

EMOTIONAL REACTIONS TO RISK PERCEPTION IN THE ROYAL PALACE OF CASERTA, ITALY

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ABSTRACT

The evaluation of the perception of risk of people represents a vital element for security management. Each individual trusts other people's opinions to do a selection and the Internet represents the place where these opinions are mostly explored, obtained, and evaluated. Opinion mining and sentiment analysis embodies valuable means. They were primarily used as market investigation means to collect opinions about products and they have later turned out to be appropriate in other areas such as safety and security. Security managers can utilize the opinions communicated by individuals to find out the unforeseen vulnerabilities of a monitored location or at least the security assessment of persons which occasionally cannot be the same of the real level of security of a given site. Opinion mining can be useful when requiring continuous feedback about risk perception and to determine when an appropriate and prompt action is required based on the perceived risk and security. Gathering the opinions to be utilized for this objective requires seeking in different open sources (OSINT (Open Source INTelligence)) and therefore processing huge amount of digital data where information and knowledge must be extracted from. The objective of this paper is to study the perception of risk in the Royal Palace of Caserta (UNESCO World Heritage Site since 1997), focusing on the emotional elements, utilizing the semantic examination of the textual contents present in Twitter.

Keywords: *perceived risk assessment for security, open-source intelligent techniques for security, OSINT, opinion mining for security, sentiment analysis for security, cultural heritage security.*

1 INTRODUCTION

The evaluation of the perception of risk of people represents a vital element for security management.

Each individual trusts other people's opinion to do a selection and the Internet represents the place where these opinions are mostly explored, obtained, and evaluated. Opinion mining and sentiment analysis embodies valuable means. They were primarily used as market investigation means to collect opinions about products and they have later turned out to be appropriate in other areas such as safety and security. Security managers can utilize the opinions communicated by individuals to find out the unforeseen vulnerabilities of a monitored location or at least the security assessment of persons which occasionally cannot be the same of the real level of security of a given site.

Opinion mining can be useful when requiring continuous feedback about risk perception and to determine when an appropriate and prompt action is required based on the perceived risk and security.

Gathering the opinions to be utilized for this objective requires seeking in different open sources (OSINT (Open Source INTelligence)) and therefore processing huge amount of digital data where information and knowledge must be extracted from [1]–[14]. In the present work, Twitter has been employed as resource and a suitable evaluation of keywords, enclosed



into different tweets, was achieved. Keywords were chosen bearing in mind that the evaluation of the perceived risk is deeply correlated to psychological features by means of emotional responses aroused from a given location, represented, in this case, by the Royal Palace of Caserta (RPC) in Italy that has been a UNESCO World Heritage Site since 1997.

The objective of this paper is to study the perception of risk in the Royal Palace of Caserta, focusing on the emotional elements, utilizing the semantic examination of the textual matters present in Twitter.

2 THE ROYAL PALACE OF CASERTA

The Royal Palace of Caserta, shown in Fig. 1 [15], is the largest royal residence in the world that belonged to the Bourbon dynasty that in the years 1734–1735 led by Charles invaded and conquered the kingdoms of Naples and Sicily which were until then under Austrian rule.



Figure 1: View of the facade of the Royal Palace of Caserta from outside.

Charles of Bourbon aimed to give the kingdom a new capital far from the sea and the threats that could come from it. The baroque royal residence par excellence was designed by the architect Luigi Vanvitelli on behalf of the sovereign in 1752. It was later completed by his son Carlo Vanvitelli and other architects trained in the same school.

The residence on the outside has a contained elegance, inside it is luxurious and with great attention to detail. Spread over four monumental courtyards, the building, which occupies 45,000 m², is faced by the spectacular park which is now a destination for thousands of tourists. With its five floors occupied by 1,200 rooms, 34 stairways, 1,742 windows it reaches a height of 36 m. The ground floor leads to the first floor with a beautiful and scenic central flight of stairs full of marble that reaches the royal apartments. All the rooms, besides the royal apartments, are of exceptional beauty, such as the Theatre, the Pictures Gallery, and the library. Inside the Palace everything is a triumph of marble, gilded decorations, bas-reliefs, and paintings. The Throne saloon is shown in Fig. 2 [15].

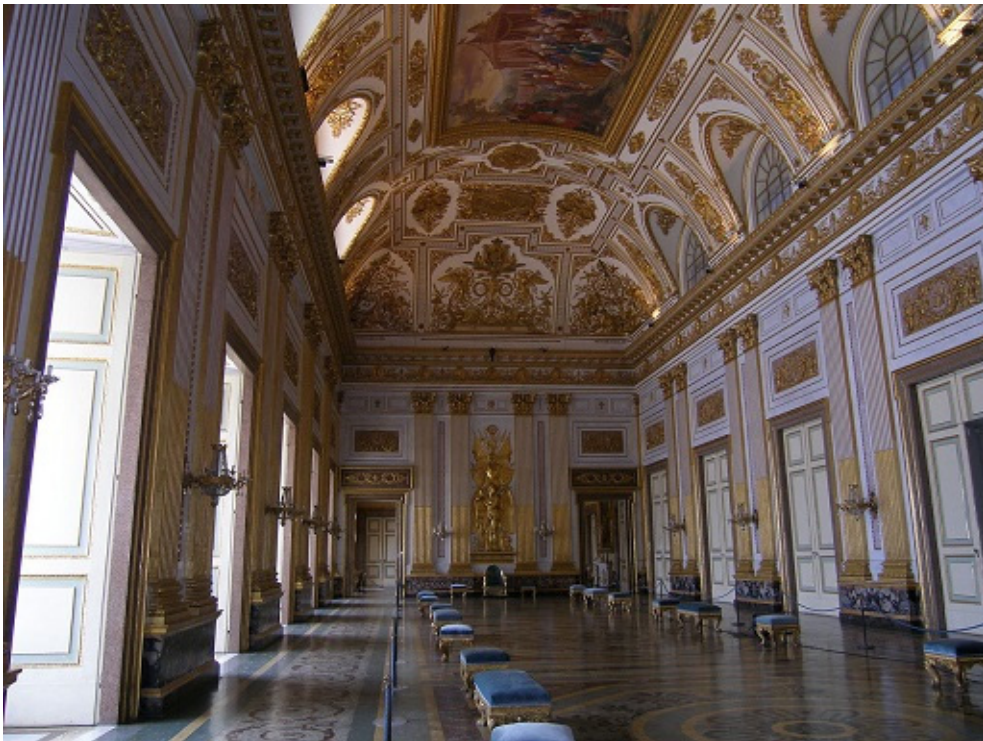


Figure 2: Views of the Throne saloon of the Royal Palace of Caserta.

The Park is a splendid and grandiose work of art and contributes to making the Royal Palace of Caserta one of the most beautiful in the world. It extends for 3 km in length over 120 hectares and includes two gardens: the Italian one and the English one. The first, articulated according to imposing geometric patterns, is a succession of pools, waterfalls, and fountains that it reaches the culmination in the Great Cascade. The second, less symmetrical and ordinary than the Italian one, leans towards a natural freedom of greenery with plants of great value, ponds, and streams.

The Royal Palace of Caserta is an ideal stage for any artistic and cultural event, a natural theatre for concerts, an exceptional space for art exhibitions. For this reason, it has been used as a film set for many famous films. In 1997 the Royal Palace of Caserta with the adjoining park was declared a World Heritage Site by UNESCO. The cultural site is visited on average by 800,000 tourists a year with a steadily increasing number of visitors before COVID-19 pandemic.

This exceptional location certainly provokes emotions in visitors affecting their awareness of the risk in this site. Inimitable and composite cultural heritage sites, as the considered one, need a noteworthy endeavour to guarantee security and safety, cultural heritage conservation and defence as well as openness for visitors, with special attention to visitors with disabilities, and for personnel generally present for site administration. These objectives can be attained by means of integrated systems [16], [17] and advanced technologies, as Internet of Things (IoT)/Internet of Everything (IoE) that allows to link people, things (mobile devices, smart sensors, apparatuses, actuators, wearable tools, etc.), data/information/knowledge and

processes [17], [18]. The IoT/IoE system have to implement and sustain an integrated multidisciplinary model for security and safety management (IMMSSM) for this location [20], [21] that includes a proper risk assessment [22]. For this reason, a suitable project named “Safety and Security for the Royal Palace of Caserta” has been activated.

The objective of this paper is to examine the risk perception in the Royal Palace of Caserta, providing importance to the emotional aspects, applying the semantic analysis of the textual matters present in Twitter. It operates as a valuable instrument serving key purposes, namely (i) supplying continuous feedbacks about the perception of risk; (ii) support planning forthcoming actions designed to increase real or perceived security as counter measures; and (iii) to acquire the outcome on the perceived security and risk.

3 OPINION MINING

The semantic knowledge included in the data can be obtained by means of sentiment analysis, also known as opinion mining [1]–[14]. This kind of evaluation obtains the personal judgments of the users about an entity of interest via the assessment of the polarity of the feeling (that can be positive, negative, or neutral) utilized to illustrate the experience with the latter. In general, the sentiment analysis is achieved following the different phases shown in Fig. 3 [3].

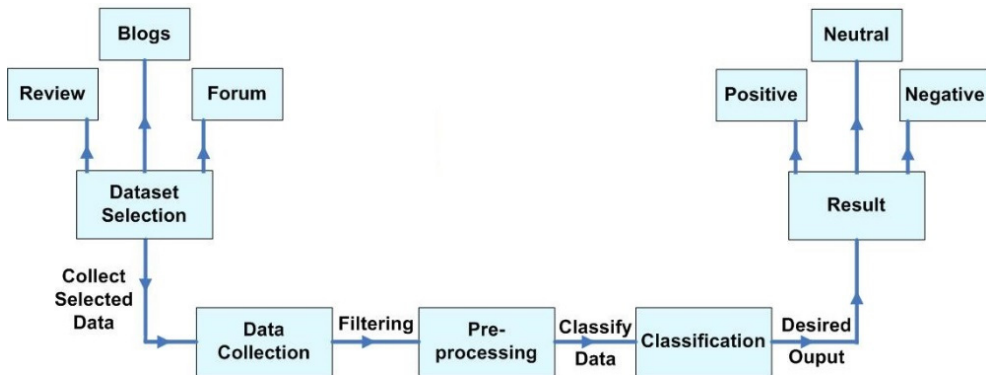


Figure 3: General opinion mining steps.

The study concentrated on the evaluation of the tweets (equally in English and Italian) of RPC with the purpose of obtaining the emotions and opinions of people to evaluate their risk perception of the place. Twitter has been selected as the supplier of data from which to extract writings since it is one of the most utilized social networks in the world and since it has the highest percentage of public profiles with respect to others (Facebook® profiles and comments are normally not public). Further, the text is the principal element (Instagram® includes mostly pictures) whose briefness, 280 characters/tweet, permits to evaluate each tweet in a more effortlessly and successfully way.

There is much software offered for social network evaluation, but NodeXL is usually the most popular since it does not need the expertise of any programming language. NodeXL is a free plug-in for Excel and the essential edition, employed in this work, lets import data and process it employing metrics. The restricted Twitter API of the basic version allows to extract up to 2,000 tweets or at least tweets no older than 7–8 days. For longer period or for a greater number of tweets it is necessary to use the pro version. In this situation, the metric “Words

and word pairs” has been employed, that counts the words and the pairs of words which occurred in the tweets. Basically, this metric achieves the sentiment analysis just by examining the text, distinguishing the words that are included in the two “Lists of sentiment words” with the number of occurrences. The keywords employed as seek term are shown in the Table 1.

Table 1: Summary of the English and Italian keywords used as search terms.

Keywords	Language
Caserta Palace	English
The Royal Palace of Caserta	English
Reggia Caserta	Italian

Furthermore, the listing of positive and negative words, a third group called “Awareness words” was implemented. It embodies a group fitting to show up if and how the site is cited in the mass media. The words are hence names of newspapers, TV channels, broadcasting companies and events that took place in the Royal Palace of Caserta.

To ensure a meaningful outcome of the evaluation, the word listing, that characterizes the categorization in one of the three groups, is produced step by step, trusting on the default English settings of the software. It is recognized that dictionary for the English and Italian language suitable for this type of evaluation are already accessible but, as some words are unique for the considered situation, it was chosen to generate a novel vocabulary of sentiments.

At this point, each word (positive or negative) was linked with the major emotion aroused by it, to get the emotional reactions of visitors. To achieve this objective, appropriate questionnaires were formed and compiled by two casually collected statistical reference sample (one composed by English native speakers and one composed by Italian native speakers) consisting of 41 people, equally divided between male and female, aged between 17 and 70. Once the outcomes of the surveys were gathered and examined, it was feasible to associate the prevalent emotions with each word.

4 RESULTS

The treating of the data to be processed have therefore generated a vast quantity of information condensed in the Table 2 while Fig. 4 shows the distribution of the number of tweets across the considered timeline.

From Table 2 it is possible to note that the number of words belonging to the list of non-categorized words, that is, uncategorized words, is very great. The main reason is because in this list it has been chosen to consider all the keywords and their combination (Palace, Royal etc.) present in numerous users’ tweets. Furthermore, in this list there are also words with an

Table 2: Total number of words used for the evaluation.

Word	Count
Words in sentiment list#1: Positive	1,877
Words in sentiment list#2: Negative	129
Words in sentiment list#3: Awareness	1,696
Non-categorized words	27,391
Total words	31,093

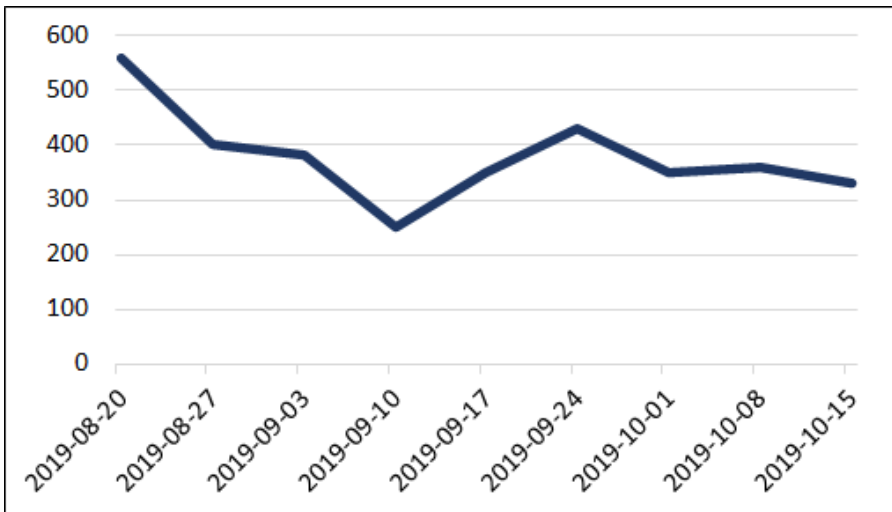


Figure 4: Considered timeline of tweets.

ambiguous meaning that do not express an evident polarity, be it positive or negative, to define belonging to the positive and negative categories.

From Fig. 4, it is possible to note some peaks that are due to events that were present in the period of data collecting in the Royal Palace of Caserta.

Considering 571 English words related to emotional reactions, however, between emotions with positive or negative valence, it emerges that “Attraction” is the dominant one, since it is about 45% of the total, as shown in Figs 5 and 6.

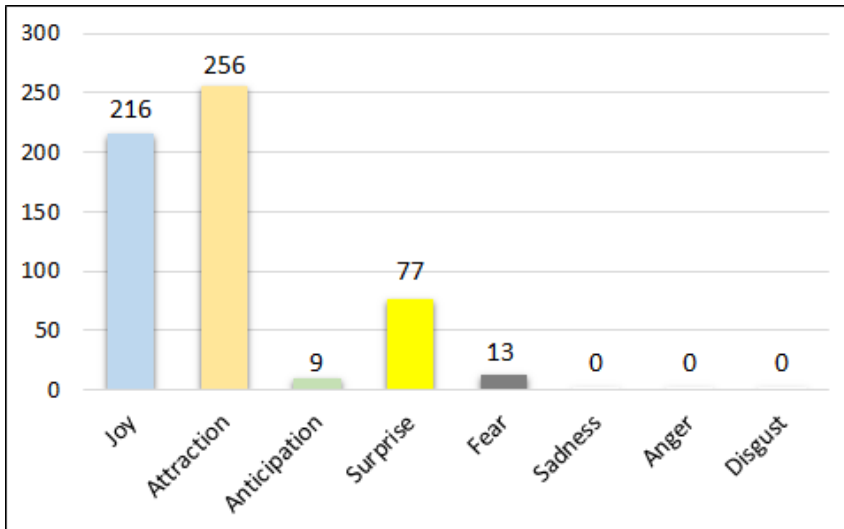


Figure 5: Incidence of each primary emotion for English words.

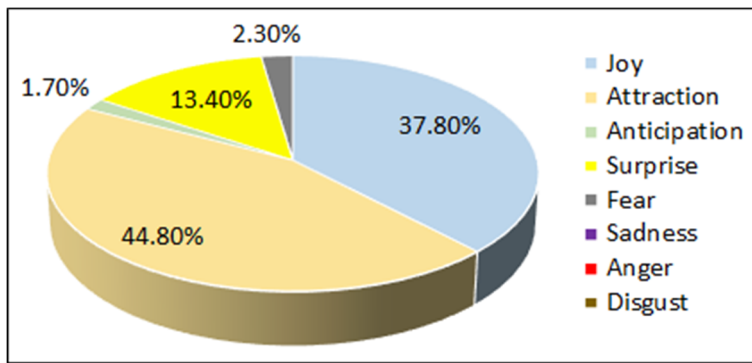


Figure 6: Percentage distribution of each primary emotion for English words.

Considering 1,435 Italian words related to emotional reactions, however, between emotions with positive or negative valence, it emerges that “Attraction” is the dominant one, as the previous case, since it is about 46% of the total, as shown in Figs 7 and 8.

Considering all the English and Italian words, between emotions with positive or negative valence, it emerges that the most dominant positive emotion is represented by “Attraction”, as shown in Figs 9 and 10.

It is thus conceivable to affirm that the overwhelming emotion provoked by the experience of visiting the Royal Palace of Caserta is Attraction (45.6%), followed by Joy (40.9%), Surprise (4.7%), Anger (3.3%), Anticipation (2.3%), Fear (2.2%), Sadness (0.6%), Disgust (0.4%).

Assessing suitably the opinions regarding the experience of the visit to the Royal Palace of Caserta, it is found that the word most extensively utilized in the English language is represented by “Great”, followed by “Art”, “Site”, “Discovering”, “Treasure”, “Amazing” “Paintings” and “World” which relates to emotions aroused by the beauty and the positive environment visited, as shown in Fig. 11(a).

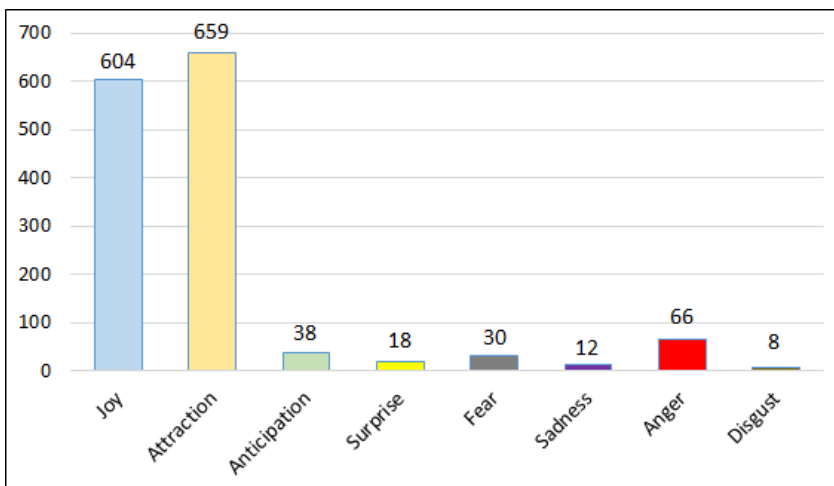


Figure 7: Incidence of each primary emotion for Italian words.

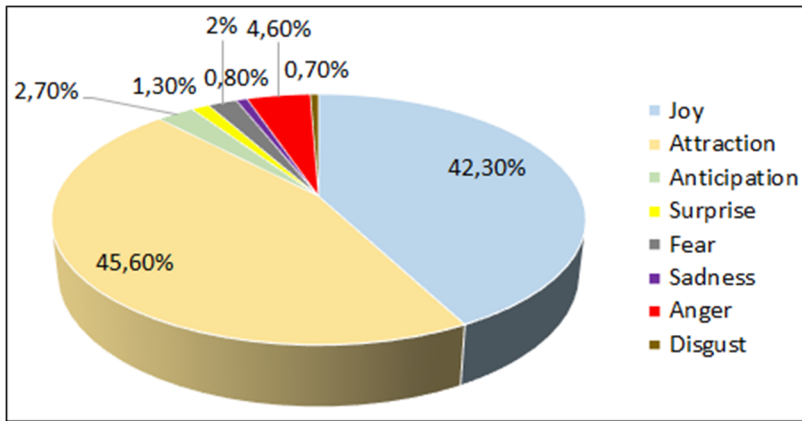


Figure 8: Percentage distribution of each primary emotion for Italian words.

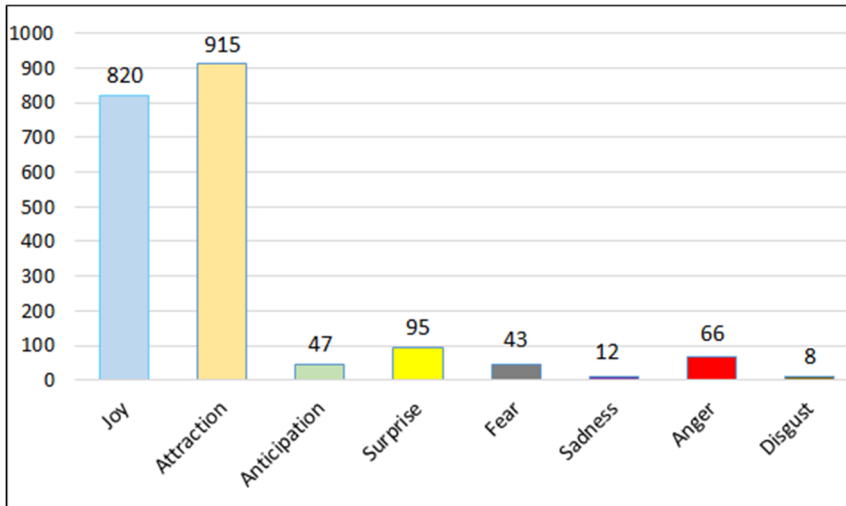


Figure 9: Incidence of each primary emotion for English plus Italian words.

The negative words used with low occurrence by English-language visitors instead are represented only by “Blitz” and “Attempt”, as shown in Fig. 12(a).

In the Italian language instead, it is found that the word most widely utilized is represented by “Summer” (due to the period of data collecting), followed by “Exhibition”, “Art”, “Beautiful”, “UNESCO”, “Great”, “Sunday”, and “Wish”, as shown in Fig. 11(b).

The negative word most used, with low occurrence, by Italian-language visitors instead is represented by “Bullying”, followed by the other words characterized with a lower occurrence, as shown in Fig. 12(b).

It is therefore possible to state that the Royal Palace of Caserta, according to the direct and unaffected judgment of the visitors who visited this place, certainly aroused positive emotions.

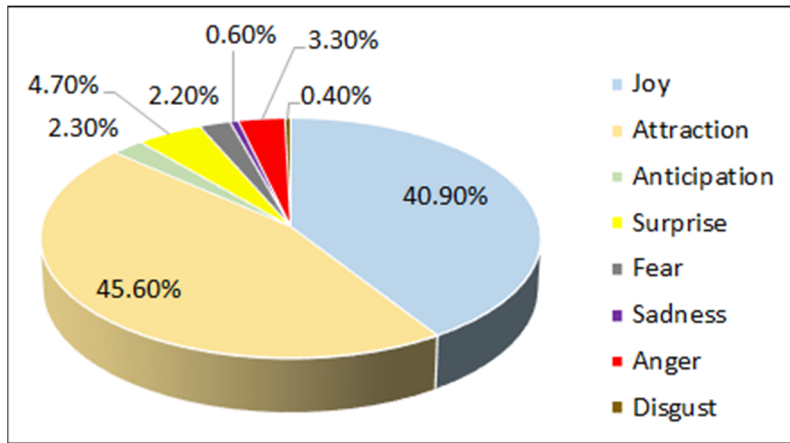


Figure 10: Percentage distribution of each primary emotion for English plus Italian words.

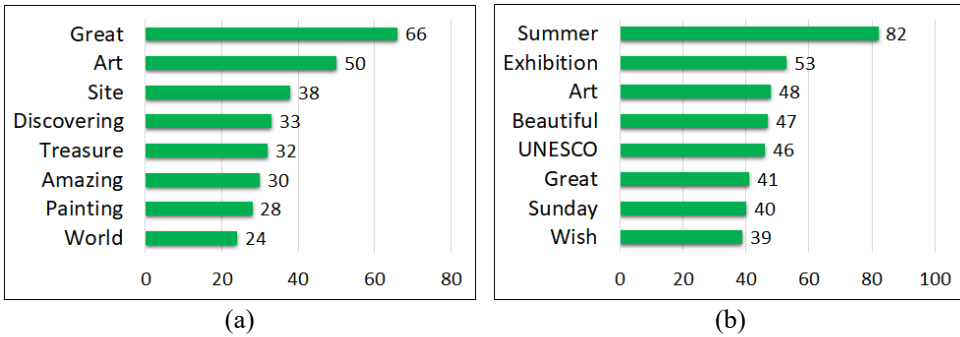


Figure 11: Ranking of the most mentioned positive words in: (a) English; and (b) Italian.

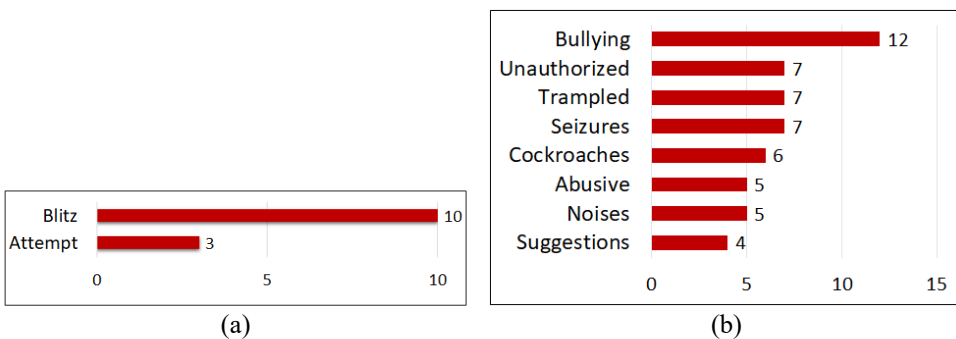


Figure 12: Ranking of the most mentioned negative words in: (a) English; and (b) Italian.

The predominant emotion aroused was the “Attraction” that reached 45.6%, slightly detached from “Joy” with 40.9%. It is clear that, without reason for criticism, there was a

notable homogeneity of judgment regarding the words; much more than half of the judgments and evaluations on the locality are associated to experiences with a positive valence.

Out of 2,006 words in total, only 129, therefore decidedly contained, have a negative value. This unfavourable judgment is aroused not so much by the place visited as by factors external to it or by completely personal influences that are not significant for the purposes of the work performed. Despite these relatively low numbers, it was considered appropriate to take them into account, in order to have a complete and exhaustive view of the final judgment of the considered site.

It pursues that the perception of risk is minimal, as all the emotions considered widely positive can confirm the absence of perceived risk, while the negative ones can be considered as a demonstration of the fear of some adverse events that the visitors experienced outside the considered place. In fact, it is well known that the intensity and the value of the perceived risk are deeply connected to the affective aspects. Beginning from sensory stimuli, via emotions, one is led to the perception of security as feeling-need. It is conceivable to achieve the complete lack of risk perception when the meaning of the lived experience is in total harmony with the existential expectation of the person. For this reason, if a person who visits a place can ascertain the presence of satisfactory security measures, he feels a state of absolute risk-freeness.

Furthermore, the assessment of the achieved results (also considering the words of sentiment lists of Table 2) lets state that there is an extensive sharing of positive emotions and sentiments, that is not an ordinary result, and to state the existence of two general average emotions, represented by “Attraction” and “Joy”, confirming Royal Palace of Caserta to be a strong catalysing environment.

5 COMPARISON WITH RESULTS OBTAINED IN POMPEII ARCHEOLOGICAL PARK AND HERCULANEUM ARCHAEOLOGICAL PARK

It is interesting to compare the attained results with the results deriving from a similar study done in Pompeii Archaeological Park [3] and Herculaneum Archaeological Park [4], that are shown in Fig. 13.

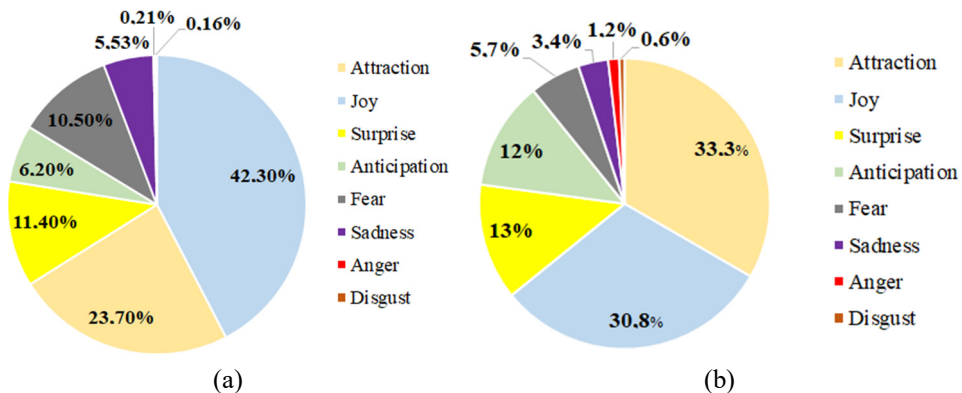


Figure 13: Percentage distribution of each primary emotion for English plus Italian words in: (a) Pompeii Archaeological Park; and (b) Herculaneum Archaeological Park.

As is it possible to see from Fig. 13, comparing it with previous figures related to the results obtained in the present work, in Pompeii Archaeological Park (PAP) the dominant emotion is represented by “Joy” (42.30%), in Herculaneum Archeological Park (HAP) “Joy” and “Attraction” are comparable and equal to about 30% each, while in the Royal Palace of Caserta (RPC) “Attraction” is the dominant emotion (45.60%). Further, it is important to note that the sum of percentages of “Joy” and “Attraction” is equal to 66% in PAP, 64.1% in HAP and 86.5% in the Royal Palace of Caserta. This is probably due to the absence of negative emotions aroused by the looming presence of Vesuvius volcano and the related remind of its terrible eruption that buried both PAP and HAP in 79 AD.

6 CONCLUSIONS

A methodology for the evaluation of the perception of risk in the Royal Palace of Caserta in Italy has been illustrated, providing importance to the emotional factors, by means of the semantic analysis of the textual matters present in Twitter.

It embodies a valuable means as it allows to receive continuously feedbacks about the perception of risk and when upcoming actions targeted at increasing effective or perceived security is put up, so that it is feasible to get the influence on the perceived risk and security. The obtained results have been also compared with results already achieved in the Pompeii Archaeological Park and the Herculaneum Archaeological Park.

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