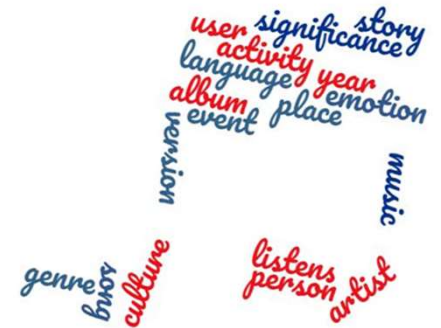




# Music-Evoked Autobiographical Memories

Julia Stelman

Professor: Petr Janata



background

- Inspiration: Alzheimer's study
- Data source: Prof. Janata's psychology students and other subject volunteers
- Data Collection: MEAMCentral "Music-Evoked Autobiographical Memories"
- Data format: Linked Data; SPARQL triples

Media

Geographic

Publications

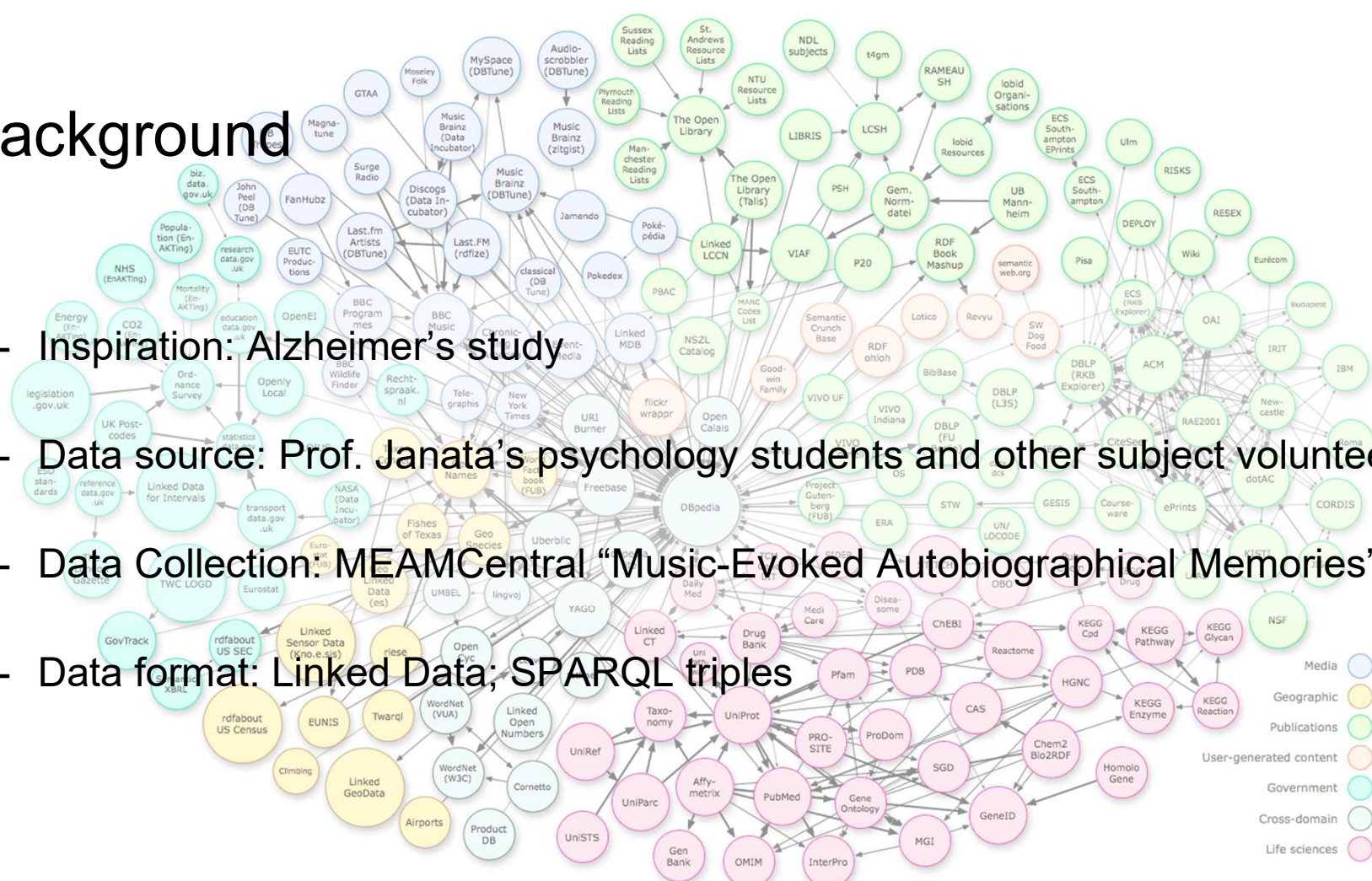
User-generated content

Government

Cross-domain

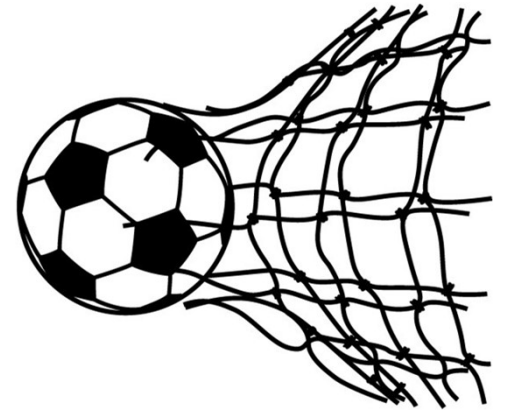
Life sciences

- Inspiration: Alzheimer's study
- Data source: Prof. Janata's psychology students and other subject volunteers
- Data Collection: MEAMCentral "Music-Evoked Autobiographical Memories"
- Data format: Linked Data; SPARQL triples



# Goals

- Efficiently integrate Python NLTK tools to perfect sentiment analysis.
- Determine significant trends between emotions in memories and sentimental characteristics of associated songs.





What is MEAMCentral?

## MEAMCentral ... where music and memories come alive ...

Account  
Connected as dbviolin  
[Logout](#)

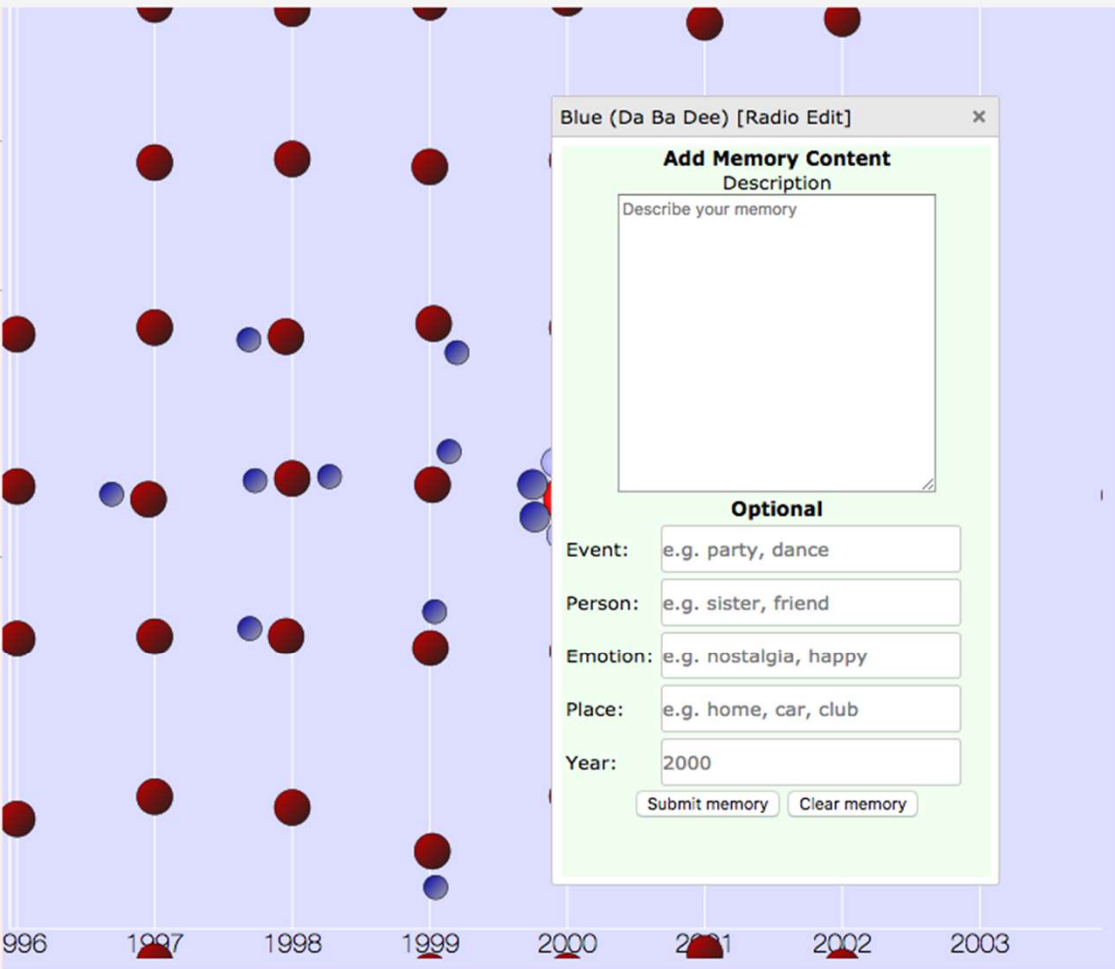
Music Sources  
Spotify  
[Login](#) [Export playlist](#)  
[Import playlist](#)

Actions  
[Fetch my songs](#)

Filters  
Year:   
[Fetch some songs](#)

Search Music  
Song:   
Artist:   
Album:   
[Find song\(s\)](#)

Memories  
Words:   
[Search memories](#)



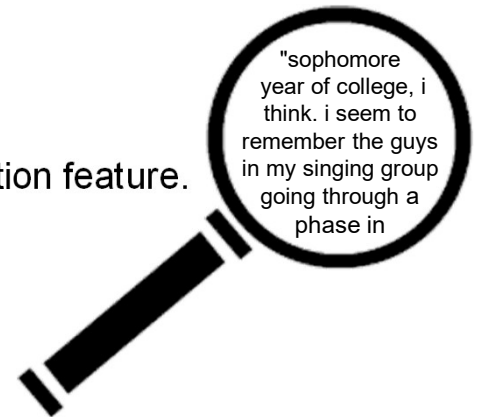
Now playing ...  
Title: Blue (Da Ba Dee) [Radio Edit]  
Artist: Eiffel 65  
Year: 2000

Instructions

- Reddish-brown orbs correspond to songs.
- Hover over one to see the title. Click on it to listen to it.
- When a song is playing and bright red, its memories become active.
- Memories are the blue orbs. Hover over them to see them.
- Clicking on an active memory turns it (and its cousins) green, and fetches all of the songs for which the author of the memory had memories.
- Click on a song while it is playing to enter your own memory.

# Investigation

- What information can be extracted from user-inputted memory?
- What can be discovered with that data and what other data is available?
  - Focus: Do memories with similar emotional trends correspond to songs with similar features?
  - Tools: Spotify Web API via “Spotipy” python library
  - Method: Track metadata, *Mood and Genre* playlists, Recommendation feature.



## Memory Narrative Example:

"sophomore year of college, i think. i seem to remember the guys in my singing group going through a phase in which they were obsessed with barenaked ladies, the band. i seem to remember bnl being played a lot during tours or retreats. i can't pinpoint a specific memory, but the memory of the era feels satisfyingly authentic."



	memory_id	mcpid	songid	title	genre	artist	word	stem
1	8ee9881a-3924-5a6d-b8c0-b180af5dd223	01mza80251	Songs that didn't come from Spotify were removed. (Some came from itunes). This is something I'm working on fixing because about 40% of the data is lost due to this.			The Hollies	exercises	exercis
2	34510e50-2853-52de-ba31-92b2774ab55f	5b318b4ef00462c6e650081d0e480ad8				Shaggy	gasping	gasp
3	34510e50-2853-52de-ba31-92b2774ab55f	5b318b4ef00462c6e650081d0e480ad8				Shaggy	freestyle	freestyl
4	34510e50-2853-52de-ba31-92b2774ab55f	5b318b4ef00462c6e650081d0e480ad8				Shaggy	brushes	brush
5	34510e50-2853-52de-ba31-92b2774ab55f	5b318b4ef00462c6e650081d0e480ad8				Shaggy	giddiness	gididi
6	422fefee-bf5d-53bd-a773-32c0b3374edf	09nlr84261				Justin Timberlake	dormmate	dormmat
7	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer	NA	Elton John	bun	bun
8	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer	NA	Elton John	bun	bun
9	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer	NA	Elton John	bun	bun
10	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer	NA	Elton John	bun	bun
11	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer	NA	Elton John	ballerina	ballerina
12	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	ballerina	ballerina
13	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	ballerina	ballerina
14	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	ballerina	ballerina
15	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	ballerina	ballerina
16	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	ballerina	ballerina
17	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	ballerina	ballerina
18	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	ballerina	ballerina
19	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	womb	womb
20	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	womb	womb
21	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	womb	womb
22	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	womb	womb
23	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	belly	belli
24	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	belly	belli
25	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	belly	belli
26	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	belly	belli
27	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	app	app
28	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	app	app
29	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer		Elton John	app	app
30	5107ec21-4f46-557b-9294-3edef8cc68c5	44d546731e336198e41d65da866cb247	22W8VZFcnj48ClaixnpWOL	Tiny Dancer	NA	Elton John	app	app



## Most popular words overall: (stop words removed)



Word size is based on frequency of the root word in the whole dataset.

# Data Preview

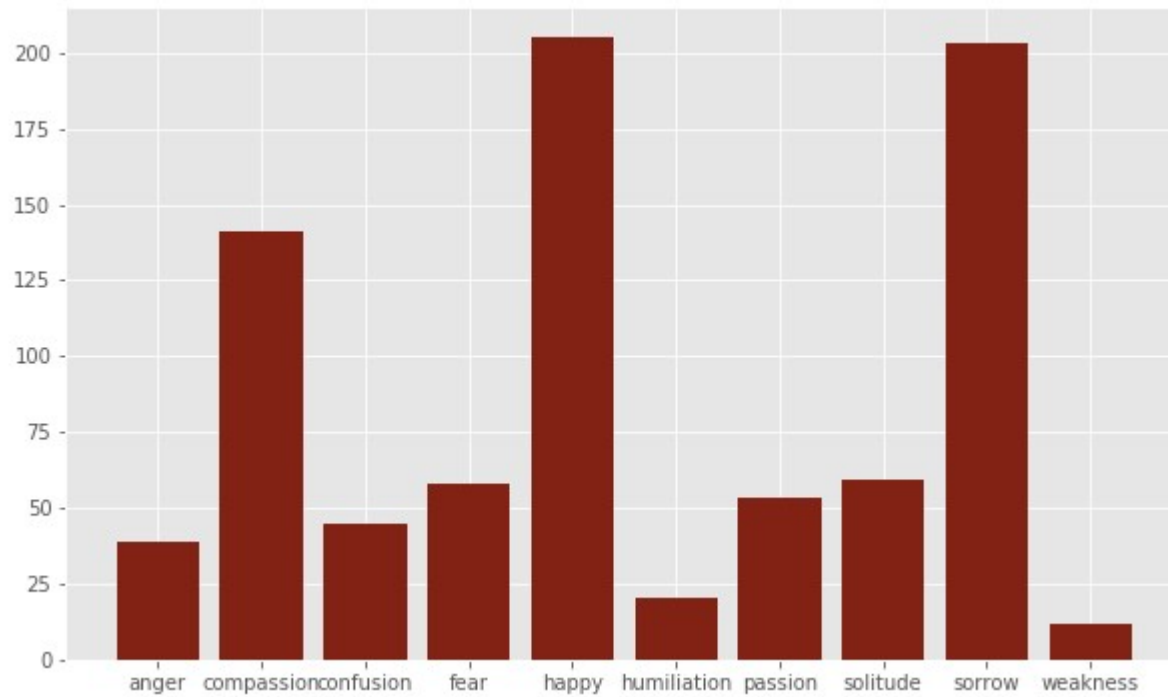
I have reviewed the data for content of ten different emotions.

The ten rows at the bottom each pertain to a specific emotion.

Their elements are frequencies of related words.

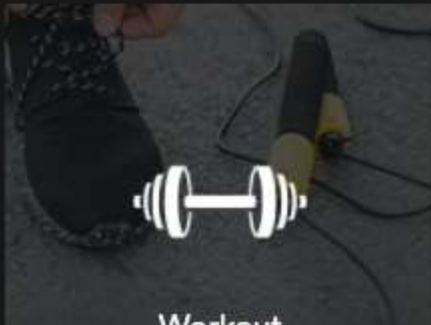
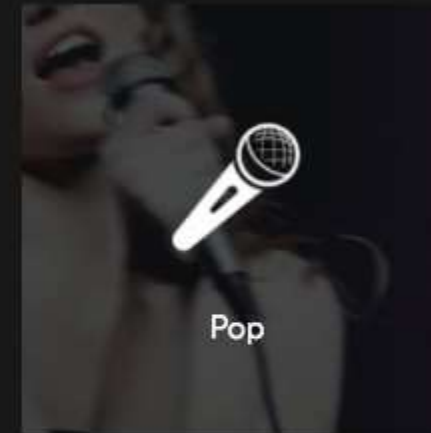
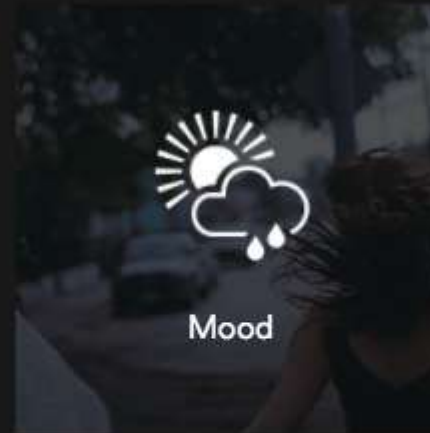
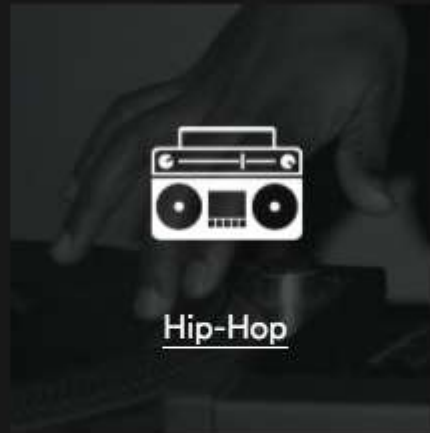
	0	1	2	3	4	5
memory_id	97dcb94f-4fae-5c58-bed3-6b7f9748dca7	328d3ca3-4a7f-5f65-8a0b-87b762464da1	34c06afd-f39d-56ab-a250-23744cfe9b0d	52a83876-8472-53b1-bc03-dd6d5de965b1	ee5a3ff6-92b3-520a-8388-359657dde000	c08ccb67-aa9f-5f47-adfc-9998315b60d0
mcpid	10nnk91051	6110747b02a89d0bd0b639d0758590fc	08kma88221	03kyb85091	01mza80251	ae1fcf5347fc7260d81568456254142
songid	38590	6YN4XKUaE8HtqL5S1sZXC9	320	608	63192	2pmpETDH4li3IWNcS1qA9q
title	The Bridge Over the River Kwai	Shiki No Uta	I Knew I Loved You	Change the World	When And If	Hairsay
artist	BBC Concert Orchestra	Levox	Savage Garden	Eric Clapton	Ari Hest	Katie Henry
album	Choice Film Soundtracks Cuts, Vol. 1: BBC Conc...	Shiki No Uta	Affirmation	Eric Clapton: The Best of - Clapton Chronicles	The Break-In	Bears in the City
desc_all	it reminds me of my asian heritage. i remember...	my older brother wanted to share his passion o...	my middle school friends and i jokingly sang t...	it reminds me of a junior high dance when all ...	i had this album by ari hest on heavy rotation...	reminds me of the babes performing this at the...
anger	0	0	0	0	0	0
compassion	2	0	0	0	0	0
confusion	0	0	0	0	0	0
fear	0	0	0	0	0	0
happy	0	0	0	0	0	0
humiliation	0	0	0	0	0	0
passion	0	1	0	0	0	0
solitude	0	0	0	0	0	0
sorrow	0	0	0	0	0	0
weakness	0	0	0	0	0	0
emovalue	2	1	0	0	0	0

# Breakdown of Emotion Words by Emotion Group

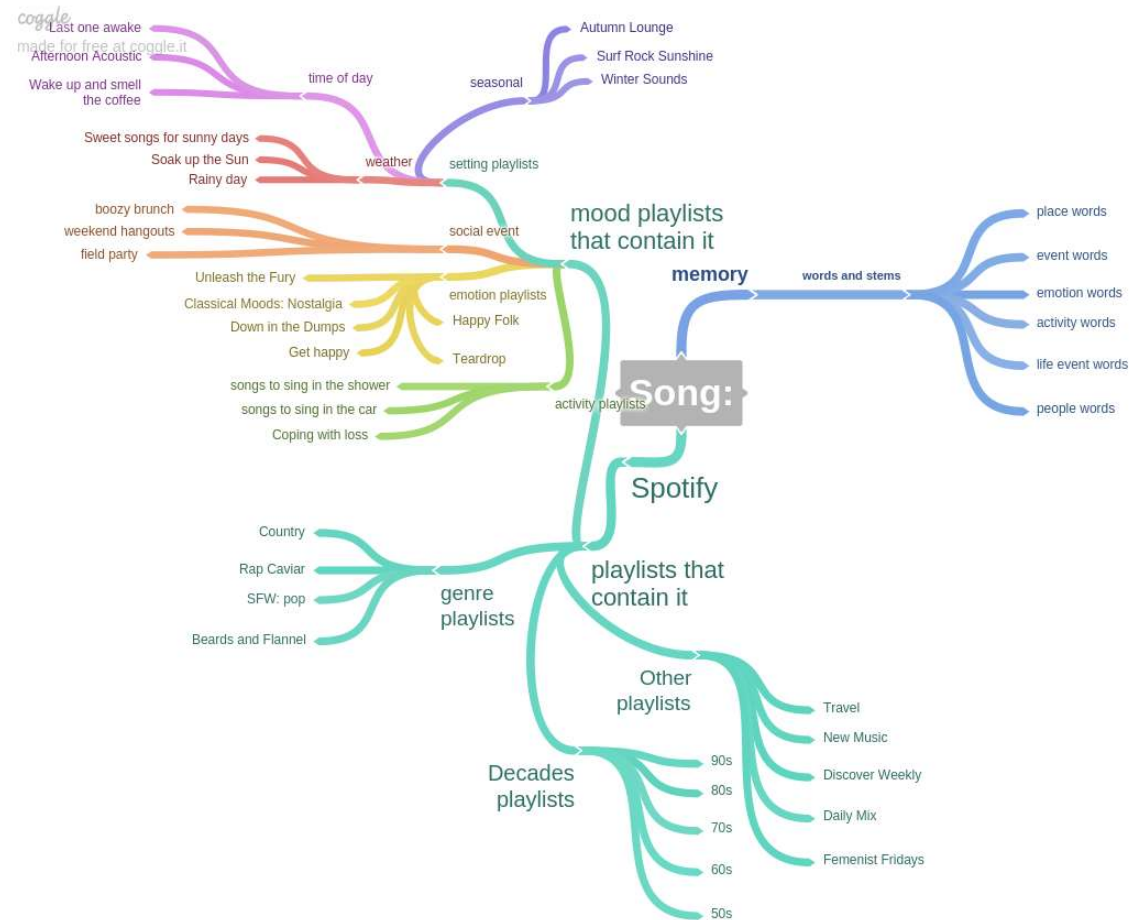


# Spotify

## Genres & Moods



Old



# What does it all mean?



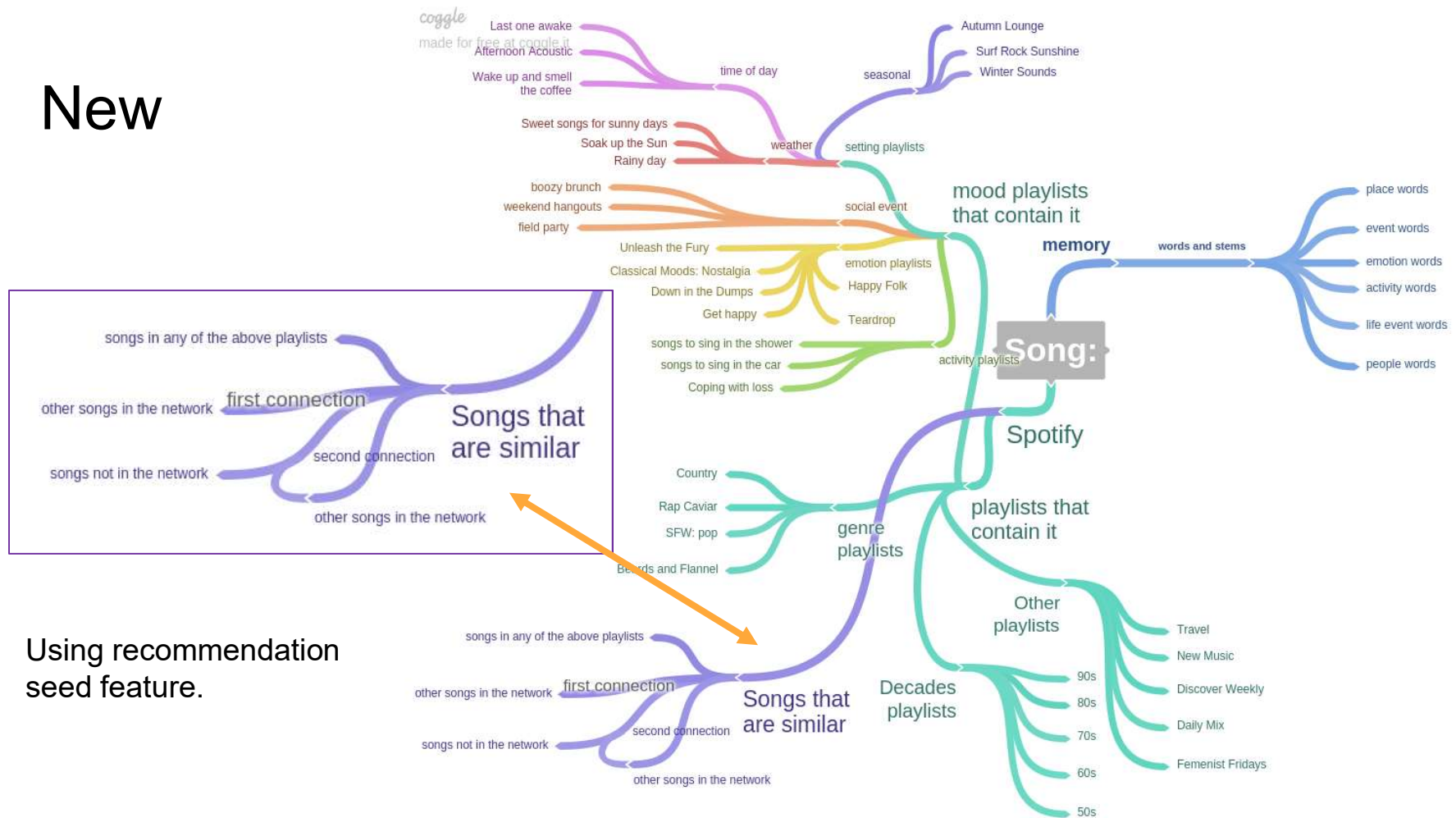
- I have over 4,000 unique memories to work with – tied to 1 song & 1 user.
- Just over 2,000 are identifiably associated with a track on Spotify
- There are roughly 100,000 songs on Spotify's collection of Mood/Genre playlists
- Less than 700 of them are identifiably associated with a song on a Mood/Genre playlist
- There are fewer than 100 unique songs in this pool
- Not much to work with 😞



## New strategy

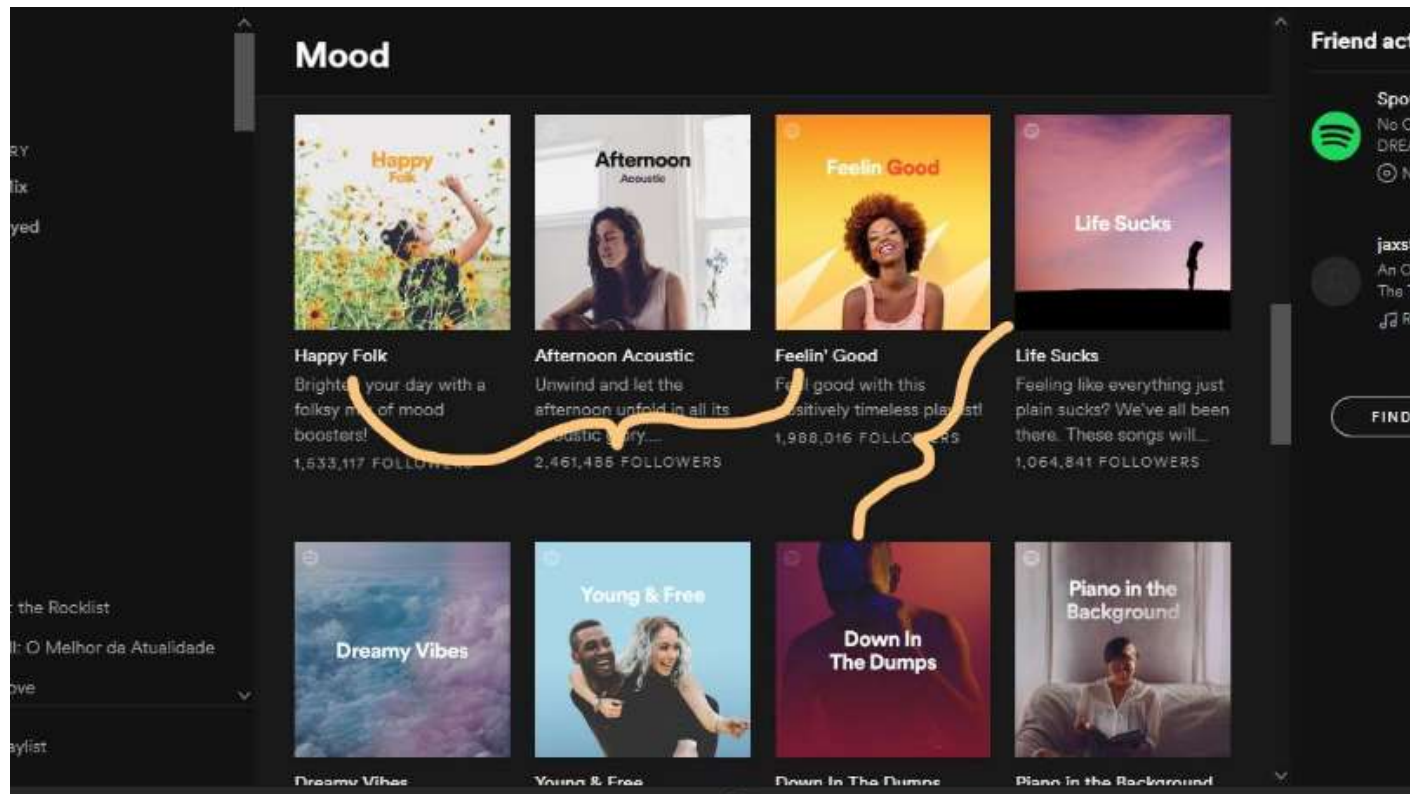
- Plan to use the recommendation seed feature on Spotify
- Can get a set of 10 songs that Spotify considers “similar” to a given track
- Look for direct connections to other songs in the network
- Indirect connections – two songs in the network connect to same external song
- Can possibly check for presence of recommended songs in Mood/Genre playlists. Can be (an)other variable(s) for analyzing the “seed” track.

New



Using recommendation seed feature.

# Mood playlists: Happy vs Sad more like Good vs Bad mood



## Mood playlists: **Happy vs Sad** more like **Good vs Bad mood**

As you can see, each playlist is has a title and a description.

The following wordcloud consists of words from every mood playlist's description.

Take a look:

Most popular words used by Spotify in the descriptions of their “Mood” playlists:



- Not very many emotion-related words.

## Adding Recommendations

- For each memory triggered by a Spotify-compatible song, ask SpotiPy to recommend 10 songs similar to the trigger song
- Save these recommendations and their seeds (corresponding trigger songs), in a DataFrame join with the DataFrame you saw last.
- Here it is again:



# Data Preview

This is the data without any recommendations added. Each memory column is unique.

This has been transposed to preserve the visibility of variable names.

	0	1	2	3	4	5
memory_id	97dcb94f-4fae-5c58-bed3-6b7f9748dca7	328d3ca3-4a7f-5f65-8a0b-87b762464da1	34c06afd-f39d-56ab-a250-23744cfeffb0d	52a83876-8472-53b1-bc03-dd6d5de965b1	ee5a3ff6-92b3-520a-8388-359657dde000	c08ccb67-aa9f-5f47-adfc-9998315b60d0
mcpid	10nnk91051	6110747b02a89d0bd0b639d0758590fc	08kma88221	03kyb85091	01mza80251	ae1fcf5347fc7260d81568456254142
songid	38590	6YN4XKUaE8HtqL5S1sZXC9	320	608	63192	2pmpETDH4li3IWNcS1qA9q
title	The Bridge Over the River Kwai	Shiki No Uta	I Knew I Loved You	Change the World	When And If	Hairsay
artist	BBC Concert Orchestra	Levox	Savage Garden	Eric Clapton	Ari Hest	Katie Henry
album	Choice Film Soundtracks Cuts, Vol. 1: BBC Conc...	Shiki No Uta	Affirmation	Eric Clapton: The Best of - Clapton Chronicles	The Break-In	Bears in the City
desc_all	it reminds me of my asian heritage. i remember...	my older brother wanted to share his passion o...	my middle school friends and i jokingly sang t...	it reminds me of a junior high dance when all ...	i had this album by ari hest on heavy rotation...	reminds me of the babes performing this at the...
anger	0	0	0	0	0	0
compassion	2	0	0	0	0	0
confusion	0	0	0	0	0	0
fear	0	0	0	0	0	0
happy	0	0	0	0	0	0
humiliation	0	0	0	0	0	0
passion	0	1	0	0	0	0
solitude	0	0	0	0	0	0
sorrow	0	0	0	0	0	0
weakness	0	0	0	0	0	0
emovalue	2	1	0	0	0	0

# Adding Recommendations

- For each memory triggered by a Spotify-compatible song, ask SpotiPy to recommend 10 songs similar to the trigger song
- Save these recommendations and their seeds (corresponding trigger songs), in a DataFrame join with the DataFrame you saw last.
- Here it is again:
- And here is what it looks like after adding recommendations:

# Data Preview

This is the data with recommendations added\*.

\*I selected these columns intentionally to show a broader variety of entries in emotion frequency and in the bottom four rows. They are not in sequential order.

In the full table columns with even one occurrence of any emotion are few and far between.

	4060	5177	5213	
songid	3aXo6nJjexSdb6wCpN7Ysy	4XcFHpBpYUN3pgzNXfib9o	4aOAzvRdOsZSwZlgwcdeL0	0JgpdKK7T18M
memory_id	11e24cea-a594-5899-bf04-42e6f691294a	b4fdfb4f-6f21-532e-a199-8c956edf18ba	b413bea8-7048-5487-b554-fb5cfa63e25e	c0661f23-e854-2d20f90b466f
mcpid	c48b73936109001049b5000e427b6929	ceec5e01ce7747555e55eab3e5985e78	1663d708b4e4cb60c277144326a344f4	ceec5e01ce774
title	Redbone	Laura: Theme (1944)	Let Down	Let Me Call You
artist	Childish Gambino	David Raksin	Radiohead	Bing Crosby
album	Nova Tunes 3.5	Itzhak Perlman - Original Jacket Collection	OK Computer	My Favorite Lon
desc_all	childish gambino wrote this song about a girlf...	there are snow scenes and it was a really inte...	when i first heard this song, it was the day b...	i remember all t the ...
anger	0	0	0	0
compassion	0	0	0	0
confusion	0	0	1	0
fear	0	0	2	1
happy	1	0	0	1
humiliation	0	0	0	0
passion	2	1	0	0
solitude	0	0	0	0
sorrow	0	0	0	0
weakness	0	0	1	0
recommendation	3UX6gkJcxopypFNdVYP4vA	5AKMXbvcCec4AddAZskCkq	7I15QDWp4v3TYh5u3pQjxa	0WlIbzDVEpmC

# Adding Recommendations

- I used these details as new variables on which I could analyze the seed tracks (“songid” row), and everything attached to them.
- That includes memory content data
  - emotional frequencies
- The following wordclouds pertain to 9 out of the 10 emotions I examined:

**Word Clouds (Unweighted)** Each memory narrative that contains a word related to the emotion of interest is pasted in the document once.

Each memory narrative that contains a word related to the emotion of interest is pasted in the document once.

anger



fear



passion



compassion



happy



solitude



confusion



humiliation



sorrow





# Word Clouds (Weighted)

Each memory narrative is pasted in the document as many times as they contain a word related to the emotion of interest.

anger



fear



passion



compassion



happy



solitude



confusion



humiliation



sorrow





## Adding Recommendation Details

- Check for presence of recommendation songs in Mood/Genre/Action playlists
- Save the details in a DataFrame and join with the DataFrame you saw last.
- Here it is again:

# Data Preview

This is the data with only the Spotify IDs of recommendations added. Each memory column is unique.

This has been transposed to preserve the visibility of variable names.

	4060	5177	5213	
songid	3aXo6nJjexSdb6wCpN7Ysy	4XcFHpBpYUN3pgzNXfib9o	4aOAzvRdOsZSwZlgwcdeL0	0JgpdKK7T18M
memory_id	11e24cea-a594-5899-bf04-42e6f691294a	b4fdfb4f-6f21-532e-a199-8c956edf18ba	b413bea8-7048-5487-b554-fb5cfa63e25e	c0661f23-e854-2d20f90b466f
mcpid	c48b73936109001049b5000e427b6929	ceec5e01ce7747555e55eab3e5985e78	1663d708b4e4cb60c277144326a344f4	ceec5e01ce774
title	Redbone	Laura: Theme (1944)	Let Down	Let Me Call You
artist	Childish Gambino	David Raksin	Radiohead	Bing Crosby
album	Nova Tunes 3.5	Itzhak Perlman - Original Jacket Collection	OK Computer	My Favorite Lon
desc_all	childish gambino wrote this song about a girlf...	there are snow scenes and it was a really inte...	when i first heard this song, it was the day b...	i remember all t the ...
anger	0	0	0	0
compassion	0	0	0	0
confusion	0	0	1	0
fear	0	0	2	1
happy	1	0	0	1
humiliation	0	0	0	0
passion	2	1	0	0
solitude	0	0	0	0
sorrow	0	0	0	0
weakness	0	0	1	0
recommendation	3UX6gkJcxopypFNdVYP4vA	5AKMXbvcCec4AddAZskCkq	7I15QDWp4v3TYh5u3pQjxa	0WlIbzDVEpmC

## Adding Recommendations Details

- Check for presence of recommendation songs in Mood/Genre/Action playlists
- Save the details in a DataFrame and join with the DataFrame you saw last.
- Here it is again:
- And here is what it looks like after adding recommendation details:

# Data Preview

This is the data with recommendation details added\*.

\*I selected these columns intentionally to show a broader variety of entries in emotion frequency and in the bottom four rows. They are not in sequential order.

In the full table columns with even one occurrence of any emotion are few and far between.

	10	99	105	
memory_id	11e24cea-a594-5899-bf04-42e6f691294a	b4fdb4f-6f21-532e-a199-8c956edf18ba	b413bea8-7048-5487-b554-fb5cfa63e25e	c0661f23-e854-2d20f90b466f
mcpid	c48b73936109001049b5000e427b6929	ceec5e01ce7747555e55eab3e5985e78	1663d708b4e4cb60c277144326a344f4	ceec5e01ce774
songid	3aXo6nJjexSdb6wCpN7Ysy	4XcFHpBpYUN3pgzNXfib9o	4aOAzvRdOsZSwZlgwcdeL0	0JgpdKK7T18M
title	Redbone	Laura: Theme (1944)	Let Down	Let Me Call You
artist	Childish Gambino	David Raksin	Radiohead	Bing Crosby
album	Nova Tunes 3.5	Itzhak Perlman - Original Jacket Collection	OK Computer	My Favorite Lov
desc_all	childish gambino wrote this song about a girlf...	there are snow scenes and it was a really inte...	when i first heard this song, it was the day b...	i remember all t the ...
anger	0	0	0	0
compassion	0	0	0	0
confusion	0	0	1	0
fear	0	0	2	1
happy	1	0	0	1
humiliation	0	0	0	0
passion	2	1	0	0
solitude	0	0	0	0
sorrow	0	0	0	0
weakness	0	0	1	0
emovalue	3	1	4	2
recommendation	3UX6gkJcxopypFNdVYP4vA	5AKMXbvcCec4AddAZskCkq	7115QDWp4v3TYh5u3pQjxa	0WlIbzDVEpmC
plName	Autumn Classical	Last One Awake	Tropical Morning	Early Alternati
plDesc	This collection brings together 50 autumnal <a...	Songs to end a long night.	We begin with tropical <a href="https://open.s...	Classic alternat pioneers...
plId	37i9dQZF1DX2d2B80QbRDa	37i9dQZF1DXdrILsL4QQPq	37i9dQZF1DWXIFKBoyoLJJ	37i9dQZF1DXd
plFolder	classical	mood	chill	decades

# Adding Recommendation Details

- I then experimented with recommendation-containing playlists, and their details, as variables on which to analyze seed tracks.
  - Includes Playlist's **folder** (i.e. “mood”, “chill”, “travel”, “classical”)
  - Playlist's **name** and Playlist's **description**
- The following wordclouds pertain to all ten of the emotions I examined:
  - Playlist **folders** are in blue, playlist **descriptions** are in orange

# Word Clouds (Unweighted)

