

TWITTER DISCOURSE SURROUNDING CLIMATE CHANGE



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Climate Change



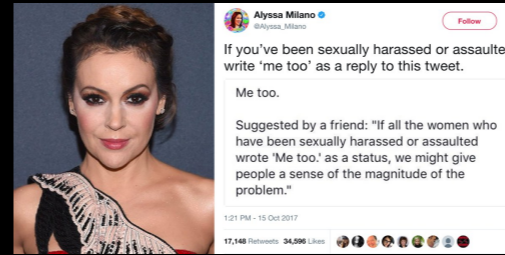
Climate Change is THE global concern of the modern era

Decades of governmental inaction to positively address climate change, and decades of deregulating the entities that contribute most to climate change have already contributed to increases in all manner of ecological disaster:

- Longer hurricane seasons with more intense, on average, hurricanes
- Longer wildfire seasons with more intense and faster spreading fires
- Rising coastlines that are already swallowing up populated regions of the world

Twitter Discourse

- Facilitating conversation
- Social media as a collective voice
 - Public opinion
 - Defining a social climate
- Starting movements
 - #MeToo, #BlackLivesMatter
 - Bringing awareness to issues



- Social media has been used to facilitate conversation between individuals of all beliefs, be it in solidarity or debate.
 - this diffusion of thoughts and opinions creates a sort of "political climate"
- Though this discourse takes place online and may be primarily minors, it has an effect on the real (nondigital) world, making it an incredibly powerful tool.
- This has been seen before. Many viral movements began online to bring awareness to topic of concern as a **call to action**
 - Me Too
 - Overwhelming response, speeches made at awards shows with millions of viewers (Oprah, Golden Globes)
 - Black Lives Matter movement also started online, but has resulted in:
 - Protests across the country
 - Kneeling during the National Anthem (millions of viewers)
 - Michael Brown's death became so publicized that his funeral was livestreamed

RESEARCH QUESTION:
how does discourse on
Twitter relate to climate
change legislation?

- Because climate change is an issue that is both topical and pressing, and because Twitter is such a powerful means of communication, we wanted to see if there is relationship between them.
 - More generally, we wanted to see if discourse online related to climate change has an influence on the court system?

Juliana v. US Lawsuit

- Narrow enough to control variables
- Large enough to bring about meaningful discourse on twitter
- Lawsuit filed in August 2015 in District Court of Oregon, by 21 youths against the United States
- Claim that by encouraging and allowing activities harmful to the environment, the government is violating the rights to life and liberty of younger generations
- Progression through courts, and Obama → Trump

In addressing our research question, we decided NOT to look at all the tweets associated with climate change (i.e. #globalwarming #climatechange). For one thing that would be a ton of data which would take forever to parse through, secondly properties of that data would be affected by a host of different factors, and would be much more difficult to interpret. We therefor decided to narrow our focus down to a particular climate change movement; the Juliana v US court case. Description of the case is on the slide. We also chose this case because it has encountered much action in the US judicial system both during the Obama and Trump administrations, gained attention in mainstream media outlets, and gained attention on twitter, making it a prime candidate to address our research question.

methods for analysis

Twitter Scraping

<https://github.com/jonbakerfish/TweetScrapper>



```
#!/bin/bash
#SBATCH --mail-type=ALL
#SBATCH -n 1
#SBATCH -p std.q
#SBATCH --time=0-24:00:00
#SBATCH --output=scrapper.qlog
#SBATCH --job-name=Tscraper
#SBATCH --export=ALL

scrapy crawl TweetScrapper -a query="juliana v united states"
```

Twitter Scraping cont.

- Locate all tweets related to the Juliana vs. US lawsuit
- August 2015 – February 8th, 2019

"juliana v united states"
"juliana v. united states"
"juliana vs united states"
"juliana vs. united states"
"juliana v us"
"juliana v. us"
"juliana vs us"
"juliana vs. us"
"youth v gov"
"youthvgov"
"juliana v gov"
"juliana v gov"
"no ordinary lawsuit"

#julianavus
#julianavsus
#julianavunitedstates
#julianavsunitedstates
#youthvgov
#julianavgov
#noordinarylawsuit
#ClimateRecoveryNOW

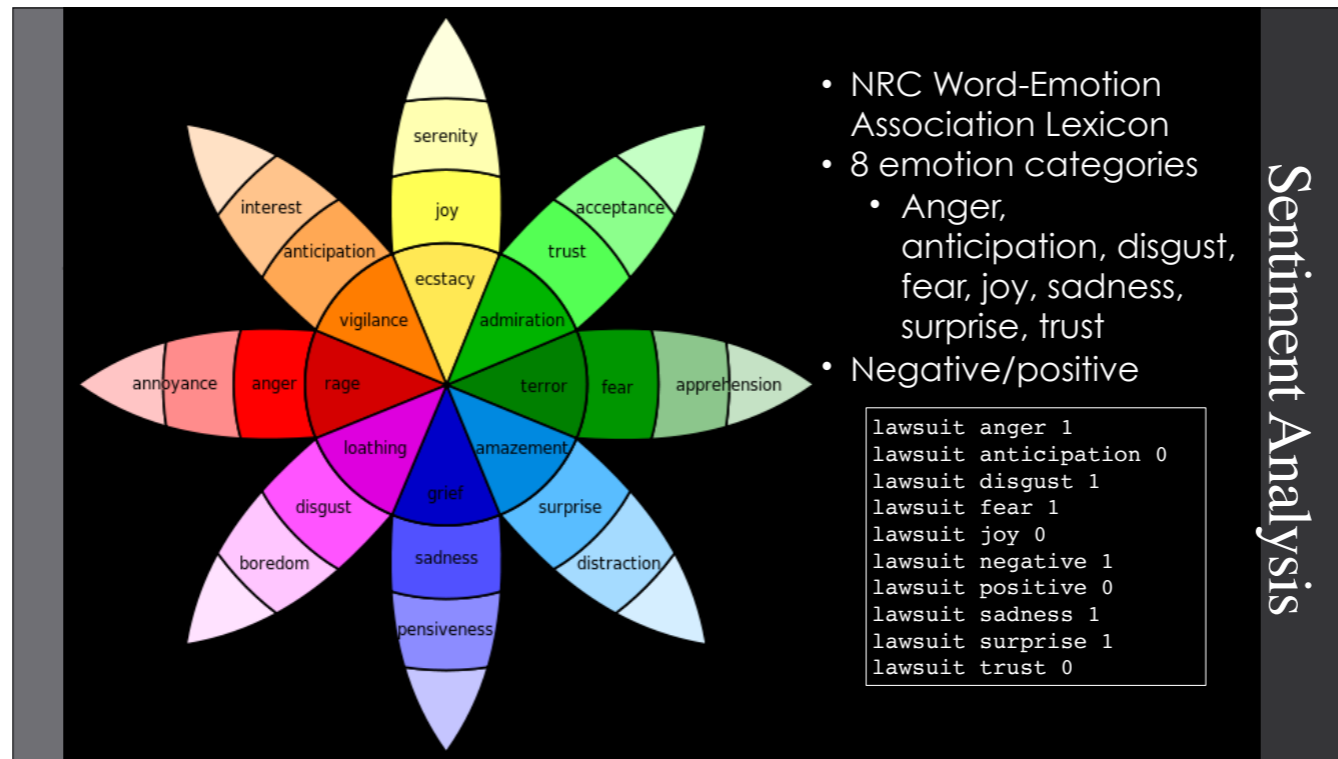
@youthvgov
"Kelsey Juliana"
"Xiuhtezcatl Martinez"
"Alex Loznak"
"James Hansen"

Sentiment Analysis

- Natural Language Processing approach
- Identifies the emotional tone of a body of text
 - Attitude towards a certain topic
- Applications
 - Business
 - Politics
 - Media



- Once we scraped these tweets, we performed sentiment analysis
- Sentiment analysis is a subcategory of the field NLP
- its goal is to identify the emotional tone of a body of text, such as a tweet, in an effort to assess an individual's attitude toward a certain topic
- For example, a brand may be concerned about the public's response to their product, a politician would want to know the desires of their potential voters, directors would care about fans response to their movies, etc.
- For our project, we wanted to see what kinds of emotions are expressed online in relation to the Juliana v Gov lawsuit



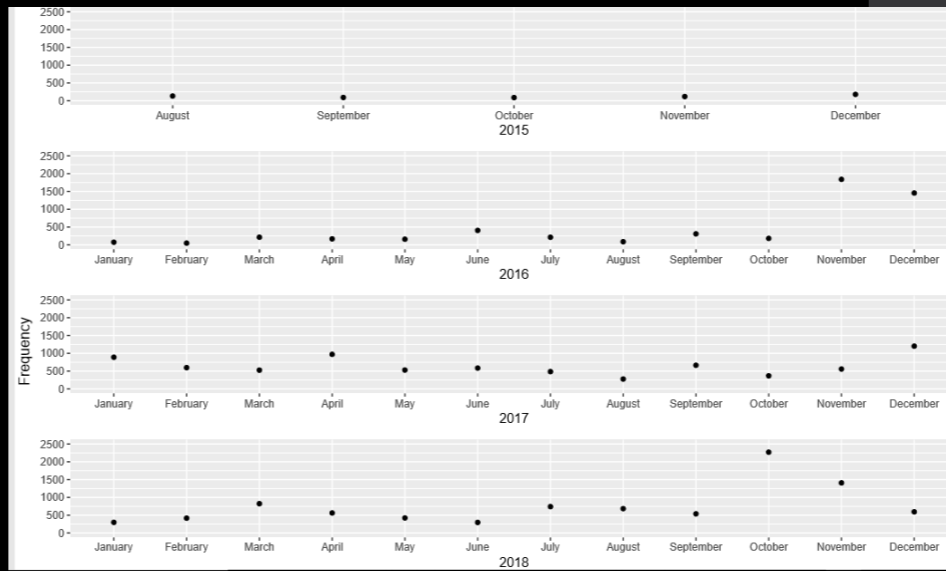
Maia

- We used many tools for sentiment analysis, primarily using R packages. One example used the NRC word-emotion association lexicon. It classifies words using ten categories: eight of which are emotions taken from the Plutchik Wheel of Emotions(), the other two are simply "negative" and "positive".
- The package thus classifies the emotion of a body of text, like a tweet, by categorizing the individual words used. For example, if the word "lawsuit" was used, the package would use a binary classifier to say that anger, disgust, fear, sadness, and surprise are expressed, and that the general tone is negative.
 - And that there is no anticipation, joy or trust expressed

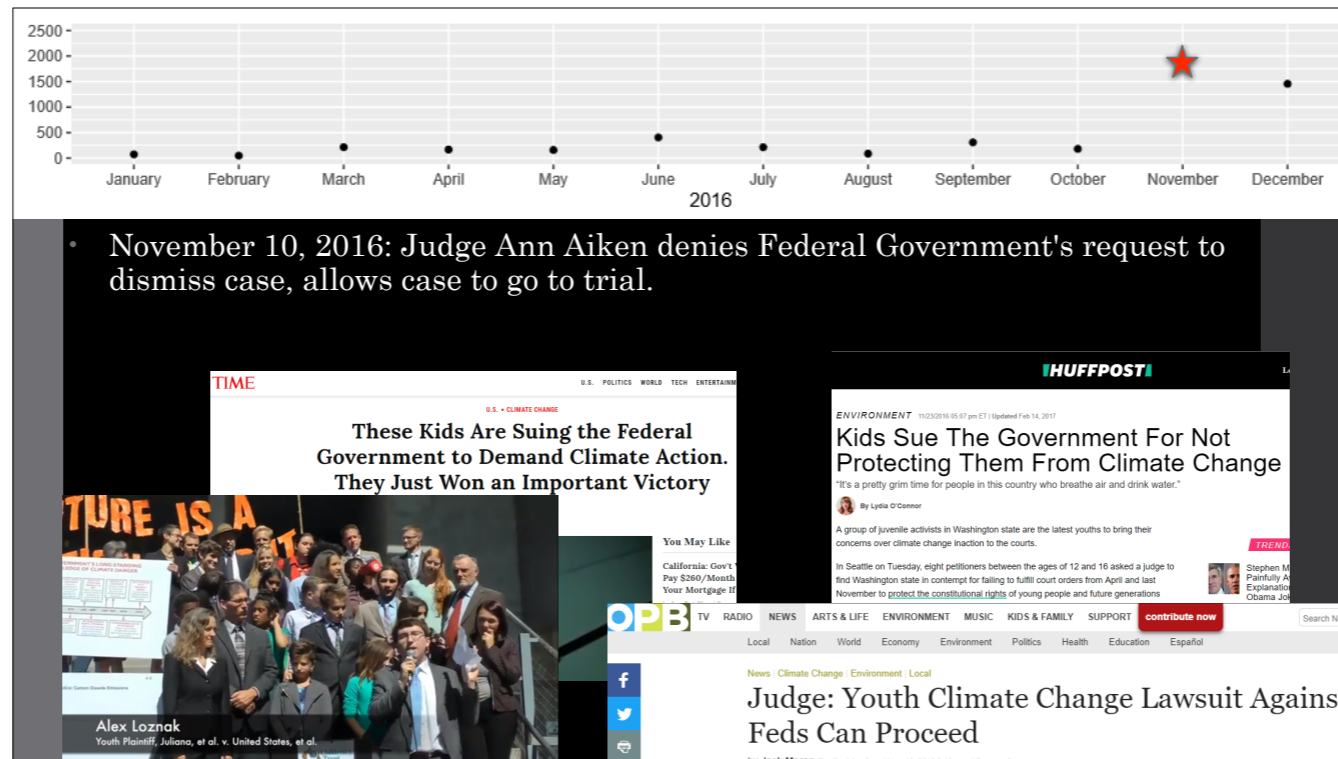
findings

Peaks vs. Events

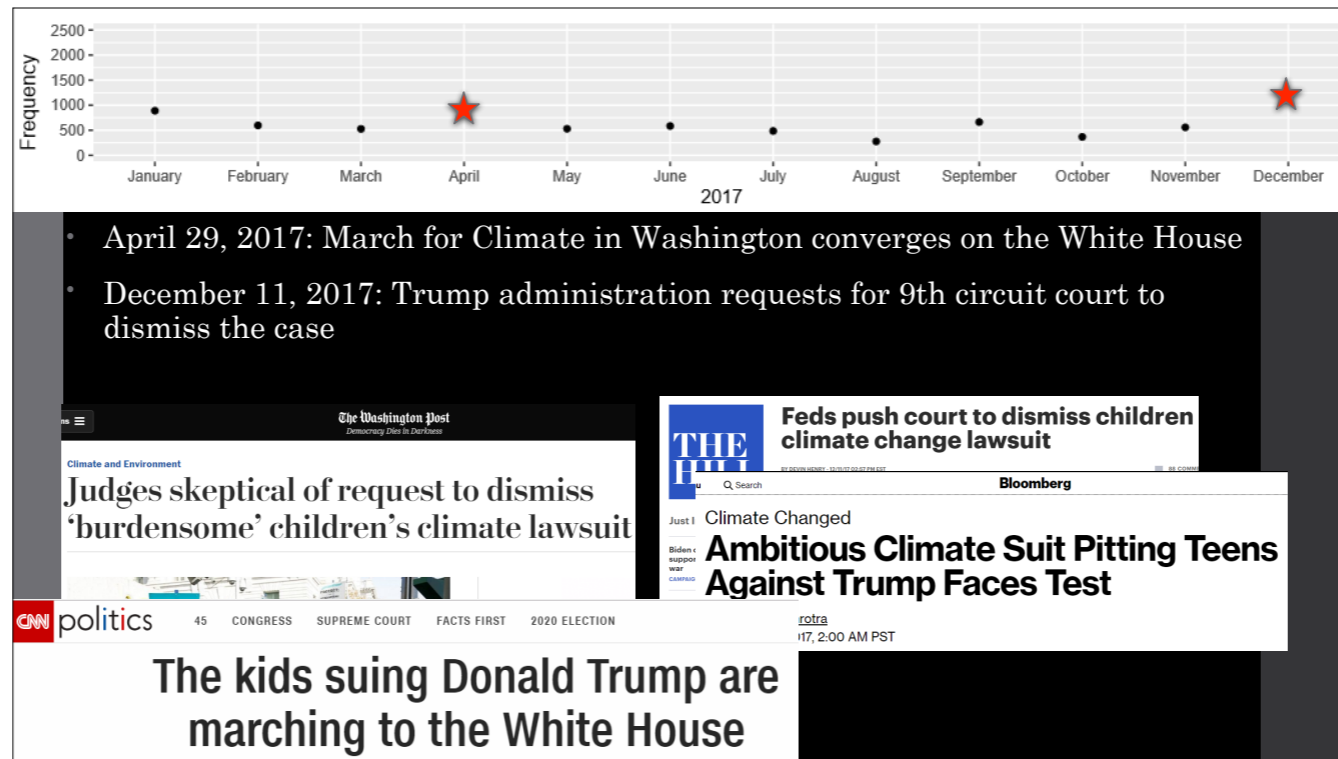
- Frequency plots reveal discourse growth over time
- Peaks in frequency can be correlated to a real world event
- Factors to consider:
 - When are courts in session
 - Seasons
 - Metric for noise



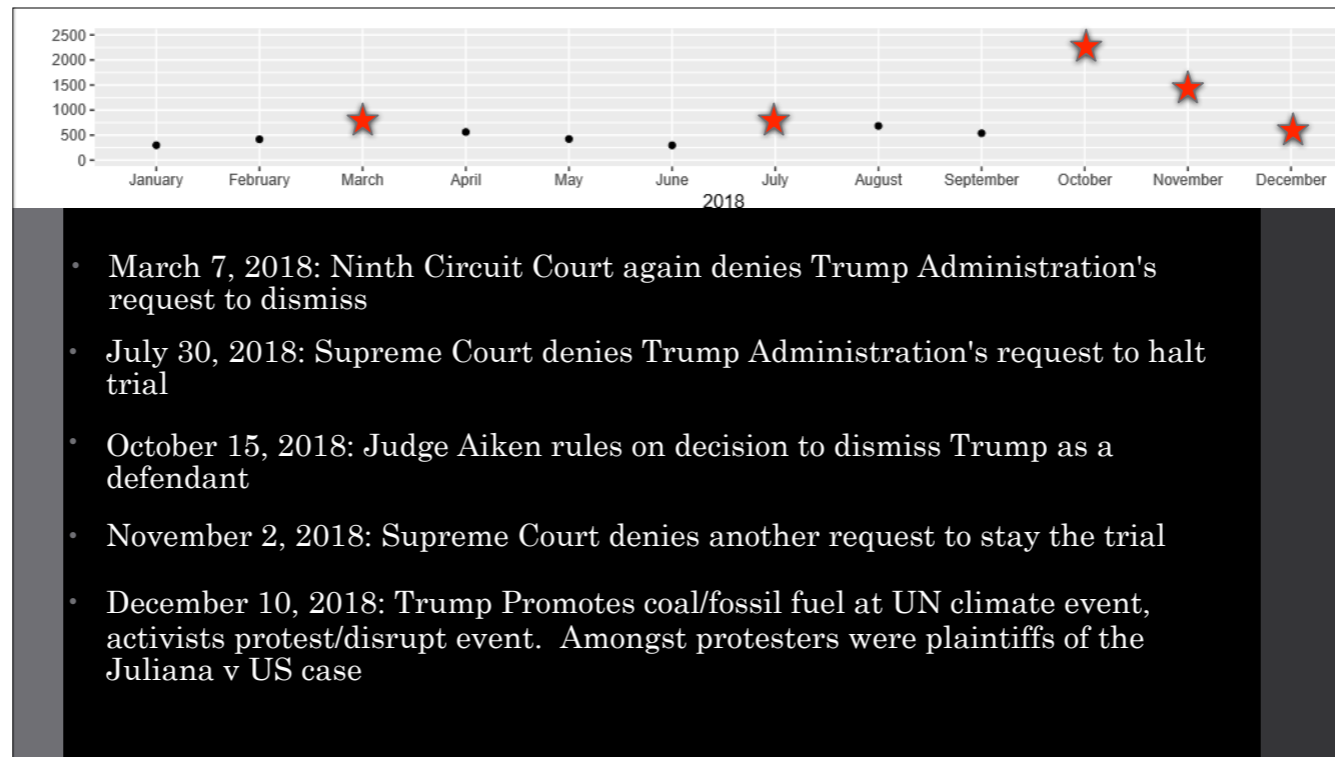
This is the frequency of tweets per month during the four years following the initial filing of the lawsuit. One can see how the conversation has grown over time.



Here we see that in November 2016, when frequency of tweets spikes, there was a ruling on the dismissal of the case in the 9th circuit court. Judge Ann Aiken decided the case was allowed to proceed. There was much mainstream media coverage of this event, so it makes sense that we see a spike in frequency of tweets around this time.

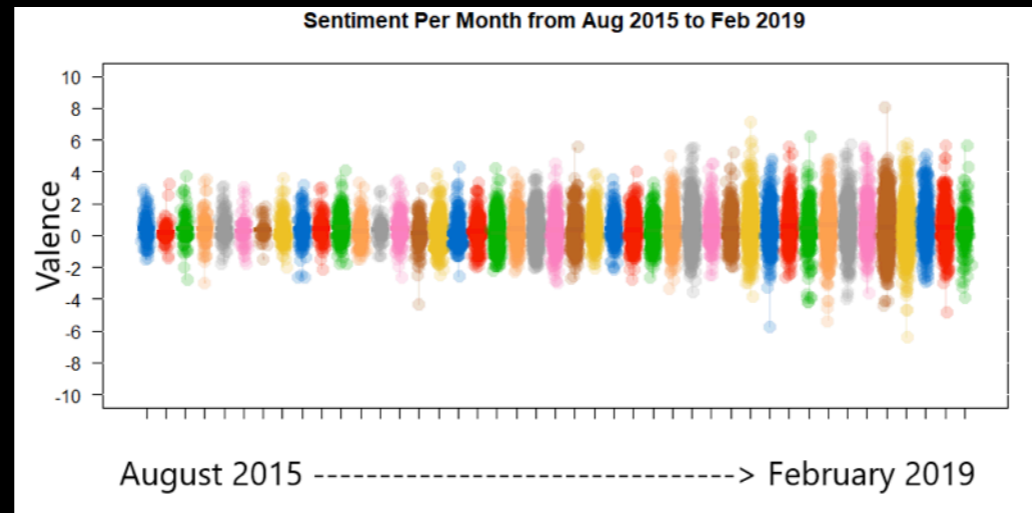


Examples of spikes in frequency, corresponding events and media coverage. Here we also have a non-legislative event, a climate change march in Washington, in which some of the plaintiffs of the case participated. Again there was much media coverage of these events including interviews of the plaintiffs by media outlets during the climate change march.



Spikes during court off season are less prominent than those during the winter months when courts are in session.

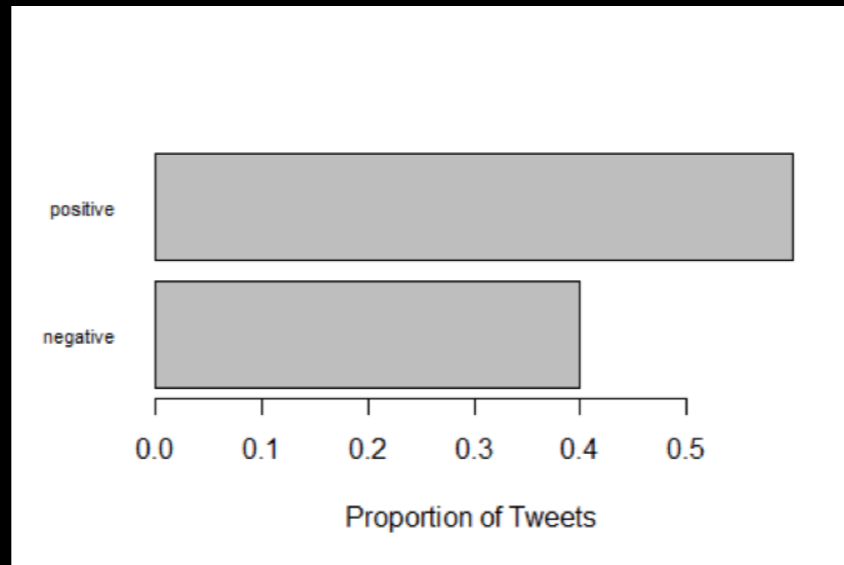
Overall Emotional Measure



There were several trends in the data. Some of them surprising, some of them not so much.

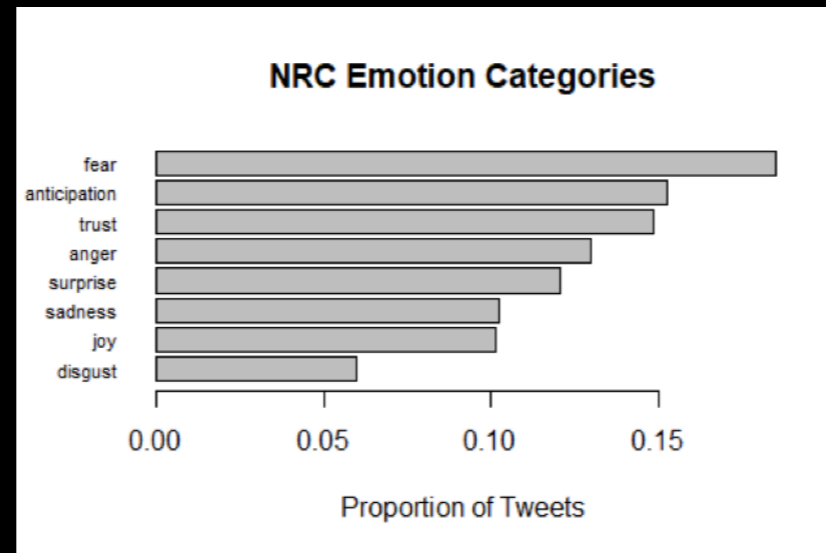
One thing we observed was that the overall tone of the conversation became more intense over time. Since the lawsuit was initiated in August of 2015, both the overall positive and overall negative valence of the conversation intensified. Although some of this increased intensity is due to more people participating in the conversation over time, because this specific sentiment analysis is just looking at the valence over the whole text dataset rather than frequencies with which certain kinds of sentiments are used, not all of this increase is due to more people tweeting in relation to the lawsuit. Over time, it isn't simply the case that more people are participating in the conversation, the contour of the conversation has changed. Our next sets of analyses illustrate these differences.

Sentiment Analysis



Illustrated in this graph, one of the things we found is that overall, there is proportionally more positive sentiment than negative sentiment across the whole tweet corpus.

Sentiment Analysis

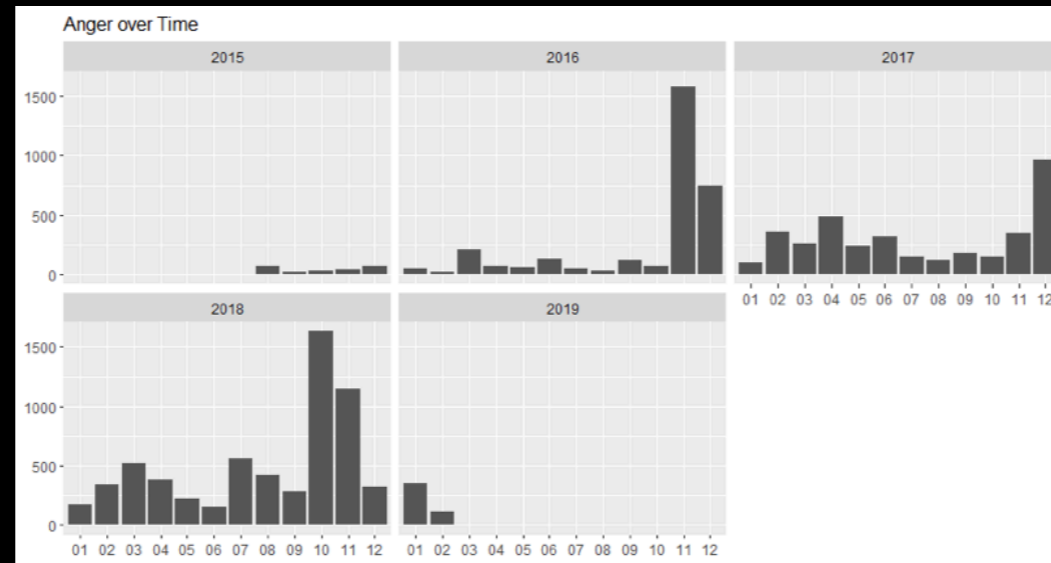


Here, we see that when we look at the proportion of each sentiment category in our analysis, we see that individually, the most expressed sentiment was fear, at around 20-ish percent, which makes sense when we remember the topic ultimately being discussed here is climate change. There are very scary predictions being made by scientists, and very scary outcomes that we've already experienced that can be attributable to human caused influences on the global climate.

However, we also see that there are relatively high proportions of anticipation and trust as individual sentiments expressed, as well. Although the cynic in me wants to attribute this to youthful naivety at whether this lawsuit will actually produce desirable and beneficial outcomes, a less sardonic interpretation is that optimism and hope that we can still make beneficial changes to limit, minimize, and ultimately help prevent continued ecological disasters is precisely the attitude to have in order to actually affect desirable and beneficial change.

However, all of these interpretations are speculative at best, and to really explore what these sentiments are actually expressions of would require human judgement to go through all of the text and make assessments.

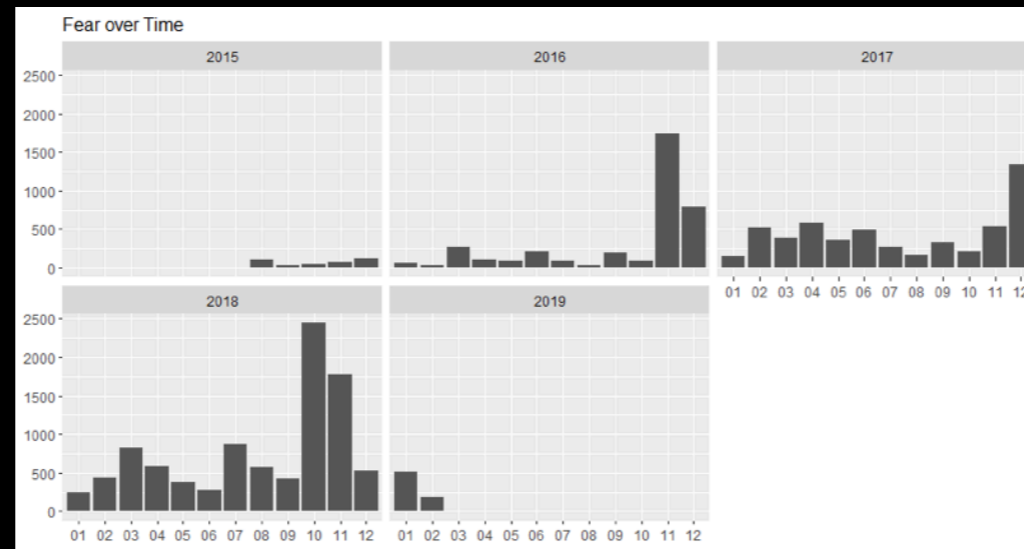
Sentiment Analysis



Our last set of results to show concern the frequency of tweets expressing a given sentiment over time, to illustrate trends with which each sentiment has been expressed over time. Each grid here represents a year, and along the x-axis in each grid shows the month.

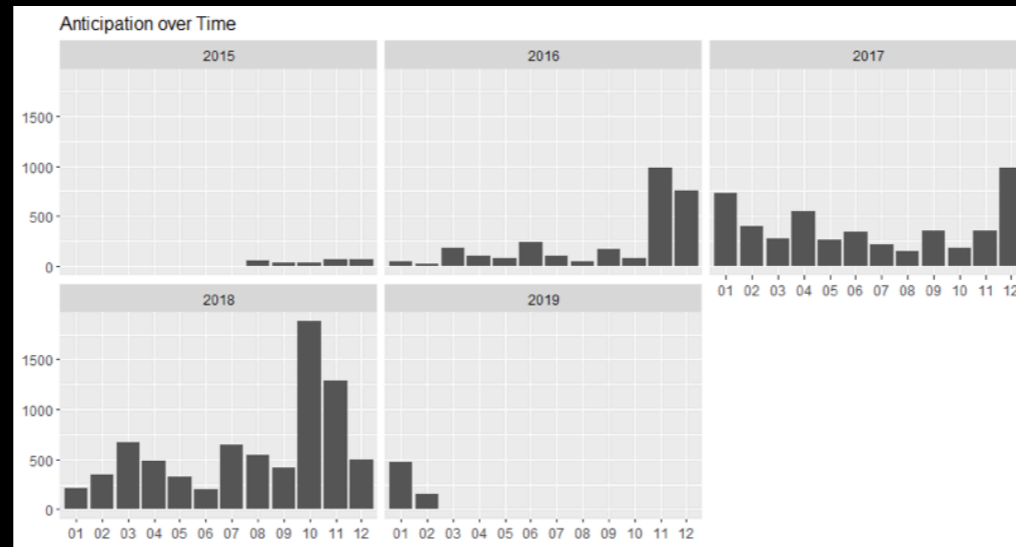
As you'll see in this and the other graphs we'll show in a moment, the conversation about the lawsuit really took off around November of 2016, which coincides with the first real victory for the plaintiffs. A US district court judge ruled against the US government and fossil fuel companies' motion to dismiss the lawsuit outright. There are several similar spikes in the conversation surrounding similar events each year. And you'll see that on basically each of the individual sentiment graphs we're going to show you, but pay attention to the different general trends in how long before that particular sentiment subsides, how intense the spikes are, and what the relatively stable level for that particular sentiment is.

Sentiment Analysis



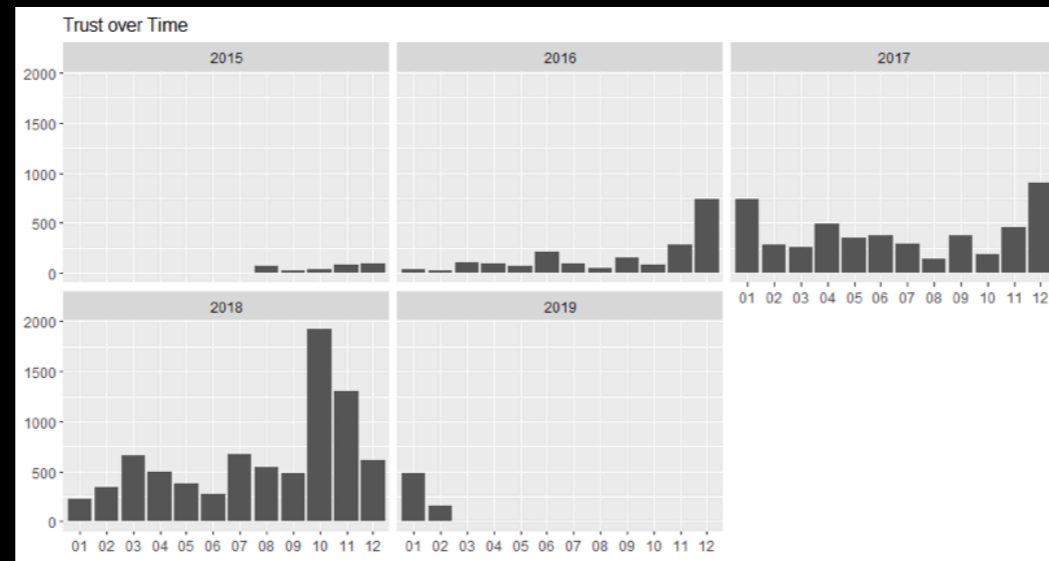
Fear sentiments progressed with the same pattern as anger sentiments, although as you'll note the y-axes are different between the two graphs, what this shows is that fear was slightly more prevalent than anger.

Sentiment Analysis



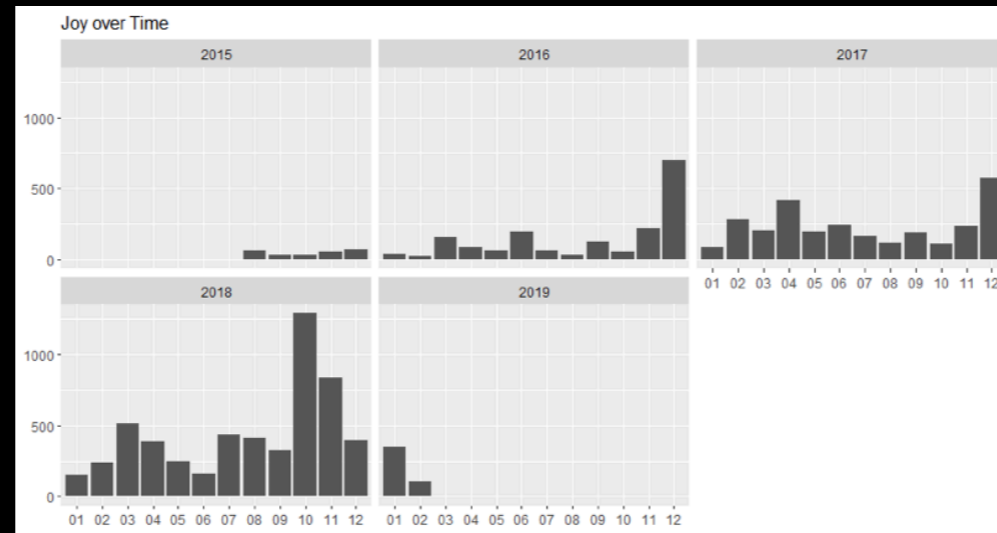
Compared to the frequency of anger and fear sentiments over time, anticipation sentiments didn't spike as high, but remained relatively more stable over time, as seen in 2017 and 2018.

Sentiment Analysis



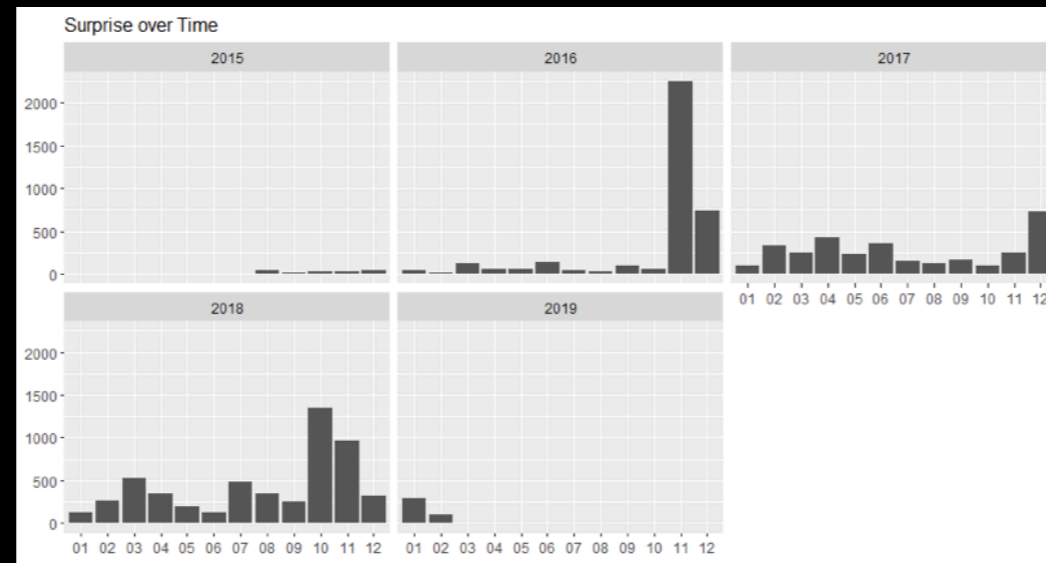
Trust also showed a similar trend as Joy and Anticipation, but was overall more frequent than Joy sentiments

Sentiment Analysis



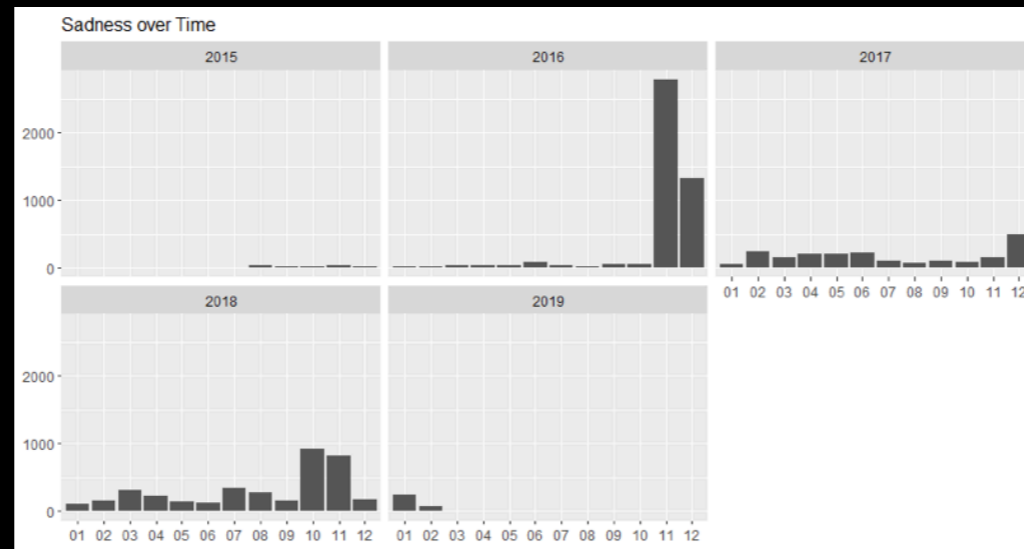
Joy sentiments also showed a different pattern than fear & anger sentiments, and was more like anticipation. The frequency over time wasn't as high, but there was more stability over time than for fear or anger

Sentiment Analysis



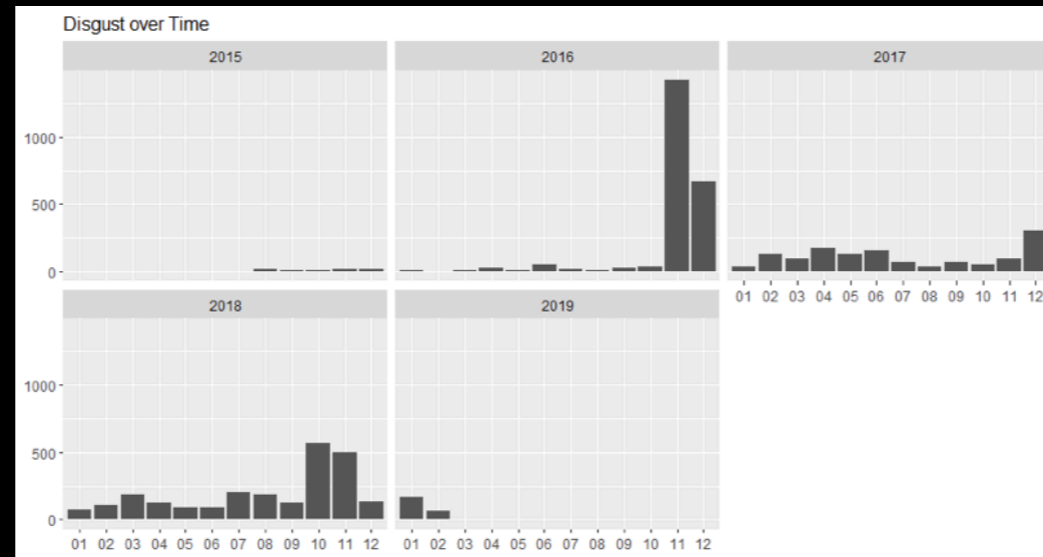
And surprise followed a similar trend as Joy

Sentiment Analysis



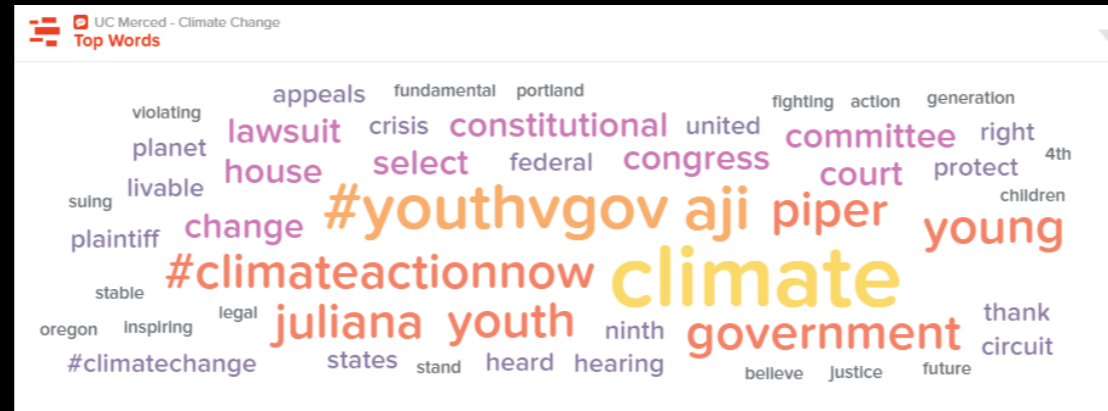
Generally speaking, there wasn't much in the way of sadness related sentiments except surrounding the events that caused general spikes in all sentiments due to the greater frequency of twitter use at those times.

Sentiment Analysis



Disgust likewise didn't really seem to be all that prevalent, and only showed minimal spikes at the end of 2016 and 2018.

Most Recent News



- As mentioned previously, we performed our Twitter scraping in early February, and thus the information we collected stopped there.
 - A word cloud created from our previous scrape showed that words like "stand", "young", and "trial" were used very frequently.
- With the help of our external mentor Karl at HP, we were able to analyze social media traffic from mid March to mid April.
 - The word cloud that analyzed the most recent tweets showed that word like "change", "young" and "lawsuit" were used most frequently, indicating that the general content of the conversation hasn't changed.

Most Recent News cont.

- Leonardo DiCaprio
 - Now This News
- Amicus Curiae ("Friend of the Court") Briefs
- 60 Minutes interview
- Youth v Gov the Film



- There was a bump in Twitter traffic in late February after a news brand called "Now This" posted a video of the plaintiffs talking about the lawsuit. This was quote tweeted by Leonardo DiCaprio, making it gain more retweets and replies, and ultimately more popularity.
- In early March, over a dozen organizations filed Friend of the Court briefs
 - When individuals or organizations who are not party to a lawsuit make statements on behalf of plaintiffs of a lawsuit in solidarity because they have a notable interest in the subject.
 - Amicus briefs are considered in legal settings because they communicate the public interest to the court.
 - These briefs show that these children not only have significant support, but also legal standing. Much of these organizations likely heard about this case via some sort of social media.
- There was also a 60 Minutes interview.
 - The median age the 60 minutes audience is actually 60, so the word has gotten out to the general public even more so than before. These aren't just teenagers talking about this.
- Finally, a film about the lawsuit is currently in the works, which will likely be documentary style and cover the proceedings.

"They said we'd never win.
Then we started winning."



Welcome!

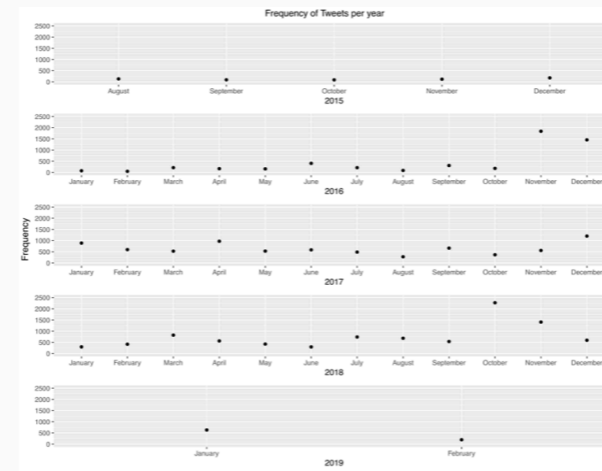
This website was created for the NRT-Interdisciplinary Computational Graduate Education program. The group behind this website are made up of graduate students who are a mathematician, a biologist, a cognitive scientist, and a physicist. We originally came together to look at the sentiment of tweets about climate change and legislative policies that have been affected by these sentiments. Throughout the project we have decided to settle on the [Juliana vs United States](#) case where young members of the community are suing the United States for not doing enough to alleviate severe climate change.

Want to know why we are named the Checkerspot Butterflies? The Bay Checkerspot Butterflies are a species of *Euphydryas* that has been declining due to climate change. It is currently listed as a endangered species.



Analysis

Frequency of Tweets per Year at the start of the case to the day of tweet scraping. Upticks in tweets often correlates with events in the Juliana v. US case.



Methods

Tweet Scraping

Tweets were scraped using this open source [TweetScraper](#) function. The hashtags used for scraping include: @youthgov, #julianavsunitedstates, #noordinarylawsuit and more. If you would like a complete list of key phrases scraped, please contact us! All tweets were outputted as a JSON file and were imported into R in order to perform the sentiment analysis.

Sentiment Analysis in R

Code used to perform the sentiment analysis is linked [here](#).



Acknowledgments

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Questions?

