Using Visual Analytics to Understand Emoji-First Communication

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Abstract

The rise of mobile digital technology has had immense impact on how people communicate. One of the most significant changes is the use of emoji, in which visual symbols are used to concisely express information such as emotions or ideas. In an effort to better understand how people use emoji, we have built and applied a suite of visual analytics tools to a dataset recording activity on the Emoji-first mobile app Opico.

Index Terms: Human-centered computing—Visualization—Visualization design and evaluation methods

1 Introduction

Our work follows in the growing tradition of using visual analytics to better understand human communication [1]. The specific communication modality we investigated was the use of emoji on the mobile app Opico [2]. Opico is a text-free social media mobile app that allows users to create reactions to locations by sharing sequences of up to five emoji with a network of friends. Our dataset contained more than 5000 entries, each consisting of a string of 1 to 5 emoji, a timestamp, the name of the place that the reaction was left for, and the type of the place. Although some emoji were more frequently used than others, users of Opico have collectively used a set of over 1300 unique emoji in their reactions.

With this novel set of emoji data, we were immediately interested in how the users' emoji usage might reflect their life habits, how their choices of emoji might have changed over time, and how individual emoji were associated with place types and other emoji. As the large numbers of emoji strings and unique emoji make it difficult to discern patterns by examining raw data, we developed a web-based visual analytics tool suite, available on `https://www.opico.io/#/visualizations`, to help us analyze the data.

2 Association between Emoji

Our dataset is unique in that every entry contains a set of emoji the user chose to use together, whereas, outside of Opico, individual emoji are more commonly used in isolation from other emoji. This provides us an opportunity to explore which sets of emoji exhibit a strong association. We created a tool consisting of bar graphs and doughnut charts, seen in Fig. 1, to study which emoji frequently appeared together in the same entry. It also shows which types of locations they were often associated with. For each selected emoji, a doughnut chart shows a breakdown of the place types that the emoji strings containing it were meant for, and a bar graph shows a list of emoji that it frequently appeared with, sorted by frequency. When an emoji in the list of frequently associated emoji is selected, an additional doughnut chart shows a place type breakdown for emoji entries in which both emoji were used. The actual emoji strings that contain both emoji and their corresponding place types are also shown. In addition to studying pairs of emoji, we also show an analysis of how often the selected emoji was used multiple times in the same entry in a bar graph.

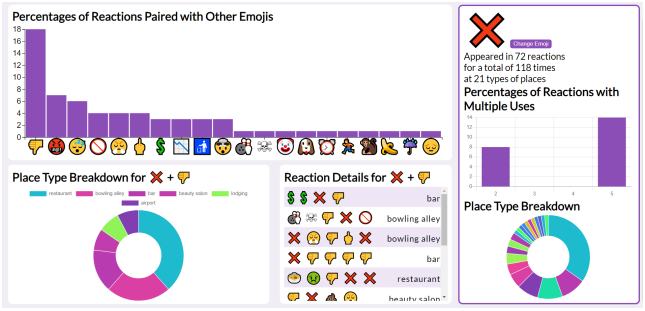

Figure 1: The cross mark emoji and its association with location types and with other emoji.

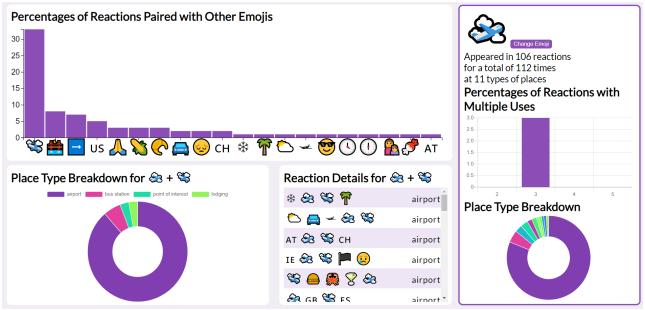

Figure 2: The plane departure emoji and its association with location types and with other emoji.

Using this tool, we discovered that the red cross mark emoji was most frequently accompanied by the thumbs down emoji, and 14 percent of the emoji entries containing it had 5 instances of it. These usage patterns reflect that the red cross mark emoji is often used as a symbol for warning or disapproval and might be used repeatedly to emphasize the negative reaction. A closely associated pair of emoji is the airplane departure and the airplane arrival emoji, shown in Fig. 2. Most of the reactions containing both emoji were posted at airports, suggesting that the users used them together to express that they had just taken a plane. Another intriguing case, in Fig. 3, is the association between the man and the woman technologist emoji and their association with the hot beverage emoji. The majority of the reactions containing both the man and woman technologist emoji were posted at points of interest, whereas most reactions containing one of the two emoji and the hot beverage emoji were posted at cafes.

3 Emoji Popularity

One of the questions we were most interested in was learning how aggregate emoji usage has evolved over time. To explore this aspect of the data, we created a stream graph that shows the counts of the monthly top N emoji from August 2017 to Feb 2019 as shown in

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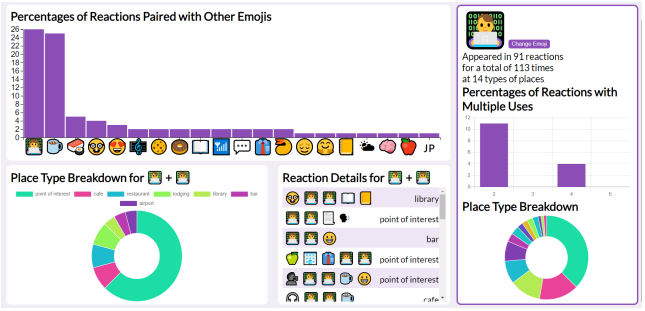

Figure 3: The male technologist emoji and its association with other emoji and with location types.

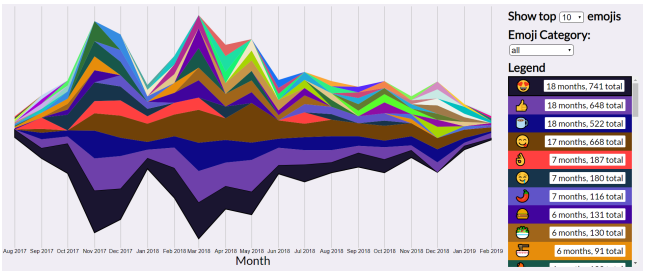

Figure 4: Counts of the monthly top 10 emoji in all categories.

Fig. 4. In every month, only the emoji that made it to the top used list would have their counts shown, while emoji that were in the top list in previous months but fell out would have their counts reduced to zero. The emoji displayed can be filtered by category, allowing for further exploration in narrower sets of emoji. In addition, analysts can vary N to see if differing patterns emerge when larger sets of emoji are visualized.

We observed that 4 emoji held on to their top spots in nearly all of the 19 months, and their combined counts took up about half of the total counts of the top 10 emoji in each month. Among these 4 emoji, the heart eyes emoji became relatively less popular towards the end of the 19-month period while the other three retained their popularity relative to the rest of the top emoji. Filtering to look at the drinks category, seen in Fig. 5, the hot beverage emoji was consistently in the top 2 list in every month while the other emoji never remained in top 2 for more than a month. In the event category, the Christmas tree emoji rose to the top in November and December 2017 as well as in December 2018, reflecting the arrival of the Christmas season. Among all these, the decline of the heart eyes emoji is the most interesting, as it lacks an obvious cause. In future work, we hope to further explore how community vocabularies evolve and how group dynamics influence these changes.

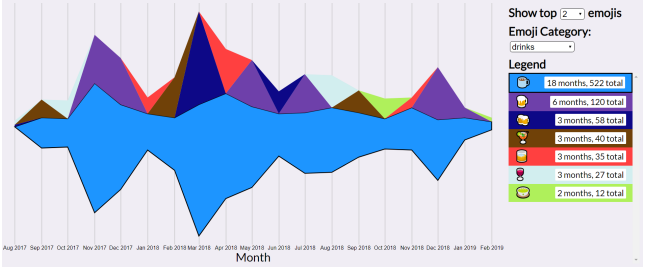

Figure 5: Counts of the monthly top 2 emoji in the drinks category.

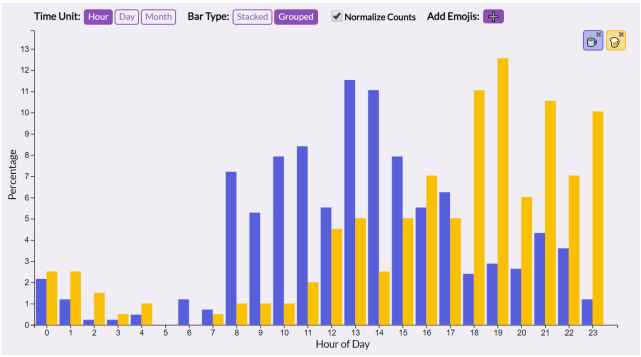

Figure 6: Comparison of the time of day that the hot beverage and beer emoji were used.

4 Temporal Patterns in Emoji Usage

In typical usage, Opico emoji reactions are triggered by an event. As a result, we can expect the time at which the users posted their reactions will be fairly close to the time that they experienced the emotions, activities, or atmosphere that they meant to express or describe in their reactions. The timestamps of the emoji entries in local time can inform us of associations between time and usage of individual emoji. To visualize these associations, we used a bar graph as shown in Fig. 6 to show the frequency of occurrences of individual emoji at different times of day. The bars can be grouped for easy comparison between different emoji, or stacked for viewing the combined counts of the displayed emoji.

One clear pattern that emerged was a difference in popular hours between the hot beverage emoji, often used as coffee, and the beer emoji. The hot beverage emoji was more frequently used in the hours of 8am to 5pm, while the beer emoji was most popular from 6pm onward until midnight, as seen in Fig. 6. This kind of pattern was also present in the hour of day comparison of salad and pizza emoji, and of the sleepy face and other face emoji.

5 Conclusion

Emoji usage is a fascinating feature of digital communication, allowing us to investigate how the use of a new communication modality evolves within a society. The toolset we have described here is a first step towards building the analytical infrastructure required to understand this phenomenon. We plan to further expand the capabilities of the tool suite, and are particularly interested in expanding the concept of word tree diagrams to emoji strings in effort to better understand emoji string structure. We also hope to extend the tool to operate on more diverse data, including text and emoji.

References

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[2] S. Khandekar, J. Higg, Y. Bian, C. Won Ryu, J. O. Talton III, and R. Kumar. Opico: A study of emoji-first communication in a mobile social app. In *Companion Proceedings of The 2019 World Wide Web Conference*, WWW '19, pp. 450–458. ACM, New York, NY, USA, 2019. doi: 10.1145/3308560.3316547