

# Sticky words: Evaluation and optimization information interactions using linguistic analysis

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## ABSTRACT

This paper describes a novel approach to systematically improve interactions with digital content based solely on its wording. Following an interdisciplinary literature review, we recognized three key attributes of words that drive successful interactions: (1) Novelty (2) Familiarity (3) Sentimentality. Based on these attributes, we developed a model to systematically improve a given content using word frequency, sentiment analysis and semantic substitution, and by employing computational linguistics and natural language processing (NLP) techniques. We conducted a pilot study ( $n=416$ ) in which the model was used to formalize evaluation and optimization of academic titles. A between-group design was used to compare responses to the original (control) and modified (treatment) titles. Results show that the modified titles had significantly higher scores for selection, user engagement and memorability. Our findings suggest that users' successful interactions with digital content is fostered by, and perhaps dependent upon, the wording being used. They also provide empirical support that engaging content can be systematically evaluated and produced. Implications and future research directions are discussed.

## KEYWORDS

Content strategy, Human-computer interaction, User experience (UX), Engagement

## INTRODUCTION

Providing users with information in a form and format that maximizes its effectiveness is a research question of critical importance. With increasing amount of digital content being published by commercial businesses, governments, healthcare organizations and private citizens, information interactions and information behavior become more complex (Toms, 2002; Wilson, 2000). User engagement (UE) is often used to describe the process of drawing favorable attention, interest and investment in an interaction between a user and a resource (O'Brien, 2016; O'Brien & Toms, 2008). Given the growing competition for users' attention and interest, it is agreed that content must engage. However, there are no clear methods or frameworks for evaluation, optimization and creation of such content (Dvir & Gafni, 2018; Gafni & Dvir, 2018).

We suggest that the phrasing of the digital content – the words being used – can impact how the information will be consumed, perceived and used. We propose a conceptual and practical framework to evaluate and improve a given content based on the identification of reliable and reusable metrics for linguistic analysis and employment of computational linguistic and NLP techniques.

Following a comprehensive literature review, we conceptualize and operationalize the process of information interaction and identify three key attributes of digital content that drive successful information interactions: (1) Familiarity - words that are known and popular, operationalized as having high frequency in popular culture (cultural relevance); (2) Novelty – words that are rare in the context of the interaction, (operationalized as having low frequency in that context); (3) Emotionality – emotive words that evoke emotional reaction, operationalized through sentiment polarity (positive, negative, or neutral).

We call these words “sticky words.” We hypothesized that when strategically placed in a given content, these words can increase the motivation to consume it, improve how it is evaluated and lead to better knowledge retention. We conducted a pilot study in which our model was used to formalize evaluation and optimization of academic titles. The pilot study was guided by the following research questions: RQ1: Can “sticky words” improve interactions with digital content? RQ2: Can such words can be systematically, or automatically, evaluated and produced?

## METHOD

A randomized between-group design was employed to observe how changes in wording (independent variable) impact information interaction and behavior (dependent variable). First, the model was used to create control and treatment groups of original and modified academic titles. Then, users' responses were recorded to observe the effect on the interaction.

We collected academic titles from the JSTOR database. We created a corpus of potential “sticky words” using the movie keyword analyzer of The Internet Movie Database (IMDB.com), which aggregates all keywords assigned to movies. These represent well-known words frequently used in popular culture. We used Term frequency–Inverse document frequency (TF-IDF) to find words with high frequency on the list of IMDB keywords (for familiarity), and with low frequency in the collection of the academic titles (for novelty). Sentiment analysis was used to categorize the words for emotional polarity (positive, negative, or neutral). We then used semantic and lexical analysis to find synonyms and make replacements of words in the

academic titles, substituting only one word at a time with a semantically equivalent “sticky word.” For example, the title “**End** of the library: Organized information and digital ubiquity” became “**Death** of library: Organized information and digital ubiquity”. We manually verify that the introduction of the new word does not alter the meaning of the text. The result is a dataset of control and treatment (modified) titles (all titles will be presented in the poster presentation).

We used Qualtrics.com to randomly present the titles and to collect responses. Participants ( $n=416$ ) were recruited using an email sent to a listserv of undergraduate students in a large research university in the U.S. After providing demographic information, each participant was randomly presented with a version of a title, either original (control) or modified (treatment). The interaction was assessed through questions relating to the different dimensions of information behavior. Specifically (a) Motivation to consume the content: Participants were asked whether they would like to read the title (b) Evaluation of the content: Participants were asked to rate the title for interest, value, readability and other factors adopted from the User Engagement Scale (UES) (O’Brien, Cairns, & Hall, 2018) (c) knowledge retention: Participants answered post-task questions to test whether they recall the information.

## RESULTS

### **RQ1: Impact of “Sticky words” on the interaction**

The effect was examined using univariate analysis of variance (ANOVA), Chi-Square and paired-samples t-tests. Results show significant difference in favor of the treatment group. The modified titles were significantly ranked higher for motivation to consume, had higher evaluation scores and higher recall rates. We observed a significant positive correlation between the treated titles and effective interactions in all dimensions. Thus, the findings indicate that “sticky words” impact information behavior and lead to a more effective interactions.

### **RQ2: Can “sticky words” be systematically identified**

While we were able to use term frequency, sentiment analysis and semantic substitution to evaluate and replace “sticky words,” we had to manually confirm that the meaning of the title did not change. The findings indicate the potential to use computational linguistics to identify factors that predict successful interactions, yet there is still a need to refine our model to achieve full automation.

## CONCLUSION

The implications of this research are twofold. First, our findings suggest that successful interactions with digital content are fostered by, and perhaps dependent upon, the wording or language being used. Second, we provide empirical support that engaging content can be evaluated and optimized systematically. We propose that computational linguistics is a useful approach for studying online information interactions and that further study can result in a broader conceptualization of content strategy and its evaluation. These empirically based insights can inform the development of digital content strategies, thereby improving the success of information interactions. Moving forward, the validity, reliability and generalizability of our model should be tested in various contexts. In future research, we propose to include additional linguistic factors and develop more sophisticated interaction measures. This research can be used as an important starting point for understanding the phenomenon of digital information interactions and behavior, the factors that promote and facilitates them, and in the development of a broad framework for systematically evaluation, optimization, and creation effective digital content.

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