[*i*] - Baseline	19/26	4 / shot(4), murder(4), violence(3)	fleeing(1), crime(1)
	[*ii*] - Agenda tags	19/32	5 / Colorado(5), lawsuit(4), teenager(4)	murder(1), violence(1)
	[*iii*]- Agendas & Filters	33/37	10 / lawsuit(10), Colorado(4), teenager(4)	murder(2), gun(1)
		71/95		
Espionage	[*i*] - Baseline	24/29	6 / Trump(6), Russia(4), treason(3), traitor(3)	U.S.(2), spy(2), veteran(1)
	[*ii*] - Agenda tags	25/37	6 / Trump(6), traitor(4), U.S.(4), Russia(3)	immigrants(1), captain(1)
	[*iii*]- Agendas & Filters	22/29	6 / U.S.(6), traitor(4), military(3), Russia(3)	spy(1), secrets(1)
		71/95		

Table 3. Table shows the several examples of distinct agendas which are newly discovered by participants for the three conditions in each article. The numbers in the parenthesis indicate the frequencies. *blm stands for '*black lives matter*' in online discussion contexts. †It shows the ratio: (# of who found at least one new agenda / # of who worked on the given condition)

results show that these differences are insignificant ($p \geq .05$). Instead, we looked into not just the sheer count but what agendas have been observed by participants in each condition to verify the effects of Hagendas.

Improvement on awareness of divergent agendas. We found several agendas brought up by more than 10% of the participants in both conditions [*ii*] and [*iii*] but did not get much attention from the participants in the baseline. For example, participants in both conditions [*ii*] and [*iii*] paid their attentions on **victim** and **felony** in others' comments, while none of participants in the baseline did (see the Wrong Arrest row in Table 3). Those in the baseline instead identified **arrest**, **admit**, and **brutality** as more salient commentary topics. All these top frequent agendas in the baseline are centered around police in the context of this article – the police *arrested* the [wrong man], the police *admitted* [their fault], and the police is *brutal*. We can also find the similar outcomes in the case of article Lawsuit. Participants found **lawsuit**, **Colorado**, and **teenager** with both conditions [*ii*] and [*iii*]. These agendas however are hardly found by those in the baseline. With the baseline, they noticed **shot**, **murder**, and **violence**, which are describing what the *officer* committed in the context of the given news article.

Prefer having the features. Majority of the participants (77.9%: 74 out of 95) preferred Hagendas for various reasons but with two difference reasons. A group of them (13 out of 41 valid responses) liked it because the agenda tags and filters helped them gain a quick overview of diverse agendas at a glance, as was our intention. They noted that they could improve their awareness of diverse agendas in news comments through the support of Hagendas features. On the other hand, another group (6 out of 41 valid responses) addressed that the features helped them easily exclude what they do not want to see. It tells us that Hagendas has a potential to enhance users' filter bubble [23] or selective exposure [12] which is against our original intention.

Prefer not having the features. In contrast, 22.1% of participants (21 out of 95) preferred the baseline which is without any agenda tags and filters. Their main claim was any additional features other than those of the baseline only disrupt their comment-reading experiences. Although those who preferred Hagendas appreciated the feeling of control over the interface, those who preferred the baseline found themselves mentally and cognitively overloaded with additional features. Therefore, they got lost on how to explore the comments due to the complicated interface. As they do not understand how to manage the novel features, they are more likely to feel overwhelmed [29]. Designing an effective display of agendas without significantly hindering the comment-reading experiences could be a next step.

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