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Introduction

As the coronavirus (COVID-19) pandemic sweeps the world, the crisis hit the tourism industry hard, costing \$935 billion in revenue worldwide in the first ten months of 2020 (Madden, 2021). In the U.S., travel economies experienced a drastic decline with nearly \$500 billion compared to 2019 (Tourism Economics, 2021) by reducing both business and leisure travel, especially internationally (Figure 1). Every state and territory experienced this downturn.

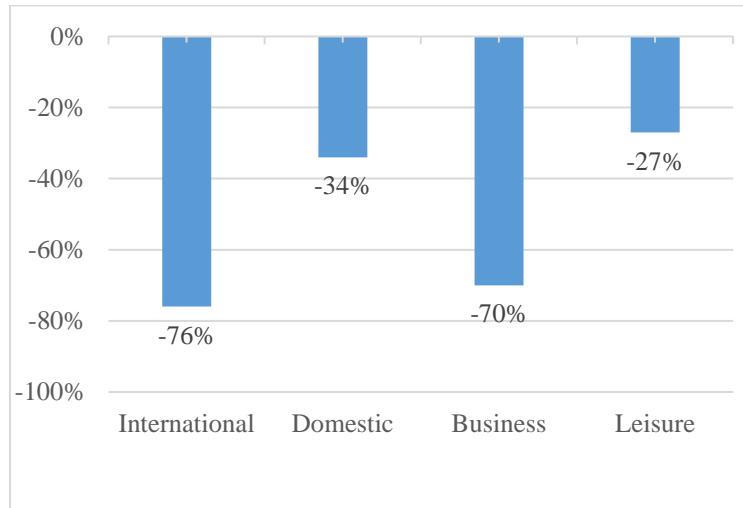


Figure 1. U.S. Travel Spending by Type (Tourism Economics, 2021)

Pandemics have not only changed the absolute number of travelers but also their travel preferences. Driven by changing supply with travel restrictions imposed by traditional destinations and attractions and by perceived differences in travel risks, potential travelers seek to spend time in the relative safety of the open spaces. Arguably, it is easier for people to keep social distance in the natural environment than indoor spaces. Indeed, a recent report shows that the pandemic stoke Americans' love for national parks (Coren, & Kopf, 2020). The people mobility research based on the cell phone tracking data shows a drop in the number of trips in all purpose categories, except for the trips to natural areas (Google LLC, 2021). The latter includes visitations to local parks, national parks, public beaches, marinas, dog parks, plazas, and public gardens. While many U.S. national parks partially or fully closed over extended periods in 2020, leading to a 43% visitation drop in the first half of 2020 compared with the same period of 2019, in the second part of 2020, visitation rebounded with only a 13% drop despite a widespread facility and campgrounds closure (NPS Stats, 2021). Moreover, visitations to the most iconic national parks in which the social distance could be maintained were record high in the second part of 2020, growing by 14% to 8.3 million visits in the Great Smoky Mountains, by 16% to 3.8 million visits in Yellowstone N.P., and by 7% to 1.3 million visits in Joshua Tree N.P. (Ibid. - note that the most visible California national parks stayed closed due to wildfires).

National parks make considerable contributions to the gateway towns leading to considerable scholarship on the economic impact of COVID-19 on the tourism industry and tourism dependent communities. At the same time, National Parks have important benefits for visitor's physical and

psychological wellbeing, providing essential getaways for people who want to get out to relieve their anxiety during pandemics. Researchers found that nature-based experiences can reduce stress and depression, restore mental fatigue, improve affect and cognition (Hull & Michael, 1995; Brymer, Cuddihy, & Sharma-Brymer, 2010; Lackey et al., 2019). Meanwhile, limited studies pay attention to changes in peoples’ feelings and experiences even though visiting a national park is undoubtedly different than it was before the pandemic. This study investigated the emotional changes in tourists’ self-reported travel experiences before and during the pandemic, expressed by visitors from different regions.

The focus of this study is Yellowstone National Park. The park is one of the most iconic U.S. travel destinations, with over 4 million visitors in 2019. It is also representative of the COVID-19 travel rebound. After closing to visitors in March 2020 for health and safety reasons, Yellowstone reopened in June 2020. In July 2020, Yellowstone had already exceeded the July 2019 number of visitations with almost 1 million tourists (2% growth - Frank, 2020). Over the rest of the year, the growth trend accelerated (Figure 2), spiking at 110% more visits in October, which is the last month of the season when the park roads are mostly open (NPS Stats, 2021).

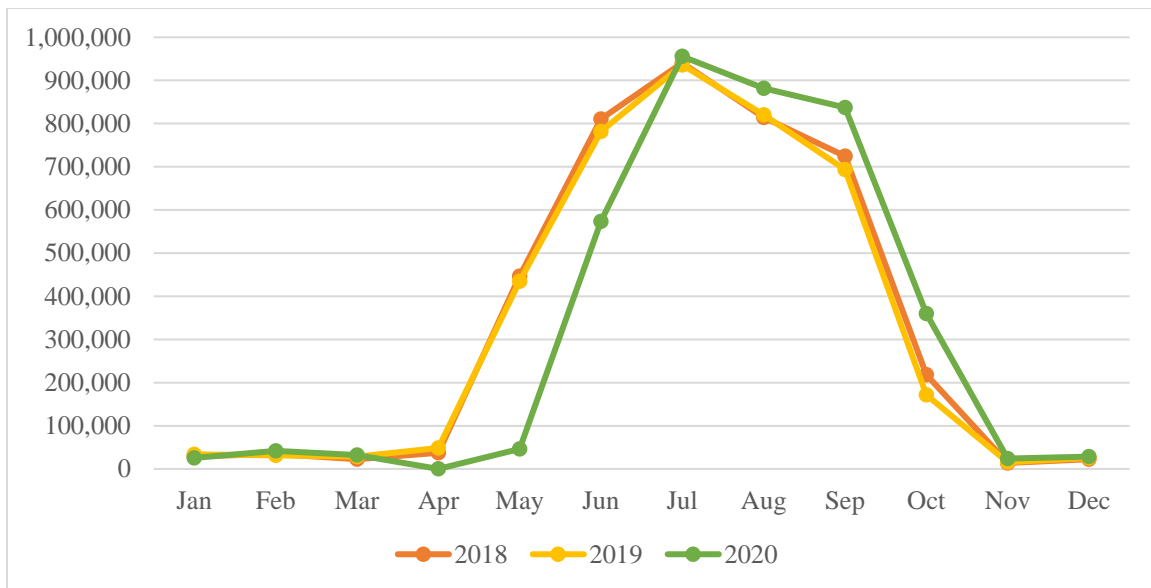


Figure 2. Monthly recreation visits to Yellowstone National Park (NPS Stats, 2021)

Literature Review

Emotions play essential roles in tourism settings. Visitors’ preferences, values, beliefs, and attitudes heavily influenced their emotions (Chhetri, Arrowsmith, & Jackson, 2004). Positive emotions, including happiness, pleasure, and joy, positively impact tourists’ satisfaction (Faillant, Matzler, & Mooradian, 2011; Grappi, & Montanari, 2011). The less frequent the negative emotions during the tourist experience are, the higher the travelers’ satisfaction level. Hence, many tourism studies concentrated on emotions’ impacts on consumer behavior, emotional response to advertising, and tourist shopping habitat (Richins, 1997; Holbrook & Batra, 1987; Yüksel, 2007; Deng, Yeh, & Sung, 2013). Other researches focus on visitor’s emotional responses to landscapes, activities, and services in natural environments (Hull & Michael, 1995; Korpela, Borodulin, Neuvonen, Paronen, & Tyrväinen, 2014; Kim & Thapa, 2018).

Visiting natural areas benefit tourists' health and wellbeing, improving mental health, relieving anxiety (Maund et al., 2019), increasing positive mood (Brooks, Ottley, Arbuthnott, & Sevigny, 2017), learning life skills (Albrecht, 2020), and recovery from stress and mental fatigue (Lackey et al., 2019). Researchers found that tourists who experienced pleasant emotions are less likely to be frustrated or bored. Although it is well established that exposure to nature leads to many positive emotions, few studies explore tourist's emotional changes in national parks under pandemics. The purpose of this study is to investigate changes in visitors' emotions in the COVID-19 year.

Emotions are complex phenomena that cannot be easily understood. Emotions are ephemeral, intense, conscious affective reactions associated with the specific stimuli (Nawijn, Mitas, Lin, & Kerstetter, 2013), which complicates their quantification. However, many scholars suggest that emotions are reducible to a set of basic emotions belonging to different domains (Ekman, 1993; Colombetti, 2009; Plutchik, 1980). Based on this productive approach, scholars proposed a variety of approaches to measure the emotions, such as the experiential sampling (Csikszentmihalyi, Larson, & Prescott, 1977) day reconstruction method (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004), daily questionnaire (Cohn, & Fredrickson, 2010), and modified Differential Emotions Scale (mDES) (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009). Those methods, however, are taxing on the research subject, requiring them to constantly record their immediate emotional states and providing unwanted interference with travel experiences.

In recent years, researchers started utilizing nonintrusive methods in emotional data collection. For instance, Matsuda et al. (2018) employed eye-gaze trackers, physical-activity sensors, and smartphones to access tourists' emotional status. This approach is effective but also very expensive and time-consuming. Sentiment analysis based on tourists' volunteered, the self-reported experience is an efficient alternative method. Tourists share massive amounts of online reviews about their travel experience. Advanced natural language processing (NLP) techniques enable emotion detection from this user-generated content. This approach is standardized, inexpensive, and suitable for detection of emotions expressed in unstructured human languages. Between the approaches, many studies detect emotions based on lexical databases such as WordNet and SentiWordNet (Kirilenko, Stepchenkova, Kim, & Li, 2018). Godnov and Redek (2019) discussed hotel guests' emotions based on NRC Word-Emotion Association Lexicon (EmoLex). This study also adopted the powerful NRC lexicon to extract and evaluate tourists' emotions from TripAdvisor reviews.

Data and Method

TripAdvisor reviews of the top ten attractions in the Yellowstone National Park were collected through website scraping. In total, 27,994 reviews were collected. The reviewers' locations were determined based on tourists' self-report place of residence using Google Geocode API and GeoNames geographical database API. The concurrent use of two different geocoding engines allowed error detection and resolution. Overall, the location of 25,979 reviewers (92.8%) was determined at a country level. The visit time is an important indicator to detect emotional changes before and during the pandemic. So, 4,581 reviews without experience date were removed, resulting in 21,398 reviews from 110 countries and regions. Table 1 shows the number of reviews left by Yellowstone visitors from different continents.

Table 1. Continents distribution of reviews with reported locations.

Ranking	Continent	Count	%
1	North America	16,027	74.90
2	Europe	3,847	17.98
3	Asia	645	3.01
4	Oceania	425	1.99
5	South America	364	1.70
6	Africa	76	0.36
7	Antarctica	14	0.07
Total		21,398	100

The collected reviews were analyzed as follows. First, the reviews written in non-English languages were translated into English through Google Cloud Translate API. Second, translated reviews were pre-processed using the standard data cleaning methodology. This study aimed to compare the emotional changes in park experiences between equivalent pre-pandemic and pandemic periods in 2020 and two previous years. Then, the reviews were grouped into three warm-season travel periods from March to September of 2018, 2019, and 2020. Note that the high elevation of Yellowstone National Park demands road closures starting from mid-October. In addition, no data was collected in March 2020 because the park was closed at that time. The 2018 and 2019 years were taken as the baseline for the pre-pandemic norm.

Then, to evaluate emotional differences, sentiment analysis based on Word-Emotion Association Lexicon (EmoLex) was used. The NRC emotion lexicon maps the sentiment-carrying words into eight basic emotions: anger, fear, anticipation, trust, surprise, sadness, joy, and disgust corresponding to Plutchik's emotion wheel (Mohammad, 2020). Effectively, this mapping also assigns words to two positive and negative sentiments. We obtained the emotion scores by calculating the ratios of the number of words associated with emotion to the total number of words in each review. Finally, emotions expressed in reviews posted in 2020 were compared among tourists from different continents.

Results

The final dataset contains 21,398 reviews from July 2008 to October 2020. Unsurprisingly, tourists use more positive words to describe their travel experiences, demonstrating positive travel experiences. However, the 2020 emotional state of the travelers was not much different from the baseline (Figure 3). Moreover, the 2020 April and May's positive emotions level immediately after the park reopened for visitors was much higher than the one during the respective 2018 and 2019 periods, with a similar difference in negative sentiments. The positive and negative sentiments return to the average level after the park fully reopened in June 2020.

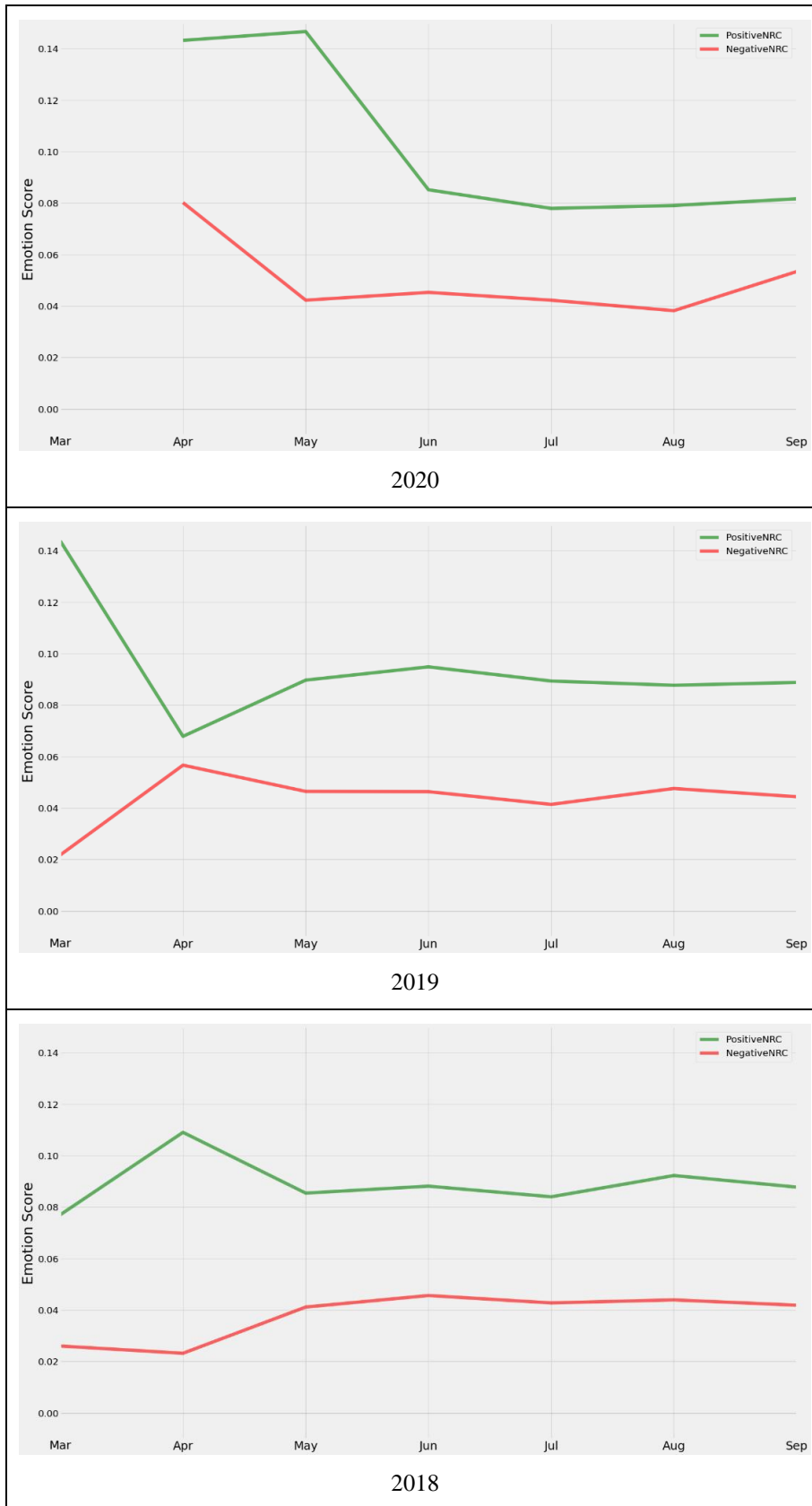


Figure 3. Polarity sentiments of reviews in three years

Between the specific base emotions, the most predominant positive one was anticipation. Tourists also conveyed trust and joy emotions in their reviews. The most frequent negative emotions were anger and sadness, representing nearly 65% of total negative emotions (Figure 4).

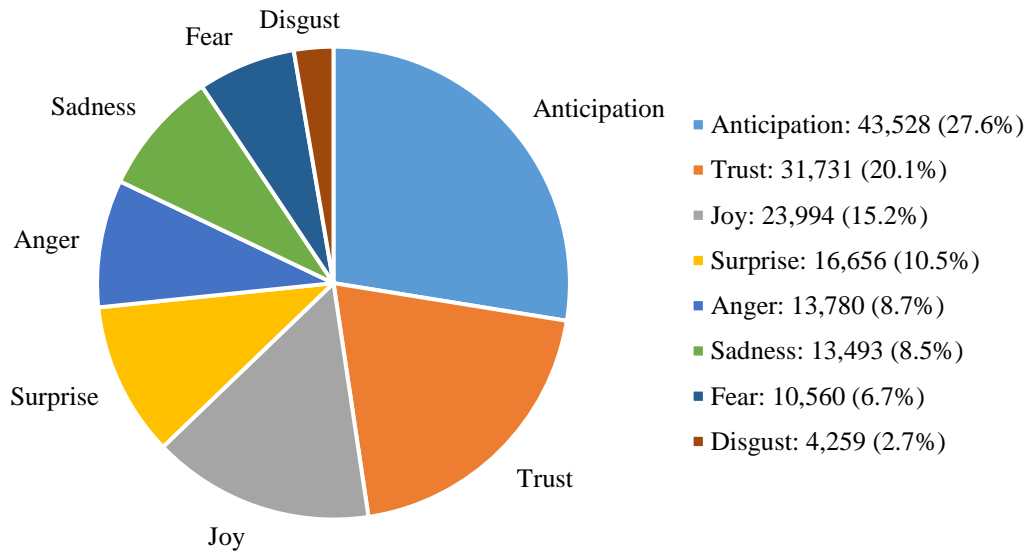
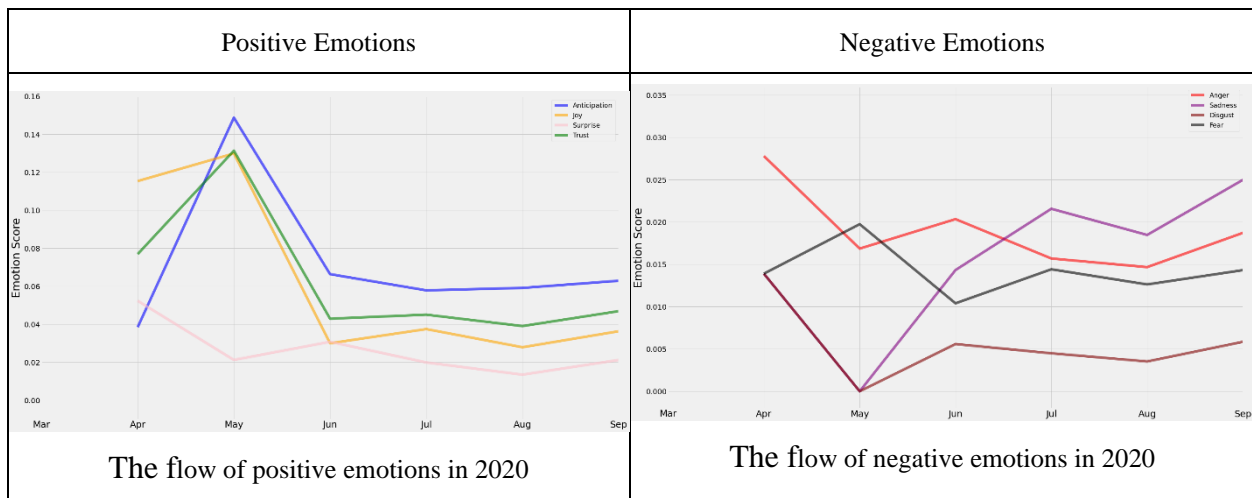


Figure 4. Emotions related words from all reviews

The 2020 emotion dynamics were distinct from the previous years (Figure 5), exhibiting higher fluctuations in positivity. In May 2020, a spike of positive visitors’ emotions was associated with park reopening, with tourists expressed more anticipation, joy, and trust than during the same period in the previous years. The positive emotion pattern however returned to the baseline norm after the park fully reopen in June.

Similarly, the negative emotions exhibited higher than usual fluctuations in 2020. The most interesting pattern is a distinct increasing trend in sadness exhibited after an unusually low in negative emotions in May 2020. Contra-intuitively, the fear emotions were not significantly different in the pandemic year.



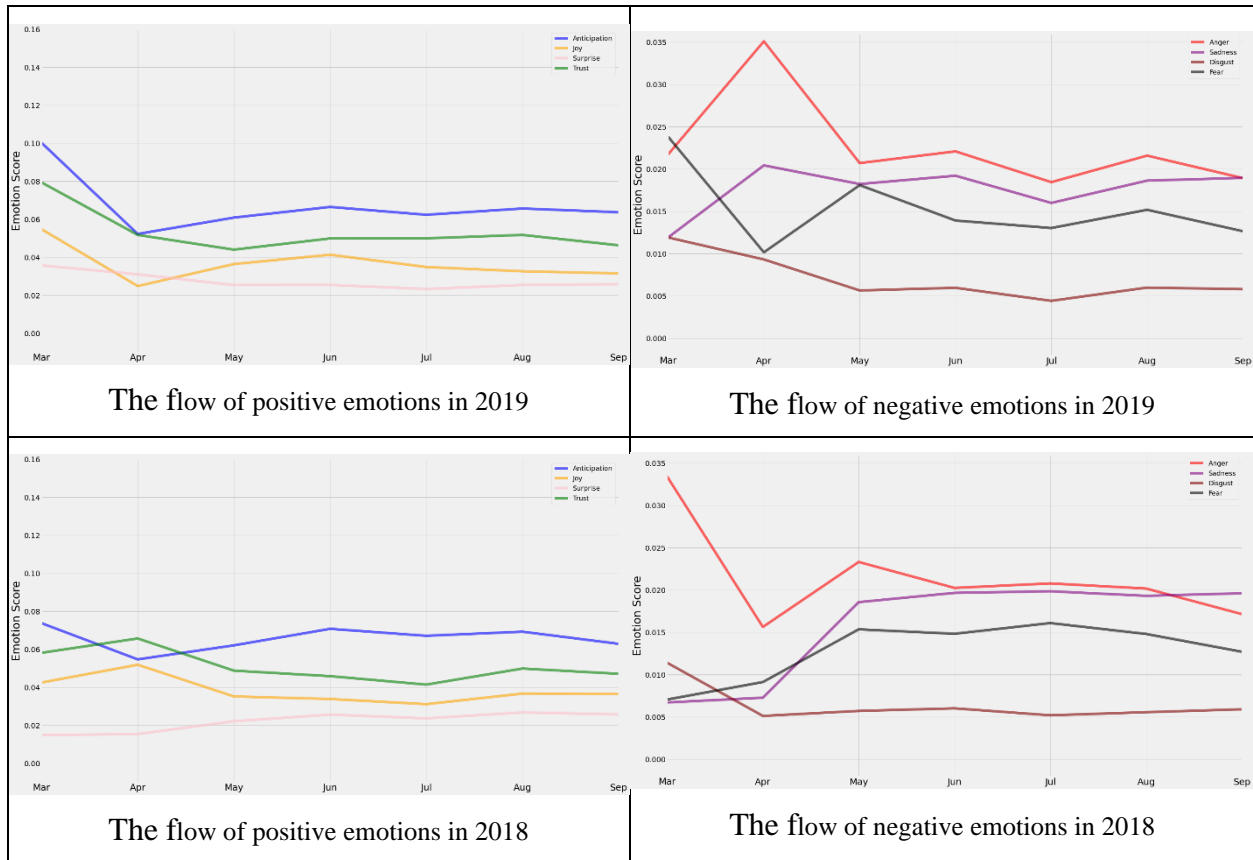


Figure 5. The Flow of positive and negative emotions in three years

This study detected the regional differences in emotion expressions from reviews in 2020. Tourists from South America expressed more positive emotions than tourists from other continents. They also expressed more negative emotions such as anger and fear. Distinctly, North American tourists expressed more negative expressions related to sadness and disgust. Asian and European tourists were the least expressive in both positive and negative emotions.

Table 2. Emotion scores of tourists' reviews in 2020 by continents.

Continent	Anticipation	Trust	Joy	Surprise	Anger	Sadness	Fear	Disgust
AS	0.047	0.044	0.030	0.007	0.012	0.003	0.009	0.003
EU	0.044	0.047	0.016	0.021	0.020	0.004	0.008	0.002
NA	0.062	0.045	0.036	0.021	0.017	0.021	0.014	0.005
SA	0.124	0.106	0.090	0.032	0.026	0.003	0.019	0.002

Conclusion and Discussion

With the coronavirus raging, we are still fighting against its impacts on the economy. The future of the tourism industry remains highly uncertain. Metropolitan areas are less popular for visiting than prior to the crisis (Destination Analysts, 2021), and national parks are now the preferred

destinations for many tourists. This study compared the trends of eight basic emotions before and after the outbreak of COVID-19 through the analysis of tourists' self-reported travel experiences.

Our study confirmed the feasibility of detecting emotions from user self-reported experiences in the park. The results are in line with Rodway-Dyer and Shaw's (2005) observation that negative, catastrophic events immediately affect visitors' behavior. The 2020 emotional fingerprint of the national park visitors was distinct. Surprisingly, there were few changes in negative emotions, but the positive emotions were significantly more variable. The park reopening played a vital role in influencing tourists' emotions. The dominant positive emotions represented by tourists were anticipation, trust, and joy. Tourists also showed low levels of sadness and disgust immediately after the reopening in May 2020. Later in the season, the tourists expressed distinctly more sad expressions, but not expressions of fear or anger.

In addition, we found regional differences in tourists' emotional expressions in describing their travel experiences. South and North American tourists were the most expressive. In contrast, Asian and European tourists used fewer emotion-related words. Such phenomena may be due to cultural differences like expression styles and confirm with Hardt and Wulff's (2012) and Buzova, Sanz-Blas, and Cervera-Taulet's (2019) observations that North Americans are more emotional and expressive than Europeans. In the future, the authors plan to analyze the detailed events that trigger the emotional changes and investigate the complex range of responses to the pandemic.

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