

Public opinion on the future of bike-sharing systems -a social media analysis-

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Introduction

Bike-sharing systems (BSS) allow users to rent in a short-term a bicycle offered in the public space on an “as-needed basis” [13, 1]. These so-called shared transportation systems have partially mitigated urban transport’s negative impacts by reducing the usage of private cars, increasing efficiency of infrastructure usage, and changing trips from private cars to more sustainable modes of transportation [11, 9, 4, 12, 2, 14]. Even with all their potential benefits, some systems have been misused, vandalized and perceived as a public nuisance [5]. Moreover, oversupply, low support of authorities and law, saturated markets and low-quality bicycles of BSS are some reasons for these system failures [5, 10]. As a consequence, waste bicycle piles and even bicycle graveyards have been created in urban areas [7].

Due to BSS’s dilemma between benefits and drawbacks, and their unclear future, we want to focus this study on the public opinion regarding this shared system, specifically, the opinion about the current situation and its future. Therefore, the main objective of this study is to analyze public opinion through social media posts on the current situation and the future of BSS. Understanding public opinion will help us to improve both the design and expansion of these active modes and preventing their collapse. In order to meet the objective, the following research question is explored: What is the current public opinion on BSS and its future on social media?

Methodology

In order to evaluate the public opinion on BSS, we carry out a quantitative discourse analysis on social media posts. The information is collected from Twitter (<http://www.twitter.com>), a social media micro-blogging platform. It does not require a reciprocation of access permission -as is the case of Facebook - between the user who posts and their follower (a person who checks posts from another user). The posts are called “tweets”, which can have a maximum size of 280 characters. Also, there is a retweet mechanism that allows followers to spread another person’s original tweet [6].

We go through two analyzes of tweets to understand the public opinion: a) tweets including the term “bike-sharing” and its related terms, and b) tweets including the term “future” and “bike-sharing”.

Both analyzes are conducted using the following methodology:

1. *Data collection.* We collect tweets in English related to “bike-sharing” and related terms for all the possible combinations that represent BSS on Twitter over a determined period of time by using the

package “twitterR” [3] from R programming language. The first challenge is to identify the different terms that people use to refer to BSS in social media, conventional media, and scientific articles. Three different types of combinations of the term “bike-sharing” were identified in newspapers and scientific papers. They are composed by root terms (i.e. mandatory words) and complimentary terms (i.e. optional words). Figure 1 shows the three different types and their possible combinations. As an example Type I includes: “public bike”, “public bicycle service”; Type II terms are for instance: “bike-share”, “public bicycle sharing system”; and finally Type III can present the words composition: “bikesharing”, “bikeshare program”.

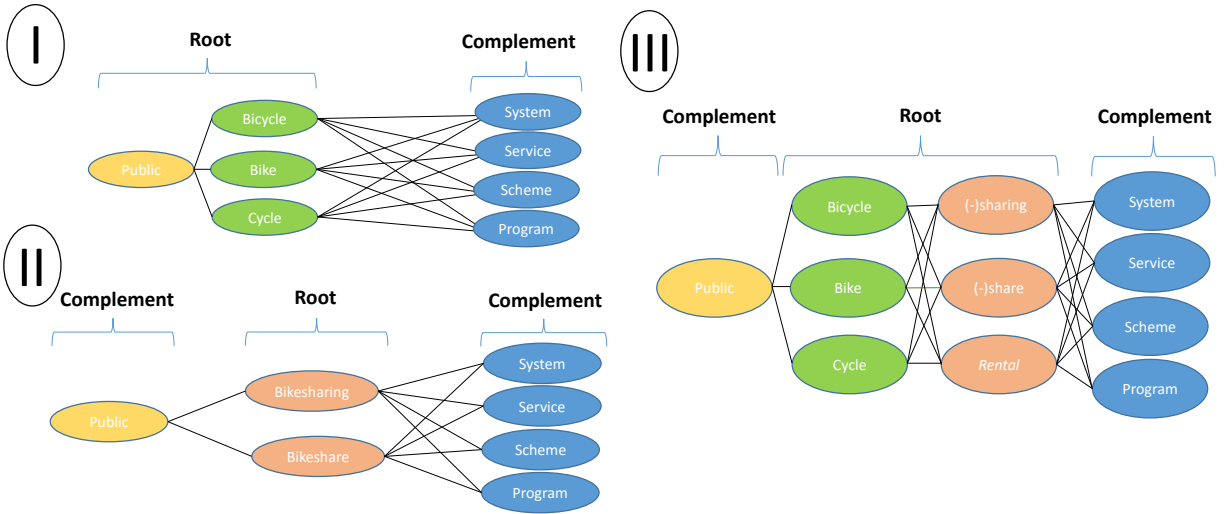


Figure 1: Words combinations referring to BSS

2. *Tweets selection and text cleaning.* We want to focus on the collection of only original ideas, which we defined as original tweets. Original tweets represent the opinion of single individuals and not the chain of an idea through retweets. Therefore, neither retweets nor identical tweets to a previously tweet are included in the study. Thus, a selection process is carried out to discard all the tweets that have more than 70% of identical words with previously posted tweets. In the selected tweets, punctuation, blank spaces, unimportant stop-words (e.g.: and, the), and URLs are deleted in order to clean the tweets and have only active words.
3. *Subset posts including the term “future”.* Once the BSS-related terms have been collected, those including the term “future” are subsetted in the intent of exploring the second part of the research question.
4. *Sentiment analysis.* Sentiment analysis is a text mining technique which evaluates sentiments from written language [8]. We use the polarity method to carry out the sentiment analysis in this study. Polarity is defined as the algebraic sum of terms classified positive or negative divided by the square root of the total words of the tweet. In order to classify the terms as “positive” (score > 0), “neutral” (score = 0) or “negative” (score < 0), we used the predefined Bing sentiment lexicon [8]. If a word in a tweet is included in the 7000 words of the Bing lexicon, it is classified as negative or positive.
5. *Terms frequency.* The most repetitive terms are aggregated for evaluation and comparison.
6. *Topic clustering.* Different tweets are clustered manually or by hierarchical cluster analysis in order to identify groups of the most common topics related to BSS. Hierarchical clustering is carried out with the software IRAMUTEQ (refer to [15])
7. *Analysis.* Evaluation of the sentiment analysis, terms frequency, and topic clustering are evaluated.

Results

All the possible combinations of BSS were searched on Twitter from 18.08.18 to 12.02.19. In total 12,498 original tweets in English were collected and cleaned with a mean of 109.6 tweets per day. A peak of around 500 tweets per day was identified on 4-7 September during the conference of the North American Bike Sharing association. Usually, there were around half of the number of tweets on the weekends than on working days.

– **Current public opinion on BSS** – The polarity evaluation showed a mean score of 0.09, where 41% of the tweets were classified as positive, 42% as neutral and 16% as negative (see Figure 2a). Without considering the neutral tweets, the mean polarity was 0.16 and the median was 0.20. For the analysis,

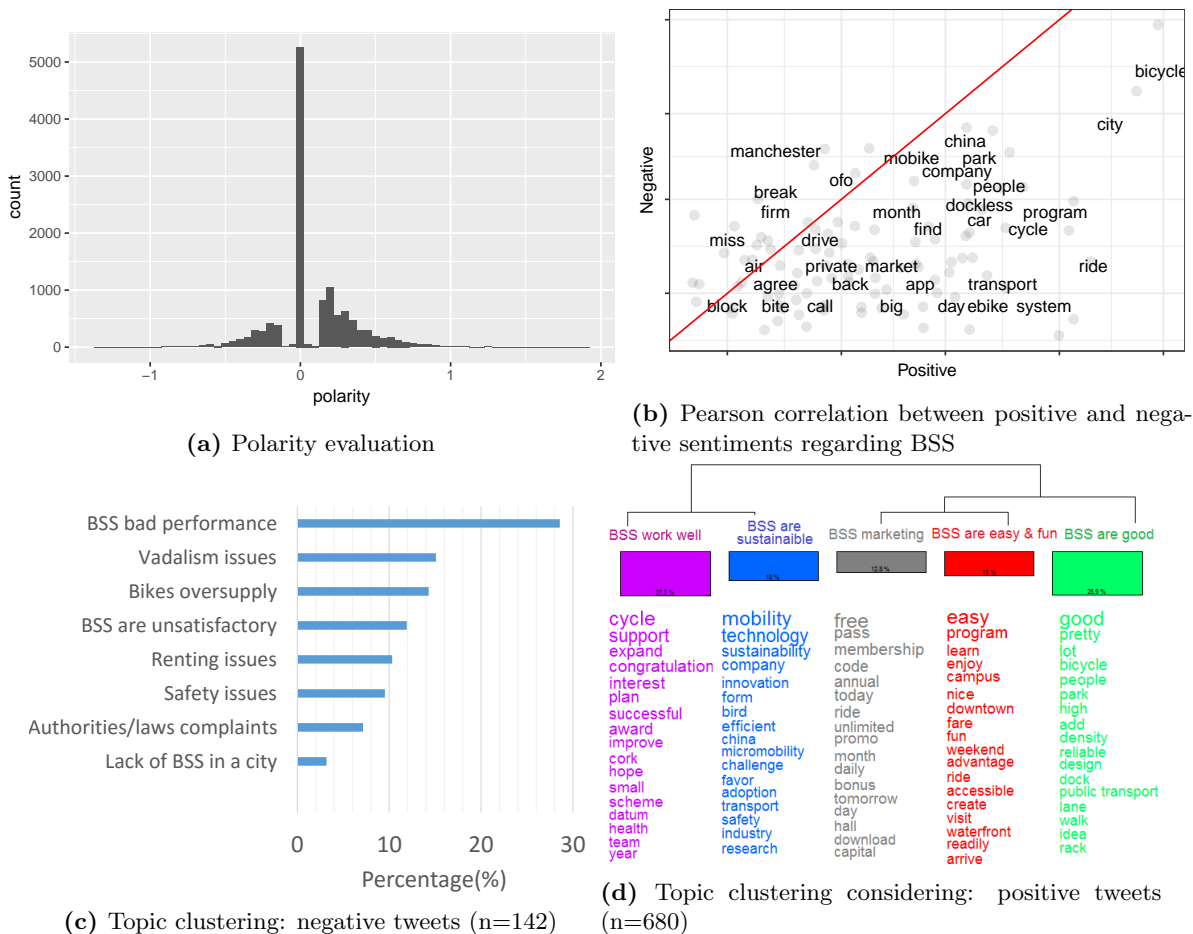


Figure 2: Sentiment analysis of tweets including the term BSS (18.08.18-12.02.2019, n=12498)

positive tweets were selected as those having a polarity score greater than 0.5 (n=680) and negative tweets a score less than -0.5 (n=142) in order to have a high probability for choosing real positive or negative tweets. After a Pearson correlation on the frequency of the terms used in tweets in both sentiments (see Figure 2b), positive tweets presented a higher correlation with, for example, the terms “bicycle”, “city”, “ride” and “e-bike”, while the negative tweets were correlated with “Manchester”, “break”, “ofo”, “miss”, and others.

According to the topic clustering, 140 negative tweets were clustered manually into 8 categories (see Figure 2c), where 23 tweets did not belong to any category. The predominant cluster (28.9%) was related to tweets describing BSS that have experienced a bad performance or that have been pull-out from a city. Around 24% of the negative tweets were related to Chinese dockless systems, and specifically to the companies ofo and mobike.

On the other hand, 83.5% of the positive tweets were aggregated into five clusters following a hierarchical clustering technique, where 87.2% generally stated that BSS work well, are good, are sustainable, and are easy and fun to ride. The remaining 12.8% are tweets related to marketing campaigns to promote BSS.

– **Public opinion on the future of BSS** – The word “future” and “bike-sharing” related terms were included in 149 tweets, in which 123 tweets could be clustered in 9 topics after a manual classification. Around 50% of the tweets state that BSS is included in the future of mobility (including other shared modes) versus an 11.9% stating that BSS is probably going to collapse. It is worth mentioning, that from the statements that BSS are going to collapse, around 50% specifically refer to Chinese dockless bike sharing systems.

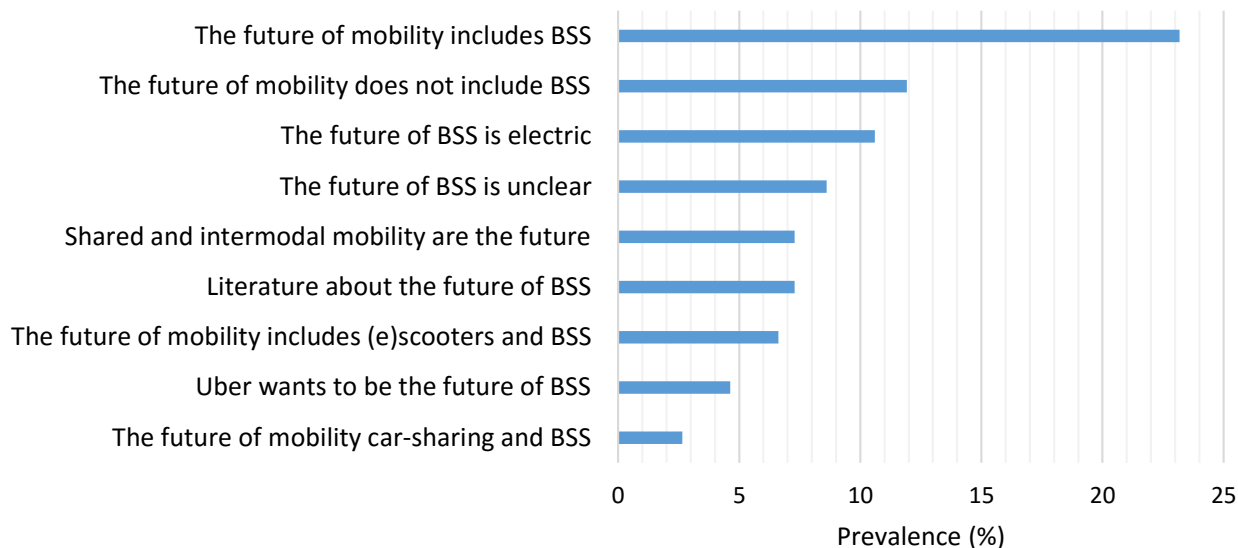


Figure 3: Topic clustering considering the BSS-related tweets classified as negative (n=142)

Conclusion

There are 2.5 times more positive original tweets including the term “bike-sharing” than negative. Users enjoy the service, however, the complaints focus on rentals and safety issues, authorities and laws, and bad performance of, especially the Chinese dockless systems. Around 50% of the tweets including the terms “future” and “bike-sharing” state that BSS are going to be part in the future of mobility in an electric version together with other shared modes. Around half statements that hesitate towards BSS being part of the future, refer to the Chinese dockless BSS.

Further research includes the comparison of tweets regarding BSS to other shared modes such as a car-sharing, scooter or ride-sharing. Also, interviews can be carried out with different people that posted about the future of BSS in order to have a deeper understanding of their opinion.

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