UNMASKING THE IMPOSTER:
Do Fake Hotel Reviewers Show Their Faces in Profile Pictures?

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INTRODUCTION

The use of deception has been witnessed in the business community to maximize earnings and gain advantages over competitors. This unethical practice is becoming more prevalent with the emergence of online review platforms where writers are paid to fabricate reviews that favor or defame vendors (Dellarocas, 2006). Identifying and removing fake reviews are therefore important for a fair market. Using their confidential algorithm, review platforms such as Yelp.com and TripAdvisor.com identify suspicious hotel and restaurant reviews. Yelp.com labels them as "not currently recommended" (hereinafter non-recommended reviews). These reviews serve as an important source of data for researchers who are interested in identifying cues of fake reviews (Barbado et al., 2019; Li et al., 2020), so as to extend the implications to other platforms that are developing means to detect fake reviews or enhancing their ability to do so.

The past decade has witnessed increasingly more scholarly works that discuss the cues to effectively differentiate between fake and authentic reviews. Cues are in general categorized as those that are review-centric or user-centric (Barbado et al., 2019; Li et al., 2020). The former refers to features like linguistic style, content concreteness, content consistency, etc. The latter refers to information self-reported by users like personal (e.g., location), social (e.g., number of friends), reviewing activity (e.g., review frequency) and trusting (e.g., reputation) features (Barbado et al., 2019). Although many studies have been done on fake reviews, the use of profile pictures as a cue to discern them has not been thoroughly investigated.

Review platforms routinely ask users for a profile picture when signing up for an account. Users can choose to post a self-selected image, or ignore this request and use the default icon instead. Among those who post an image, some may elect to use a human face(s). This decision to use a profile picture and the type of image may expose imposter behaviors. Ekman (1996) concludes that concealment is a typical behavior of liars; that is, those who deliberately omit information that reveals their faults and weaknesses. Therefore, omission is central to lying. Since lying manifests unethical or even criminal activities, liars deliberately increase the difficulties of being identified (Noyes & Jenkins, 2019). The liars in this context, that is, fake review writers, might forego posting a profile picture (i.e., omission) which would otherwise increase their likelihood of being caught. So, we hypothesize that:

H1: Fake review writers are less likely to have a profile picture than authentic review writers

The theory of deception behavior suggests that some liars deliberately behave like a truth-teller (Zuckerman et al., 1981). Like many other authentic users, they might offer a profile picture to disguise their true intentions. However, owing to their concerns of being identified, they might omit themselves in the profile pictures. In other words, information is likely to be withheld in fear of exposure so these fake review writers may not want to show their faces. Therefore, we hypothesize that:

H2: Fake review writers are less likely to show their faces in profile pictures than authentic review writers

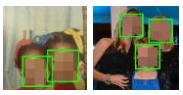
To validate our hypotheses, we conduct a big data analysis on hotel reviews extracted from Yelp.com.

STUDY 1: BIG DATA ANALYTICS

Las Vegas hotels are the unit of analysis in this study. A Python program was developed to scrape all available Yelp.com data. Like previous research, non-recommended reviews are considered fake reviews, albeit fake is not the exhaustive filtering criterion. The program scraped 8,436 fake reviews (70 hotels) and 144,886 authentic reviews (223 hotels). The profile pictures together with covariates including review star rating, review length (word count), review recency (days since the first review of the hotel), same location (reviewer based in Las Vegas), number of friends, and number of previous reviews were compiled (Li et al., 2020). Data with corrupted hyperlinks to the profile pictures were discarded. The final dataset contains 143,624 authentic reviews and 8,394 fake reviews.

Data without profile pictures were first sorted out. Those with pictures were processed via applying a Python-based artificial intelligence (AI) program called OpenCV to detect the number of faces included in each profile picture. Table 1 lists the descriptive statistics of the analyzed profile pictures.

Table 1: Use of profile pictures

	Frequency *(Column %)*		Sample picture[a]
	Fake	Authentic	
No picture	3,395 *(46.9%)*	28,553 *(19.9%)*	
Picture			
No face	3,038 *(36.2%)*	75,970 *(52.9%)*	
1 face	1,252 *(14.9%)*	35,222 *(24.5%)*	
2 or more faces	169 *(2.0%)*	3,879 *(2.7%)*	
Total	8,394 (*100%*)	143,624 *(100%)*	

Notes: [a]Green boxes highlight detected faces which are mosaicked for confidentiality.

A series of hierarchical logistic regression analyses were performed to test our hypotheses. Fake reviews (as opposed to authentic reviews) were the dependent variable while covariates and profile pictures were the independent variables. As shown in Table 2, the results support H1 as fake reviews are more likely to be written by users without profile pictures. Among the reviewers with a profile picture, the number of faces does not differentiate a fake from an authentic review. It appears that showing their face is not a concern of fake review writers (H2 is not supported). This is however challenged by the uncertainty of whether the face in

the picture belongs to the writer. Thus, we conduct an online experiment to validate the findings.

Table 2. Logistic Regression Results that Predict Fake Reviews

	B	95% CI for Odds Ratio		
		Lower	Odds	Upper
No picture (baseline)				
No face	-0.727***	0.459	0.483	0.509
1 face	-0.781***	0.427	0.458	0.490
2 or more faces	-0.721***	0.414	0.486	0.571
No face (baseline)				
1 face	-0.054	0.885	0.947	1.014
2 or more faces	0.006	0.857	1.006	1.183
1 face (baseline)				
2 or more faces	0.061	0.899	1.063	1.256
Covariates				
Review star rating	0.106***	1.096	1.112	1.129
Same location	0.669***	1.828	1.952	2.084
Review recency	0.000***	1.000	1.000	1.000
Number of friends	-0.001***	0.999	0.999	0.999
Number of previous reviews	-0.016***	0.984	0.984	0.985
Review length	-0.002***	0.998	0.998	0.999

Note: *** $p<0.001$; authentic reviews=0, fake reviews=1

STUDY 2: EXPERIMENT

The online experiment was conducted with participants recruited from Amazon Mechanical Turk. A between-subject design was used to conduct the experiment with 632 participants who are 18 or older and travel review website users. The participants were randomly assigned to either fake or authentic review conditions. In the former, participants were asked to imagine that someone asks them to fabricate an online review about a stay experience at a hotel. They create a user account and choose one of five options for profile picture: "Not going to upload a picture," "Picture without face," "Picture showing only my face," "Picture showing my face and others' face," and "Picture only showing others' face." These five options are also offered to those who write an authentic review, during which the participants imagine that they are about to write an online review regarding their recent hotel stay experience. The research design has been approved by the university research ethics committee.

The chi-square test shows that the use of a profile picture is contingent on whether the participants write a fake or an authentic review ($\chi^2(4)=94.087$, $p<0.001$). Specifically, compared to their authentic review counterparts, fake review writers are less likely to provide a picture (H1 is supported). Even if they do so, they do not want to show their own face. In contrast, the authentic reviewers are more likely to upload a picture with their face regardless whether there are other faces in the same picture. So, H2 is supported.

Table 3. Fake Reviews (versus Authentic Reviews) by Use of Profile Picture

Frequency (% within the column)	Authentic review (n=316)	Fake review (n=316)

No picture	33 (10.4%)[a]	75 (23.7%)[c]
Picture without face	45 (14.2%)[a]	91 (28.8%)[c]
Picture with own face	127 (40.2%)[b]	48 (15.2%)[d]
Picture with own and others' face	77 (24.4%)[b]	35 (11.1%)[d]
Picture with others' face	34 (10.8%)[a]	67 (21.2%)[c]

Notes. Subscript letters denote differences in proportions within the column. Different letters (a versus b and c versus d) indicate $p<0.05$.

CONCLUSION

This study addresses two unresolved research questions: (1) are fake review writers less likely to provide a profile picture, and (2) do fake review writers show their faces in their profile pictures? The findings which are based on an analysis of data from Yelp.com and an online experiment confirm our hypothesis that fake review writers are less likely to provide a profile picture. That means they recognize their misbehavior, and thereby refraining from providing a picture which could identify and expose their true identity.

As for Question 2, the findings in the two studies do not reach a consensus. The inconsistent findings are possibly because the face in the profile pictures of Yelp.com are not the users per se. Therefore, the conclusion should be drawn from our experimental study which revealed that fake review writers tend to omit their face on their profile because this act would increase the chances of being caught for fabricating the reviews. It is noteworthy that fake review writers are just as likely to use a profile picture that only shows the face of others as one without face or not providing any image at all. As such, they are probably attempting to disguise their misbehavior (Noyes & Jenkins, 2019).

Using mixed methods to triangulate the results is recommended in future related studies. Although the experimental design can better address our research questions, its external validity is not comparable to the field data of Yelp.com. The uncertainty about the realism of faces in Yelp's profile pictures indicates that the cues of fake reviews cannot solely rely on Yelp.com data. Validation using experimental design can provide a solid conclusion. This implication, however, is valid only if profile pictures are examined as the cue because of the focus of this study. Similar research should be conducted for other cues.

This study adds knowledge to the literature on deception theory and electronic word-of-mouth communication by exploring the use of profile pictures in detecting fake reviews. The current study also offers important implications to practitioners on how to improve the review system. Online review platforms should consider the availability of profile pictures and whether it is really the user's face when developing algorithm to identify fake reviews. The implications, however, may not be applicable to platform where only its customers can write the reviews (for example, Booking.com).

As with all studies, this research has its limitations. Even though the accuracy of OpenCV is widely acclaimed, there is still room for improvement. Also, our big data analytics only focuses on hotels in Las Vegas and the results may vary with different contexts. Future studies can expand on these limitations. Future research can also examine other pictorial cues

of fake review such as characteristics of picture (Ert & Fleischer, 2020), and if detectability of fake review by profile picture varies with user anonymity (Deng et al., 2021).

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