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Service Providers' Facial Ratios Impact Customer Satisfaction in the Hospitality E-Distribution Context

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Abstract

Purpose: Past studies have discovered that broader faces, indicated by a higher facial width-to-height ratio, are associated with antisocial personality traits and behaviors such as aggression and untrustworthiness. Extending these findings, this study investigates whether service providers' facial width-to-height ratios influence guest satisfaction evaluations in the hospitality e-distribution context (i.e., Airbnb). **Research design, data and methodology:** This research examines Airbnb host and property data in New York, employing a machine-learning-based facial recognition algorithm to analyze the facial images of approximately 18,000 hosts. **Results:** The findings reveal that hosts with broader faces receive lower guest ratings than those with narrower faces. Furthermore, the effect of facial ratio on ratings is moderated by accommodation type—entire homes versus shared or private rooms. When guests stayed in entire homes and did not share space with hosts, hosts' facial ratios did not significantly affect ratings. Conversely, when guests stayed in shared or private rooms, where they shared space with the hosts, hosts with broader faces received lower ratings. This study also finds that hosts' facial ratios influence Host ID verification behavior. **Conclusions:** This study suggests that service providers' facial width-to-height ratios can influence customers' evaluations of services, particularly in the context of hospitality distribution platforms such as Airbnb.

Keywords : Hospitality E-Distribution, Airbnb hosts, Guest Ratings, Facial Width-to-Height Ratio, Facial Recognition

JEL Classification Code: D12, L83, M31

1. Introduction

The supply chain in the hospitality industry has seen significant changes since the advent of hospitality e-distributors such as Airbnb and Booking.com (Turker & Ozdemir, 2020). Online booking systems have allowed customers to book accommodations directly, resulting in the elimination of intermediaries, such as travel agents, between service providers and end consumers (Tse, 2003). Changes have occurred not only among intermediaries but also on the side of service providers. In the past, established companies like Hilton and Marriott primarily handled supply; however, with the emergence of Airbnb, ordinary individuals have also been able to enter the market as service providers. This shift means that people who have not undergone traditional corporate-level hiring and training processes can now serve as providers. Previously, the appearance of service providers in hotels (e.g., their language, attitude, smile, and attire) was standardized through such recruitment and training processes (Nickson et al., 2005). In contrast, on platforms

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like Airbnb, the services provided by hosts can vary greatly. Given this shift, a better understanding of the impact of service providers on customers in the hospitality distribution supply chain has become increasingly important.

The importance of retail store employees in influencing customer satisfaction has been widely emphasized in retail and distribution research. Specifically, previous studies have identified factors such as employees' professional knowledge, prompt responsiveness, kindness, trustworthyness, and attentiveness that influence customer satisfaction, trust, revisit intention, and recommendation intention (Choo & Jung, 2015; Li et al., 2017; Lin et al., 2018). SERVQUAL (Parasuraman et al., 1988) is one of the most widely used measures to assess customers' perceived service quality in retail business research. It includes several items that assess various aspects of employees, such as neatness, courteousness, knowledge, personalized attention, and willingness to help (Kim et al., 2014; Parasuraman et al., 1991). Collectively, these studies highlight the significant role of employees in shaping positive customer perceptions of service in retail stores.

Among the many factors discussed, employees' appearance and facial expressions are particularly important in forming first impressions (Söderlund & Sagfossen, 2017), which in turn shape customers' perceptions of employees' traits such as trustworthiness (Ert et al., 2016; Jaeger et al., 2019). Therefore, retail workers need to maintain positive facial expressions and appearance. Given that employees' emotional exhaustion negatively impacts retail performance (Kang et al., 2016), extensive research has explored strategies to prevent burnout and promote positive emotions and attitudes in various retail contexts, such as department stores (Bae & Kim, 2011) and convenience stores (Kim et al., 2024). The importance of appearance and facial expressions extends to online environments as well (Wang et al., 2017; Yim et al., 2023).

The emergence of sharing economy and platform businesses has blurred the distinction between formal retail workers and strangers from the public. For example, when booking a room, a traveler might check in with a hotelier at Hilton or message a stranger who listed their room on Airbnb. When buying used goods, a customer might ask questions to a retail worker at a Goodwill store or a stranger who has posted their used goods on Facebook Marketplace. Similarly, when renting a car, a customer may interact with an employee at an Avis rental desk, or with a stranger sharing a car through Turo. In the latter case, where customers interact with strangers via platforms rather than through established businesses, they have less information about sellers or service providers. This makes it even more crucial for them to assess whether service providers at platforms such as Airbnb, Facebook Marketplace, and Turo are trustworthy.

Initially, Airbnb encountered challenges in convincing investors that individuals may be willing to stay in strangers' homes or host strangers in their homes, as explained by Joe Gebbia, a co-founder of Airbnb, in his 2016 TED Talk[1]: "No one in their right minds would invest in a service that allows strangers to sleep in people's homes. Why? Because we've all been taught as kids, strangers equal danger." Alleviating guests' worries and concerns about staying in properties owned by strangers has been a key focus of Airbnb. To address these concerns, the company introduced various measures such as host ID verification. In the same talk, Gebbia also emphasized the efforts made to help guests and hosts overcome the "stranger-danger" bias—a belief that strangers are inherently dangerous—and share homes.

Despite these measures, guests may continue to harbor concerns regarding the safety of staying in strangers' homes. However, guests are not always required to share accommodation with hosts, as Airbnb offers a category of accommodation termed Entire Homes, wherein guests occupy the entire property without the host being present. Additionally, Airbnb offers two other accommodation types: Private Rooms—where guests are allocated a private room but share common areas, such as the kitchen, with hosts or other guests; and Shared Rooms—where guests share the room and other spaces with hosts or other guests. When renting an entire home, guests typically do not need to interact with the host except to receive the key at check-in. Conversely, when renting a private or shared room, guests are likely to meet the host, making the host's identity and safety a more significant consideration. The level of concern likely depends on whether the accommodation is shared with the host or others; concerns may be higher for shared or private room rentals than for entire home rentals.

Previous research has indicated that individuals with wider faces, relative to their facial height, tend to exhibit more antisocial behavioral tendencies (Carré & McCormick, 2008; Geniole et al., 2014a; Haselhuhn & Wong, 2012; Lefevre et al., 2014a; Welker et al., 2015). However, these studies have faced significant criticism. For instance, a study using large-scale data (Kosinski, 2017) failed to identify such relationships. Consequently, the evidence remains inconclusive, and debates persist regarding whether facial width-to-height ratio is associated with aggressive or antisocial behaviors or personalities.

Nevertheless, even if such relationships do not exist, facial width-to-height ratio may influence how individuals perceive others' personalities or behaviors. Prior research on prejudice, stereotypes, and biases has demonstrated that individuals sometimes base their perceptions on inaccurate beliefs regarding the relationship between certain aspects of facial appearance and personal traits (e.g., Clayson & Maughan, 1986; Takeda et al., 2006). Therefore, some individuals may perceive those with higher facial width-to-

height ratio as more violent or antisocial, even if their beliefs are inaccurate and they are unaware of holding such biases. If this is the case, guests' perceptions and evaluations of hosts and their stays may be influenced by the hosts' facial width-to-height ratios. Additionally, the influence of such facial ratios on evaluations may be more pronounced when guests are likely to meet hosts in person—such as when staying in private or shared rooms—compared to situations where they are unlikely to meet hosts—such as when renting entire homes. This study examines whether the facial width-to-height ratios of Airbnb hosts influence guests' evaluation of their stays and whether this influence varies with accommodation type (entire homes versus private or shared rooms).

2. Literature Review

2.1. Facial Width-to-height Ratio and Antisocial Behavioral Tendencies

Various fields, including biology, evolution, and anthropology, have sought to identify biological features that differ by gender. For instance, males tend to have greater muscularity, stronger cranial structures, larger stature, and greater strength than females (Frayer & Wolpoff, 1985). These features typically do not exhibit differences during childhood but begin to do so around puberty—a phenomenon known as sexual dimorphism. Among these features, facial features are a key area of interest; numerous facial features have been identified as sexually dimorphic. For example, females tend to have larger eyes, prominent cheekbones, and greater eyebrow height (Lefevre et al., 2012; Penton-Voak et al., 2001). The relative facial width-to-height ratio has also been identified as a sexually dimorphic characteristic. These include the ratio of the width of the face to the height of the lower face (the area from the eyes to the chin) and the ratio of the height of the lower face to the height of the entire face (Penton-Voak et al., 2001; Weston et al., 2007). Weston et al. (2007) measured the width and height of 68 male and 53 female Homo sapiens facial skulls. Their findings indicate that males exhibit a greater breadth (represented by the distance between the right and left zygions) than females, whereas males and females have similar facial heights (represented by the distance between the nasion and prosthion points).

Researchers have explored whether sexual dimorphic features in facial structures serve as reliable cues for masculine traits and behaviors (Carré & McCormick, 2008). Among these features, the facial width-to-height ratio has garnered considerable attention. Several studies have reported associations between higher facial width-to-height ratio and various antisocial personality traits and behaviors. These include higher self-reported aggression (Lefevre et al., 2014a), higher self-reported Machiavellianism scores (Noser et al., 2018), higher aggressive behavior in professional hockey players (Carré & McCormick, 2008), higher cheating behavior in a lottery for a cash prize (Geniole et al., 2014a; Haselhuhn & Wong, 2012), more fouls committed by soccer players in the 2010 Men's World Cup (Welker et al., 2015), higher deceptive behavior in negotiations (Haselhuhn & Wong, 2012), and more exploitative behavior in the trust game in behavioral economics (Stirrat & Perrett, 2010).

Even in animals, similar findings have been reported. Broader faces have been identified as sexually dimorphic in chimpanzees (Weston et al., 2004). In capuchin monkeys, facial width-to-height ratio is positively correlated with alpha status, indicating the highest-ranking individual (Lefevre et al., 2014b). The study also reveals that these ratios are sexually dimorphic in adult monkeys but not in juveniles, suggesting that changes in facial width or height develop during puberty.

Although several studies have highlighted the influence of facial width-to-height ratio on various antisocial traits and behaviors, these studies have also faced criticism. First, some studies have been criticized for small samples, which made them underpowered (Kosinski, 2017). Second, Kramer and his colleagues failed to demonstrate that facial width-to-height ratios differ by gender (Kramer, 2017; Kramer et al., 2012), although the conclusion of Kramer (2017) was criticized for methodological issues by Köllner et al. (2018). Moreover, some studies have failed to replicate the associations between facial width-to-height ratios and self-reported aggression and other traits (Kosinski, 2017; Özener, 2012).

Additionally, testosterone has been speculated to be a mechanism explaining the links between facial width-to-height ratios and sexual dimorphism, antisocial traits, and behaviors (Carré & McCormick, 2008). However, several studies, including one with a large sample, have examined the influence of testosterone but failed to identify a significant relationship between facial width-to-height ratios and testosterone (Bird et al., 2016; Eisenbruch et al., 2018; Kordsmeyer et al., 2019).

2.2. Facial Width-to-height Ratio and Observers' Judgments and Evaluations

Even if facial width-to-height ratios are neither sexually dimorphic nor influenced by testosterone, observers' judgments or predictions of others' behaviors may still be influenced by these ratios, given that numerous prior studies have identified associations between these ratios and various antisocial traits and behaviors (Durkee & Ayers, 2021). Alternative theoretical grounds have been proposed to

explain the establishment of such associations (Kramer, 2017). First, individuals may perceive those with wider faces as angry because of the resemblance between wider and angry faces. When individuals were induced to appear angry, their facial width-to-height ratios increased (Marsh et al., 2014). The increase in their facial width-to-height ratios caused observers to predict aggressiveness. This implies that individuals may associate wider faces with angry faces. Consequently, they may believe that those with wider faces are aggressive. Second, wider faces are perceived as babyfaces owing to their resemblance to a round shape (Zebrowitz et al., 2015). Baby-faced individuals from low socioeconomic backgrounds were found to commit more criminal behavior (Zebrowitz et al., 1998). This is because baby-faced individuals are stereotyped as submissive, physically weak, and warm. Therefore, they tend to show more stereotype-disconfirming behaviors to refute the stereotype. Considering these alternative explanations, proving sexual dimorphism or its association with testosterone is not necessarily required to explain the influence of facial width-to-height ratio on observers' judgments and behavior predictions.

If, as discussed thus far, facial width-to-height ratio is associated with individuals' personalities and behaviors, this ratio may serve as a cue to observers' social inferences of others. Consistent with this prediction, several studies have demonstrated that judgments of others' traits and behaviors are influenced by their facial width-to-height ratio. Specifically, observers judged individuals with higher facial width-to-height ratios as more aggressive (Carré et al., 2009; Geniole et al., 2014b), less trustworthy (Stirrat & Perrett, 2010), more threatening (Geniole et al., 2015), and meaner (Durkee & Ayers, 2021).

If facial width-to-height ratios influence observers' judgments of others, it is also expected that these ratios may influence their judgments of services provided by them. For instance, customers may be more suspicious of car repair services offered by an automotive mechanic that appears less trustworthy compared to when the mechanic appears more trustworthy. This can lead to lower customer satisfaction. Several studies have found that customer evaluations of services are influenced by service providers' facial expressions (Pugh, 2001; Tidd & Lockard, 1978; Tsai, 2001) and appearance (Guéguen, 2012; Jiang & Galm, 2014; S.-B. Kim et al., 2018).

Although traits influenced by facial width-to-height ratio, such as aggressiveness, trustworthiness, dominance, deception, and exploitation, are critical in service marketing, few studies have examined its influence in such contexts, except for Bashir and Rule (2014). In one of their experiments, Bashir and Rule (2014) demonstrated that participants perceived a message delivered by a retailer as more accurate when the retailer had a higher facial width-to-height ratio compared to a retailer with a lower ratio. The authors also measured the perceived dominance of the retailer, highlighting that a retailer with a higher facial width-to-height ratio was perceived as more dominant. This suggests that a higher facial width-to-height ratio led to greater dominance, which, in turn, resulted in a high perceived accuracy of the delivered message. Further research on the influence of facial width-to-height ratio in marketing is required.

2.3. Hypotheses Development

Even if facial width-to-height ratios are neither sexually dimorphic nor influenced by testosterone, observers' judgments or predictions of others' behaviors may still be influenced by these ratios, given that numerous prior studies have identified associations between these ratios and various antisocial traits and behaviors (Durkee & Ayers, 2021).

This study examines the influence of facial width-to-height ratios in the context of hospitality distribution platforms such as Airbnb. In Airbnb, hosts are of key interest to guests, along with their location and properties (Tussyadiah & Zach, 2017). Airbnb guests are interested not only in a property's conditions but also in the host's personality and character. Two information categories in the host profile—text description and photos—may be a major source of information for guests to infer hosts' personality and character. Text descriptions that include storytelling narratives enhance the popularity of properties (Mauri et al., 2018). When hosts described themselves as well-traveled, guests perceived them as more trustworthy (Tussyadiah & Park, 2018). The more detailed the descriptions of hosts, the more reviews the properties received (Liang et al., 2020). Additionally, host profile photos offer guests clues about hosts. Specifically, individuals can infer the level of trustworthiness of hosts from their photos (Ert et al., 2016; Jaeger et al., 2019). These results imply that guests consider the hosts of a property and attempt to infer information about them from both profile text and photos.

Inferred traits from Airbnb host images, such as trustworthiness and emotional expressions, influence guest ratings, booking intention, and listing prices (Ert et al., 2016; Fagerstrøm et al., 2017; Jaeger et al., 2019; Jang, 2022, 2023). For instance, participants were more inclined to book properties managed by hosts who appeared more trustworthy than those who appeared less so (Ert et al., 2016). Thus, facial width-to-height ratio may influence guests' evaluations of host services by serving as clues for trait inferences. Given that facial width-to-height ratio is predominantly associated with negative traits such as untrustworthiness, hosts with higher ratios may receive lower guest ratings. Therefore, this research proposes the following hypothesis:

H1: Higher facial width-to-height ratio of Airbnb hosts leads to lower guest ratings.

Furthermore, this study considers a moderator for the influence of facial ratio: whether guests are likely to meet hosts in person. This likelihood varies with accommodation type. Guests are unlikely to meet their hosts in person when entire homes are rented. Conversely, guests are more likely to meet a host in person when renting private or shared rooms, as they share certain sections of the property, such as a living room or kitchen. In such instances, a host's personality and character become important. When guests expect to meet or interact with a host, they are more likely to avoid interacting with someone perceived as aggressive, deceptive, or untrustworthy. Additionally, they may safeguard themselves from becoming victims of crime, given past criminal incidents in the home-sharing industry (Binns & Kempf, 2021; S. Wang, 2024). Therefore, the extent to which facial width-to-height ratio influences guest ratings is expected to be greater for private or shared room rentals than for entire-home rentals. Thus, this research proposes the following hypothesis:

H2: The influence of facial width-to-height ratio on guest ratings is moderated by accommodation type. Specifically, the influence is more negative for private or shared rooms than for entire homes.

As discussed earlier, higher facial width-to-height ratios are associated with untrustworthy behaviors such as cheating and deceptive behavior (Geniole et al., 2014a; Haselhuhn & Wong, 2012). In the context of Airbnb, it is possible that hosts with wider faces are less likely to complete host ID verification, leading to lower guest ratings. In other words, host verification may mediate the relationship hypothesized in H1, that is, the relationship between facial width-to-height ratios and guest ratings. Based on this reasoning, H3 was proposed as follows:

H3: Host ID verification mediates the relationship between facial width-to-height ratios and guest ratings.

Furthermore, if host ID verification mediates this relationship, it is also plausible that it mediates the moderation effect hypothesized in H2, specifically, the moderation effect of accommodation type on guest ratings (see Figure 1 for the conceptual model illustrating all hypotheses). Thus, this research proposed H4 as follows:

H4: Host ID verification mediates the moderating effect of accommodation type on guest ratings. Specifically, host verification significantly mediates that relationship for private and shared room rentals, but not for entire home rentals.

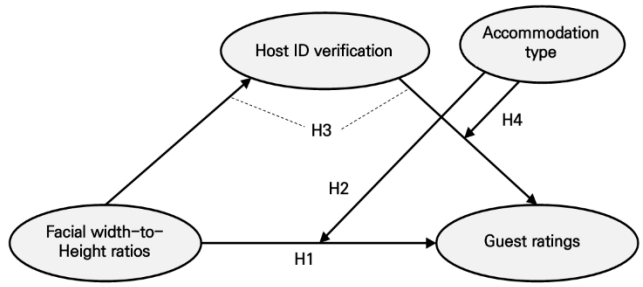


Figure 1: Conceptual model illustrating hypotheses on the effects of facial width-to-height ratios, host verification, and accommodation type on guest ratings

Early research on facial width-to-height ratios has focused on whether these ratios could predict individuals' traits and behaviors. Subsequent research has explored whether observers could infer the traits of others based on their facial width-to-height ratio. This study examines whether the influence of facial width-to-height ratios extends to observers' evaluations of services provided by these individuals, using data from Airbnb hosts with properties in New York City.

3. Research Methods

3.1. Dataset

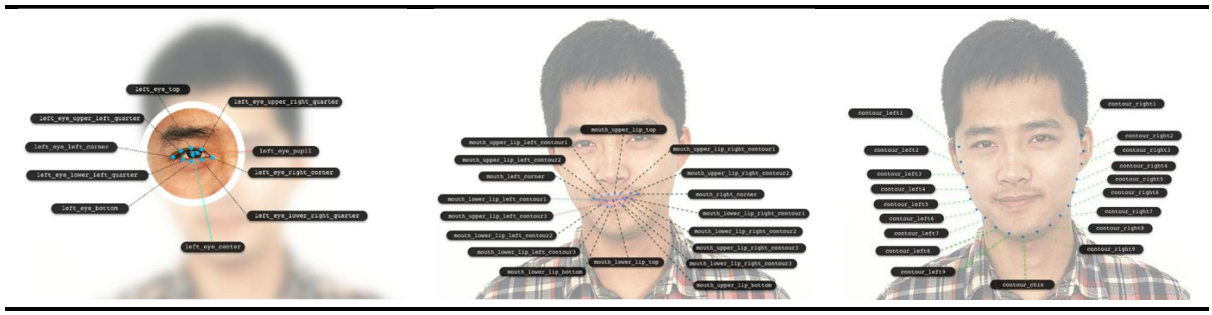
The Airbnb dataset used in this study was obtained from Inside Airbnb (insideairbnb.com). The dataset from Inside Airbnb has been widely used in business research (Lim et al., 2021; Luca et al., 2024; Rossi, 2024). It includes several information, such as guest ratings and accommodation types, for all Airbnb listings in New York City as of June 2020, totaling 49,530 listings. This study only included listings with guest ratings and available URLs for profile photos for facial feature analysis described in the next section. This filtering process yielded a dataset of 37,243 listings.

3.2. Facial Analysis

The facial recognition algorithm provided by Face++ was used for facial analysis. Face++ is a leading facial recognition provider, along with Microsoft Azure, Amazon Rekognition, and Google Cloud Vision. The performance of the Face++ algorithm is on par with that of Microsoft, Amazon, and Google, and studies on facial recognition commonly include Face++ as a state-of-the-art algorithm (Jung et al., 2018; Li & Choi, 2021; Raji & Buolamwini, 2019). Moreover, Face++ has been widely used in research involving facial analysis (e.g., Jang, 2023; Jung et al., 2017; Kosinski, 2017; Yildiz et al., 2017).

The primary purpose of using Face++ was to obtain

coordinate information of key facial points from host photos and calculate the facial width-to-height ratios for each host. Some host images contained multiple faces. In such instances, it was not possible to determine which facial image(s) among the many may have influenced guest ratings. Therefore, this research included host images featuring a single face. The URLs of the host profile photos were submitted to Face++ via its API to obtain information about the number of faces present in each photo. For photos containing only one face, the URLs were resubmitted to Face++ to obtain detailed facial landmark information. Face++ provides 83 landmarks (see Figure 2), including the coordinates of features such as the top point of the upper lip for each host image. Additionally, hosts' age and gender information were requested and obtained from Face++, which were subsequently included as covariates in the statistical analyses. The number of images featuring a single face that Face++ could analyze and provide landmark information was 17,891.



Source: Face ++ website (www.faceplusplus.com)

Figure 2: Facial landmarks from Face++

This study used two types of facial width-to-height ratios, both of which have been actively investigated in past studies. The two ratios differ in their facial height measurement: the first measures the distance from the top of the eyes to the top of the upper lip (e.g., Kramer et al., 2012), whereas the second measures the distance from the midpoint of the eyes to the chin (e.g., Penton-Voak et al., 2001). Despite this difference, both ratios use the same facial width, defined as the distance between the left and right facial contours. The first ratio has garnered more attention from researchers than the second. However, the first ratio has sometimes failed to replicate past findings regarding sexual dimorphism, whereas the second has successfully replicated them (Hodges-Simeon et al., 2021; Lefevre et al., 2012; Robertson & Kingsley, 2018). The first ratio is referred to as $fWHR_{lip}$ (facial width-to-height ratio using the lip), and the second as $fWHR_{chin}$ (facial width-to-height ratio using the chin) in subsequent sections of this article.

3.3. Statistical Analyses

Hierarchical linear modeling was employed because some hosts owned multiple properties. The guest star ratings for each Airbnb listing served as the dependent variable. Guest rating data from the Inside Airbnb dataset was on a 100-point scale, although guests rated properties using a five-star system. This was because Inside Airbnb transformed the rating data by multiplying the raw star ratings on a five-point scale by 20. Independent variables included facial width-to-height ratios in the model testing H1 and facial width-to-height ratios, accommodation type, and the interaction between the ratios and accommodation type in the model testing H2. The two facial width-to-height ratios were mean centered. Accommodation type was coded as 1 for entire home rentals and -1 for shared room and private room rentals[2] (see Tables 1A and 1B). Covariates included the host's age, gender, host verification (i.e., whether the host's ID has been verified), number of reviews per month, listing price, cleaning fee, number of bathrooms, number of bedrooms, and capacity (i.e., the maximum number of guests that a property could accommodate).

Table 1A: Descriptive Statistics for Guest Ratings, $fWHR_{lip}$, $fWHR_{chin}$, and Age

Variables		M	SD	Min	Max
Guest ratings		94.12	8.94	20	100
Facial width-to-height ratios	$fWHR_{lip}$	2.06	0.22	1.17	4.67
	$fWHR_{chin}$	1.17	0.08	0.71	1.89
Age		32.77	8.54	0	73

Table 1B: Descriptive Statistics for Accommodation Type and Gender

Variables		N	%
Accommodation type	Entire home	11,320	51.3%
	Private room	10,299	46.7%
	Shared room	458	2.1%
Gender	Female	12,048	54.6%
	Male	10,029	45.4%

4. Results

4.1. Main Effect of Facial Width-to-height Ratios

A series of hierarchical linear models were run with facial width-to-height ratios as the independent variable and guest ratings as the dependent variable. Each facial width-to-height ratio type, $fWHR_{lip}$ and $fWHR_{chin}$, was entered into separate models. The results (see Table 2) revealed a significant effect of the facial width-to-height ratios on guest ratings[3]. Both ratio types, $fWHR_{lip}$ and $fWHR_{chin}$, were significant, with $fWHR_{chin}$ having a stronger effect than $fWHR_{lip}$, as indicated by its higher coefficient. The effect of either ratio remained significant in models that additionally included covariates. These results support H1.

Table 2: Results from the Models Testing the Main Effect of Facial width-to-height Ratios

Variables		Model 1	Model 2	Model 3	Model 4
Main variables	$fWHR_{lip}$	-0.6369 *	-0.6089*		
	$fWHR_{chin}$			-2.6440***	-2.3397 **
Control variables	Age		0.0564***		0.0541 ***
	Gender		0.2995***		0.3294 ***
	Host verification		0.5349***		0.5307 ***
	# of reviews / month		0.4860***		0.4859 ***
	Listing price		0.0008*		0.0008 *
	Cleaning fee		0.0138***		0.0137 ***
	# of bathrooms		-0.3959*		-0.4003 *
	# of bedrooms		-0.0758		-0.0766
	Capacity		-0.2365***		-0.2372 ***
	(Intercept)	94.4098 ***	92.4090***	94.4062***	92.4858 ***

*Note: †p < .10, * p < .05, ** p < .01, *** p < .001*

4.2. Moderating Effect of Accommodation Type

Another series of hierarchical linear models were run, with guest ratings as the dependent variable and facial width-to-height ratios, accommodation type, and the interaction term between the ratios and accommodation type as independent variables. The results (see Table 3) demonstrated a significant main effect of the facial width-to-height ratios on guest ratings for both $fWHR_{lip}$ and $fWHR_{chin}$. The coefficients were greater in models with $fWHR_{chin}$ than in those with $fWHR_{lip}$.

Table 3: Results from the Models Testing the Moderating Effect of Accommodation Type

Variables		Model 1	Model 2	Model 3	Model 4
Main variables	$fWHR_{lip}$	-0.6952 *	-0.6307*		
	$fWHR_{chin}$			-2.5851***	-2.3134 **
	Accommodation type	0.5631 ***	0.5685***	0.5610***	0.5675 ***
	$fWHR_{lip} \times$ Accommodation	0.4945 †	0.4759†		
	$fWHR_{chin} \times$ Accommodation			2.0478**	1.9169 **
Control variables	Age		0.0534***		0.0513 ***
	Gender		0.2974***		0.3265 ***
	Host verification		0.5074***		0.5019 ***
	# of reviews / month		0.5035***		0.5024 ***
	Listing price		0.0006†		0.0006 †
	Cleaning fee		0.0108***		0.0108 ***
	# of bathrooms		-0.1685		-0.1782
	# of bedrooms		0.0507		0.0550
	Capacity		-0.3835***		-0.3839 ***
	(Intercept)	94.3553 ***	92.6356***	94.3587***	92.7127 ***

*Note: †p < .10, * p < .05, ** p < .01, *** p < .001*

Regarding the interaction term, models with $fWHR_{chin}$ exhibited a significant interaction effect, while models with $fWHR_{lip}$ yielded a marginally significant interaction effect. These results remained consistent when covariates were

additionally included in the models. Subsequent spotlight analyses (Irwin & McClelland, 2001) were conducted on $fWHR_{chin}$ to further elucidate the direction of the coefficients for each accommodation type. The results revealed that $fWHR_{chin}$ was negatively associated with guest ratings for shared or private room rentals (β = -4.2303, t = -3.85, p = .0001), whereas the effect of the ratio was not significant for entire home rentals (β = -0.3965, t = -0.38, p = .7003). Similar spotlight analyses were conducted for models with $fWHR_{lip}$, although the interaction terms in these models were only marginally significant. The results confirmed that the directions of influence were consistent with those of the models with $fWHR_{chin}$. Specifically, $fWHR_{chin}$ was negatively associated with guest ratings for shared or private room rentals (β = -1.1065, t = -2.65, p = .0081), whereas the effect of the ratio was not significant for entire home rentals (β = -0.1548, t = -0.40, p = .6907).

4.3. Mediation and Mediated Moderation Effects of Host ID Verification

Before conducting the mediation and mediated moderated analyses, the effect of facial width-to-height ratios on host ID verification was examined. As the ID verification variable was binary, logistic regression analysis was conducted with host ID verification as the dependent variable, facial width-to-height ratio as the independent variable, and age and gender as covariates. The results indicated a significancy effect of facial width-to-height ratios on host ID verification for both $fWHR_{lip}$ (β = -0.1746, z = -2.85, p = .0044) and $fWHR_{chin}$ (β = -1.0671, z = -6.58, p < .0001). This suggests that hosts with wider faces are less likely to provide ID verification.

A mediation analysis was performed to examine whether host ID verification mediates the relationship between facial width-to-height ratio and guest ratings for both $fWHR_{lip}$ and $fWHR_{chin}$. A bootstrapping method was used to test the significance of the indirect effect of facial width-to-height ratio on guest ratings through host verification in the mediation analysis using R's bootstrap package with 1,000 samples. The results showed that the indirect effect of facial width-to-height ratios on guest ratings, mediated by host verification, was significant for both $fWHR_{lip}$ (*indirect effect* = -0.039, 95% CI: -0.0845, -0.0149) and $fWHR_{chin}$ (*indirect effect* = -0.2688, 95% CI: -0.3524, -0.1990). These results indicate that hosts with wider faces are less likely to provide ID verification, which leads to lower guest ratings.

Next, a mediated moderation analysis (Muller et al., 2005) was conducted to assess whether host ID verification mediates the moderating effect of accommodation type on guest ratings. The same bootstrapping method was used to test the significance of the indirect effect of facial width-to-height ratios on guest ratings through host verification and the interaction between accommodation type and host verification in the mediated moderation analysis. The results showed that $fWHR_{lip}$ did not significantly mediate this moderating effect (*indirect effect* = 0.0114, 95% CI: -0.0023 to 0.0232), whereas $fWHR_{chin}$ did (*indirect effect* = 0.0630, 95% CIs: 0.0124 to 0.1344). The significance of $fWHR_{chin}$ supports H4, indicating that the negative effect of $fWHR_{chin}$, mediated by host verification, on guest ratings is more pronounced for private and shared room rentals than for entire-home rentals.

Note that Muller et al. (2005) suggest that one of the necessary conditions for a mediated moderation was a significant interaction between the moderator and the main independent variable—in this study, the interaction between accommodation type and facial width-to-height ratios. However, as discussed in the previous section, the interaction was not significant for $fWHR_{lip}$. Therefore, a nonsignificant mediating moderation effect for $fWHR_{lip}$ was expected. Nevertheless, for confirmatory purposes, a mediation analysis was conducted for $fWHR_{lip}$.

5. Discussion

This study provides evidence that the facial width-to-height ratios of service providers negatively affect customer evaluations in the context of the hospitality distribution platform, Airbnb. Hosts with higher facial width-to-height ratios received lower guest ratings than those with lower ratios. Additionally, this study suggests that the negative effect of facial ratios is moderated by the extent to which customers interact with hosts in person. When Airbnb guests occupy entire homes, meaning that they do not need to share a property or stay with hosts, the effect of facial ratios is not significant. In contrast, when guests stay in shared or private rooms, where they share accommodation with hosts, facial ratios negatively affect guest ratings. Furthermore, through mediation and mediated moderation analyses, this study demonstrated that hosts with wider faces are less likely to provide ID verification, and this reduced verification rate leads to lower guest ratings. Additionally, the negative effect of lower ID verification rates on guest ratings is more pronounced for shared and private rooms than for entire-home rentals.

These findings extend the previous literature on facial width-to-height ratios by demonstrating their influence on observers' evaluations. Prior studies on facial width-to-height ratios have only demonstrated that the ratios influence observers' trait estimates. However, no studies have investigated whether these trait estimates can be extended to other judgments. Numerous marketing research has demonstrated that positive facial expressions influence not only the evaluations of service providers (Luong, 2005) but

also those of the services offered by them (Brown & Sulzer-Azaroff, 1994; Pugh, 2001). Therefore, facial width-to-height ratio can be expected to influence both trait estimates of service providers and evaluations of their services. This is the first study to demonstrate that service providers' facial ratios influence customer evaluations of the services offered by service providers. Additionally, this study shows that facial width-to-height ratios are associated with behavior, specifically ID verification, contributing to the literature by providing another example of the link between facial ratios and behavior.

Another contribution of this study is the comparison of the two types of facial width-to-height ratios, $fWHR_{lip}$ and $fWHR_{chin}$, and the finding that $fWHR_{chin}$ has a stronger effect than $fWHR_{lip}$. $fWHR_{lip}$ has received more scholarly attention than $fWHR_{chin}$, since Weston et al. (2007) initially reported that the facial ratio exhibited sexual dimorphism. However, $fWHR_{lip}$ has sometimes failed to replicate past findings, such as sexual dimorphism, whereas $fWHR_{chin}$ has succeeded in replicating them (Hodges-Simeon et al., 2021; Lefevre et al., 2012; Robertson & Kingsley, 2018). This study provides further evidence that $fWHR_{chin}$ is a better measure than $fWHR_{lip}$. One reason for the stronger effect of $fWHR_{chin}$ could be attributed to the chin being a more noticeable endpoint than the lips. In other words, individuals may tend to use the chin as the endpoint when measuring the length of the face rather than the top of the upper lip. Therefore, even if a higher $fWHR_{lip}$ may more accurately predict greater aggressive or deceptive behavior than $fWHR_{chin}$, observers who witness such behaviors may associate it with the distance ending at the chin rather than the lip. Future research could consider examining another facial ratio type using the distance from the top of the face to the chin rather than from the midpoint of the eyes to the chin, as the top of the face may be even more noticeable than the midpoint of the eyes.

This research also contributes to distribution literature by examining the impact of service providers' appearance on customer satisfaction. The rise of hospitality e-distributors like Airbnb and Booking.com has led to significant changes, both in the intermediaries between service providers and end consumers, and on the service providers' side in the hospitality supply chain. This shift has made the role and importance of service providers in retail more pronounced. The findings offer new insights into existing distribution studies.

Based on previous findings regarding the association between facial ratios and observers' trait estimates, this study predicted the influence of hosts' facial width-to-height ratios on guest ratings, demonstrating that these facial ratios impact guest ratings. However, one limitation of this study is that it does not confirm whether observers' trait estimates play a role in this influence. In other words, it remains unclear whether guests perceived hosts with broader faces as more aggressive or untrustworthy, and whether these perceptions contributed to lower guest ratings. Future research could address this limitation by assessing guests' perceptions and analyzing whether any perceived traits mediate the influence observed in this study. Additionally, future research could identify the specific traits among those associated with facial ratios that mediate this influence.

Another limitation of this study is that it examines only Airbnb data. Consequently, Airbnb listings and guest ratings may reflect platform-specific dynamics. To derive more generalizable insights, future research should explore whether these findings can be applied to other online platforms.

These findings have practical implications for Airbnb platform and Airbnb hosts. Specifically, hosts with wider faces got worse guest reviews for private/shared rooms, but not entire homes. Therefore, if these hosts apply a simplistic version of these findings, they could consider switching to renting out entire homes over renting private or shared rooms. However, this strategy may not be realistic, as the choice of accommodation type depends on other factors. Furthermore, applying these findings in this manner may raise concerns regarding discrimination. Research on Airbnb has already revealed racial discrimination, demonstrating evidence of bias and suggesting possible remedies (Cheng & Foley, 2018; Cui et al., 2020; Edelman et al., 2017; Laouénan & Rathelot, 2022). Given these concerns, rather than leaving individual hosts to devise countermeasures, Airbnb should implement more fundamental solutions to mitigate the influence of facial appearance on guest decisions. One possible approach is to encourage the use of branding instead of personal names or profile photos. In other online stores, such as Etsy, amateur sellers who post their handmade goods often use brand names and logos instead of personal images, preventing customers from forming first impressions of the sellers based on appearance.

This issue extends beyond Airbnb to other online platforms, where service providers' photos are often publicized. This exposure renders them vulnerable to customer biases. Therefore, further research is required to understand these biases in digital marketplaces better, and online platforms should explore strategies to minimize their impact.

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Endnotes:

1. TED Talk, "How Airbnb designs for trust" (ted.com/talks/joe_gebbia_how_airbnb_designs_for_trust).
2. Shared rooms were grouped with private room rentals owing to their small proportion (2.1%, see Table 1B). Coding shared rooms separately did not yield different results.
3. Multicollinearity was assessed for each independent variable in all the models by calculating the variance inflation factors (VIFs). No multicollinearity issues were found, as all VIFs were below 2.5.