Discovering Hashtag Trails with Cross-Platform Hashtag Search Engines: A State-of-Art Analysis

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Abstract
Although the hashtag convention was originally initiated by Twitter, it has become a common functionality across multiple social media platforms. As hashtags have become universal and linked across multiple social media platforms, the issue involves how users can search hashtags beyond the boundary of individual social media platform. This study aims to investigate the industry trends in hashtag search engines using a morphological analysis and particularly focuses on those engines supporting hashtag searching across platforms instead of on a single platform. As a preliminary result, this study found that the innovation of hashtags has added value to the social media universe and transcended borders of social media. Additionally, this study found that new hashtag functionalities have been developed to address user information needs; hashtags can be interconnected through the emerging hashtag search engines; and the hashtag trails may be profiled to gain more insights into the stories behind the hashtags.
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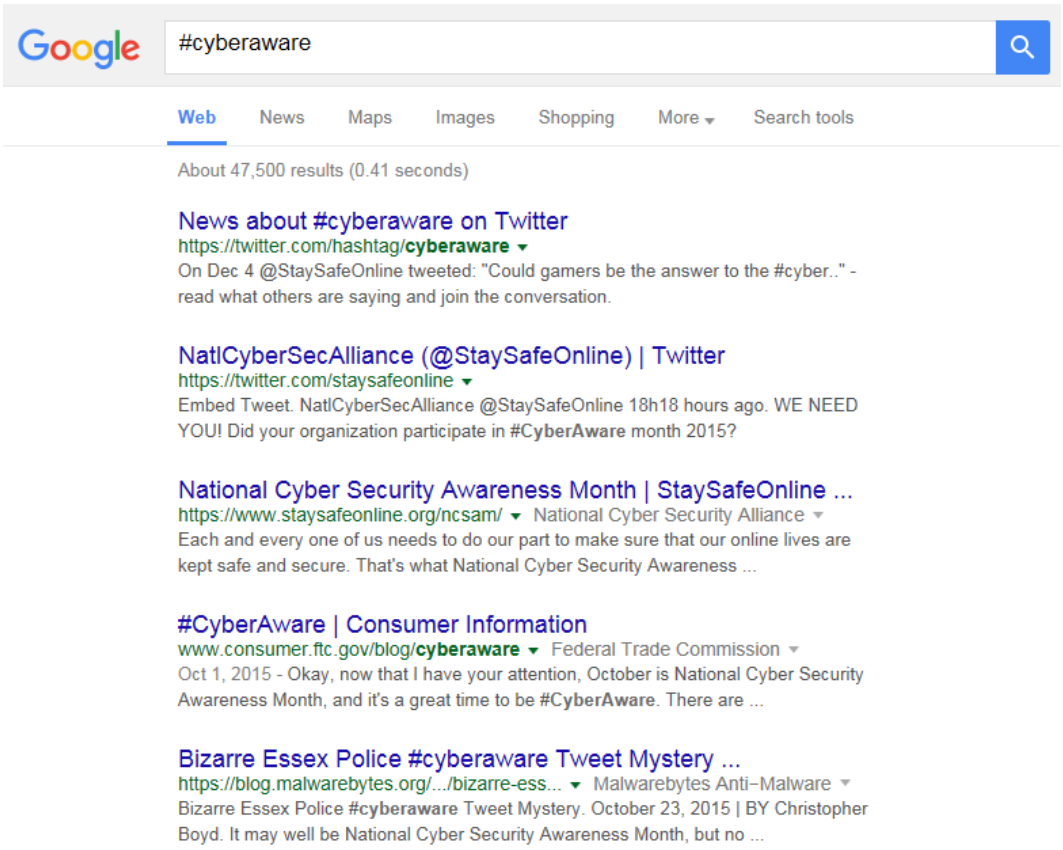
1 Introduction

Although the hashtag convention was originally initiated by Twitter in 2009, it has become a common functionality across multiple social media platforms, ranging from Facebook, Google Plus, Tumblr, Instagram, Pinterest and Vine to Flickr. Not only do hashtags reflect real-time "what is happening" trends, but they also resemble the notion of "associative trails" (Bush, 1945) that facilitate organizing, curating, and re-finding information. As hashtags have become universal and linked across multiple social media platforms, the issue involves how users can search hashtags beyond the boundary of individual social media platforms. This work-in-progress study aims to investigate the industry trends in hashtag search engines and particularly focuses on those supporting cross-platform hashtag searching instead of single-platform (i.e., Twitter) hashtag searching. It is interesting to investigate why there have been multiple hashtag search engines developed and what functionalities differ from the dominate search engines, such as Google, Yahoo, and MSN/Bing.

Taking the hashtag #CyberAware as an example (because October is national cyber security awareness month) and searching this hashtag using Google, Yahoo, and MSN/Bing, the top 5 returning results from three search engines are displayed as follows.



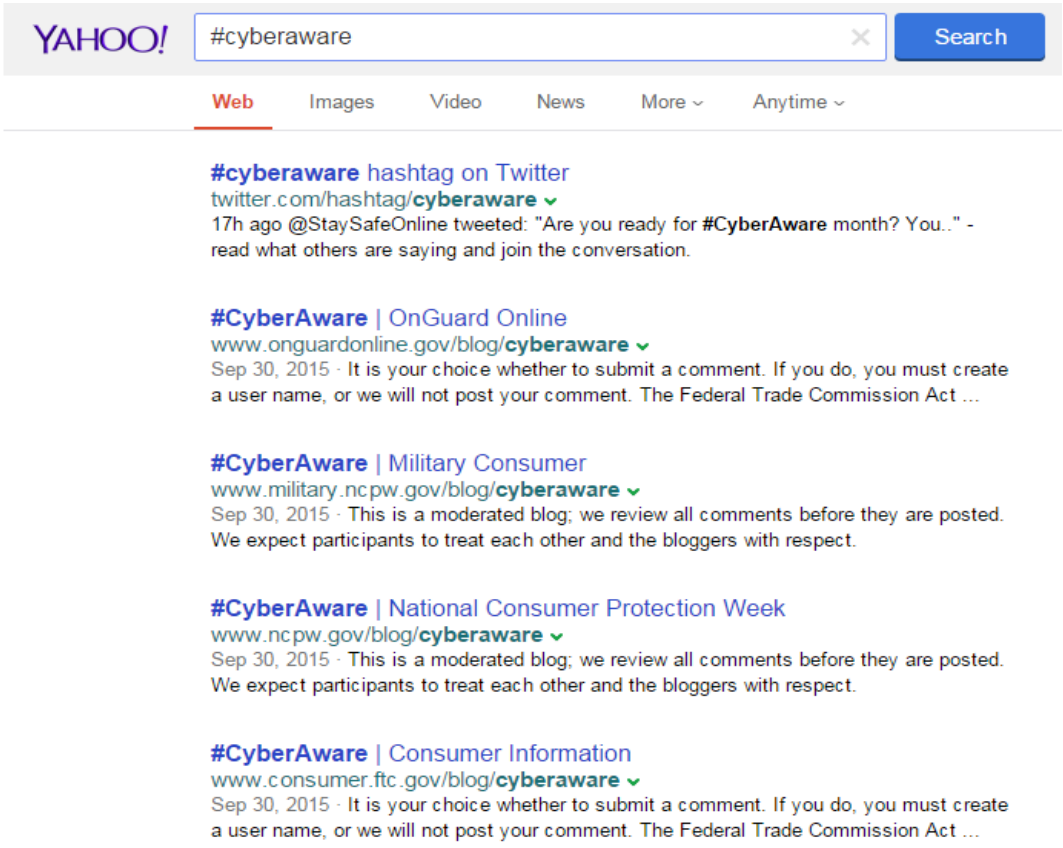


Figure 1. Top 5 (#CyberAware) Search Results from Google

Figure 2. Top 5 (#CyberAware) Search Results from Yahoo

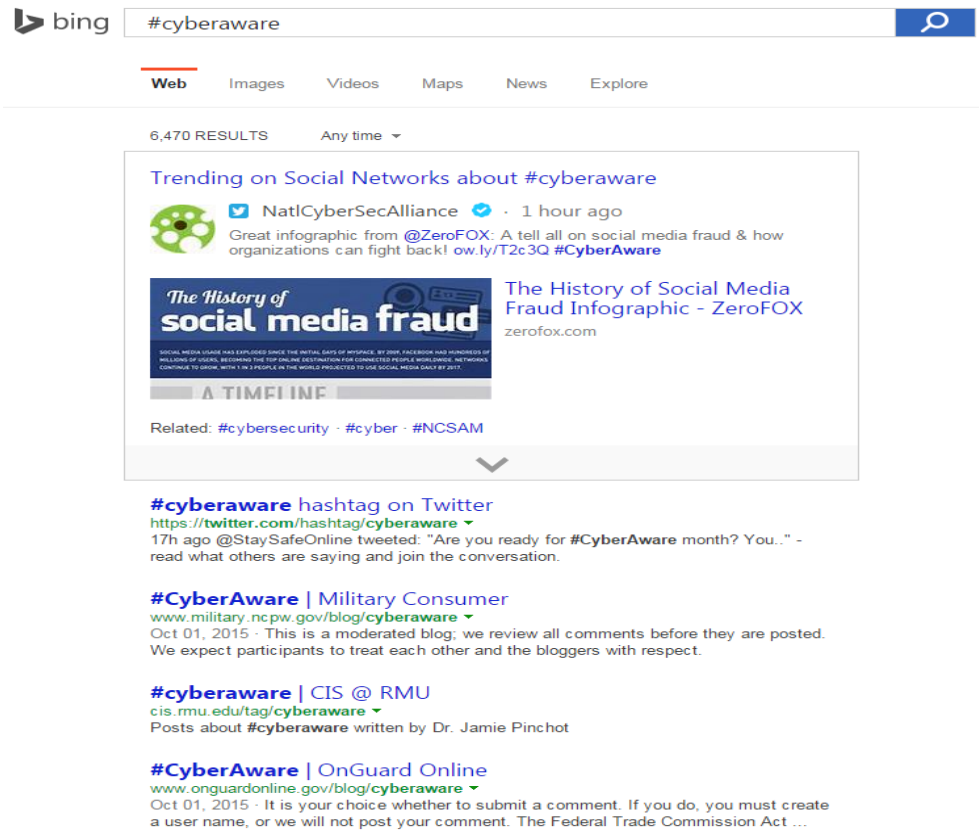


Figure 3. Top 5 (#CyberAware) Search Results from MSN/Bing

Based on the top five search results, three major search engines have done a thorough job including real-time Twitter hashtag search results. However, the hashtag search results from other social media platforms with shared hashtag conventions have not been shown in the top ten search results.

It seems that hashtags are considered a marketing tool because Twitter started to promote hashtags as an advertising option. However, the emergence of hashtag search engines implies that hashtags give a new meaning to "relevance." Therefore, the main research question of this study focuses on what users need from emerging hashtag search engines in order to find something that conventional search engines cannot offer. Through examining the design features that existing hashtag search engines provide, researchers could learn more about the new information needs, so to speak, either in real-time, in retrospect, or what was happening associated with an event.

2 Related Work

Like Topsy and Keyhole, the hashtag search engines are useful research tools to study different topics discussed on Twitter (Risam, 2015). Risam (2015) has tracked hashtag #feminism with Topsy and Keyhole to understand the evolution of feminism according to the communication on Twitter. Spears et al. (2015) used HashAtIt search engine to retrieve the digital trail of hashtag #appreciateamate to evaluate the effect of social marketing campaigns. Other than research tools, Tagboard has been viewed as curation and community building tools (Cochrane et al., 2014). Cochrane and colleagues adopted Tagboard to compile hashtag trails with pre-defined hashtags (#marmw2013 and #moco360) for pedagogy, which facilitated their investigation of the instructional interactions and feedback received on Twitter, Google Plus, Vine, and Instagram. Likewise, social media activity streams on Google Plus, Twitter, and Vine were curated through searching a course hashtag (#autmsm2014) using Tagboard. After examining the trends or patterns hidden in the social media activity data, it is evident that no individuals could gather and analyze social media streams from multiple sources without the aid of the hashtag search engines.

3 Research Methodology: A Morphological Analysis

Richey & Klein (2007) identified two main types of design and development research: (1) product and tool research and (2) model research. To inform better design decisions, it is important to conduct thorough product and tool research. Morphological analysis has been suggested as one of the best modelling approaches fitting well to solve wicked problems (Richey, 2011 & 2013), also called "social messes" (Horn, 2001) which are characterized by being "seen differently from different points of view" and "tightly interconnected, economically, socially, politically, technologically" (Horn, 2001, p.1). Therefore, hashtag issues may be considered as wicked problems. In addition, along with Taylor's value-added model (1986) addressing user requirements, morphological analysis was applied to synthesize functionalities of Twitter hashtag applications that could be integrated in libraries' systems (Chang & Iyer, 2013). Hence, this study uses the same analytic framework and analysis method to analyze the trends in hashtag search engines.

The hashtag search engines chosen to be compared in this study are platforms supporting searching hashtags across more than one social media channel, including HashAtIt, Keyhole, and Tagboard. As shown in Table 1, the number of searchable social media platforms ranges from two to six. Interestingly, all of the compared hashtag search engines include Twitter and Instagram, whereas two out of three hashtag search engines include Facebook as a searchable platform. Additionally, the slogans indicate the market positions of those hashtag search engines, ranging from social (media) search engine to hashtag tracking and display platform.

Hashtag Search Engine	Slogan	Searchable Platforms
HashAtIt	The Social Search Engine	Facebook, Twitter, Instagram, Pinterest
Keyhole	Hashtag Tracking for Twitter, Instagram and Facebook	Twitter, Instagram
Tagboard	The Social Search & Display Platform	Twitter, Facebook, Flickr, Instagram, Google+, Vine

Table 1. A List of Compared Hashtag Search Engines

According to Richey (2011), the steps for conducting a morphological analysis are (1) identify user requirements; (2) list the function attributes as column headings; (3) list available variations of the attributes; (4) select one item from each column randomly or mix interesting combinations of items; (5) evaluate whether the combination is feasible or alternatively recombine the elements in another new way. To replicate Chang & Iyer's methodology (2013), this study adopted/modified their framework to conduct a morphological analysis in hashtag search engines. Table 2 indicates the corresponding product functional attributes, called interfaces by Taylor (1986), in the first entry and the subordinate attributes, called value-added examples by Taylor (1986), in the second entry. This case study outlines three functional characteristics relevant to the user requirement on information organization needs: search, directory, and archive, based on Ames & Naaman's taxonomy (2007). Although Ames & Naaman's taxonomy in social tagging context is quite suitable for describing hashtag "search" and "archive" features, "directory" does not seem to fully capture the dynamic representations of hashtag trails. Maybe it is due to the difference between social tags and hashtags. Social tags have usually been organized in static directories encompassing different tag collections, while hashtags somehow can be organized not only in static directories grouped by topical categories (e.g., brands, events, etc.) but also in dynamic communication interactions, such as live events, real-time hashtag monitoring dashboard, and app extensions. Therefore, as for the function characteristics in Table 2, this study adds "display" to one of the interfaces.

User Requirements		Organization	
Function Characteristics (Interfaces)	Search	Display/Directory	Archive
Function Attributes (Value-Added examples)	Keyword, hashtag, or URL search Multiple queries Advanced search Hashtag definition Related hashtags Sort and filter Start and End date/time	Live events Real-time analytics Dashboard Sentiment (Keywords/hashtags) word clouds Sources Locations Demographics Timeline Embeds App extensions Blocking obscene language Statistics	Live Curation tool Historical data Historical reports Saved searches

Table 2. Morphological Analysis of Hashtag Search Engines

According to the morphological analysis of three hashtag search engines, we found that the attributes of hashtag search functions go beyond the conventional search engines in terms of granular sort and filter feature (i.e., selecting social media platforms) and allow for specifying real-time or start/end search date/time. Moreover, regarding the hashtag display function, we found that the dashboard/wall views of presenting real-time social media streams and various hashtag metrics or statistics provide users with access to many facets of hashtag trails, for example, sentiment, word clouds, location-based visualization, real-time analytics, and timeline. As a result, the hashtag archive function supports live curation as well as historical data and reports that users have never had access to such useful forms until now.

4 Conclusion

Previous studies regarding hashtags seldom investigate the emerging hashtag services in general but specifically focus on improving hashtag recommendations or performing hashtag analytics on certain topics of interest. In the preliminary results, this study found that the innovation of hashtags has added value to the social media universe and transcended borders of social media. Additionally, this study concluded that new hashtag functionalities have been developed to address new information needs; hashtags can be interconnected through the emerging hashtag search engines and associated hyperlinks; and the hashtag trails may be profiled to gain more insights into the stories behind the hashtags.

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