A comparison of implicit and explicit error detection and their
effects on purchase intention and judgments of quality

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A COMPARISON OF IMPLICIT AND EXPLICIT ERROR DETECTION AND THEIR
EFFECTS ON PURCHASE INTENTION AND JUDGMENTS OF QUALITY

by

Rachel B. Fernandes

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Abstract

In an online study of purchase intent based on Chinese menu inspection, explicitly noticing grammatical errors by hotspot click was more detrimental to judgments of quality than implicit detection by error estimation. When they estimated errors in a survey question (ordinal measure), participants who reported many (more than nine) errors had lower purchase intent and ratings of quality compared to those with few (about six) or no errors. However, with the more novel, continuous measure based on hotspot detection, participant purchase intent did not decrease as the number of errors noticed increased. Importantly, there were no differences between the hotspot and no hot spot conditions on any of the variables of interest. Surprisingly throughout, detection of more errors was associated with lower self-ratings of xenophobia. Despite having similar levels of hotspot accuracy and efficiency, people with high xenophobia were more biased against reporting errors (i.e., they responded conservatively) than people with low xenophobia. High xenophobia was unrelated to quality and yet those with high xenophobia had significantly lower purchase intent. In summary, method of error detection did not alter results and many errors impacted measures of quality. People with high xenophobia tend not to notice errors but choose not to support a Chinese restaurant, irrespective of perceptions of quality.

Keywords: error detection, purchase intention, judgments of quality, xenophobia
A Comparison of Implicit and Explicit Error Detection and Their Effects on Purchase Intention and Judgments of Quality

When presented with a text, several factors can influence the reader’s judgments about the quality of a text. On the surface, grammatical errors in a message might seem like a minor issue, necessitating that the reader take a bit longer to infer its meaning than it would normally take, but not affecting the transmission of the message beyond that. However, while they might seem like surface errors, the influence of these errors can go beyond increasing the amount of time or effort needed to understand a text. The presence of grammatical errors can result in negative perceptions about text quality (Figueroedo & Varnhagen, 2005; Johnson et al., 2017). Additionally, these errors can affect the reader’s perception of the author’s abilities, causing the reader to assume that the author is less intelligent and even less trustworthy (Vignovic & Thompson, 2010).

Despite substantial evidence that the presence of grammatical errors can influence individuals’ perceptions of a text and its author, little is known about whether these errors affect people’s behavior in response to reading the text. Previous research has found that grammatical errors in text can influence participants’ ratings of behavior such as dating intention (Van der Zanden et al., 2020), hiring choices (Martin-Lacroux, 2017; Martin-Lacroux & Lacroux, 2017), and intentions to purchase from a business (Stiff, 2012; Mozafari et al., 2019). Although more recent research has begun to focus on the effect of errors on behaviors, there is still a paucity of literature investigating how these errors affect purchase intentions. The present study aims to address this issue by examining how errors on a Chinese restaurant menu affect an individual’s intent to purchase food from the restaurant and their perceptions of the restaurant’s quality.
Moreover, the majority of research involving the presence of errors has focused on implicit rather than explicit error detection. While implicit error detection relies on exposing participants to a text containing errors without telling them about errors being present, explicit error detection involves presenting participants with error laden text, informing them about the possible presence of errors, and asking them to identify any errors they find. Implicit error detection does not rely on the conscious detection of errors. Recent research (Mozafari et al., 2019; Planken et al., 2019) has reported that implicit and explicit methods of error detection might differ in their ability to influence readers’ perceptions. To investigate this further, we employ several different error detection methods in the present study and contrast their results.

We motivate the work by first reviewing prior research on how the presence or absence of errors affects judgments of the writer and behavioral intentions of the reader. Then, we look at prior research on whether the number of errors in a text affects judgments of the writer. Finally, we explore how being explicitly warned about the potential presence of errors in a text may affect the effect of these errors on judgments and behavioral intentions.

The Effect of Exposure to Errors (Implicit Error Detection)

The presence of errors in text has been found to negatively impact a reader’s judgments of both the quality of the text and the abilities of the author. In a study that investigated exposure to different types of errors in essays, Johnson et al. (2017) found that the presence of both lower-level errors (i.e., poor spelling and grammar) and higher-level errors (i.e., a lack of compelling arguments and clear structure) negatively influenced undergraduate participants’ perceptions of both the quality of the text and the author’s characteristics compared to essays where no errors were present. However, people gave harsher evaluations when lower-level errors were present compared to higher-level errors. The relationship between the presence of errors and perceptions
was further examined by Queen and Boland (2015), who presented participants with email messages written by potential housemates that either had no errors, typos (e.g., abuot instead of about), or grammatical errors unique to written errors (e.g., selecting the incorrect to/too/two). Both types of errors influenced ratings on a scale that evaluated the writer academically (e.g., if the email was well-written), with higher numbers of errors leading to more negative assessments. However, only grammatical errors were correlated with lower ratings on a social subscale. The presence of errors can also influence other types of decisions made by a reader such as the desire to purchase from a seller.

Stiff (2012) presented undergraduate participants with reviews from previous buyers based on those seen on real-life feedback forums such as eBay. The reviews either had no errors, typographical errors, or grammatical errors. Participants had less favorable ratings of the seller’s reputation and less desire to spend money with the target (the seller) when they were exposed to errors in negative reviews. The detrimental effects of errors also extended to judgments of the review writer (i.e., previous buyers). Analogous to errors in text by sellers, errors by commenters also decreased the favorability of impressions and levels of trust towards the people who wrote them.

The presence of errors can influence decision making in several domains. For instance, Van der Zanden et al. (2020) investigated how errors influence an individual's decision to date someone. They presented participants with dating profiles that either had language errors or no language errors. Error detection was implicit, participants were not informed about or asked to comment on the possible presence of errors. The presence of mechanical and rule-based errors led to lower judgments of attentiveness and intelligence scores. The attribution of lower attentiveness by the author in turn led to lower physical attraction, social-romantic attraction, and
Dating intention is not the only behavior that can be impacted by errors. The presence of errors also impacts the likelihood of being shortlisted for a job interview by a sample of professional recruiters (Martin-Lacroux & Lacroux, 2017). Participants were asked to read a job offer and four applications responding to the offer. The applications varied in the level of job experience and presence of grammatical and word choice errors (either ten, five, or no errors). Error detection was implicit. The presence of spelling errors and work experience were both found to influence the recruiters’ decisions as to whether to shortlist an applicant. Outcomes for applications that included five or ten errors did not differ. These findings were replicated in a similar study by Martin-Lacroux (2017) where qualitative data were also collected using verbal protocol analysis. Recruiters’ behavior was more negatively affected by spelling errors than typographic errors. This is because they associated spelling errors with a lack of professionalism and intelligence.

Thus, the presence of errors can interfere with judgments and actions as well as impressions of a text and its author. Unresolved is whether effects are graded such that the number of errors in a text may have different effects on behavior; maybe a few errors are forgivable, but a large number of errors is not.

**Detecting Few vs. Many Errors**

Previous research on whether the presence of many errors is more detrimental than fewer errors has had conflicting results. For instance, some research reported that the presence of fewer errors is just as detrimental as having many errors compared to text that is error free. One such study was conducted by Morin-Lessard and McKelvie (2019), who presented undergraduate
participants with a text that requested financial assistance that either had none (zero), few (11), or many (22) spelling, grammatical, punctuation, and typographical errors. The presence of any errors resulted in participants evaluating the writer’s behavior negatively, with lower conscientiousness scores for authors who made either few or many mistakes compared to authors who made no mistakes. This is consistent with Martin-Lacroux and Lacroux’s (2017) findings where the presence of few errors was detrimental, as was the presence of many errors. In contrast, Kreiner et al. (2002) found that the presence of few errors did not have the same negative impact as the presence of many errors. In their first experiment that included only four errors in an essay, Kreiner et al. (2002) found no effect of errors. Only in a second experiment that included an essay with 12 errors did they find that college students rated the author of the essay as having lower intellectual, logical, and writing ability. Detrimental effects of errors on assessments of the author arose only with a larger proportion of errors.

Thus, while claims that the impact of errors is dependent on the number of errors present in a text may seem inconclusive, an alternative interpretation is that what may be crucial is not the number of errors in the text but rather the number of errors that a reader detects. One potential reason for this lack of consistency is not that a smaller number of errors is more acceptable than a larger number. Instead, if there is a small number of errors in the text, they may not be noticed at all by some readers. If a reader does not notice any errors, they may be less likely to be negatively affected by them. In the next section we review research investigating differences between merely being exposed to errors and explicitly noticing them.

**Error Detection vs. Exposure to Errors**

People do not always notice errors in text, and errors might affect perceptions negatively only when their presence is noticed. For instance, Van der Zanden et al. (2020) found that only
one-third of the participants in their study reported noticing errors and the negative effect of errors was driven solely by these participants who reported noticing the errors. Although Van der Zanden et al.’s (2020) study was designed such that error detection was implicit and the negative effect of errors was assumed to be a result of unconscious processes, they found that errors mattered only for those who consciously noticed errors.

People are more likely to notice errors when they are explicitly informed that errors may be present and asked to identify any errors they see. We term this methodology explicit error detection. Further, when participants are made aware of the possible presence of errors those errors are more likely to have a negative effect. For example, Figueredo and Varnhagen (2005) presented undergraduate students with essays that had either no errors, common homophone spelling errors (e.g., vial for vile), or non-homophone errors, which were phonologically acceptable spelling errors with orthographically legal letter sequences (e.g., vyle for vile). The researchers asked participants to circle any spelling errors that they saw, thus measuring participants’ ability to detect errors explicitly by informing them about the possible presence of errors. Participants’ judgments about the quality of the text and about the authors’ abilities worsened more when they read essays with the types of errors that are typically flagged by a spell checker (i.e., non-homophone errors) and when they read essays with homophone errors. Spelling errors in the essay were attributed to the author’s inability to write rather than to the spell checker, indicating that the author is considered responsible for writing error-free text, even when spell check is available using a word processor.

Planken et al. (2019) also found that it is error detection, not the mere exposure to errors that leads to negative consequences for the writer. They compared the influence of errors on native and non-native speakers’ judgment of the author and text. They used samples of petitions
written in English by native speakers of Dutch that either included or did not include errors; either grammatical, vocabulary, spelling, or punctuation errors appeared in the version of the petition with errors. Native and non-native speakers of English evaluated the text, the author, and the persuasiveness of the text. Participants also were asked to indicate if they noticed errors and copy and paste any errors they found into a text box. Thus, error detection was explicit. The outcome was no effect of the presence of errors on judgments about the author or the text’s persuasiveness for either group, although the perception of errors (measured by participants indicating if they noticed errors either with yes or no) resulted in lower ratings of text attractiveness, and the author’s competence, trustworthiness, and friendliness. Indicating that the text contained errors (i.e., explicit error detection) influenced judgments more than whether or not it actually did.

In another study that demonstrated that explicit measures of error detection might be more informative than passively exposing participants to errors and examining indirect effects on another behavior, Mozafari et al. (2019) recruited a sample of mostly university students and presented them with a brief advertisement for either a blue-collar service (an oil change) or a white-collar service (a computer memory upgrade) that either contained language errors or no errors. The language errors consisted of grammatical, spelling, punctuation, and capitalization errors. When participants viewed the error-laden advertisement, they reported themselves to be less interested in using the business. However, errors only lowered perceived quality of the business, advertisement, and employees when participants noticed at least one error in the advertisement, highlighting that to affect judgments, error detection needs to be explicit rather than implicit and based only on exposure. Therefore, the presence of errors in a given text is not
sufficient to negatively influence judgments of quality. Instead, it is the conscious detection of errors that is detrimental to judgments about a text, its author, and an associated business.

When noticed, errors generally negatively impact judgments of a writer’s intelligence and other personal characteristics, but these errors may be worse in some contexts than in others. In Mozafari et al. (2019) the effect of presence of errors on purchase intent was present only for the business that provided the white-collar service, where higher levels of education are expected and considered necessary, than the blue-collar service, where “book-learning” may be more optional. Whether the writer is a native speaker of English is another factor that may affect how harshly errors are judged. Vignovic & Thompson (2010) found that the presence of language violations (i.e. spelling and grammatical errors) and etiquette deviations (i.e. short or terse emails with a reduced conversational tone) both affected judgments of the email sender’s conscientiousness, intelligence, agreeableness, extraversion, cognitive trustworthiness, and affective trustworthiness. However, mentioning that the sender was from another culture reduced negative perceptions that occurred as a result of language violations but not those that occurred as a result of etiquette violations, demonstrating that including additional information about the language history of the author such as their linguistic or cultural background can help mitigate the negative effects of grammatical errors (Vignovic & Thompson, 2010).

The Current Research

In this study we compare the effects of implicit versus explicit error detection on reactions to a Chinese restaurant menu. First, we manipulated whether grammatical errors were present in the document. Given Mozafari et al.’s (2019) and Planken et al.’s (2019) findings that the detection rather than the presence of errors matters, and given Johnson et al.’s (2017) findings that lower-level errors (such as grammatical errors) are more noticeable than higher-
level errors (such as a lack of compelling arguments and clear structure), we chose to include only grammatical errors in the present study. A second benefit of restricting the manipulation to grammatical errors is that it was the type of error most prevalent in previous research (Morin-Lessard & McKelvie, 2019; Martin-Lacroux & Lacroux, 2017; Stiff, 2012; Queen & Boland, 2015; Vignovic & Thompson, 2010; Johnson et al., 2017).

In addition to implicit error detection, we measured error detection explicitly. Explicit error detection is a relatively recent technique and it is important because research comparing implicit and explicit error detection (Mozafari et al., 2019; Planken et al., 2019) has suggested that errors must be consciously noticed to influence perceptions. In the present study, we investigated whether Mozafari et al.’s (2019) and Planken et al.’s (2019) findings that demonstrate that explicit error detection is more influential on perceptions than implicit error detection replicate. First, we investigated the effect of the presence of errors by comparing participants’ perceptions when presented with an error laden text to an error free text. Then, to investigate if error detection is more impactful than the presence of errors, we compared ratings between people who reported noticing errors compared to people who did not report noticing errors. These comparisons allowed us to determine whether explicitly noticing errors was more detrimental more than the (implicit) presence of errors.

We also investigated whether the detrimental effect of errors increases as the number of errors detected increases. We used a categorical (ordinal) and a continuous measure to do so. The ordinal measure was a simple question that involved choosing between three estimates of number of errors detected. The continuous measure was more novel. We employed the Qualtrics “hotspot” survey tool as a method of continuous error detection. The Qualtrics hotspot tool allows researchers to create hotspots on areas of interest on an image, such as areas where errors
occur. Whether or not each hotspot is clicked on is recorded. Additionally, Qualtrics provides the time of the first click on the image, the last click on the image, and the total time taken to look at the image. In the current study, we presented participants with an image of the menus and asked them to click on any errors they detected, allowing us to use the hotspot tool to collect data and calculate error detection accuracy and response bias. Hotspots can thus be a highly informative manner of error detection.

We investigated these questions using a Chinese restaurant menu as the experimental text. We chose a Chinese menu because we were interested in how readers would respond to errors made by a non-native speaker. However, the choice of a Chinese menu may have introduced other variables especially because data were collected in May and June of 2020, in the midst of the 2020 COVID-19 pandemic. Some have claimed that xenophobia in the time of COVID-19 might have influenced whether or not people chose to purchase from Chinese restaurants during this time (Reny & Barreto, 2020). To address this issue, we included a xenophobia scale (Van Der Veer et al., 2011). Similarly, government policies about restaurant closures during the COVID-19 pandemic made many people scared to eat at restaurants because of the fear that they might contract the coronavirus, therefore participants’ perceived infectability and germ aversion, was measured by the Perceived Vulnerability to Disease Scale (Duncan et al., 2009). Xenophobia towards foreign people is exacerbated by individuals’ perceived vulnerability to disease, making them more xenophobic during times of a pandemic (Faulkner et al., 2004; Kim et al., 2016). Germ aversion has also been established as negatively correlated with pro-immigrant attitudes (Duncan et al., 2009). We therefore hypothesized that those participants who have higher levels of xenophobia would also have higher levels of germ aversion and purchase intention.
The dependent variables that we focused on were the participants’ judgments of how good quality the restaurant was and their likelihood to purchase take-out food from there. We asked whether the presence of errors in text impacts the reader’s judgments of quality (Figueredo & Varnhagen, 2005; Johnson et al., 2017; Mozafari et al., 2019). We therefore anticipated that exposure to errors would negatively impact ratings of quality. In turn, we expected these negative judgments of quality to influence participant’s intention to purchase from a business under the assumption that assessments of quality have an influence on purchase intentions (Bai et al., 2008; Hsu et al., 2012; Waluya et al., 2019). We also chose to include a measure of food importance (i.e., how important each participant considers food to be) to investigate if differences between groups for quality and purchase intention coincided with how important participants considered food.

We investigate these questions in a general population sample. One criticism of much of the previous work is that they employ samples that primarily consist of undergraduate students who might be more critical of errors than the general population. Undergraduate students are not representative of the general population, and their higher education might make them detect errors differently than the average person does. To address this concern, participants were sourced from Prolific Academic. Doing so allowed us to recruit a more diverse group of participants than undergraduate students (Stewart et al., 2015; Gosling et al., 2010; Behrend et al., 2011). Although the external validity of results sourced from online crowdsourcing marketplaces is still a matter of debate (see Landers & Behrend, 2015), recent studies comparing online sampling to conventional methods of data collection have found that data collected via online crowdsourcing methods can be comparable to the data collected via more conventional means (Mortensen & Hughes, 2018; Briones & Benham, 2017; Kees et al., 2017). In fact, some
claim that participants recruited via online methods are more attentive during data collection than undergraduate subject pool participants (Hauser & Schwarz, 2015).

The primary aim of the present study was to extend the previous work on error detection on purchase intention and judgments of quality for a restaurant whose menu appeared online to different participants with or without errors in the text. Building on the insight (Mozafari et al., 2019; Planken et al., 2019) that perception of errors is a better predictor than presence of errors, we aim to extend those findings by varying the ways in which we measure the perception of errors, and hope to identify restaurant characteristics for which this is true. Our specific hypotheses were thus, as follows:

H1: Exposure to errors: Exposure to errors will negatively influence readers’ judgments of quality and purchase intent behavior.

This first hypothesis was motivated by previous research that found a detrimental effect of errors based on implicit error detection (Johnson et al., 2017; Queen & Boland, 2015; Stiff, 2012; Van der Zanden et al., 2020; Martin-Lacroux & Lacroux, 2017; Martin-Lacroux, 2017).

H2: Error detection: The detection of errors will negatively influence readers’ judgments of quality and intent to purchase over and above the presence of errors.

H3: Number of errors: The detection of errors is graded such that ratings of the restaurant’s quality and participant purchase intent will decrease as the number of errors noticed increases.

**Method**

**Participants**

We recruited a total of 808 online participants from Prolific Academic between May 3rd, 2020 and June 12th, 2020 in two waves of data collection. We excluded six participants for failing to follow instructions. Additionally, given previous research showing that the sensitivity
of non-native speakers to detect errors might differ from that of native speakers, we excluded all
participants who reported learning to speak English at four years of age or later. As a result, 106
participants were excluded, resulting in a sample of 696 participants. After exclusions, all
participants in the present sample were 18 years or older ($M = 32.93, SD = 12.48$) and 55.2% identified as female.

Materials

The experimental text consisted of a snippet of a Chinese restaurant menu. There were
two versions of the menus: one version did not include any errors, and the other version included
36 grammatical errors (see Appendix A). To check for both the effect of presence of errors and
the effect being explicitly asked to use hotspots to identify errors, participants were assigned to
one of three menu conditions. Thus, the three conditions were as follows: no errors with no
hotspot, errors with no hotspot, and errors with hotspot. Comparing the first two conditions
allowed us to compare participants’ judgments of the restaurant depending on the presence and
absence of errors to test the first hypothesis. Comparing the second two conditions allowed us to
determine whether the method of counting hotspots functions in the same way as other methods
of error detection.

To assess the primary variable of interest, purchase intent, we created a three-item scale
consisting of 5-point Likert scale questions with response options ranging from 1 (Strongly
Disagree) to 5 (Strongly Agree). The scale included the questions “It is likely I would try this
restaurant if I was invited and it were convenient,” “I would try this restaurant if I wanted to
order take-out and it were convenient,” and “I will try this restaurant the next time I order
takeout if convenient.” The average of these three items served as the measure of purchase
intention ($M = 3.96, SD = 0.94$, Cronbach’s $\alpha = .90$). The present secondary variable of interest,
quality, was measured using seven 5-point quality questions ranging from 1 (*Not at all*) to 5 (*Very*) to measure aspects of quality including liking, quality, taste, nutrition hygiene, service, and value for money (See Appendix B).

Purchase intention and error detection can differ depending on personal attitudes. Therefore, we included several individual difference measures. One was how important the participant considers food to be (food importance), measured by a 5 item scale (See Appendix C; \(M = 3.53, SD = .70,\) Cronbach’s \(\alpha = .73\) that consisted of items such as “I attach great importance to which restaurants I eat at” measured on 5-point Likert scales ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*).

We also measured germ aversion (\(M = 3.39, SD = 0.69,\) Cronbach’s \(\alpha = .71\)) and perceived infectability (\(M = 2.69, SD = 0.75,\) Cronbach’s \(\alpha = .79\)) on the 15-item Perceived Vulnerability to Disease Scale (See Appendix D; Duncan et al., 2009). Third, we measured xenophobia on Van Der Veer et al.’s (2011) 5-item xenophobia scale (See Appendix E; \(M = 1.75, SD = 0.93,\) Cronbach’s \(\alpha = .91\)).

We measured conscious error detection in two ways. First, we assessed whether participants noticed any errors: “Did you notice any spelling or grammatical errors in the menu you saw? If so, please describe what they were.” Participants responded either “yes” or “no” and then listed any errors they noticed. For the purposes of this paper, we only focused on whether or not participants noticed errors and not on which errors they reported. Second, we assessed how many errors participants noticed: “If you noticed any grammatical errors in the menu, how many would you say there were?” Participants responded to this question either with “zero,” “about six,” or “nine or more.” Responses to both the above questions served as our categorical and ordinal methods of error detection.
For the hotspot versions, we used the hotspot function in Qualtrics as a more precise method to examine the detection of errors. We created a hotspot for each of the 36 errors on the menu. Additionally, we created 36 fake hotspots on the menu as distractors. We used an explicit error detection strategy in this condition: participants were instructed to click on any errors they noticed as they read the menu. Here it is possible to assess the precise number of real errors that are detected as well as correct text that is treated as an error.

**Procedure**

Participants were recruited using Prolific Academic. The experiment was conducted online through Qualtrics and took approximately seven minutes to complete. As compensation, participants received $1.11. The testing protocol had several parts. Participants were first presented with a consent form. After giving consent, they were presented with a version of the menu\(^1\). Participants who received a hotspot version of the menu were asked to click on any errors that they see on the menu and those not in a hotspot condition were asked to only read the menu and were not informed about the possible presence of errors. Afterwards, participants indicated whether they noticed errors and rated the restaurant on the present variables of interest using the measures described above. Finally, they provided demographic information.

**Results**

Responses to the scales for the variables of interest (purchase intention, quality, food importance, perceived infectability, germ aversion, xenophobia) showed high reliability (see Materials section for Cronbach’s \(\alpha\)) and were thus averaged to form a composite for each variable. Assumptions of normality were violated for purchase intention and xenophobia. To

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\(^1\) In addition to the manipulations mentioned above, we also manipulated owner name such that the owner of the restaurant was either Chinese or not Chinese. However, this manipulation did not interact with any of the error measures. We therefore collapsed across this manipulation.
offset this violation and for consistency, we used nonparametric tests for all analyses that included categorical and ordinal measures of error detection. Given their highly skewed nature, we dichotomized both of these variables for any analyses involving a continuous measure of error detection.

**Exposure to Errors**

We first examined whether the mere presence of errors affected judgments of quality and purchase intentions for the restaurant. We conducted a Mann-Whitney *U* test on each of the variables of interest, comparing the group who saw the version of the menu with errors to the group who saw the version of the menu with no errors (see Table 1). Ratings for the error group and the no error group did not significantly differ on purchase intention, quality, importance given to food, perceived infectability, and germ aversion. Overall, people who saw the menu with errors and those who saw it without did not differ, failing to support hypothesis 1. Surprisingly, however, groups differed on self-ratings of xenophobia, such that people who saw the menu with errors (*Mdn* = 1.2) had significantly lower scores of xenophobia than the people who saw no errors (*Mdn* = 1.6); *U*(N<error> = 56, N<no_error> = 130) = 31258.50, *z* = -2.78, *p* = .006.
Table 1
*Mann-Whitney U test* Results Comparing People Who Saw Errors (N=566) to Those Who Did Not See Errors (N=130)

<table>
<thead>
<tr>
<th></th>
<th>Errors</th>
<th>No Errors</th>
<th>U</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Rank</td>
<td>Sum of Ranks</td>
<td>Mean Rank</td>
<td>Sum of Ranks</td>
<td></td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>344.34</td>
<td>194898.50</td>
<td>366.60</td>
<td>47657.50</td>
<td>34437.50</td>
</tr>
<tr>
<td>Quality</td>
<td>350.26</td>
<td>198248.50</td>
<td>340.83</td>
<td>44307.50</td>
<td>35792.50</td>
</tr>
<tr>
<td>Food Importance</td>
<td>351.65</td>
<td>199036</td>
<td>334.76</td>
<td>43520</td>
<td>35005</td>
</tr>
<tr>
<td>Perceived Infectability</td>
<td>354.49</td>
<td>200642.50</td>
<td>322.41</td>
<td>41913.50</td>
<td>33398.50</td>
</tr>
<tr>
<td>Germ Aversion</td>
<td>351.93</td>
<td>199194.50</td>
<td>333.55</td>
<td>43361.50</td>
<td>34846.50</td>
</tr>
<tr>
<td>Xenophobia</td>
<td>338.73</td>
<td>191719.50</td>
<td>391.05</td>
<td>50836.50</td>
<td>31258.50</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01 ***p < .001

In summary, there were few reliable differences on the variables of interest between groups based simply on the exposure to errors on the menus they viewed. This is consistent with Mozafari et al.’s (2019) and Planken et al.’s (2019) findings that manipulations based solely on exposure to errors might not have a reliable deleterious effect on behavior and judgments. The differences between groups that did arise were related to xenophobia, a measure that is unlikely to reflect an experimental manipulation and more likely to reflect individual differences and biased assignment of participants between groups.

**Error Detection**

Our previous results provided no support for the claim that exposure to errors result in worse ratings, so next we investigated whether explicit detection of errors negatively influenced judgments. To do so, we focused on the subsample of participants who saw a version of the
menu with errors (n = 566) and compared ratings for participants who indicated that they noticed errors (n = 377; 66.61%) to participants who reported that they did not (n = 189), measured by their responses to a survey question. We conducted a Mann-Whitney U test (see Table 2) on each of the variables of interest, this time comparing the 377 people who noticed errors to the 189 people who did not notice errors. Differences reflect the effect of explicit detection of errors.

Table 2
Mann-Whitney U test Results Comparing People Who Reported Seeing Errors (N=377) to Those Who Did Not Report Seeing Errors (N=189)

<table>
<thead>
<tr>
<th>Notice Errors</th>
<th>Did Not Notice Errors</th>
<th>U</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase Intention</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Rank</td>
<td>275.83</td>
<td>298.79</td>
<td>32736.00</td>
<td>-1.60</td>
</tr>
<tr>
<td>Sum of Ranks</td>
<td>103989</td>
<td>56472.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Rank</td>
<td>271.32</td>
<td>307.80</td>
<td>31033.50</td>
<td>-2.51</td>
</tr>
<tr>
<td>Sum of Ranks</td>
<td>102286.50</td>
<td>58174.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Importance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Rank</td>
<td>275.55</td>
<td>299.35</td>
<td>32630.50</td>
<td>-1.64</td>
</tr>
<tr>
<td>Sum of Ranks</td>
<td>103883.50</td>
<td>56577.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Infectability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Rank</td>
<td>284.42</td>
<td>281.66</td>
<td>35279.50</td>
<td>-.19</td>
</tr>
<tr>
<td>Sum of Ranks</td>
<td>107226.50</td>
<td>53234.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germ Aversion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Rank</td>
<td>289.27</td>
<td>272</td>
<td>33453</td>
<td>-1.19</td>
</tr>
<tr>
<td>Sum of Ranks</td>
<td>109053</td>
<td>51408</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xenophobia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Rank</td>
<td>273.31</td>
<td>303.83</td>
<td>31783.50</td>
<td>-2.18</td>
</tr>
<tr>
<td>Sum of Ranks</td>
<td>103036.50</td>
<td>57424.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05 **p < .01 ***p < .001

In this analysis, there was a significant effect of reporting errors on assessments of quality. Participants who noticed errors (Mdn = 3.43) thought the restaurant was significantly lower quality than those who did not notice them (Mdn = 3.60); U(N_error = 377, N_no_error= 189) = 31033.50, z = -2.50, p = .012), providing partial support for hypothesis 2. These results combined with the results from the previous analysis support the conclusion by Mozafari et al.
(2019) that verbal reports indicating that errors are present and thus consciously noticed is detrimental to judgments of quality in a way in which passive exposure seems not to be.

Interestingly, the groups also differed on xenophobia. Again, people who noticed errors ($Mdn = 1.10$) reported significantly lower xenophobia scores than people who did not notice errors ($Mdn = 1.60$); $U(N_{error} = 377, N_{no\text{ error}}= 189) = 31783.50, z = -2.18, p = .029$).

**Number of Errors**

We then asked if the detection of errors is graded such that participant ratings of the restaurant’s quality and reports of purchase intent decreased as the number of errors they noticed increased. We restricted the present sample to only those participants who saw a version of the menu with errors ($n = 566$) and measured the number of errors they detected in two ways. First, for all participants who saw the version of the menu with errors, participants estimated whether they had seen zero, about six, or more than nine errors. We treat this measure as ordinal. Second, for those participants whose visual display of the menu had hotspot functionality, we measured the number of errors they clicked on. We discuss the effect of both error measures on the variables of interest.

**Explicit Number of Errors Based on Verbal Report (Ordinal)**

For each of the variables of interest, we conducted a Kruskal-Wallis $H$ test to compare people who estimated noticing zero errors, about six errors, and more than nine errors in the menu conditions with errors$^{2}$ (see Table 3). The Kruskal-Wallis $H$ test on purchase intent revealed significant group differences in intention to purchase from the restaurant, $H(2) = 8.89, p = .012$. People who reported seeing zero errors had a mean rank value score of 298.24, people

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$^{2}$ Of the 566 people who received the version of the menu with errors, 143 (25.27%) reported seeing no errors, 229 (40.46%) reported seeing about 6 errors and 189 (33.39%) reported seeing 9 or more errors. Five people who got the version of the menu with no errors chose to not respond to this question, bringing the sample size to 561.
who reported seeing about six errors had a score of 293.38, and people who saw nine or more errors had a score of 252.96. Using post-hoc Dunn tests, we found that people who reported seeing nine or more errors rated their purchase intent as significantly lower than the people who reported seeing about six errors ($p = .030$) and the people who reported seeing zero errors ($p = .031$), supporting hypothesis 3. Explicit detection of zero errors and six or fewer errors did not differ from each other with respect to purchase intent whereas nine or more errors negatively impacted purchase intent compared to the other groups. Results are consistent with Mozafari et al.’s (2019) work on purchase intention where noticing the presence of errors negatively impacted purchase intention. The present work extends that of Mozafari et al.’s (2019) in that we also found this effect for restaurant-related behavior. Additionally, the present study is the first study, to our knowledge, to demonstrate that purchase intent is not affected simply by whether or not people notice errors. Instead, noticing a higher number of errors (i.e., about nine) was significantly more detrimental than either noticing no errors or few (i.e., about six) errors. It is likely that in the previous analysis, we did not find differences on purchase intention between groups when we compared people who reported noticing errors to those who did not notice errors because the measure of error detection was not fine grained enough; thus, the behavior of participants who noticed few errors did not differ from participants who noticed no errors at all.
Table 3
Kruskal-Wallis H test Results Comparing People Who Reported Seeing Zero (N=143) vs. About Six (N=229) vs. Nine or More Errors (N=189)

<table>
<thead>
<tr>
<th></th>
<th>Mean Rank</th>
<th>Independent Samples Kruskal-Wallis H</th>
<th>Post hoc Dunn (with Bonferroni correction)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zero</td>
<td>About 6</td>
<td>9 or more &lt; about 6*</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>298.24</td>
<td>293.38</td>
<td>8.89</td>
</tr>
<tr>
<td>Quality</td>
<td>303.06</td>
<td>294.99</td>
<td>.012*</td>
</tr>
<tr>
<td>Food Importance</td>
<td>294.53</td>
<td>281.08</td>
<td>12.51</td>
</tr>
<tr>
<td>Perceived Infectability</td>
<td>284.40</td>
<td>275.41</td>
<td>.002**</td>
</tr>
<tr>
<td>Germ Aversion</td>
<td>276.08</td>
<td>284.10</td>
<td>.793</td>
</tr>
<tr>
<td>Xenophobia</td>
<td>300.89</td>
<td>291.24</td>
<td>.923</td>
</tr>
<tr>
<td></td>
<td>253.54</td>
<td></td>
<td>.010*</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01 ***p < .001

The pattern replicated for quality. The high detection of errors (nine or more) also influenced judgments of quality, \( H(2) = 12.51, p = .002 \), supporting hypothesis 3. People who reported seeing zero errors had a mean rank value quality score of 303.06, people who reported seeing about six errors had a score of 294.99, and people who saw nine or more errors had a score of 247.36. Post-hoc Dunn tests revealed that people who reported seeing nine or more errors rated the restaurant to be significantly lower in quality than either the people who reported seeing about six errors (\( p = .008 \)) or the people who reported seeing zero errors (\( p = .006 \)). Results are consistent with Mozafari et al.’s (2019) work on product quality, where exposure to errors lowered judged quality of the business. Finding that effects of error detection are graded
such that detecting many errors had a strong negative effect on quality whereas detecting few errors did not is a new contribution to the literature.

Once again, groups based on rate of error detection differed on ratings of xenophobia, $H(2) = 9.23, p = .010$. People who reported seeing zero errors had a mean rank value score of 300.89, people who reported seeing about six errors had a score of 291.24, and people who saw nine or more errors had a score of 253.54. Post-hoc Dunn tests indicated that people who reported seeing nine or more errors rated their xenophobia as significantly lower than the people who reported seeing about six errors ($p = .041$) and the people who reported seeing zero errors ($p = .018$).

Not only did people who reported noticing a high number of errors on the menu have lower purchase intent and rated the restaurant as having significantly lower quality. They also considered themselves significantly less xenophobic than people who noticed fewer errors or no errors at all.

**Explicit Number of Errors Based on Hot Spot Clicking (Continuous)**

The final measure of error detection used Qualtrics’ hot spot functionality. The participants who received the menu. With hotspot functionality (N=303) were instructed to click on any errors they noticed on the menu as they read it, before they answered any question about how many errors they detected (zero, six or nine). The number of hotspots that participants clicked on served as an explicit (and continuous) measure of error detection.

Hotspots are a new way of detecting which errors participants notice. They have great potential as a research technique because they enable the researcher to get online measures of the number of errors detected, identify grammatically correct text classified as errors, collect data on the time to click on the first hotspot, the time to click on the last hotspot, and the time that
participants spent examining the menu overall. These data allowed us to calculate participant accuracy and response bias by using a signal detection analysis (see Stoeber & Eysenck, 2008 and Stoeber, 2011). Following Stoeber (2011), we used this information to calculate error detection efficiency from the total time and accuracy measure. Thus, we had three different measures of efficiency based on the timing of the first click, last click, and total time which we called first click efficiency, last click efficiency, and total time efficiency. As a result, we had a total of seven continuous measures (i.e., hits (errors detected correctly), false alarms (errors detected incorrectly), accuracy (measured taking into account both, hits and false alarms), response bias (i.e., participants’ bias against reporting errors), first click time, last click time, total time, efficiency (first click), efficiency (last click), efficiency (total time) that emerged from the hot spot analysis.

**Comparing Hotspot vs. No Hotspot.** Before interpreting the hotspot data, we had to ascertain that the process of clicking on errors did not affect menu reading regardless of how it affects error detection. Accordingly, we needed to demonstrate that quality ratings between people who saw hot spots and people who saw no hot spots did not differ. We summarize the responses of participants who saw the menu with errors in the hotspot (N = 302) and no hotspot conditions (N = 264) in Table 4. Importantly, there were no differences between the hotspot and no hot spot conditions on any of the variables of interest.
Table 4
*Mann-Whitney U test* Results Comparing People in the Hotspot condition (N=302) to Those Not in the Hotspot Condition (N=264)

<table>
<thead>
<tr>
<th></th>
<th>Hotspot</th>
<th>No Hotspot</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Rank</td>
<td>Sum of Ranks</td>
<td>Mean Rank</td>
<td>Sum of Ranks</td>
<td>U</td>
<td>Z</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>284.75</td>
<td>85994.50</td>
<td>282.07</td>
<td>74466.50</td>
<td>39486.50</td>
<td>-.20</td>
</tr>
<tr>
<td>Quality</td>
<td>277.55</td>
<td>83819.50</td>
<td>290.31</td>
<td>76641.50</td>
<td>38066.50</td>
<td>-.93</td>
</tr>
<tr>
<td>Food Importance</td>
<td>287.12</td>
<td>86711</td>
<td>279.36</td>
<td>73750</td>
<td>38770</td>
<td>-.57</td>
</tr>
<tr>
<td>Perceived Infectability</td>
<td>281.31</td>
<td>84957</td>
<td>286.00</td>
<td>75504</td>
<td>39204</td>
<td>-.34</td>
</tr>
<tr>
<td>Germ Aversion</td>
<td>279.99</td>
<td>84556</td>
<td>287.52</td>
<td>75905</td>
<td>38803</td>
<td>-.55</td>
</tr>
<tr>
<td>Xenophobia</td>
<td>287.72</td>
<td>86890.50</td>
<td>278.68</td>
<td>73570.50</td>
<td>38590.50</td>
<td>-.69</td>
</tr>
</tbody>
</table>

*p < .05 **p < .01 ***p < .001

With more than 250 participants in each condition, there were no differences between hotspot vs. no hotspot conditions on any behavioral or the quality measures. The outcome suggests that using a hotspot to gauge error detection may not work significantly differently from asking participants to simply read a text and estimate the number of errors they saw. However, the online measure provided additional temporal information about participants’ error detection behavior, such as the time taken to find the first and last error, and the total time taken to read the menu.

**Comparison High vs. Low Groups on Continuous Hotspot Measures.** The hotspot with errors condition can provide insights not available from more traditional measures. Thus, we excluded all participants who failed to click on any hotspots and ran a final set of analyses on the 183 participants who used the hotspot functionality. We used these measures to compare those high and low on each of the variables of interest.
Given the highly skewed data for purchase intention and xenophobia and for the sake of consistency, we chose to perform a median split and dichotomize our data into high and low categories for each of our variables of interest (i.e., purchase intention, quality, food importance, perceived infectability, germ aversion, xenophobia) for each of our hotspot analyses. Then, we conducted independent samples $t$-tests on all seven of the present continuous measures to determine if people who were categorized into a low group differed from those who were categorized into a high group. The high and low groups for purchase intention, quality, food importance, perceived infectability, and germ aversion did not differ on any of the error detection measures, failing to support hypothesis 3. We did, however, find significant differences between the high and low xenophobia groups (see Table 5) on three of the present measures.
Table 5

\textit{t-test} Results Comparing People Who Were in the Hotspot Condition and Reported High Xenophobia (N=104) to Those Who Reported Low Xenophobia (N=79)

<table>
<thead>
<tr>
<th></th>
<th>High Xenophobia</th>
<th>Low Xenophobia</th>
<th>(t)-test</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hits</strong></td>
<td>16.24</td>
<td>19.70</td>
<td>-2.76</td>
<td>.006**</td>
</tr>
<tr>
<td><strong>False Alarms</strong></td>
<td>.47</td>
<td>.91</td>
<td>-3.11</td>
<td>.002**</td>
</tr>
<tr>
<td><strong>Accuracy ratio(^1)</strong></td>
<td>1.85</td>
<td>1.99</td>
<td>-1.45</td>
<td>.148</td>
</tr>
<tr>
<td><strong>Response Bias</strong></td>
<td>1.09</td>
<td>.88</td>
<td>3.35</td>
<td>.001**</td>
</tr>
<tr>
<td><strong>Efficiency (First Click)</strong></td>
<td>.68</td>
<td>.80</td>
<td>-1.53</td>
<td>.128</td>
</tr>
<tr>
<td><strong>Efficiency (Last Click)</strong></td>
<td>.05</td>
<td>.06</td>
<td>-1.41</td>
<td>.161</td>
</tr>
<tr>
<td><strong>Efficiency (Total Time)</strong></td>
<td>.03</td>
<td>.03</td>
<td>-1.43</td>
<td>.154</td>
</tr>
</tbody>
</table>

\(^*p<.05 \quad **p<.01 \quad ***p<.001\)

\(^1\) Accuracy ratio = accuracy = IDF.NORMAL(hit rate, 0, 1) ÷ IDF.NORMAL(false alarm rate, 0, 1)

Level of xenophobia had an effect on hits (clicking on real errors) such that people in the high xenophobia group \((M = 16.24, SD = 8.73)\) had a significantly lower hit rate compared to people in the low xenophobia group \((M = 19.70, SD = 7.92)\); \(t(181)=-2.76, p = .006\). Thus, people who were high in xenophobia detected significantly fewer errors correctly than people who were low in xenophobia. False alarms (clicking on non-errors) were also significantly different between groups, with people in the high xenophobia group \((M = .47, SD = .70)\) having significantly lower false alarms than those who had low xenophobia \((M = .91, SD = 1.10)\);
\( t(123.99) = -3.11, p = .002^3 \). Similarly, there were group differences for response bias.

Participants who had high xenophobia \((M = 1.09, SD = .43)\) had significantly higher response bias (participants’ bias against reporting errors) than participants who had low xenophobia \((M = .88, SD = .39)\); \( t(181) = 3.35, p = .001 \). Evidently, people high in xenophobia were significantly less likely to report an error (i.e., they were more biased against reporting errors) than people who were low in xenophobia.

Despite differences in hits, false alarms, and response bias between people who rated themselves high or low on xenophobia, there were no other differences between groups. This implies that people with low xenophobia both find more errors and click on more fake errors. People with high xenophobia on the other hand, make significantly fewer mouse clicks (as seen in their high response bias) in their responses despite having a similar level of efficiency (and thus, similar timings) as those with high xenophobia.

**Xenophobia and Purchase Intent.** Xenophobia was negatively related to error detection regardless to the way in which errors were measured. In order to gain greater insight into its relation to more conventional measures of purchase intent, we combined measures and examined whether people who scored high on xenophobia differed in their ratings of the other variables of interest (purchase intention, quality, food importance, perceived infectability, and germ aversion) from those who scored low on xenophobia. Given the skewed nature of purchase intention, we conducted a Mann-Whitney \( U \) test on each of the variables of interest, comparing the group who scored high on xenophobia to the group who scored low on xenophobia (see Table 6). We included data from all 696 participants in these analyses and found no differences for any of the variables except purchase intent. Participants in the group with high xenophobia

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3 The degrees of freedom for false alarms was adjusted because the Levene’s test indicated unequal variances.
(Mdn = 4) had significantly lower purchase intent than the group with low xenophobia (Mdn = 4); \(U(N_{\text{high xenophobia}} = 410, \ N_{\text{low xenophobia}} = 286) = 47358.50, \ z = -4.39, \ p < .001\). Basically, participants who had high xenophobia rated themselves as less likely to make a purchase from the restaurant than people who had low xenophobia but did not differ on measures related to quality or health.

Table 6  
*Mann-Whitney U test* Results Comparing People Who Had High Xenophobia (N=410) to Those Who Had Low Xenophobia (N=286)

<table>
<thead>
<tr>
<th></th>
<th>High Xenophobia</th>
<th>Low Xenophobia</th>
<th>(U)</th>
<th>(Z)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase Intention</td>
<td>321.01</td>
<td>387.91</td>
<td>47358.50</td>
<td>-4.39</td>
<td>.000***</td>
</tr>
<tr>
<td>Quality</td>
<td>344.06</td>
<td>354.87</td>
<td>56809.50</td>
<td>-.70</td>
<td>.485</td>
</tr>
<tr>
<td>Food Importance</td>
<td>353.94</td>
<td>340.71</td>
<td>56401.50</td>
<td>-.86</td>
<td>.391</td>
</tr>
<tr>
<td>Perceived Infectability</td>
<td>340.63</td>
<td>359.79</td>
<td>55401.50</td>
<td>-1.24</td>
<td>.215</td>
</tr>
<tr>
<td>Germ Aversion</td>
<td>351.28</td>
<td>344.51</td>
<td>57489.50</td>
<td>-.44</td>
<td>.662</td>
</tr>
</tbody>
</table>

\(*p < .05 \quad **p < .01 \quad ***p < .001\)

**Discussion**

In this study, we examined the effect of errors on judgments and purchase intentions toward the business that produced a document with grammatical errors. We began by examining whether the mere exposure to errors on a menu could influence readers’ judgments of a restaurant’s quality and their intention to purchase from the establishment. Consistent with the
results from Mozafari et al. (2019) and Planken et al. (2019), the results suggested that presence of errors did not affect quality judgments or purchase intentions. Given that the presence of errors did not have a detrimental effect, we moved to the detection of errors by comparing a group who reported noticing errors to a group who did not notice any errors. This measure differed from the original method of error detection in that detection was explicit and not based simply on the presence of errors. People who reported noticing errors rated the restaurant to be lower in quality.

We then asked whether the number of errors a reader detects influences judgments of a restaurant’s quality and intentions to purchase and determined that as verbal report of number of errors decreased, positive ratings increased. As an ordinal measure, we collected responses to an error detection question and compared participants who reported seeing either zero, about six, or nine or more errors. Participants who reported seeing nine or more errors rated the restaurant as lower quality and themselves as less likely to purchase from it than people that noticed about six errors or no errors at all. Based on verbal reports of errors noticed, higher estimates were more detrimental than estimates of fewer errors or no errors at all.

Effects of number of errors on purchase intention and quality did not replicate when the number of errors was assessed using the continuous measure of detection hot spot, however. This discrepancy may be related to lower power associated with a smaller sample size, given that we had to exclude a large number of participants for not responding to the instruction asking them to click on the menu.

The results for xenophobia were unexpected. Across all variants of error detection, people who noticed more errors had lower xenophobia scores, and people who noticed fewer errors (measured on the continuous or categorical measure of error detection) were lower in
xenophobia than those who noticed fewer errors. Neither passive exposure nor explicit detection of errors altered the negative relation between detection and xenophobia.

The relation with errors was unique to xenophobia. Germ aversion and perceived infectability did not follow the same relation to errors as did xenophobia, even though germ aversion has been previously established to be correlated with xenophobia (Duncan et al., 2009). Similarly, perceived vulnerability to disease while closely related to xenophobia (Faulkner et al., 2004; Kim et al., 2016) did not pattern in the same way and were not significant. Because higher xenophobia is associated with noticing fewer errors, the overall pattern is not consistent with the idea that xenophobia is an aspect of a general tendency towards cautiousness or attention to detail as that same relation should also arise for errors with vulnerability to disease, germ aversion and perceived infectability. It also does not appear to be related to some participants being sloppy in responding and accidentally indicating that they were high in xenophobia (perhaps by responding to the scale without reading it) and also not noticing errors because people high in xenophobia also had fewer false alarms than those low in xenophobia and were no less efficient at finding errors than people low in xenophobia.

People who rated high versus low on xenophobia differed on purchase intention. People who had higher xenophobia rated themselves as less likely to make a purchase from the restaurant than people who had low xenophobia. This is unsurprising given that the restaurant served a foreign cuisine. However, these results are unexpected when error detection is taken into account. Although the link between errors and quality is well-established, the failure to detect contrasting judgments of quality between people high and low in xenophobia suggests that their differences in purchase intent cannot be linked in any direct way to indices of quality. Thus,
why people high in xenophobia might choose not to purchase from an establishment cannot be linked to implicit or explicit measures of error detection.

One tentative explanation for these lower xenophobia scores is that judgments of errors in a text extends beyond the function of the text to attributes of the person who wrote it including perhaps their proficiency in English. Reading an error laden text might lead a reader to draw the conclusion that the writer might be from another culture or a non-native speaker of the language. In Vignovic and Thompson (2010), mentioning that the author of an error laden text was from another culture mitigated the negative effects of language errors on judgements of the writer. Plausibly, the presence of grammatical errors on the menu of a restaurant serving a foreign cuisine, gave participants in the present study the impression that the owner is not a non-native speaker of the language or is from another culture, thus sanctioning greater tolerant of the errors that the author made. It is also possible that seeing grammatical errors in an immigrant-cuisine menu temporarily lowers feelings of threat associated with immigration and thus, their xenophobic feelings as a result. Of course, one cannot rule out the possibility that these differences between groups are simply a result of individual differences, given the between subjects design although the large sample size makes this unlikely. Future research should more systematically investigate the relationship between the presence of errors and lower ratings of xenophobia and the conditions when this might occur.

**Theoretical Contributions**

It is important to note that hotspots are a new, informative method of error detection. We did not find any differences when we compared people who received a hotspot version of this experiment to people who did not receive a hotspot version. This suggests that using a hotspot to gauge error detection may not work significantly differently from asking participants to simply
read a text and report their errors. Moreover, online detection might serve as an effective method to provide researchers with more detailed information about error detection such as time taken to notice errors, accurate count of errors detected, and frequency of types of errors detected. Collecting online data in this manner also allows for the data from a larger number of people in a shorter amount of time. A majority of error detection studies collect data from small samples. Using hotspots would allow researchers to collect more data and avoid potential power issues. However, future research that relies on hotspots should ensure that instructions to click on the image are salient to avoid participant unresponsiveness as we may have faced in the present study.

The present findings that people respond similarly to zero errors and few errors but more negatively when many errors are detected is in contrast to Morin-Lessard and McKelvie’s (2019) and Martin-Lacroux & Lacroux’s (2017) results. They found that presence of a few errors was just as detrimental as having many errors compared to zero errors. Instead, the present results supported those from Kreiner et al. (2002), where the negative effect of errors was found only when many (twelve) errors were introduced into the text as compared to few (four) errors. One option is that Kreiner et al. (2002) did not find an effect when fewer errors were included was because participants did not notice them. Another is that people who reported noticing fewer errors did not consider errors to be detrimental and their ratings were not significantly impacted relative to those who noticed no errors at all. Of course, it also is possible that all errors are not equivalent.

**Limitations and Future Directions**

The present study is not free from limitations. One limitation is that we did not take participants’ level of education into account and could not control for aspects of language
proficiency. It is possible that people who are more highly educated would detect errors at a
different rate than people who are not as highly educated and perhaps those are the same people
who tend to be less xenophobic. Future research should investigate the role that level of
education might play on error detection and subsequent judgments made in conjunction with
these errors.

A second shortcoming of the present study is that the data were collected during the
COVID-19 pandemic. If people were less likely to purchase food from Chinese restaurants
during the pandemic because of xenophobia (Reny & Barreto, 2020), then the present results
might fail to generalize to other cuisines or contexts. Whether these results hold true even in non-
pandemic contexts and for other types of cuisines should be investigated in the future. A third
limitation to the generality of the present results arises from the way in which we collected the
data. Although it was collected online, content sharing within a social network was not possible.
Therefore, the present results fail to provide insights into word-of-mouth based marketing
strategies that are prevalent on social networks (Rodrigues et al., 2011). Future research should
investigate the impact of errors in online word-of-mouth based marketing such as reviews and
blogs.

The current study adds to the literature by introducing hotspots as a new method of error
detection. Hotspots can provide time-sensitive information about participants’ online abilities to
detect errors without an added layer of artificiality due to explicitly reporting. Additionally, we
have established a possible negative relationship between error detection and xenophobia.
Although errors can make one less likely to consider a restaurant to be good quality or to avail of
its services, it is possible that this choice is not indicative of xenophobia toward the people who
own the restaurant and work there. The present results suggest that readers can be forgiving
when only a few errors are present, choosing to avoid a business only when detect an unusually higher number of errors. In conclusion, the presence of errors goes beyond simply making a written message harder to interpret. Instead, they impact judgments of the author and their business. In order for a business to be considered high in quality, urban wisdom is to avoid errors, especially large numbers of errors, no matter how trivial they might seem.
References


Martin-Lacroux, C. (2017). “Without the spelling errors I would have shortlisted her…”: The impact of spelling errors on recruiters’ choice during the personnel selection process.


Appendix A
Menu With No Errors (left) and Errors (right)

Appetizers

Siu Mai (4) .........................$3.95
Traditional steamed Chinese dumplings made with stir-fried pork pieces marinated in Shaoxing rice wine, shiitake mushrooms and onion.

Fried Shrimp Toast (4) ............$3.95
Small triangles of bread brushed with egg and coated with minced shrimp and water chestnuts. Deep-fried till crispy and golden brown.

Chicken Spring Rolls (4) ...........$3.95
Spring rolls fried in a delicate and delicious wrap filled with chicken marinated in soy sauce and rice wine and sautéed julienned vegetables.

Pork Belly Buns (3) .................$6.95
Slow-cooked pork belly sliced and simmered in a sweet-savory caramelized ginger sauce served with cucumber slices, cilantro, scallions, sesame seeds and sandwiched between soft, pillowy steamed buns.

Wang’s Special Sichuan Style Chicken Wings (8) .......................$11.95
Crispy chicken wings marinated then tossed in a special blend of chillies, cumin, anise and Sichuan peppercorns. Can be served deep-fried (recommended) or baked.

Appetizers

Siu Mai (4) .........................$3.95
Traditional steamed Chinese dumplings made with stir-fried pork pieces marinated in Shaoxing rice wine, shiitake mushrooms and onion.

Fried Shrimp Toast (4) ............$3.95
Small triangle of bread blush with egg and coat with mince shrimps and water chestnuts. Deep-fryd till crisp and gold brown.

Chicken Spring Rolls (4) ...........$3.95
Spring rolls fryd into delicate and delicious wrap fill with chicken marinated in soy sauce and rice wine and sautéed julienned vegetables.

Pork Belly Buns (3) .................$6.95
Slow-cook pork belly slice and simmer in sweet-savory ginger caramelized sauce serving with cucumber slice, cilantro, scallion, sesame seed and sandwich between soft, pillowy steam buns.

Wang’s Special Sichuan Style Chicken Wings (8) .......................$11.95
Crisp chicken wing marinate after toss in a special blend of chillies, cumin, anise and Sichuan peppercorn. Can be serving deep-fry (recommend) or bake.
Appendix B
Quality Questionnaire

Liking -- How much do you expect to like this restaurant?
Quality -- How high quality do you expect this restaurant to be overall?
Taste -- How tasty do you expect the food from this restaurant will be?
Nutrition-- How nutritious do you expect the food from this restaurant will be?
Hygiene -- How sanitary do you expect the food from this restaurant will be?
Service -- How good do you expect the service at this restaurant will be?
Value -- How good value do you expect this restaurant will be?
Appendix C
Food Importance Questionnaire

I attach great importance to which restaurants I eat at.
New dishes at restaurants interest me a lot.
The dining experience at restaurants interests me a lot.
Appendix D
Perceived Vulnerability to Disease Scale (Duncan et al., 2009)

1. It really bothers me when people sneeze without covering their mouths.
2. If an illness is ‘going around’, I will get it.
3. I am comfortable sharing a water bottle with a friend.
4. I do not like to write with a pencil someone else has obviously chewed on.
5. My past experiences make me believe I am not likely to get sick even when my friends are sick.
6. I have a history of susceptibility to infectious disease.
7. I prefer to wash my hands pretty soon after shaking someone’s hand.
8. In general, I am very susceptible to colds, flu and other infectious diseases.
9. I dislike wearing used clothes because you do not know what the last person who wore it was like.
10. I am more likely than the people around me to catch an infectious disease.
11. My hands do not feel dirty after touching money.
12. I am unlikely to catch a cold, flu or other illness, even if it is ‘going around’.
13. It does not make me anxious to be around sick people.
14. My immune system protects me from most illnesses that other people get.
15. I avoid using public telephones because of the risk that I may catch something from the previous user.

Reverse coded: 3, 5, 11, 12, 13, 14
Perceived Infectability: 2, 5, 6, 8, 10, 12, 14
Germ Aversion: 1, 3, 4, 7, 9, 11, 13, 15
Appendix E
Xenophobia Scale (Van Der Veer et al., 2011)

Interacting with immigrants makes me feel uneasy
With increased immigration I feel like our way of life will change for the worse
I am afraid that our own culture will be lost with an increase in immigration
Immigration in this country is out of control
I doubt that immigrants will put the interest of this country first