



Negative Airbnb Reviews: An Aspect Based Sentiment Analysis Approach

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Negative Airbnb Reviews: An Aspect Based Sentiment Analysis Approach

ABSTRACT

Purpose

The current paper aims at exploring negative aspects in reviews about Airbnb listings in Athens, Greece.

Design/methodology

The aspect-based sentiment approach (ABSA), a subset of sentiment analysis, is used. The study analyzed 8,200 reviews, which had at least one negative aspect. Based on dependency parsing, noun phrases were extracted, and the underlying grammar relationships were used to identify aspect and sentiment terms.

Findings

The extracted aspect terms were classified into three broad categories, i.e., the location, the amenities and the host. To each of them the associated sentiment was assigned. Based on the results, Airbnb properties could focus on certain aspects related to negative sentiments in order to minimize negative reviews and increase customer satisfaction.

Originality

The study employs the ABSA, which offers more advantages in order to identify multiple conflicting sentiments in Airbnb comments, which is the limitation of the traditional sentiment analysis method.

Keywords: Airbnb, Negative reviews, Aspect-based sentiment analysis, consumer behavior,

Article classification: Empirical Research Paper

1. Introduction

It is estimated that Airbnb presents approximately \$4-\$5 billion in revenue per year by offering more than 7 million Airbnb home listings worldwide (Jenkins, 2020). According to Milanova and Maas (2007) Airbnb presents greater capacity for growth, compared to hotels. Airbnb is an online platform through which two main types of accommodation (i.e., entire houses and single rooms) are rented (Guttentag, 2019). The process of looking for and booking the accommodation is similar to other platforms (e.g., Booking.com, Expedia). However, a two-sided reputation system is offered in the Airbnb platform; the host and the tourist have the opportunity to leave a review simultaneously after check-out (Baute-Díaz *et al.*, 2019; Bridges and Vásquez, 2016).

Online reviews are a reliable source of information for tourists' destination selection process (Murphy *et al.*, 2007) as they affect the decision-making process (Assimakopoulos *et al.*, 2014) and also contain valuable information for tourism managers who could ameliorate the service quality based on them (Dellarocas *et al.*, 2007). Lalicic *et al.* (2021) add that marketing strategies could be based on different tourists' perception reflected in Airbnb reviews. According to Kwok *et al.* (2020) the analysis of online reviews connected to the 7Ps could also help hosts and webmasters to design differentiated strategies and assist policymakers to imply certain restrictions so as to more effectively regulate the home-sharing market. Moreover, as Kirkos (2022) states, Airbnb online reviews could be used to evaluate Airbnb listings' performance. However, in online reviews a positive bias is observed (Bridges and Vásquez, 2016). Several research studies have focused on the positive skewed distribution of online products and services' ratings (e.g., Yannopoulou *et al.*, 2013; Zervas *et al.*, 2015).

Zervas *et al.* (2015) found that the average rating on Airbnb was 4.7 out of 5, whilst the average on TripAdvisor was lower (i.e., 3.8 on a 5-point scale). Nevertheless, the content

of the review is not always connected to the number of stars assigned to the property. As Fradkin *et al.* (2018) note, even if guests post a five-star rating, 13% of their comments include negative texts. Guests also include negative context in 45% of four-star reviews and 75% of three-star reviews (Fradkin *et al.*, 2018).

Although several studies have demonstrated that consumers are more influenced by negative than positive reviews (e.g., El-Said, 2020; Ghosh, 2018; Yan and Jiang, 2018) and overall negative comments are more useful than positive (Park and Nikolau, 2015), there are very limited studies that exclusively focus on negative reviews or complaints against Airbnb (e.g., Phua, 2019). Most of the studies that explore negative reviews use grounded theory to extract the results (e.g., Phua, 2019) or content analysis (e.g., Sthapit, 2019; Sthapit and Björk, 2019). Only a couple of papers in the tourism industry use machine learning techniques to analyze online reviews (e.g., Cheng and Jin, 2019; Fradkin *et al.*, 2018; Kwok *et al.*, 2020; Kirkos, 2022).

Since the rating is not always connected to the negative text in online reviews, the current paper investigates negative aspects in all Airbnb reviews in Athens, Greece. Greece presents a significant increase in hosts' revenue of 105% since 2017 and Athens is one of the most important Greek Airbnb markets (airdna.co). As Guttentag (2015; 2019) proposes, it would be interesting for future studies to investigate factors that influence guests in destinations where Airbnb has a considerable presence. Furthermore, as Güçlü *et al.* (2020) explain, the number of research papers which focus on Airbnb in a particular city are limited.

A comment posted on the Airbnb platform may contain a combination of positive and negative feelings, attitudes and experiences regardless of its rating. Traditional sentiment analysis techniques, which investigate the overall polarity of a comment, would probably not reveal reliable results, particularly in cases of conflicting feelings. For this reason, the exploration of the polarity of each detected aspect separately was decided as a

methodological approach. Against this background, this paper aims at detecting negative aspects in reviews by using aspect-based sentiment analysis (ABSA). This task contributes to the effective identification and extraction of aspects and sentiments from reviews which are publicly available on the Airbnb platform. As such, hosts and other stakeholders in the Airbnb industry could more effectively evaluate comments written (e.g., Airbnb could offer relevant services and provide hosts with reviews' analysis, **managers could train the workforce in the Airbnb industry to gain any benefits from big data analysis (Chatterjee *et al.*, 2022))** and incorporate them into their strategies.

Based on the above, the following two main research questions could be formed:

RQ1: Which are the most important negative aspects in Athens Airbnb reviews?

RQ2: Which are the main sentiments related to negative aspect terms found in Athens Airbnb reviews?

2. Literature review

2.1. Online reviews

Travellers feel the urge to write reviews on the platform in order to improve the accommodation provider (Ert *et al.*, 2016). Chang and Wang (2018) found that guests of all ages are influenced by reviews. Individuals often rely on positive or negative online reviews written by other people (Sparks and Browning, 2011). Online travel reviews are considered as one of the most powerful and reliable information sources for customers while making purchase choices (Ahani *et al.*, 2019; Chen *et al.*, 2020; Tan *et al.*, 2018) as they can directly display customers' satisfaction or dissatisfaction (Zhao *et al.*, 2019). Online reviews are very helpful in reducing consumer (traveler or tourist) perceived risk and confusion (El-Said, 2020; Zeng *et al.*, 2020). **Maintaining positive reviews can make business sustainable, whilst replying to negative reviews is important for product/service improvement and image**

restoration (Sarumaha, 2020). Although some studies (Floh *et al.*, 2013; Zhong *et al.*, 2014) indicate that positive reviews have a greater impact on consumer attitudes, the majority of researchers highlight the significant impact of negative reviews on customer purchase decisions (e.g., El-Said, 2020; Filieri *et al.*, 2019; Ghosh, 2018; Zhao *et al.*, 2015).

Negative information has a stronger impact on consumer evaluations than positive (Papathanassis and Knolle, 2010; Sparks and Browning, 2011) as they gain a more negative weight by the consumer (Smith *et al.*, 1999). This may be due to the tendency of individuals to more intensively focus on negative information which could possibly lead to a 'be careful' attitude (Fiske, 1993; Sparks and Browning, 2011). As Park and Nikolau (2015) conclude, negative reviews are more useful than positive ones. The perceived usefulness of negative reviews is higher even than extremely positive ratings. Casado-Díaz *et al.* (2020) proved that consumers are influenced by negative reviews as they form unfavourable attitudes towards a hotel when reading negative online reviews. Moreover, negative reviews are connected to low booking intentions. Fiske (1980) adds that negative information is perceived by consumers as more informative compared to neutral or positive information. Browning, Fung and Sparks (2013) showed that recent negative reviews influence tourists' attribution of service quality and may outbalance the ratings of the hotel.

However, both positive and negative online reviews have a strong effect on a company's reputation (Hennig-Thurau *et al.*, 2004) and sales (Chatterjee, 2020). Furthermore, the online reviews give the organizations an opportunity to accurately accomplish comprehensive customer behavior analysis (Ahani *et al.*, 2019). From a managerial perspective, reviews available on the platform, offer Airbnb providers an online decision-making tool that may be used in the design of corporate strategies (Baralou and Tsoukas, 2015).

2.2. Negative online reviews for Airbnb

Varma *et al.* (2016) found that reviews are important for guests when selecting an Airbnb accommodation. According to Guttentag (2019), reviews are a key feature of Airbnb as they contribute to the building of trust between the host and guests. Xie and Mao (2017) found that accommodation ratings and review count influence demand. Studies conducted so far agree that reviews in sharing economies platforms present an overall positive rating (Cheng and Jin, 2019; Ert *et al.*, 2016; Zervas *et al.*, 2015) and thus a positivity bias is observed (Bridges and Vásquez, 2016).

The theory of J-shaped distribution indicate that online reviews present an asymmetric, positively skewed distribution. According to Hu, Zhang and Pavlou (2009), there are more 5-star reviews than 1-star assessments, whereas moderate reviews are limited. However, the authors also note that there is a small but important number of very negative (i.e., 1-star rating) reviews. Fradkin *et al.* (2015) found that the very positive reviews (i.e., 5-star rating) consist approximately 70% of the total number of reviews in Airbnb. This percentage is higher compared to TripAdvisor, which is around 30% (Fradkin *et al.*, 2015).

Zervas *et al.* (2015) compared Airbnb to TripAdvisor reviews and concluded that ratings on Airbnb are far more positive. It is worth noting that when comparing properties reviewed on both platforms, the authors found differences which may be due to the nature of the platform. However, the authors argued that “the larger question of an explanation for why posted Airbnb ratings are so dramatically high, remains open” (Zervas *et al.*, 2015, p. 12).

A possible explanation of this positive bias could be the lower and more realistic expectations that consumers may have for accommodations offered by individuals that are also related to human interactions (Yannopoulou *et al.*, 2013). As Bridges and Vásquez

(2016) add, it could be quite difficult for a consumer to submit negative feedback straight after having personally interacted with the host. Dellarocas and Wood (2008) agree that possibly for the same reason (i.e., difficulty to submit a negative review straight after a personal meeting with the host), negative reviews in online platforms that permit two-sided reviews are limited. Moreover, individuals ‘carefully express their complaints in online reviews, mainly due to the feeling of familiarity created by Airbnb (Bridges and Vásquez, 2016). Another explanation for the limited negative reviews in Airbnb is the lack of anonymity, as reviews are connected to the guest’s authenticated profile (Bridges and Vásquez, 2016). In addition, Fradkin *et al.* (2018) estimated that 61% of those who have a negative experience do not review the Airbnb accommodation. Finally, according to Bridges and Vásquez (2016) certain reviews may not be published by Airbnb (e.g., for not respecting the platform’s guidelines or directly attacking the host). As Santos *et al.* (2020) add, this positive bias phenomenon may cause the concealment of bad hosts. As a result, the authors suggest that reviews on platforms of the sharing economy should be differently interpreted to eliminate bias towards positivity.

Bridges and Vásquez (2016, p. 2065), who analyzed 400 both host and guest reviews found that most negative Airbnb reviews “serve as a caution to future guests and/or as suggestions for improvement to the host”. Furthermore, these authors point out that most of the negative reviews are connected to the lack of comfort, communication, or cleanliness, while Fradkin *et al.* (2018) argue that guests’ intention to submit a negative review to the Airbnb platform is connected to the social interactions they had with the host. Sparks and Browning (2010) state that most of the hotel reviews focus on the main hotel’s functions (e.g., lack of room cleanness) or customer service (e.g., negative interactions with people working in the hotel). Varma *et al.* (2016) agree that guests give emphasis, among others, on location, price and service quality. Cheng and Jin (2019), who examined Sydney Airbnb

reviews, demonstrated that most comments focus on location, accommodation amenities and the host (e.g., helpfulness, friendliness). Tussyadiah and Zach (2017) also concluded that comments mostly concentrate on location, service, facilities and feeling welcome.

Sthapit (2019) also focused on negative reviews using data from the TrustPilot website. The author used five words (i.e., bad, awful, poor, terrible, and horrible) to search the website's forum and then analyzed reviews using content analysis. Sthapit and Björk (2019), explored the sources of distrust and applied the same methodology but used the keyword "trust" to collect reviews from guests who had a negative experience with Airbnb accommodation. Phua (2019) investigated complaints related to Airbnb properties. The author explored reviews from Sitejabber.com and randomly used a grounded theory approach to analyze 664 reviews by guests.

3. Methodology

The paper uses sentiment analysis (SA), a task that permits the automatic extraction of opinions posted in reviews (Shafie *et al.*, 2018). Sentiment analysis allows the identification of subjective information from a collection of reviews, which consequently allows the improvement of companies' marketing strategies (Giatsoglou *et al.*, 2018). Traditional sentiment analysis tries to detect the overall polarity of a sentence, comment or document regardless of the target entities and/or aspects mentioned. User reviews, however, may contain multiple aspects with sometimes conflicting sentiments. For example, a comment like "The host was very polite, but the kitchen was old and not well equipped." expresses positive sentiment towards the host but also includes negative sentiment to the amenities of the apartment. ABSA (Ding *et al.*, 2004) is a subset of sentiment analysis (SA) that aims to overcome this complexity, by identifying and extracting the aspect terms and assigning to each of them the associated sentiment.

The typical steps in an ABSAs are: (1) identify and extract aspect terms and sentiment words; (2) classify aspect terms to aspect categories; (3) identify the polarity of the sentiment associated with each aspect category. The first step, sometimes also called Aspect Term Extraction (ATE), is usually the most challenging. There are many alternative approaches to ATE. The four main categories are lexicon based, supervised learning, unsupervised learning and rule-based methods (Liu and Zhang, 2012). Lexicon-based methods do not require any training but suffer from inferior accuracy due to the limited coverage of the lexicons. They also do not scale well to large data. Unsupervised methods are mainly based on topic modelling (Brody and Elhadad, 2010; Lin and He, 2009), they also do not require labelled training data, they scale well to large datasets, but still lack performance. Supervised machine learning techniques achieve the highest accuracy but require a fairly large labelled training dataset. Obtaining such a dataset, however, may be time consuming and labour intensive.

This paper uses a rule-based approach for ATE, that is related to dependency parsing (Marneffe *et al.*, 2006) to extract noun phrases and utilizes the underlying grammar relationships to identify aspect and sentiment terms (Poria *et al.*, 2014, Shafie *et al.*, 2018). Part of Speech (POS) tagging, and dependency parsing are performed using the Stanford CoreNLP toolset (Manning *et al.*, 2014), a natural language processing software written in the Java programming language by researchers from Stanford university. To demonstrate the result of the parser, an example comment is used. In Figure 1 the Part of Speech of each word may be observed, as well as the grammar relationships with each other.

[Figure 1 Here]

Next, given the dependencies and part of speech, rules are constructed to extract only those that refer to aspect terms and their associated sentiment. Nouns are candidates for aspect terms whereas adjectives, verbs and adverbs for sentiment. The most common types of

dependency relations are “adjectival modifier” and “nominal subject” between noun and adjective/verb to derive aspect - sentiment pairs, “conjunct” that joined multiple aspect terms to a sentiment word or multiple sentiment word to an aspect, “compound” that identify multiword expressions and “negations” and “adverbial modifiers” that enhance and or negate a sentiment. The analysis includes all 15 relations suggested in Shafie et al. (2018).

After acquiring the aspect terms, these are lemmatized, mapped to a vector space and then clustered. Three main aspect categories appear: host, location, and amenities. For each comment, the sentiment words are aggregated by aspect category and then a lexicon-based approach is used to determine the polarity. The lexicon is built by adjusting the VADER (Valence Aware Dictionary for Sentiment Reasoning) model (Hutto and Gilbert, 2014) with domain (hospitality) specific sentiment expressions. The paper analyzes the dataset published in December 2019, regarding Athens found at <http://insideairbnb.com/>, which is publicly available.

4. Results

4.1. Descriptives

Based on the available data, the total number of listings in Athens is 11,263, while the mean price is €65.96 per night and the median price is €48.00. Table I shows the number of listings per year.

[Table I Here]

The total number of (non-empty) reviews is 402,101 (2010-2019). Approximately 78% of the reviews are written in English, whilst 6.5% are written in French and 5.5% in Greek. Non-English reviews are excluded from the analysis. In total 313,638 (non-empty

written in English) reviews were analyzed following the process of the ABSA process. Table II presents the number of reviews per year for listings in Athens.

[Table II Here]

The reviews with at least one negative aspect are 8,200 (approximately 5% of the total comments). The average length of comments is 279 characters (median: 214, mode: 88). Table III presents three examples of extracted comments, their dependency relationships and aspect/sentiment terms.

[Table III Here]

4.2. Location

Several comments refer to location, which seems to be quite important for tourists. They frequently comment on noisy neighbourhood/street or lack of transportation. It is also crucial for Airbnb visitors for the place to be convenient (i.e., next to attractions, restaurants). Finally, safety as a key aspect appears in some comments. The following direct quotes from reviews include aspects/sentiments related to location:

“Very bad neighbourhood, rubbish everywhere, looks like not so safe to be there. The rooms are not look like on photo (much worst). Uncomfortable to stay.”

“The apartment was very clean and nice, although the location was not great. It was not close to the city center and took about 20 minutes to get to the center by bus. We were told by multiple taxi drivers that the area was not very safe and to not walk around after it got dark.”

“The location was not ideal, but we were only passing through, so we didn't mind. Even so, there are few dinner options nearby for a real meal. The apartment is a lot older than it appears in the photos, but the Wi-Fi was strong and the rooms comfortable.”

“Close to the metro, but it was a very old building in a relatively bad neighbourhood.”

The ABSA process revealed that the most frequent aspect terms related to the location category are: “location” (36.07%), “neighbourhood” (19.07%), “area” (17.02%), “street” (12.78%), “metro” (8.29%), neighbour (3.41%), restaurant (1.41%), and sport (1.27%) and distance (1.06%). The word cloud that follows (Figure 2) incorporates all aspect terms for the location category.

[Figure 2 Here]

The words used for the negative polarity of the sentence related to the location topic were: “noisy” (11.33%), “bad” (2.25%), “very noisy” (1.9%), “dodgy” (1.66%), “avoid” (1.43%), “not good” (1.29%), “scary” (1.25%) and “not safe” (1,23%). All negative sentiments are appeared in the word cloud below (figure 3).

[Figure 3 Here]

4.3. Amenities

Comments about amenities usually include, among others, aspects related to bed (e.g., uncomfortable hard mattress) and Wi-Fi (e.g., did not work, required a password which was not initially given, weak signal, etc.). Furthermore, certain problems in bathroom/toilet (e.g., dirty, lack of hot water, low water pressure) appeared in respondents’ comments. The following direct quotes incorporate some amenities’ aspects:

“We had a really nice time! Only problem is that the Wi-Fi sometimes didn’t work.”

“If you want to turn on heater in both rooms, the light just turns off in all apartment, conditioner is very noisy. You can hear every step from the outside, awful noise insulation.

Very close railway. It was difficult to connect to Wi-Fi, and it worked alternately.”

“OK apartment for a short stay...but the beds were not comfortable at all.”

“The place is quite noisy but that was already stated in the other reviews. Also, we went in March and were a bit cold as there was no heating.”

The aspect-based analysis demonstrated that the most frequent aspect terms that were under the amenities category were: “bed” (7.04%), “water” (4.53%), “Wi-Fi” (3.13%), “view” (2.88%), “shower” (2.59%), “room” (2.17%), bathroom (1.99%), “door” (1.96%), “kitchen” (1.43%), “mattress” (1.38%), “space” (1.36%), “window” (1.29%), “internet” (1.26%), “floor” (0.82%), “fridge” (0.74%) and “balcony” (0.72%). All aspect terms found in the analysis are presented in the following word cloud (figure 4).

[Figure 4 Here]

For the negative polarity attached to the amenities the most frequently words used are: “not work” (5.52%), “hard” (2.94%), “miss” (2.57%), “noisy” (2.66%), “dirty” (2.17%), “uncomfortable” (1.77%), “low” (1.74%), “not hot” (1.31%), “not clean” (1.21%), “lack” (1.15%), “difficult” (1.06%), “leak” (0.90%) and “stop” (0.88%). These findings are included in the following word cloud (figure 5).

[Figure 5 Here]

4.4. Host

For the host category, the most frequent aspect terms were “host” (51.03%) and “communication” (4.82%). The analysis also showed hosts’ names as aspect terms (e.g., Maria, Anna, Alex, etc) (figure 6).

Some examples of comments related to the host are presented below:

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3 “We’ve not seen host. When arrived just called by phone (see forgot that we are arriving this
4 day) and got instructions where to get keys and etc.”
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8 “The lights in the apartment went out so when we asked for new bulbs the landlord refused
9 and later accused us of stealing light bulbs from the apartment.”
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13 “The host didn't reply on any of our messages, we walked a lot to the flat and nobody
14 appeared. We waited 40 minutes and no chance to reach anybody through email or telephone
15 call. What a bad experience.”
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24 **[Figure 6 Here]**
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27 The words used for the negative polarity of the sentence related to the host topic were:
28 “cancel” (41.66%), “leave” (37.74%), “not available” (1.68%), “warn” (1%), “not
29 recommend” (1%) and “difficult” (0.93%). The full list of sentiment terms of this category is
30 shown in figure 7.
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39 **[Figure 7 Here]**
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41 **5. Discussion and conclusion**

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43 Negative reviews are particularly important for Airbnb listings. As Phua (2019) points
44 out, Airbnb should effectively deal with dissatisfaction through appropriate customer service.
45 According to Golmohammadi *et al.* (2020), service companies, particularly with a global
46 presence, need to carefully monitor negative e-WOM. The current paper explores the
47 negative aspects and their related sentiments in order to provide a base for dissatisfaction
48 limitation. Hosts and Airbnb providers could take into consideration the key findings to build
49 more effective marketing strategies. The reduction of negative aspects in Airbnb comments
50 would also enhance favourable decision making and preference for the property. Our findings
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offer important theoretical contributions to Airbnb tourism research and practical implications for hosts.

This study makes several theoretical contributions to the negative online review comments in the Airbnb literature. Firstly, the current study contributes to the existing limited literature on negative online reviews as only a handful of studies explore this issue in the Airbnb context (Phua, 2019; Sthapit, 2019). Secondly, the findings of the current study enrich our knowledge of negative online reviews for Airbnb in a specific city. Even though Airbnb exists in many cities, the current research body is centred only in a small number of cities (i.e., New York) neglecting cities which are significant tourism destinations (Güçlü *et al.*, 2020). Thirdly, the study offers factors that influence guests responding to Guttentag's call (2015; 2019) for more research in places where Airbnb has a noticeable existence. Finally, this study employs the ABSA which offers more advantages in order to identify multiple conflicting sentiments in Airbnb comments, which is the limitation of the traditional sentiment analysis method.

From a managerial point of view, the current study provides several significant practical implications. The J-shaped distribution of Airbnb reviews and the highly positive mean score of a property may not be totally reliable. As Hu *et al.* (2009) note, the mean score of online product reviews may be a biased estimator. Based on the current paper's results, a listing's mean score could not reflect the full visitors' evaluation since negative aspects/sentiments are incorporated even in very highly rated properties. Thus, hosts should not merely rely on ratings, but focus on each comment separately to detect any areas that could be possibly improved. ABSA could be used in the tourism industry to analyze reviews since certain aspects related to negative sentiments can be detected, regardless of the rating of the property or the inclusion of mixed feelings in the comment.

The analysis of the current paper showed that location is a key aspect category. The relevant literature demonstrates that tourists prefer to stay in hotels or other accommodation close to the main tourist attractions. Guttentag (2016) argues that Airbnb guests evaluate higher practical attributes, such as location, compared to experiential attributes. Gutierrez et al. (2017) proved a positive relation between the key sights of tourists' interests and the location of the accommodation. Sthapit and Jiménez-Barreto (2018), who studied the factors which contribute to a memorable Airbnb hospitality experience also pointed out that location is an important aspect.

Thus, it may be concluded that Airbnb accommodation description should include the proximity to the tourist attractions (Sthapit and Jiménez-Barreto, 2018) so as to make sure that guests be aware of the strengths and limitations of the listing's location before their visit. Moreover, hosts could provide related services (e.g., private transportation to the airport, free lifts to sightseeing) in cases where location presents certain withdraws (e.g., lack of public transportation). Apart from the property's location, Airbnb providers should also focus on the neighbourhood, street and entire area in general. As noise seems to be quite important for guests, they could try to eliminate unpleasant conditions for example by adding sound insulation equipment to the property where possible or warn potential guests in the listing's description that there is some noise in the area. Also, regarding safety, Airbnb hosts in areas with safety issues could provide better safety services (e.g., hire security guards, offer shuttle bus services).

In addition, results showed that communication is crucial within the host category, while, among others, cancelation and unavailability could be mentioned as negative aspects/sentiments in reviews.

The important role of the host within the tourism context has been pointed out by past studies (e.g., Chan, 2006; Cheng and Zhang, 2019). Hosts' motivations primarily include

monetary compensation but could also aim at socially interacting with guests (Cheng and Zhang, 2019; Lampinen and Cheshire, 2016). The guest-host relationship has attracted significant attention in the peer-to-peer accommodation industry where the guest–host interactions are closer (Yannopoulou *et al.*, 2013). The role of guest-host interaction is actually one of the key dimensions of the Airbnb experience (Tussyadiah and Pesonen, 2016; Yannopoulou *et al.*, 2013). Sthapit and Jiménez-Barreto (2018) found that the attitude of the host constitutes a dimension of a positive Airbnb experience. Particularly, social interactions and the attitude of the host could result in building trust (Guttentag, 2015). Liang et al. (2017) showed that guests are even willing to pay more for accommodations managed by “superhosts”.

Sthapit and Jiménez-Barreto (2019), who conducted interviews with guest in Spain and Finland, found that most negative Airbnb reviews are related to poor communication between guests and the host. Hosts should be available, try to help guests in any way, while cancelation of the booking should be avoided.

Most authors agree that one of the main factors that constitute the Airbnb experience are amenities (Guttentag, 2015). Amenities are connected to guests’ satisfaction (Wang and Jeong, 2018; Wang and Nicolau, 2017). Airbnb amenities are not the same to those found in hotels; most guests expect Airbnb listings to have certain amenities that they use at home such as kitchen and a washing machine (Wang and Jeong, 2018). On the other hand, Walls (2013) argues that the importance of Airbnb ambient environment (e.g., everyday facilities, house environment and a balcony) is similar to the hotels. Negative reviews connected to the facilities mostly focus on the difference between the actual amenities and what was described in the Airbnb website. As most guests need to feel comfortable and have a ‘like being at home’ experience in an Airbnb accommodation. As a result, hosts should include amenities that would cover this need (Sthapit and Jiménez-Barreto, 2018). As the findings of this paper

showed, emphasis should be given on beds (e.g., quality of the mattress, comfort beds, etc.) and water (e.g., hot water/water at the right temperature should be available 24/7). Furthermore, Wi-Fi seems to be quite important for guests and any problem (e.g., weak signal) connected to Wi-Fi could be included as a negative aspect in reviews. Finally, hosts should pay attention to cleanliness, which is one of the most basic living needs and an important factor for guest satisfaction or dissatisfaction. The rise of internet has significantly affected the tourist experience as well as the future transformation of the entire tourism industry (Monaco, 2018). Digital technologies are particularly important to SMEs for being competitive in dynamic markets (Chatterjee *et al.* 2021a). Reviews in peer-to-peer platforms are crucial since evaluators are “normal citizens” (Van den Bussche and Dambrin, 2020). The analysis of online reviews could influence future Airbnb guests to select a place to stay, whilst the analysis of negative aspects and sentiments could clearly indicate potential core elements or details which tourists should evaluate before booking a listing. On the other hand, data extracted from comments in online platforms may result in better understanding of tourists’ feelings and, consequently, ameliorate the actions of the place brand (Lima *et al.*, 2022). Moreover, through big data analysis managers could assess changes in internal and external environments and possibly seize emerging opportunities (Chatterjee *et al.*, 2022). According to Monaco (2018) reviews could be considered as a starting point for tourist operators, hoteliers, retailers etc., for implementing innovative strategies and corrective practices. Improving this two-way communication that exists between hosts and tourists could contribute to the complex process of building customer relationships (Sarmaniotis *et al.*, 2013). Airbnb hosts could concentrate on any negative elements that may be improved and try to offer future tourists a more pleasant experience. On top of that, organizations and individuals involved in the Airbnb industry could try to improve their technical expertise (Chatterjee *et al.*, 2021b) for better assessment and understanding reviews’ analysis. Finally,

as Lima *et al.* (2022) argue, studies which focus on sentiment analysis could be used by public managers in order to more profoundly comprehend tourist behaviour and design effective tourism destination strategies.

6. Limitations and directions for further study

The main limitation of this study is connected to the lack of a labelled dataset. A labelled dataset would permit the use of supervised machine learning techniques, which would provide more accurate results. Moreover, some grammatical rules could not be truly explored, due to slang phrases, idioms, double negative terms, etc. For instance, a comment such as “host could not have been better” would be classified as negative, although the reviewer shared a positive aspect. However, these cases are limited, and results could not be influenced by certain rarely presented phrases. Moreover, some negative aspects/sentiments could possibly not be extracted due to misspellings. Although some obvious spelling mistakes have been taken into consideration when constructing the aspect lexicon, this procedure was not exhaustive, so there could be some cases that were misclassified. Further research could explore the relationship between negative context of reviews and certain characteristics of the properties (e.g., neighbourhood of Athens where the listing is located, price, size of the property, etc). It could also compare different areas of Greece (e.g., Athens vs Thessaloniki or Crete) or different countries or cities (e.g., Athens vs Paris). Finally, as Vilenica et al. (2021) argue, the Covid-19 pandemic has seriously affected the housing industry in Greece. Thus, it would be interesting to compare the results of this study to post-Covid datasets.

References

- Ahani, A., Nilashi, M., Yadegaridehkordi, E., Sanzogni, L., Tarik, A. R., Knox, K., Samad, S. and Ibrahim, O. (2019), "Revealing customers' satisfaction and preferences through online review analysis: The case of Canary Islands hotels", *Journal of Retailing and Consumer Services*, Vol. 51, pp. 331-343.
- Assimakopoulos, C., Papaioannou, E., Sarmaniotis, C. and Georgiadis, C.K. (2014), "Online reviews as a feedback mechanism for hotel CRM systems", *Anatolia: An International Journal of Tourism and Hospitality Research*, Vol. 26, No.1, pp. 5-20.
- Baralou, E. and Tsoukas, H. (2015), "How is new organizational knowledge created in a virtual context? An ethnographic study," *Organization Studies*, Vol. 36 No. 5, pp. 593-620.
- Baute-Díaz, N., Gutiérrez-Taño, D. and Díaz-Armas, R. (2019), "Interaction and reputation in Airbnb: An exploratory analysis," *International Journal of Culture, Tourism and Hospitality Research*, Vol. 13 No. 4, pp. 370-383.
- Bridges, J. and Vásquez, C. (2016), "If nearly all Airbnb reviews are positive, does that make them meaningless?" *Current Issues in Tourism*, Vol. 21 No. 18, pp. 2057-2075.
- Brody, S. and Elhadad, N. (2010), "An unsupervised aspect-sentiment model for online reviews," Human Language Technologies: Conference of the North American Chapter of the Association of Computational Linguistics, Proceedings, June 2-4, Los Angeles, California, USA.
- Browning, V., Fung, K.K. and Sparks, B. (2013), "The influence of online reviews on consumers' attributions of service quality and control for service standards in hotels," *Journal of Travel and Tourism Marketing*, Vol. 30 No. 1/2, pp. 23-40.
- Casado-Díaz, A.B., Andreu, L., Beckmann, S.C. and Miller, C. (2020), "Negative online reviews and webcare strategies in social media: effects on hotel attitude and booking intentions," *Current Issues in Tourism*, Vol. 23 No. 4, pp. 418-422.

- Chan, Y. W. (2006), "Coming of age of the Chinese tourists: The emergence of non-Western tourism and host—Guest interactions in Vietnam's border tourism," *Tourist Studies*, Vol. 6 No. 3, pp. 187-213.
- Chatterjee, S., Chaudhuri, R. and Vrontis, D. (2022), "Big data analytics in strategic sales performance: mediating role of CRM capability and moderating role of leadership support", *EuroMed Journal of Business*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/EMJB-07-2021-0105>
- Chatterjee, S., Chaudhuri, R., Vrontis, D. and Basile, G. (2021a), "Digital transformation and entrepreneurship process in SMEs of India: a moderating role of adoption of AI-CRM capability and strategic planning", *Journal of Strategy and Management*, Vol. ahead-of-print No. ahead-of-print, <https://doi.org/10.1108/JSMA-02-2021-0049>
- Chatterjee, S., Chaudhuri, R., Vrontis, D., Thrassou, A., Ghosh, S.K. and Chaudhuri, S. (2021b), "Social customer relationship management factors and business benefits", *International Journal of Organizational Analysis*, Vol. 29 No. 1, pp. 35-58.
- Chatterjee, S. (2020), "Drivers of helpfulness of online hotel reviews: A sentiment and emotion mining approach," *International Journal of Hospitality Management*, Vol. 85, pp. 1023-56.
- Chen, F., Liu, S.Q. and Mattila, A.S. (2020), "Bragging and humblebragging in online reviews," *Annals of Tourism Research*, Vol. 80, pp. 1028-49.
- Cheng, M. and Jin, X. (2019), "What do Airbnb users care about? An analysis of online review comments," *International Journal of Hospitality Management*, Vol. 76, pp. 58-70.
- Cheng, M. and Zhang, G. (2019), "When Western hosts meet Eastern guests: Airbnb hosts' experience with Chinese outbound tourists," *Annals of Tourism Research*, Vol. 75, pp. 288-303.

- Dellarocas, C. and Wood, C.A. (2008), "The sound of silence in online feedback: Estimating trading risks in the presence of reporting bias," *Management Science*, Vol. 54 No. 3, pp. 460–476.
- Dellarocas, C., Zhang, X. and Awad, N. F. (2007), "Exploring the value of online product reviews in forecasting sales: The case of motion pictures," *Journal of Interactive Marketing*, Vol. 21 No. 4, pp. 23-45.
- El-Said, O. A. (2020), "Impact of online reviews on hotel booking intention: The moderating role of brand image, star category, and price," *Tourism Management Perspectives*, Vol. 33, pp.100604.
- Ert, E., Fleischer, A. and Magen, N. (2016), "Trust and reputation in the sharing economy: The role of personal photos in Airbnb," *Tourism Management*, Vol.55, pp. 62-73.
- Filieri, R., Raguseo, E. and Vitari, C. (2019), "What moderates the influence of extremely negative ratings? The role of review and reviewer characteristics," *International Journal of Hospitality Management*, Vol. 77, pp. 333–341.
- Fiske, S. T. (1980), "Attention and weight in person perception: The impact of negative and extreme behavior," *Journal of Personality and Social Psychology*, Vol. 38 No. 6, pp. 889-906.
- Fiske, S. (1993), "Social cognition and social perception," *Annual Review of Psychology*, Vol. 44, pp. 155-194.
- Floh, A., Koller, M. and Zauner, A. (2013), "Taking a deeper look at online reviews: The asymmetric effect of valence intensity on shopping behaviour," *Journal of Marketing Management*, Vol. 29 No. 5/6, pp. 646–670.
- Fradkin, A. and Grewal, E. and Holtz, D. (2018), "The determinants of online review informativeness: evidence from field experiments on Airbnb," Available at SSRN: <https://ssrn.com/abstract=2939064>.

- Giatsoglou, M., Vozalis, M., Diamantaras, K., Vakali, A., Sarigiannidis, G. and Chatzisavvas, K. (2017), "Sentiment analysis leveraging emotions and word embeddings," *Expert Systems with Applications*, Vol. 69, pp. 214-224.
- Ghosh, T. (2018), "Predicting hotel book intention: The influential role of helpfulness and advocacy of online reviews," *Journal of Hospitality Marketing & Management*, Vol. 27 No. 3, pp. 299-322.
- Golmohammadi, A, Mattila, A.S. and Gauri, D.K. (2020), "Negative online reviews and consumers' service consumption," *Journal of Business Research*, Vol. 116, pp. 27-36.
- Güçlü, B., Roche, D. and Marimon, F. (2020), "City characteristics that attract Airbnb travellers: Evidence from Europe," *International Journal for Quality Research*, Vol. 14 No. 1, pp. 271-290.
- Gutierrez, J., Garcia-Palomares, J. C., Romanillos, G. and Salas-Olmedo, M. H. (2017), "The eruption of Airbnb in tourist cities: Comparing spatial patterns of hotels and peer-to-peer accommodation in Barcelona," *Tourism Management*, Vol. 62, pp. 278-291.
- Guttentag, D. A. (2015), "Airbnb: Disruptive innovation and the rise of an informal tourism accommodation sector," *Current Issues in Tourism*, Vol. 18 No. 12, pp. 1192-1217.
- Guttentag, D. (2019), "Progress on Airbnb: A literature review," *Journal of Hospitality and Tourism Technology*, Vol. 10 No. 4, pp. 814-844.
- Hennig-Thurau, T., Gwinner, K.P., Walsh, G. and Gremler, D. D. (2004), "Electronic word-of-mouth via consumer-opinion platforms: What motivates consumers to articulate themselves on the Internet?" *Journal of Interactive Marketing*, Vol. 18 No. 1, pp. 38-52.
- Hu, N., Zhang, J. and Pavlou, P. (2009), "Overcoming the J-shaped distribution of product reviews," *Communications of the ACM*, Vol. 52 No. 10, pp. 144-147.

- Hu, M. and Liu, B. (2004), "Mining and summarizing customer reviews. In Proceedings of the tenth ACM," SIGKDD international conference on Knowledge discovery and data mining. ACM, New York, NY, USA, pp. 168-177.
- Hutto, C.J. and Gilbert, E. (2014), "Vader: A parsimonious rule-based model for sentiment analysis of social media text," In Eighth international AAAI conference on weblogs and social media. Available at <https://www.aaai.org/ocs/index.php/ICWSM/ICWSM14/paper/view/8109>.
- Jenkins, A. (2020), "Coping with a bad trip at Airbnb," *Fortune*, Vol. 181 No. 1, pp. 67-75.
- Kirkos, E. (2022), "Airbnb listings' performance: determinants and predictive models," *European Journal of Tourism Research*, Vol. 30, pp. 3012.
- Kwoka, L., Tangb, Y. and Yuc, B. (2020), "The 7 Ps marketing mix of home-sharing services: Mining travelers' online reviews on Airbnb," *International Journal of Hospitality Management*, Vol. 90, 102616, <https://doi.org/10.1016/j.ijhm.2020.102616>
- Lalicic, L., Marine-Roig, E., Ferrer-Rosell, B. and Martin-Fuentes, E. (2021), "Destination image analytics for tourism design: An approach through Airbnb reviews," *Annals of Tourism Research*, Vol. 86, pp. 103100.
- Liang, S., Schuckert, M., Law, R. and Chen, C. C. (2017), "Be a 'superhost': The importance of badge systems for peer-to-peer rental accommodations," *Tourism Management*, Vol. 60, pp. 454-465.
- Lima, J.I.M.P., Pessanha, G.R.G., Araújo, M.V.P., Alves, R.C. de. A., Cesário, M.F.P. and Rocha, A.C.F. de. O. (2022), "Place branding Pernambuco: analysis of the feelings of the users through Instagram hashtags," *Brazilian Journal of Marketing*, Vol. 21, No. 1 154-184.

- Lin, C. and He, W. (2009), "Joint sentiment/topic model for sentiment analysis," Proceedings of the 18th ACM conference on Information and knowledge management, November, pp. 375–384.
- Liu, B. and Zhang, L. (2012), A survey of opinion mining and sentiment analysis. In C. C. Aggarwal, & C. Zhai, (Eds.), *Mining text data*, (pp.415-463). Boston, MA: Springer.
- Marneffe, M.D., MacCartney, B. and Manning, C.D. (2006), "Generating typed dependency parses from phrase structure parses," International Conference on Language Resources and Evaluation, May, Genoa, Italy.
- Manning, C. D., Surdeanu, M., Bauer, J., Finkel, J., Bethard, S. J. and McClosky, D. (2014), "The Stanford Core NLP Natural Language Processing Toolkit," In Proceedings of 52nd Annual Meeting of the Association for Computational Linguistics: System Demonstrations, pp. 55-60.
- Milanova, V. and Maas, P. (2017), "Sharing intangibles: Uncovering individual motives for engagement in a sharing service setting," *Journal of Business Research*, Vol. 75, pp. 159-171.
- Monaco, S. (2018), "Tourism and the new generations: emerging trends and social implications in Italy", *Journal of Tourism Futures*, Vol. 4 No.1, pp. 7-15.
- Murphy, L., Mascardo, G. and Benckendorff, P. (2007), "Exploring word-of-mouth influences on travel decisions: friends and relatives vs. other travellers," *International Journal of Consumer Studies*, Vol. 31 No. 5, pp. 517-527.
- Park, S. and Nicolau, J. L. (2015), "Asymmetric effects of online consumer reviews," *Annals of Tourism Research*, Vol. 50, pp. 67–83.
- Papathanassis, A. and Knolle, F. (2011), "Exploring the adoption and processing of online holiday reviews: A grounded theory approach," *Tourism Management*, Vol. 32, pp. 215-224.

- Phua, V. C. (2019), "Perceiving Airbnb as sharing economy: The issue of trust in using Airbnb," *Current Issues in Tourism*, Vol. 22 No. 17, pp. 2051-2055.
- Poria, S., Cambria, E., Winterstein, G. and Huang, G.B. (2014), "Sentic patterns: Dependency-based rules for concept-level sentiment analysis," *Knowledge-Based Systems*, Vol. 69, pp. 45-63.
- Santos, G., Mota, V.F.S., Benevenuto, F. and Silva, T.H. (2020), "Neutrality may matter: sentiment analysis in reviews of Airbnb, Booking, and Couchsurfing in Brazil and USA," *Social Network Analysis and Mining*, Vol. 10, 45, <https://link.springer.com/article/10.1007/s13278-020-00656-5>
- Sarmaniotis, C., Assimakopoulos, C. and Papaioannou, E. (2013), "Successful implementation of CRM in luxury hotels: determinants and measurements", *EuroMed Journal of Business*, Vol. 8 No. 2, pp. 134-153.
- Sarumaha, Y. (2020), "Airbnb Sentiment Analysis with Python", <https://medium.com/@yogi.sarumaha/airbnb-sentiment-analysis-with-python-e81e66fee6a6> (accessed 22 April 2022)
- Shafie, A. S., Sharef, N. M., Murad, M. A. A. and Azman, A. (2018), "Aspect extraction performance with POS tag pattern of dependency relation in aspect-based sentiment analysis," Fourth International Conference on Information Retrieval and Knowledge Management (CAMP), 17 September 2018, Kota Kinabalu, Malaysia.
- Smith, A. K., Bolton, R. N. and Wagner, J. (1999), "A model of customer satisfaction with service encounters involving failure and recovery," *Journal of Marketing Research*, Vol. 36 No. 3, pp. 356-372.
- Sthapit, E. (2019), "My bad for wanting to try something unique: source of value co-destruction in the Airbnb context," *Current Issues in Tourism*, Vol. 22 No. 20, pp. 2462-2465.

- Sthapit, E. and Jiménez-Barreto, J. (2018), "Exploring tourists' memorable hospitality experiences: An Airbnb perspective," *Tourism Management Perspectives*, Vol. 28, pp. 83-92.
- Sthapit, E. and Jiménez-Barreto, J. (2019), "You never know what you will get in an Airbnb: poor communication destroys value for guests," *Current Issues in Tourism*, Vol. 22 No. 19, pp. 2315-2318.
- Sthapit, E. and Björk, P. (2019), "Sources of distrust: Airbnb guests' perspectives," *Tourism Management Perspectives*, Vol. 31, pp. 245-253.
- Sparks, B. A. and Browning, V. (2010), "Complaining in cyberspace: The motives and forms of hotel guests' complaints online," *Journal of Hospitality Marketing and Management*, Vol. 19 No. 7, pp. 797-818.
- Sparks, B. A. and Browning, V. (2011), "The impact of online reviews on hotel booking intentions and perception of trust," *Tourism Management*, Vol. 32, pp. 1310-1323.
- Tan, H., Lv, X., Liu, X. and Gursoy, D. (2018), "Evaluation nudge: Effect of evaluation mode of online customer reviews on consumers' preferences," *Tourism Management*, Vol. 65, pp. 29-40.
- Tussyadiah, L. and Pesonen, J. (2016), "Impacts of peer-to-Peer accommodation use on travel patterns," *Journal of Travel Research*, Vol. 55 No. 8, pp. 1022–1040.
- Tussyadiah, I. P. and Zach, F. (2017), "Identifying salient attributes of peer-to-peer accommodation experience," *Journal of Travel and Tourism Marketing*, Vol. 34 No. 5, pp. 636-652.
- Van den Bussche, P. and Dambrin, C. (2020), "Peer-to-peer evaluations as narcissistic devices: fabricating an entrepreneurial community", *Accounting, Auditing & Accountability Journal*, Vol. 34 No. 3, 2021, pp. 505-530.

- Varma, A., Jukic, N., Pestek, A., Shultz, C. J. and Nestorov, S. (2016), "Airbnb: exciting innovation or passing fad?" *Tourism Management Perspectives*, Vol. 20, pp. 228-237.
- Vilenica, A., Katerini, T. and Hrast, M.F. (2021), "Housing Commodification in the Balkans: Serbia, Slovenia and Greece," *Social Policy*, Vol. 14, pp. 81-98.
- Visser, G., Erasmus, I. and Miller, M. (2017), "Airbnb: the emergence of a new accommodation type in Cape Town, South Africa," *Tourism Review International*, Vol. 21 No. 2, pp. 151-168.
- Wang, C. and Jeong, M. (2018), "What makes you choose Airbnb again? An examination of users' perceptions toward the website and their stay," *International Journal of Hospitality Management*, Vol. 74, pp. 162-170.
- Wang, D. and Nicolau, J. L. (2017), "Price determinants of sharing economy based accommodation rental: A study of listings from 33 cities on Airbnb.com," *International Journal of Hospitality Management*, Vol. 62, pp. 120-131.
- Xie, K. and Mao, Z. (2017), "The impacts of quality and quantity attributes of Airbnb hosts on listing performance," *International Journal of Contemporary Hospitality Management*, Vol. 29 No. 9, pp. 2240-2260.
- Yan, X. and Jiang, P. (2018), "Effect of the dynamics of human behavior on the competitive spreading of information," *Computers in Human Behavior*, Vol. 89, pp. 1-7.
- Yannopoulou, N., Moufahim, M. and Bian, X. (2013), "User-generated brands and social media: Couch surfing and Airbnb," *Contemporary Management Research*, Vol. 9 No. 1, pp. 85-90.
- Zeng, G., Cao, X., Lin, Z. and Xiao, S. H. (2020), "When online reviews meet virtual reality: Effects on consumer hotel booking," *Annals of Tourism Research*, Vol. 81, pp. 102860.

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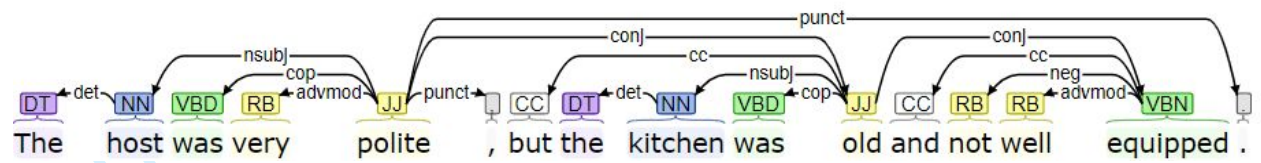
Zervas, G., Proserpio, D. and Byers, J. (2015). A first look at online reputation on Airbnb, where every stay is above average. Available at: <https://doi.org/10.2139/ssrn.2554500>

Zhao, Y., Xu, X. and Wang, M. (2019), “Predicting overall customer satisfaction: Big data evidence from hotel online textual reviews,” *International Journal of Hospitality Management*, Vol. 76, pp. 111-121.

Zhao, X., Wang, L., Guo, X. and Law, R. (2015), “The influence of online reviews to online hotel booking intentions,” *International Journal of Contemporary Hospitality Management*, Vol. 27 No. 6, pp. 1343–1364.

Zhong, Z., Yang, Y. and Zhang, M. (2014), “Role of online reviews in hotel reservations intention based on social media,” *Journal of Applied Sciences*, Vol. 14 No. 4, pp. 341–347.

Figure 1: Part of Speech and grammar relationships



[illegible]

Figure 4: Aspect terms for the Amenities Category



Figure 5: Words Used for the Negative Polarity Related to the Amenities

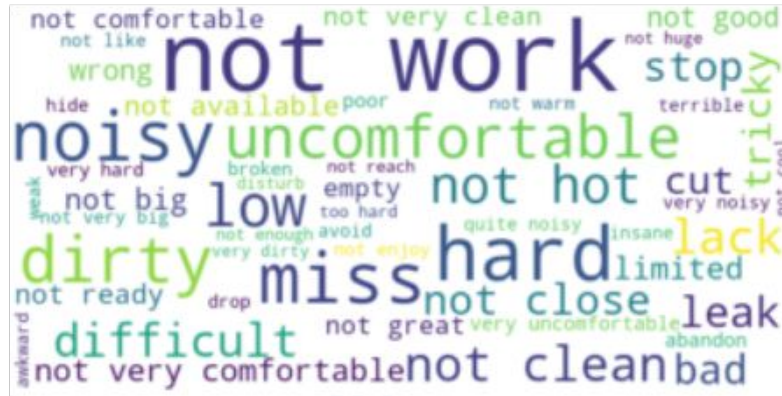


Figure 7: Words Used for the Negative Polarity Related to the Host



Table I: Number of Listings in Athens per year (2010-2019)

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
#of listings	6	16	58	105	185	348	861	1416	2657	3338

Table II: Reviews per year

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
#of reviews	23	170	552	2,079	6,137	15,245	31,606	65,132	117,730	163,427

Table III: Example of Comments, Dependency Relationships and Aspect/Sentiment Terms

Text	Dependency Relationships	Aspect (Terms) / Sentiment (Terms)
<p>“Location was fantastic but apart from that there is nothing we liked about the apartment. Bed creaked a lot. Gas stove didn't work. Shower door was broken and almost fell on my 8 year old daughter. All rooms did not have air conditioning. Before making the reservations we had asked the host if we can leave the luggage after checkout since our flight wasn't until 6 PM and she said that we will figure something out. Well on the departure day when we were out at acropolis at 8.30 am she sends us a link for locker storage! I would have appreciated a little more warning that she is unable to store our luggage. Overall it was a very disappointing experience.”</p>	<p>location ←(nsubj) fantastic bed ←(nsubj) creak gas ←(compound) stove stove ←(nsubj) work not ←(negation) work shower ←(compound) door door ←(nsubj) break room ←(nsubj) have not ←(negation) have disappoint ←(amod) experience very ←(amod) disappoint overall ←(advmod) experience</p>	<p>LOCATION ← POSITIVE ----- location : fantastic AMENITIES ← NEGATIVE ----- bed: creak gas stove: not work shower door: break room air condition: not have</p>
<p>“The apartment is very bad. The sofas in the hall, leaky and dirty! It is not possible to sit on them, wooden sticks stick out! Toilet door does not close! The toilet is constantly puddle! Stinks all over the apartment. The shower works, but it is broken, just on snot.”</p>	<p>apartment ←(nsubj) bad very ←(advmod) bad hall ←(nmod) sofas leaky ←(nmod) hall dirty ←(conj) leaky wooden ←(amod) sticks</p>	<p>AMENITIES ← NEGATIVE ----- apartment: bad hall sofas: leaky dirty sticks: wooden stick out toilet door: not close toilet: constantly puddle</p>

	stick ←(nsubj) sticks out ←(compound) stick toilet ←(compound) door close ←(nsubj) door not ←(negation) close toilet ←(nsubj) puddle puddle ←(advmod) constantly shower ←(nsubj) works works ←(conj) broken	shower: work break
“Communication with host was impossible. We found a towel hanging from the ceiling light and at once we complained and requested to cancel our booking however host refused to refund us. If it wasn't for Airbnb help center we wouldn't have taken our money back”	host ←(nmod) communication communication ←(nsubj) impossible towel ←(acl) hanging we ←(nsubj) complain cancel ←(xcomp) request host ←(nsubj) refuse refund ←(nsubj) refuse apartment ←(nsubj) bad	HOST ← NEGATIVE ----- host communication: impossible host: refuse refund