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### The power of numbers

#### an examination of the relationship between numerical cues in online review comments and perceived review helpfulness

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# **The Power of Numbers: An Examination of the Relationship between Numerical Cues in Online Review Comments and Perceived Review Helpfulness**

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# **The Power of Numbers: An Examination of the Relationship between Numerical Cues in Online Review Comments and Perceived Review Helpfulness**

## **Abstract**

**Purpose** – The purpose of this study is to empirically examine the effects of the numerical cues used in online review comments on perceived review helpfulness and the underlying psychological mechanisms.

**Design/methodology/approach** – An experimental design approach was employed to investigate the proposed research questions. Two experiments were conducted to test the hypotheses. Mplus 7 and Stata 14.0 were used for data analysis.

**Findings** – Empirical findings support the positive correlation between the presence of numerical cues in online review comments and perceived review helpfulness across different product categories. This relationship is mediated by two psychological responses of consumers: cognitive elaboration and credibility perception.

**Research limitations/implications** – This research adds to the existing literature by focusing on the value of numerical cues in online review comments and how they can enhance perceived review helpfulness. Some practical implications are also addressed. For example, marketers can encourage consumers to post reviews that contain quantitative information to facilitate their target markets' comprehension of a product or brand.

**Originality/value** – Building on the previous literature, the work adds incremental knowledge on the role numerical cues in online review comments play in affecting consumers' perceptions. In addition, the research uncovers the underlying psychological responses that mediate the relationship between numerical cues in review comments and perceived review helpfulness.

**Keywords** Online review comments, Numerical cues, Perceived review helpfulness, Cognitive elaboration, Credibility perception

**Paper type:** Research paper

## 1. Introduction

Interactivity has become an indispensable part of present-day marketing practice (Wang, 2021). With the facilitation of technology, consumers can now interact with each other via user-generated content like online reviews (Jiang et al., 2021; Wang, 2021). Despite the benefits, the exponential increase in interactive content has presented consumers with a new challenge—information overload (Baek et al., 2012, 2015). As a consequence, consumers often have to spend a large amount of time to search, browse and process numerous reviews before they are able to obtain helpful and useful information. One solution has been for websites to allow consumers to decide upon review helpfulness, with the subsequent voting results displayed for other consumers to use as a reference (Filiari et al., 2018; Lopez and Garza, 2021).

As revealed by the extant literature, qualitative characteristics (e.g., argument quality, extremity and language style) as well as quantitative characteristics (e.g., ratings, review volume and review length) of reviews are of great value in determining review helpfulness (Huang et al., 2015; Agnihotri and Bhattacharya, 2016; Singh et al., 2017; Filiari et al., 2018; Nettelhorst et al., 2020). However, one important type of quantitative information, namely numerical information found in qualitative user-generated content (i.e., review comments), often used by reviewers to describe product attributes and user experience, remains under-researched. Such research gap limits the understanding of the impact online reviews can make in the consumer value exchange process (Wang, 2021).

The current research refers to numerical cues in online review comments as quantitative information found in qualitative review narratives generated by consumers via online platforms. For instance, the number “12” found in the online review comment “the battery of this cell phone can last up to 12 hours” can be considered as one such cue. The extant literature suggests that numbers are efficient in eliciting more precise, persuasive and unequivocal meanings and implications (Daft et al., 1987; Li et al., 2013; Schultze and Loschelder, 2021). As a result, consumers will likely perceive review comments supported with numerical cues to be more helpful than those that are purely qualitative. To that end, the goal of this research is to empirically explore whether and how the numerical cues used in review comments impact consumer decision-making by answering the following research questions:

- ◆ Do numerical cues in review comments have a positive effect on perceived review helpfulness?
- ◆ If so, what are the psychological mechanisms behind this relationship?

This research can be enlightened by the Stimulus-Organism-Response model (or S-O-R model), which proposes that environmental stimuli (S) affect the internal emotional states of an individual (O), which then influences their behavioral responses (R) (Mehrabian and Russell, 1974). In essence, numerical cues in online review comments (S) can evoke readers’ psychological responses (O), and in turn, affect review helpfulness perceptions (R). Based on previous research, the current research proposes that cognitive elaboration (Metzger, 2007; Doh and Hwang, 2009; Wadhwa and Zhang, 2015; Graham and Wilder, 2020) and credibility perception (Cheng and Ho, 2015; Kim et al., 2020; Al-Emadi and Ben Yahia, 2020; Muda and Hamzah, 2021) are the two central psychological responses consumers experience when reading online review comments with numerical cues. Hence, this research builds upon the theoretical ground that numerical cues in review comments enhance perceived review helpfulness through the aforementioned psychological mechanisms.

This research makes several contributions. First, it strengthens the understanding of numbers' role in interactive marketing content. This study argues that numerical cues in online review comments are more effective in shaping consumers' perceptions regarding review helpfulness. It contributes to interactive marketing research by broadening the academic understanding of numbers used in qualitative customer feedback aimed at facilitating customer engagement and informational exchange (Wang, 2021).

Second, the work reveals the psychological mechanisms underlying the relationship between numerical cues in online review comments and perceived review helpfulness. Such findings help marketing academics and practitioners better understand the impact of user-generated content (e.g., online review comments) and how quantitative information found in such content may enhance its value (Wang, 2021)

## **2. Literature Review**

### *2.1. Studies on perceived review helpfulness*

Extant research on online review helpfulness primarily focuses on uncovering the driving factors of consumer helpfulness perceptions. For instance, Filieri et al. (2018) found that information quality, customer ratings and overall product rankings play an important role in determining consumer decision-making. Huang et al. (2015) concluded that word count has a threshold on its impact on review helpfulness, past helpfulness records are helpful in predicting future helpfulness ratings, and reviewer characteristics and/or review message characteristics have varying degrees of impact on review helpfulness. Similarly, Zhu and Zhang (2010) concluded that lengthy descriptive reviews that contain moderate ratings are perceived as more helpful when all previous reviews have been posted recently. The study also found that evaluative reviews with extreme ratings are perceived as more helpful when previous reviews demonstrate greater discrepancies (Zhu and Zhang, 2010).

Previous studies on review helpfulness share some commonalities. First, review source characteristics (e.g., trustworthiness and expertise) and qualitative characteristics (e.g., review quality, review extremity, objectivity and linguistic elements) are widely examined (e.g., Mudambi and Schuff, 2010; Weathers et al., 2015). Furthermore, quantitative measures used to reveal opinion-based metrics, such as ratings and overall rankings, are also found to be related to perceived review helpfulness (e.g., Wu, 2013). However, such close-ended metrics are designed by online review platforms to help consumers more easily quantify their attitudes toward a product (i.e., to what extent they like a product).

Research on how numerical information in open-ended qualitative review content can affect consumers' perceptions of review helpfulness remains scarce. For instance, an overall rating of an iPhone 8 (e.g., 5 stars out of 5) by one consumer shows their attitude toward this product based on subjective evaluation. However, quantitative information associated with a particular feature of an iPhone 8 (e.g., battery lasts for 13.5 hours), revealed by review comments left by a customer, unfold more objective information that pertains to an attribute of the product. In this vein, our research aims at uncovering the role of numerical cues in the latter context.

### *2.2. Studies on numbers*

Numbers exist in various forms in online reviews and play important roles (Sridhar and Srinivasan, 2012; Koçaş and Dogerlioglu-Demir, 2020). Numbers used to indicate review

volume and ratings are very important review information. Ratings (or star ratings) represent review valence. The system of numerical assessment of a product by consumers is typically based on a numeric scale designed by each website, usually on a one (bad) to five (good) scale (Tirunillai and Tellis, 2012; Mudambi and Schuff, 2010).

In a review system incorporating both text and ratings, consumers can post qualitative feedback and numerical ratings at the same time. Numerical ratings have been widely studied by the extant literature. For instance, Zhu and Zhang (2010) showed the differential effects of ratings on products with different popularity and on consumers with different levels of Internet experience. Baek et al. (2012) found that consumers tend to consider a review helpful when its rating is close to the average rating of a product, thereby demonstrating the effect of normative social influence. However, in a study by Eslami and Ghasemaghaei (2018) that investigated the relationship between ratings and product quality, researchers found that the average rating was not a very good indicator of the product's objective quality because of the subjective emotions involved when the ratings were given. From the perspective of cultural influences, Koh et al. (2010) also drew a similar conclusion that consumers with extreme opinions are more likely to report their opinions than consumers with moderate opinion. This indicates that online ratings may be a biased estimator of a product's true quality.

The extant studies indicated the importance of numbers not only to consumers in general, but also to readers of online review comments specifically. Main literature on antecedents of perceived review helpfulness is presented in the Appendix (Supplemental Table 1). These research efforts focus mainly on investigating numerical cues in the form of ratings and review volume. As aforementioned, the current research focuses on examining the relationship between numerical cues in review comments and consumers' perceived review helpfulness, as well as the underlying psychological mechanisms. By filling this research gap, the current study points to a new direction regarding the role numbers can play in enhancing the value of interactive marketing content.

### **3. Theoretical Background and Hypotheses Development**

#### *3.1. Effect of numerical cues on perceived review helpfulness*

Numbers are capable of expressing more precise and unequivocal meanings and implications (Daft et al., 1987; M. Li et al., 2013) while text can give more fluid, elaborate and vivid evaluations that can convey in-depth messages about a product or service experience (Chevalier and Mayzlin, 2006). However, numbers can be processed at a surface level, making it faster and easier to recognize compared with equivalent verbal information (Schindler et al., 2006). Such differences may be because the processing of text requires the input of time, energy and cognition; whereas the processing of numbers can happen more promptly due to its simplicity, intuitiveness and easy-to-process nature.

According to the cue-summation theory, the effect of information becomes greater as the number of available cues or stimuli increases (Severin, 1967). Therefore, numerical cues, in combination with text in review comments, can potentially make a message clearer, more salient and eye-catching. The combination should also be capable of expressing both subjective, subtle feelings and precise, unambiguous meanings (Daft et al., 1987). In summary, the value of numerical cues in review comments is derived from enhanced information quality (Racherla et al., 2012), reduced information equivocality (Lim and Benbasat, 2000), improved

comprehensibility, (Li and Zhan, 2011) and intensified information perception and memory (Daft et al., 1987). As a result, we hypothesize that:

*H1: Numerical cues in review comments have a positive effect on consumers' perceived review helpfulness.*

### *3.2. The mediating role of consumers' psychological responses*

Review helpfulness is a perceived characteristic, implying that it is not just a consequence of review-related factors per se but also a byproduct of consumers' subjective evaluations of relevant review content (Cao et al., 2011; Baek et al., 2012; Agnihotri and Bhattacharya, 2016; Filieri et al., 2018). In turn, consumers' psychological processes most likely play a role in the relationship between numerical cues in review comments and perceived review helpfulness. From an environmental psychology perspective and in particular from the standpoint of the S-O-R model (Mehrabian and Russell, 1974), consumers' psychological responses (O) to numerical cues in review comments (S) can play a mediating role on the relationship between such numerical cues and perceived review helpfulness (R). Based on the literature, consumers' cognitive elaboration and credibility perception are two key psychological responses in relation to the quantitative characteristics of online reviews and have great potential to predict consumers' reactions concerning review helpfulness (Li and Zhan, 2011; Baek et al., 2012; Cheng and Ho, 2015; Mudambi and Schuff, 2010; Weathers et al., 2015).

Concerning cognitive elaboration, numbers can encourage consumers' reliance on cognition (Wadhwa and Zhang, 2015). For example, review comments with numerical cues, compared with those that consist of text only, can prompt readers to stimulate more cognitive activities regarding product attributes, benefits and/or risks based on others' evaluations. More cognitive processing of such information helps improve an information recipient's factual understanding of a product, as well as the ways in which knowledge is organized (Alba and Hutchinson, 1987; King and Janiszewski, 2011). As a consequence, a consumer's cognitive elaboration of the product information can be enhanced (Doh and Hwang, 2009), which is both useful and helpful for decision-making. Furthermore, numerical cues often serve as a heuristic for decision-making, thus such cues may help shorten consumers' cognitive processing time (Pelham et al., 1994). Hence, consumers should consider review comments with numerical cues more helpful than those with text only given such review content stimulates their cognitive elaboration (Jerez-Fernandez et al., 2014). The following is hypothesized as a result:

*H2: Numerical cues in review comments have a positive effect on perceived helpfulness by stimulating reader's cognitive elaboration.*

Toulmin's model of argumentation posits that an assertion, data and explanative backing make a credible and persuasive argument (Toulmin, 1958). In this model, data, in the form of numbers, are evidence to support the assertion and therefore are very important for establishing the credibility of information (Kim and Benbasat, 2006; Racherla et al., 2012). Recent literature has highlighted the importance of consumers' credibility perception toward review comments and its effect on perceived review helpfulness. For instance, Kim et al. (2020) found that reviewers prefer to upload a profile photo to improve the credibility of their reviews. Lopez and Garza (2021) discovered that sensory reviews are less likely to be helpful than non-sensory reviews. Muda and Hamzah (2021) investigated the effect of the source credibility of voluntary



user-generated content on consumers' attitude, purchase intention and electronic word-of-mouth. Shen (2021) studied the influence of source credibility on information adoption.

The relationship between numbers and information credibility has also been affirmed by many studies (Racherla et al., 2012; Schindler et al., 2006). Such affirmation can be attributed to the fact that numbers are persuasive for their verifiability and factuality and thereby can decrease information equivocality (Lo and Yao, 2019). In this respect, review comments with numerical cues are more likely to be perceived as credible by consumers relative to those that contain text only. As review credibility is a critical antecedent to perceived review helpfulness and a driver of information adoption, as being demonstrated in many prior studies (Shen, 2021; Baek et al., 2012; Cheng and Ho, 2015; Li and Zhan, 2011), we postulate that:

*H3*: Numerical cues in review comments have a positive effect on perceived review helpfulness by stimulating reader's credibility perception.

## 4. Methodology and Results

### 4.1. Study 1

This research employs an experimental design approach. The objective of Study 1 is to test H1, which posits that numerical cues in review comments can positively impact perceived helpfulness.

**Stimuli.** Cell phone was chosen as the experimental product given it is frequently purchased online and abundant online review content can be found on cell phones. Based on some field reviews, four review comments were prepared: (1) a positive review without numerical cues; (2) a positive review with numerical cues; (3) a negative review without numerical cues; and (4) a negative review with numerical cues. Other than the difference in valence (e.g., good vs. bad and high quality vs. low quality) or in numerical cue presence (with numbers vs. without numbers), these reviews are otherwise very similar (e.g., length, wording, linguistic characteristics, emotional intensity and product properties covered), as shown in the Appendix (Supplementary Table 2). Through this setup, all other plausible drivers of review helpfulness perceptions are ruled out.

**Pretest.** In order to test for the existence of negativity bias, a pretest was conducted prior to the formal experiment. 46 students from the business school of a comprehensive university in Eastern China were invited to rate the helpfulness of two review comments put side-by-side: the positive review comment without numerical cues and the negative review comment without numerical cues. Although similar designs in prior studies found no position effect (Schindler et al., 2006), one of the two review comments was still placed on the left side half of the time and on the right side the other half of the time to eliminate any potential biases. Scale adopted from (Wu, 2013) ( $\alpha = 0.92$ ) was used to measure perceived review helpfulness. The results showed a significant negativity bias. When everything else was equal, the perceived helpfulness of the negative review was higher than that of the positive review ( $M_{\text{negative}} = 3.971$  vs.  $M_{\text{positive}} = 3.493$ ,  $t [44] = 1.840$ ,  $p < 0.05$ ).

**Design.** Pairwise comparisons were conducted to test whether reviews with numerical cues in comments are perceived to be more helpful than those without numerical cues when everything else is equal (identical in valence); and when there are additional differences (opposite in valence). Three conditions were thereby designed to compare the perceived

helpfulness of the two reviews. The first two conditions were designed to meet the first determination of this experiment. Two reviews, which are identical in valence but different in the inclusion of numerical cues (with numerical cues vs. without numerical cues), are compared in perceived helpfulness. The third condition was designed to meet the second determination. Two reviews, which are opposite in valence and different in the inclusion numerical cues (with numerical cues vs. without numerical cues), are compared. In order to facilitate comparison in each scenario, two reviews were displayed side-by-side. Like the Pretest, one of the two reviews was placed on the left side half of the time and the other was placed on the right side the other half of the time. 180 university students were recruited using a campus advertisement and they were given 10 CNY for their participation. All of them had the habit of reading online reviews for online purchases and reported at least one online shopping experience during the past three months.

**Procedure and measures.** In a simulated shopping environment, participants were assigned to three conditions randomly. They were asked to imagine shopping for a cell phone online. In order to rule out the potential effects of brand and product design, we did not provide them with brand names or product pictures. Then we showed them a pair of reviews for a cell phone, which were different across the three scenarios described previously. After reading the two reviews, participants were required to respond to items from the helpfulness scale, which was the same as the one used in the Pretest.

**Results.** An AVOVA test yielded a significant effect of the numerical cues on perceived review helpfulness not only when everything else was equal, but also when differences existed. As Table 1 shows, in the first two scenarios, perceived helpfulness of the negative review with numerical cues (NC) was significantly higher than perceived helpfulness of the negative review without numerical cues ( $M_{\text{negative with NC}} = 4.38$  vs.  $M_{\text{negative without NC}} = 3.32$ ,  $t[76] = 6.415$ ,  $p < 0.001$ ), and perceived helpfulness of the positive review with numerical cues was also significantly higher than that of the positive review without numerical cues ( $M_{\text{positive with NC}} = 4.20$  vs.  $M_{\text{positive without NC}} = 2.80$ ,  $t[62] = 6.826$ ,  $p < 0.001$ ). These results support H1.

In addition, in spite of the existence of negativity bias, the results suggested that this bias became insignificant when numerical cues were added in the positive review in the third scenario. Although a negative review is usually perceived as being more helpful than a positive one when neither of them have numerical cues, the perceived helpfulness of the positive review increased so significantly after numbers were included that it even slightly exceeded the perceived helpfulness of the negative review ( $M_{\text{positive with NC}} = 3.75$  vs.  $M_{\text{negative without NC}} = 3.43$ ,  $t[92] = 1.716$ ,  $p < 0.05$ ). This further supports the prediction that numerical cues in comments make reviews more helpful from consumers perspective.

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INSERT TABLE 1 ABOUT HERE  
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**Discussion.** By manipulating review content and valence, Study 1 concludes that the reviews with numerical cues are perceived to be more helpful than those without numerical cues regardless of valence. Interestingly, positive review comments with numerical cues were

found to be more helpful than negative review comments without numerical cues. The results indicate that numerical cues in review comments can influence the effect of review valence on perceived review helpfulness. In this regard, the findings support our prediction that numerical cues enhance the perceived helpfulness of online reviews.

#### 4.2. Study 2

The purposes of Study 2 are to (1) extend the generalizability of Study 1 findings by testing the relationship between numerical cues in review comments and perceived helpfulness using a different product type; and (2) investigate the underlying mechanisms of the relationship between numerical cues in review comments and perceived review helpfulness.

**Stimuli.** In this study, shower gel was chosen as the experimental product given that it is considered as a hedonic product, in contrast to cell phone being considered as a utilitarian product (Sen and Lerman, 2007; Mudambi and Schuff, 2010; Melnyk et al., 2012; Singh et al., 2017). Furthermore, just like a cell phone, shower gel is also a frequently purchased product with many reviews available online. Similar to Study 1, two review comments for shower gel were designed (shown in the Appendix, Supplementary Table 3). Both of them were very similar in length, quality, wording, emotional intensity and product attributes covered. Hence, the only difference between them is the presence/absence of numerical cues.

**Design.** Like Study 1, the hypothesis was tested by conducting pairwise comparisons. The review comments with numerical cues were compared with the ones without numerical cues in terms of their effect on perceived helpfulness. Further, the underlying psychological mechanisms were tested. The difference in design of this study from Study 1 was that the two reviews used for comparison were not placed side-by-side, but in an up-and-down arrangement. Although prior research reported no significant effect of order in such design (Naylor et al., 2012), in order to eliminate the potential sequence bias, a counterbalanced order was adopted by exhibiting the two reviews in the order of AB half of the time and BA the other half of the time. Thus, two conditions were created in this experiment.

**Procedure and measures.** In this experiment, data was collected through an online information service website ([www.sojump.com](http://www.sojump.com)). On this website, many respondents voluntarily take part in online surveys for a small compensation. This sampling method allowed us to overcome the shortcomings of the student sample (Fischer et al., 2010). Another advantage of this website is that it offered customized services allowing us to randomize different scenarios so that participants could be assigned to two conditions automatically and randomly. After posting the experiment stimuli, 244 participants took part in the entire procedure. Their demographic profiles are provided in the Appendix (Supplementary Table 4).

Participants were firstly briefed about this experiment. They were required to imagine shopping for shower gel online. Then after reading two specific review comments, they filled out five-point Likert scales on perceived review helpfulness, cognitive elaboration and review credibility for the two reviews. The scale on review helpfulness was the same as used in Study 1. The scale on cognitive elaboration was adopted from Thompson and Hamilton (2006). The scale on review credibility perception was from Cheung et al. (2012).

**Results.** Mplus 7 and Stata 12.0 were used for data analysis. As Table 2 shows, all Cronbach's alpha values were above 0.75, indicating that the scales have high reliability (Nunnally, 1978). Convergent validity was demonstrated as each factor loading of all items was above 0.58 and the average variance extracted (AVE) for every construct was greater than

0.5 (Fornell and Larcker, 1981). Table 3 shows confirmatory factor analysis results support discriminate validity for a three-factor construct (Podsakoff et al., 2003).

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INSERT TABLES 2 and 3 ABOUT HERE

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A stepwise regression model was applied to test the predictions. First of all, no significant effect was found regarding the control variables (i.e., gender, age and education) on perceived helpfulness, cognitive elaboration or credibility perception (as shown in Table 4). These findings revealed that demographics do not affect the processing of numerical cues in review comments.

In Model 1, the coefficient of numerical cues on perceived review helpfulness was 0.209 ( $p < 0.001$ ), which indicated a significant effect of numerical cues on perceived review helpfulness. However,  $R^2$  was rather small (0.028), indicating that numerical cues alone could not fully explain the variance in review helpfulness. In Model 2, cognitive elaboration was included in the model. The results showed that cognitive elaboration had a positive effect on helpfulness ( $\beta = 0.527, p < 0.001$ ) while the positive effect of numerical cues was still significant despite that the p-value and coefficient decreased ( $\beta = 0.108, p < 0.05$ ). The increase in  $R^2$  ( $\Delta R^2 = 0.311$ ) showed a better fitting effect in this model. In Model 3, credibility perception exhibited a significant effect on perceived helpfulness ( $\beta = 0.666, p < 0.001$ ) with an increase in  $R^2$  ( $\Delta R^2 = 0.440$ ). At the same time, the coefficient of numerical cues and p-value decreased ( $\beta = 0.105, p < 0.05$ ). Both Model 2 and Model 3 indicated a possible partial mediating effect. When cognitive elaboration and credibility perception were introduced into Model 4 together, both of them predicted perceived helpfulness ( $\beta = 0.246$  and  $0.514, p < 0.001$ ) with an even larger increase in  $R^2$  ( $\Delta R^2 = 0.485$ ).

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INSERT TABLE 4 ABOUT HERE

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Sobel-Goodman model was used to test the mediation effect (MacKinnon et al., 2002). As Table 5 indicates, in the first route (numerical cues  $\rightarrow$  cognitive elaboration  $\rightarrow$  helpfulness), coefficient A (the regression coefficient of numerical cues on cognitive elaboration) and coefficient B (the regression coefficient of cognitive elaboration on helpfulness) were both significant. Additionally, the direct effect (0.110,  $p < 0.05$ ) and the indirect effect (0.099,  $p < 0.01$ ) were both significant, indicating the existence of partial mediation of cognitive elaboration between numerical cues and review helpfulness. In the second route (numerical cues  $\rightarrow$  credibility perception  $\rightarrow$  helpfulness), coefficient A (the regression coefficient of numerical cues on credibility perception) and coefficient B (the regression coefficient of credibility perception on helpfulness) were both significant. We can also see that the direct effect (0.105,  $p < 0.05$ ) and the indirect effect (0.104,  $p < 0.01$ ) were both significant, implying that there was also a partial mediation effect in the relationship between numerical cues and perceived review helpfulness. H2 and H3 are both supported.

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INSERT TABLE 5 ABOUT HERE  
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**Discussion.** Study 2 explores the effect of numerical cues on perceived review helpfulness and its underlying psychological mechanisms using a different product type. The findings extend the conclusion of Study 1 in that the positive effect of numerical cues on perceived review helpfulness applies not only to a utilitarian product, but also to a hedonic product. Furthermore, it is found that numerical cues stimulate consumers' psychological responses (cognitive elaboration and credibility perception), which in turn promote the perception of review helpfulness.

## **5. General Discussion**

### *5.1. Summary*

Review helpfulness perceived by readers is an embodiment of the value of review information and therefore a focal point for consumers, researchers and marketers. Unlike much of the extant research on quantitative measures in online reviews that have focused on understanding how metrics such as close-ended ratings scales can impact consumers' perceived review helpfulness (e.g., Filieri, 2015; Kwok and Xie, 2016; Park and Nicolau, 2015), this research examines the impact of numerical information used in open-ended review comments, which often helps illustrate claims that relate to product attributes and/or service quality (Kwok and Xie, 2016; Li and Zhan, 2011; Saumya et al., 2018).

By focusing on different product categories and manipulating different levels of review valence in two studies, the current research finds that numerical cues in review comments impact perceived review helpfulness positively and significantly. Additionally, numerical cues in review comments are powerful enough to attenuate negativity bias by diminishing or amplifying the helpfulness perceptions of the negative versus positive reviews (Sen and Lerman, 2007; Wu, 2013), granted that the positive review comments contain numerical cues and the negative ones don't.

Further, this research investigates the underlying mechanisms based on consumers' psychological responses. Results show that the effect of numerical cues in review comments on perceived review helpfulness can be attributed to cognitive elaboration and credibility perception. These findings demonstrate the value of numerical cues in review comments and indicate that both review characteristics and consumer characteristics should be taken into consideration (Mudambi and Schuff, 2010; Weathers et al., 2015; Soylemez, 2021) when exploring antecedents to perceived review helpfulness.

### *5.2. Implications*

The research provides several theoretical implications for interactive marketing research. First, this study extends the extant research into a new realm by uncovering on the value of numerical cues in review comments and how they can facilitate perceived review helpfulness. As online review comments are user-generated content aimed at stimulating consumer interaction and information exchange (Wang, 2021), the findings of our research enrich the understanding of interactive marketing content. The results not only revealed a new antecedent

to perceived review helpfulness based on prior theoretical underpinnings in the areas of review helpfulness and numerical cues, but also went further in explaining the inconsistent findings in prior literature on negativity bias (Sen and Lerman, 2007; Wu, 2013).

Second, this research uncovers consumers' psychological responses to numerical cues in review comments. From the perspective of environmental psychology (Mehrabian and Russell, 1974), S-O-R model is used to explain how numerical cues in review comments evoke consumers' psychological responses, and in turn, enhance perceived review helpfulness as a reaction to the stimuli. With this respect, the research provides further theoretical and empirical support regarding the underlying mechanisms behind the relationship between numerical cues in review comments and perceived review helpfulness. In essence, cognitive elaboration and credibility perception can effectively explain how consumers respond to environmental stimuli and behave subsequently. As the environmental stimuli in our study are user-generated numerical cues in review comments, our research further contributes to interactive marketing by deconstructing the inner processes readers go through when they attempt to gain value from online review comments (Wang, 2021).

Third, by using experimental methods, strong causal support is provided to the theoretical foundation regarding the relationship between numerical cues in review comments and perceived review helpfulness, and complement extant studies in the area of review helpfulness. Previous studies have argued that review length, valence, and ratings are significantly related to review helpfulness (Huang et al., 2015; Koçaş and Dogerlioglu-Demir, 2020; Sridhar and Srinivasan, 2012). However, the effects of such factors on review helpfulness may interactively influence each other, leading to mixed results. Though experimental methodology, the effect of numerical cues in review comments was tested while other plausible factors are controlled. The results demonstrate that numerical cues have a positive effect on review helpfulness regardless of review valence.

This research also has managerial implications for marketing practice. In the era of electronic commerce, how to search for useful and helpful information among a multitude of reviews is important to consumers and marketers. For example, owners of online shops should pay more attention to the review comments that include concrete numerical information. Customer service staff would be able to better address customer concerns if they can identify specific numerical information provided in the review comments that reflect satisfaction and/or dissatisfaction. On the other hand, they will be able to gather more precise information related to customer perceptions on product attributes and user experiences, which in turn can help the marketing team to better improve the products and services.

Because numerical cues in review comments lead to enhanced review helpfulness by stimulating readers' cognitive elaboration and credibility perception, marketers can encourage consumers to post reviews that contain quantitative information to facilitate their target markets' comprehension of a product or brand and to build trust. Further, marketers are advised to search for numerical cues in review comments to better deconstruct consumer demands and preferences. Such information can be used as a basis for product improvement and innovation. This is especially useful when the review comments containing numerical cues are voted as highly helpful by consumers. In sum, the numerical cues in review comments are of great importance in the practice of interactive marketing, and the value of such cues need to be utilized by both consumers and marketers.

### *5.3. Limitations and future research*

This research is not without limitations. Firstly, we adopted a controlled experiment approach instead of a field experiment approach, which helped to ensure internal validity but not external validity. Due to the prevalence of online reviews, future researchers may expand the results by employing field data in online websites. Secondly, we only explored the mediating role of two psychological responses in the relationship between numerical cues in review comments and perceived review helpfulness. It can be expected that other factors, including contextual or temporal ones, may affect the value of numerical cues and play a role in this relationship. This could also be an interesting and meaningful direction for future researchers to pursue further.

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**Table 1. Means and Standard Deviations for Study 1**

Measure	Positive		Negative		Mixed valence	
	With Numbers	Without Numbers	With Numbers	Without Numbers	Positive with Numbers	Negative without Numbers
Perceived Helpfulness	4.20 (0.79)	2.80 (0.70)	4.38 (0.65)	3.32 (0.78)	3.75 (0.84)	3.43 (0.95)

**Table 2. Reliability and Validity (Study 2)**

<b>variables</b>	<b>Items</b>	<b>Factor loading</b>	<b>Cronbach's <math>\alpha</math></b>	<b>AVE</b>
Perceived review helpfulness	1. This review is informative.	0.588	0.750	0.521
	2. This review is useful to me.	0.782		
	3. This review is helpful to me.	0.779		
Cognitive elaboration	4. I was thinking to a large extent about the product's features.	0.766	0.782	0.549
	5. I evaluated the product feature by feature rather than evaluating the product as a whole.	0.764		
	6. I was highly involved.	0.690		
Credibility perception	7. I think this review is believable.	0.598	0.802	0.516
	8. I think this review is factual.	0.708		
	9. I think this review is accurate.	0.759		
	10. I think this review is credible.	0.792		

**Table 3. Results of Confirmatory Factor Analyses (Study 2)**

Model	$\chi^2$	df	$\chi^2/df$	CFI	TLI	RMSEA	SRMR
One-factor model	180.597*	35	5.160	0.898	0.869	0.092	0.051
Two-factor model	150.226*	34	4.418	0.919	0.893	0.084	0.048
Three-factor model	68.697*	32	2.147	0.974	0.964	0.048	0.030



**Table 4. Results of Stepwise Regression Analysis**

	Model 1	Model 2	Model 3	Model 4
Numerical cues	0.209***	0.108*	0.105*	0.081
Cognitive elaboration		0.527***		0.246***
Credibility perception			0.666***	0.514***
Gender	-0.045	-0.090	-0.003	-0.033
Age	-0.031	0.056	0.018	0.047
Education	-0.015	-0.038	-0.027	-0.035
Constant Term	4.215***	2.103***	1.530***	1.155***
$R^2$	0.028	0.339	0.468	0.513
$\Delta R^2$	-	0.311	0.440	0.485
$F$	3.42**	30.57***	34.60***	34.93***

Note: Model estimation using OLS estimation, Robust standard deviation; N=488; dependent variable is perceived review helpfulness;

\* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.001$

**Table 5. Mediation Test based on Sobel-Goodman Model**

Predictions	A	B	Direct effect	Indirect effect	Total effect
Numerical cues→cognitive elaboration→helpfulness	0.193**	0.513***	0.110*	0.099**	0.209***
Numerical cues→credibility perception→helpfulness	0.157**	0.664***	0.105*	0.104**	0.209***