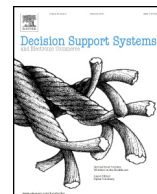




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Explaining and predicting online review helpfulness: The role of content and reviewer-related signals

Michael Siering^a, Jan Muntermann^{b,*}, Balaji Rajagopalan^c

^a Goethe University Frankfurt, Theodor-W.-Adorno-Platz 4, 60323 Frankfurt, Germany

^b University of Goettingen, Platz der Göttinger Sieben 5, 37073 Göttingen, Germany

^c Northern Illinois University, College of Business, 1425 W. Lincoln Highway, DeKalb, IL 60115, USA

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ABSTRACT

Online reviews provide information about products and services valuable for consumers in the context of purchase decision making. Online reviews also provide additional value to online retailers, as they attract consumers. Therefore, identifying the most-helpful reviews is an important task for online retailers. This research addresses the problem of predicting the helpfulness of online product reviews by developing a comprehensive research model guided by the theoretical foundations of signaling theory. Thereby, our research model posits that the reviewer of a product sends signals to potential buyers. Using a sample of Amazon.com product reviews, we test our model and observe that review content-related signals (i.e., specific review content and writing styles) and reviewer-related signals (i.e., reviewer expertise and non-anonymity) both influence review helpfulness. Furthermore, we find that the signaling environment affects the signal impact and that incentives provided to reviewers influence the signals sent. To demonstrate the practical relevance of our results, we illustrate by means of a problem-specific evaluation scenario that our model provides superior predictions of review helpfulness compared to earlier approaches. Furthermore, we provide evidence that the proposed evaluation scenario provides deeper insights than classical performance metrics. Our findings are highly relevant for online retailers seeking to reduce information overload and consumers' search costs as well as for reviewers contributing online product reviews.

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1. Introduction

Online product reviews have become increasingly important in recent years. On the one hand, consumers consider product reviews to obtain information before making their actual purchase decisions [1–3]. On the other hand, online retailers attract consumers by providing a platform that enables customers to exchange their consumption experiences [4].

Given the amount of relevant information provided by online product reviews, a large number of reviews is often beneficial for consumers. However, extensive numbers of product reviews can also create significant information overload for the reader and, hence, high search costs. These costs reduce the use and thereby the value of product reviews [5,6]. To address this problem, online retailers regularly present the most-helpful reviews first. To rank reviews based on helpfulness, several merchants offer their customers the opportunity to vote on whether they perceive a review to be helpful. While the advantage of

such an approach is that it is based on direct feedback, its limitation is that older reviews (compared to more recent reviews) receive votes over longer periods of time, and more recent reviews have a lower opportunity to gain comparable visibility. Furthermore, it is difficult to rank reviews that have not yet received any votes [5]. Consequently, a priori knowledge about which factors make a review helpful can be the key to highlighting the potential value of reviews. With such knowledge, merchants are able to estimate the helpfulness of online reviews that have not yet been assessed by any consumers. Merchants can then use this estimation to display the most-helpful reviews first.

Recent studies (e.g., [4,5,7]) provide insights into the factors explaining and predicting the helpfulness of online reviews. For example, Mudambi and Schuff [4] show that review depth, review extremity, and product type are factors explaining the helpfulness of online reviews. Other studies have investigated additional factors, such as specific emotions [6,8] or review readability [5,9].

We build upon previous research as well as signaling theory and argue that readers of online product reviews analyze signals related to the review content and signals related to the author of the review. When the reader (i.e., the recipient of the signals) receives the signals, information asymmetry related to the product is reduced, which consequently influences review helpfulness. Thereby, signaling theory

* Corresponding author.

E-mail addresses: siering@wiwi.uni-frankfurt.de (M. Siering), muntermann@wiwi.uni-goettingen.de (J. Muntermann), brajagopalan@niu.edu (B. Rajagopalan).

provides a complementary theoretical perspective on review helpfulness, as it allows modeling and exploring the relationship between different signals and review helpfulness. The development of meaningful signal categories within the social commerce context provides a conceptual basis for exploring this relationship [10]. Signaling theory also enables us to extend previous research and to hypothesize on the role of the signaling environment as well as the impact of signaler incentives. We address this research gap as previous studies do not investigate how the presence of other online reviews alters the assessment of review helpfulness and how the provision of reviewer incentives impacts review generation.

When evaluating the predictive power of models on review helpfulness, previous studies make use of classical performance metrics in the form of predictive accuracy [5] and correlations between actual and predicted helpfulness ranking [11]. Nevertheless, neither measure allows for a specific evaluation of how well the most-helpful product reviews can be identified a priori. Our work seeks to build and empirically validate a predictive model for the helpfulness of a product review using a problem-specific evaluation scenario. In this scenario, we assess the predictive performance of the model when online retailers aim at displaying the most-helpful online product reviews first.

In sum, our study builds upon prior work on review helpfulness and provides a comprehensive model to predict the helpfulness of online reviews. Our work contributes to the growing body of knowledge in this domain in the following ways: a) we build upon signaling theory and identify two categories of signals in the context of social commerce (review content-related signals and reviewer-related signals) for studying their relationship with review helpfulness, b) we propose a model to predict review helpfulness and demonstrate the value of these different signals, c) we specifically take into account the role of the signaling environment on signal impact, d) we consider the impact of signaler incentives on the signals sent, and, finally, e) we provide a problem-specific evaluation scenario in order to empirically demonstrate and compare the predictive performance of the proposed model when identifying the most-helpful reviews.

The remainder of this paper is organized as follows. In Section 2, we introduce the theoretical background, providing a basis for our research model, and we derive our research hypotheses and rationale. In Section 3 we present our methodology, including details on dataset generation, textual and statistical analysis, and our empirical evaluation approach. In Section 4, we present our empirical results, apply our novel evaluation scenario, and analyze the predictive performance of the proposed model. Finally, Section 5 concludes the paper and provides a discussion about future research directions.

2. Background and research model

2.1. Review helpfulness and signaling theory

Previous research in the field of review helpfulness builds upon to the economics of information literature and outlines that consumers pursue a purchase decision-making process that aims at reducing uncertainty related to the product. Here, it is argued that review helpfulness is “a measure of perceived value in the decision-making process” and resembles the diagnosticity of the online review related to the reduction of uncertainty [4].

Signaling theory complements this stream of previous research and provides the theoretical foundation of which parties are involved in the field of online reviews, explaining why the different online reviews are contributed and why signals have a differing impact. In this research, we draw upon signaling theory to delineate the relationship between signals conveyed by means of online product reviews and their authors. Furthermore, we build upon signaling theory to explain how these signals are valued by the reader. Extending previous research in the field of review helpfulness, signaling theory also enables us to hypothesize on

the impact of the signaling environment and the impact of signaler incentives.

In short, signaling theory proposes that signals help reduce the information asymmetry between two parties [12]. Here, signals are “in part designed to communicate” and “carry information [...] from those with more to those with less information” [12]. The origins of the theory can be found in the labor market [13]. As noted by Spence [14], signals are “activities or attributes of individuals in a market which, by design or accident, alter beliefs of or convey information to, other individuals in the market”. Signaling has largely been explored in principal agent situations where one party (agent) possesses more information than the other (principal) [15,16]. Here signals are sent by the agent to reduce the principal's information gap [13,17].

We build upon signaling theory as a theoretical lens in the field of online reviews and identify the key aspects of signaling theory – *signalers*, *signals*, *receivers*, and the *signaling environment*. We first briefly outline these key aspects and then relate them to our context of online review helpfulness, where a signaler (reviewer) sends signals to receivers (reader of the review) in a signaling environment (other online reviews) to reduce the information asymmetry related to a product. Consequently, this makes the online review connected to these signals more helpful.

At the core of signaling theory are *signalers* – individuals who generate signals. Typically, these are individuals with insider knowledge about another individual, product, or service. In our context, the insiders or signalers are the product users who have experience with the product and hence have the knowledge that potential users do not yet have access to.

Insiders who have access to private information about a product or a service can choose to divulge this information to the receiver by means of *signals*. Signaling theory distinguishes between two different types of signals, differentiated by a specific level of reliability [10,18]: *assessment signals* and *conventional signals*. *Assessment signals* require that the signaled quality is possessed and are thus perceived to be reliable. In contrast, *conventional signals* are seen as less reliable. Here, the quality signaled needs not actually be possessed. In the field of information cues displayed in the social commerce context, both assessment signals and conventional signals typically prevail [19].

Generally, a categorization of signals sent in a specific field can be regarded as a research contribution itself [20]. In the context of online reviews, we identify two general categories of signals: *review-related signals* (i.e., signals embedded in the content of a review), and *reviewer-related signals* issued by the social commerce platform. These different signals are clearly observable for users. The costs for sending review-content-related signals are lower, as the signaler can directly include them within the review. In contrast, reviewer-related signals are costlier to obtain, as they require long-term activities or verification by the social commerce platform. Generally, the provision of incentives to the signaler might influence which signals are sent. In the field of online reviews this refers to the provision of free products that have to be reviewed. Nevertheless, the specific influences of signaler incentives have been neglected so far [20].

The *receiver* of the signal is the outsider who is seeking knowledge about the product or service. A key aspect of the receiver is what the individual gains from the signal. In our context, this is straightforward. Receivers are potential users who gain critical knowledge about the product or service they are about to purchase.

Signaling theory also posits that the *environment* might have an influence on the question of how signals are processed, but this specific influence is regarded to be under-researched [20]. In the context of online reviews, further user-generated content in the form of online reviews might be available which might also influence which factors determine review helpfulness. With our study, we close these research gaps.

2.2. Research model

To identify different signal categories, we relied on previous research, which has investigated factors influencing purchase decisions.

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