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What makes you tick? The psychology of social media engagement in space science communication

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ABSTRACT

The rise of social media has transformed the way the public engages with science organisations and scientists. 'Retweet', 'Like', 'Share' and 'Comment' are a few ways users engage with messages on Twitter and Facebook, two of the most popular social media platforms. Despite the availability of big data from these digital footprints, research into social media science communication is scant. This paper presents a novel empirical study into the features of engaging science-related social media messages, focusing on space science communications. It is hypothesised that these messages contain certain psycholinguistic features that are unique to the field of space science. We built a predictive model to forecast the engagement levels of social media posts. By using four feature sets (n-grams, psycholinguistics, grammar and social media), we were able to achieve prediction accuracies in the vicinity of 90% using three supervised learning algorithms (Naive Bayes, linear classifier and decision tree). We conducted the same experiments on social media messages from three other fields (politics, business and non-profit) and discovered several features that are exclusive to space science communications: anger, authenticity, hashtags, visual descriptions—be it visual perception-related words, or media elements—and a tentative tone.

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1. Introduction

Every second more than 7000 tweets are sent out on Twitter (Internet Live Stats, 2016). If the users of the popular social network website Facebook were a country, it would be the most populous country in the world, with a citizenry of 1.65 billion people (Facebook Inc., 2016). This flood of information presents new opportunities for evidence-based research into science communication (Brossard & Scheufele, 2013). Scientific data is now accessible to anyone with an internet connection, granting the public spectator status to the making of science (Jepson, 2014). Social media enables fast-paced discussions on important topics between scientists and the public (Bik & Goldstein, 2013). Audiences also actively produce and curate content, while simultaneously serving as gatekeepers to their own community by evaluating and selectively disseminating information (Sandu & Christensen, 2011, pp. 22–32).

In this paper, two studies are presented. They investigate the features of engaging space science-related social media messages using supervised learning (Study 1), and examine if these features are exclusive to the field of space science (Study 2). Our objective is to provide scientists and scientific institutions with insights into the ingredients of successful social media engagement in science communication ('What makes your audience tick?') that will ultimately help them effectively communicate their messages to the general public.

1.1. Space science and social media

Our study of social media science communication focuses on space science to allow us a more targeted approach in data collection and result interpretation. NASA's Twitter account

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commands a following of a staggering 16 million users[1]; its Facebook page has close to 16 million likes.[2] Popular astrophysicist and science communicator Neil deGrasse Tyson's personal Twitter account has more than five million followers[3] and his Facebook page has close to four million likes.[4]

Space science is intrinsically visually exciting because it unites cutting-edge technology with the visual splendour of our universe. Our brains are attuned to react to visual information (Delello & McWhorter, 2013). By making photo and video sharing an integral function, social media has become an indispensable and formidable tool for science communicators to capture the attention of their audience. In 2012, NASA landed the Curiosity rover on Mars. The accompanying social media activities generated 1.2 billion tweets, 17.4 million Facebook interactions and 36.4 million webcast streams (Pinholster & Ham, 2013). Three years later, the New Horizons spacecraft flew by Pluto. On 14 July 2015, NASA released the first ever close-up picture of Pluto's surface on its Instagram account. In the first 3 h, the image gathered more than 370,000 interactions (including shares and comments) and 142,000 likes (McCulloch, 2015); the associated Pluto Flyby messages reached 38.6 million people on Twitter and 29.9 million people on Facebook (NASA, 2015).

However, what precisely makes these messages so engaging is still poorly understood. The process and outcomes of science communication on social media have never been critically and systematically analysed (Brossard, 2013). Given the scarcity of systematic analysis into the mechanisms of social media science communication, current science communication practices are based on intuition and experiential rather than empirical evidence.

1.2. Machine learning and psychometrics

Digital traces and patterns emerging from the usage of social media platforms can be studied using sophisticated computational techniques such as machine learning to produce insights into audience behaviour (Lazer et al., 2009). Machine learning is a subdomain in computer science that focuses on constructing algorithms to analyse and learn the hidden patterns in data and make predictions based on these analyses (Bishop, 2006). By teaching machines how to learn, researchers no longer need to explicitly program computers to complete a particular task. The value of machine learning lies in its ability to uncover patterns and correlations from data sets that are large, diverse and fast changing—e.g. social media streams—and to create accurate predictive models to guide future actions (Bishop, 2006).

Retweet, like, share and comment are some of the commonest ways users engage with messages on Twitter and Facebook. Consequently, these metrics are a reflection of the interestingness or value of a post (Naveed, Gottron, Kunegis, & Alhadi, 2011). It is therefore important to know what are the ingredients of social media messages that prompt active user engagement.

Previous research has demonstrated that it is possible to use supervised learning—a type of machine learning that creates predictive models from labelled data—to predict the popularity of social media messages by using contextual (e.g. number of followers) and content-based (e.g. sentiment, URL, hashtags) features (Naveed et al., 2011; Petrovic, Osborne, & Lavrenko, 2011). The extent to which content-based features are used has mostly been limited to more 'obvious' type of features such as the presence of URLs and hashtags. However, newest advances in psychometrics have opened up a way forward for researchers to conduct more in-depth investigations of social media mechanisms using psycholinguistic features.

1.3. Aim of study

The primary aim of this paper is to examine the features of engaging space science-related social media messages and investigate in particular the possibility of using content-based features—especially psycholinguistic features—to predict these messages. A secondary aim is to investigate whether these features are unique to the field of space science. Our project was divided into two studies to achieve these aims.

1.3.1. Study 1

The first study focused on using supervised learning to study the predictive power of content-related features in foretelling the engagement potential of space science-related social media messages. We formulated the following hypothesis:

H1. The success of space science-related social media messages, defined in terms of their engagement rate, can be predicted using only content-based features.

The related research questions are:

RQ1a. Do certain content-based features exist in engaging space science-related social media posts that set them apart from less engaging posts?

RQ1b. Can the engagement level (i.e. high or low) of a space science-related social media post be predicted?

1.3.2. Study 2

To investigate if there are any particular content-based features that are unique to space science, the same procedures were applied to data from three other fields: politics, business and non-profit. Results were compared with findings from Study 1 to test the following hypothesis:

H2. Engaging space science-related social media posts contain certain psycholinguistic features that are unique to space science.

The related research questions are:

RQ2a. What are the most prominent features of engaging space science-related social media posts?

RQ2b. Among the significant features of engaging space science-related social media posts, are there any features that are unique to space science?

RQ2c. Are there any similarities between the features found on different platforms, i.e. Facebook vs. Twitter?

2. Literature review

2.1. Predicting popularity and classification of social media posts

There is a large body of work that analyses and predicts resharing and reposting behaviour of social media users. Twitter is the focus of many such studies due to its popularity as a news sharing platform (Kwak, Lee, Park, & Moon, 2010). Retweet volume is influenced by many factors, one of which is an agency called 'informational value' (Rudat & Budar, 2015). Tweets with high informational value tend to receive larger number of retweets. The concept of informational value is derived and adapted from news

[1] https://twitter.com/nasa, accessed on 11 May 2016.
[2] https://www.facebook.com/NASA/, accessed on 11 May 2016.
[3] https://twitter.com/neiltyson, accessed on 11 May 2016.
[4] https://www.facebook.com/neildegrassetyson, accessed on 11 May 2016.

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