

## **Lecture 13:**

# **From sentiment analysis to affect computing**

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# Agenda

- ▶ Recap
- ▶ Sentiment analysis
- ▶ Affect states
  - Emotion
  - Personality traits

**Static embedding:** one fixed embedding for each word in the vocabulary

**Dynamic embedding:** the vector for each word is different in different contexts

# Word2vec

Instead of **counting** how often each word  $w$  occurs near "apricot"

- Train a classifier on a binary **prediction** task:
  - Is  $w$  likely to show up near "apricot"?

We don't actually care about this task

- But we'll take the learned classifier weights as the word embeddings

Big idea: **self-supervision**:

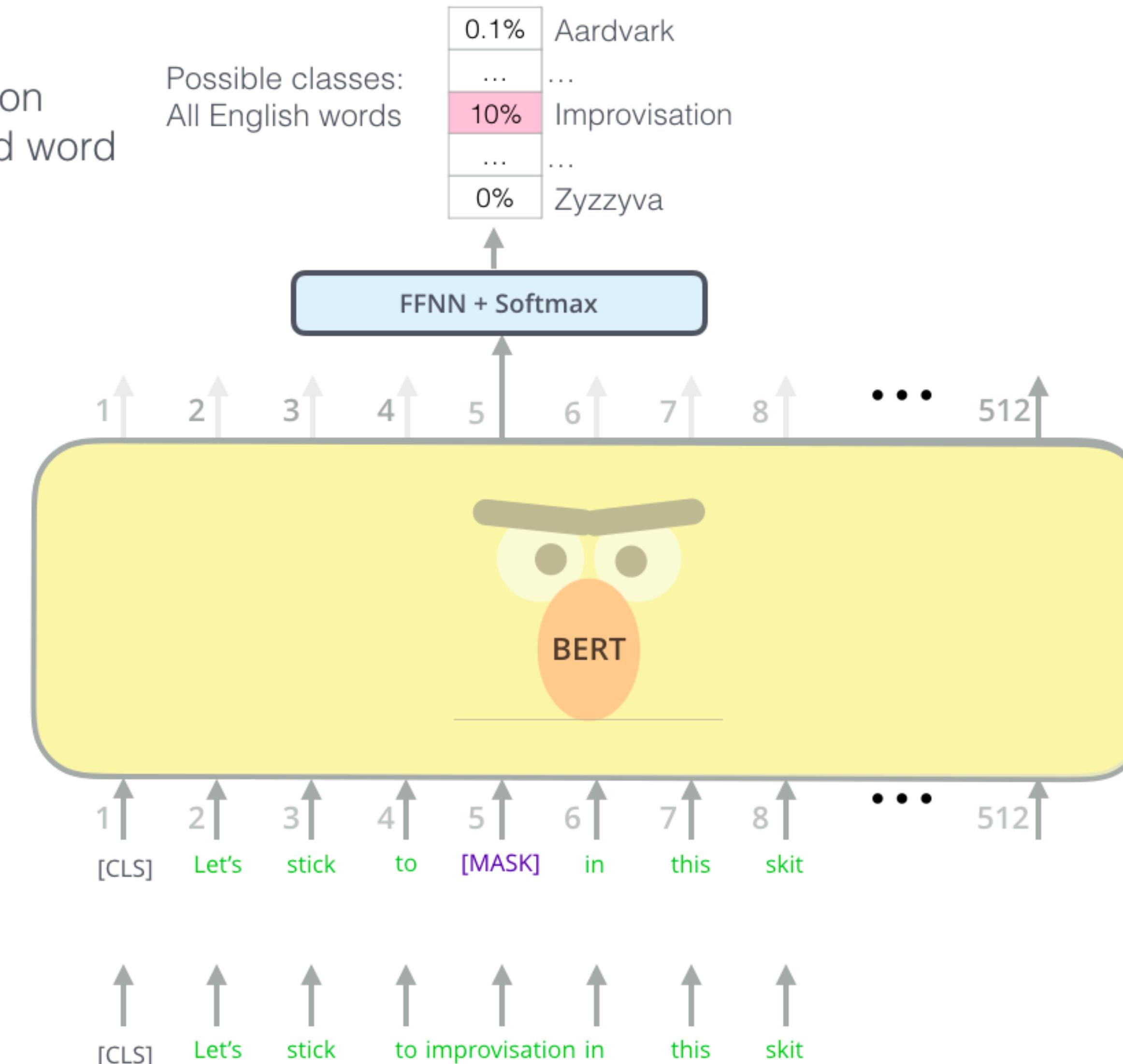
- A word  $c$  that occurs near apricot in the corpus cats as the gold "correct answer" for supervised learning
- No need for human labels
- Bengio et al. (2003); Collobert et al. (2011)

# Masked language model

Use the output of the masked word's position to predict the masked word

Randomly mask 15% of tokens

Input



# Next sentence prediction

Predict likelihood  
that sentence B  
belongs after  
sentence A

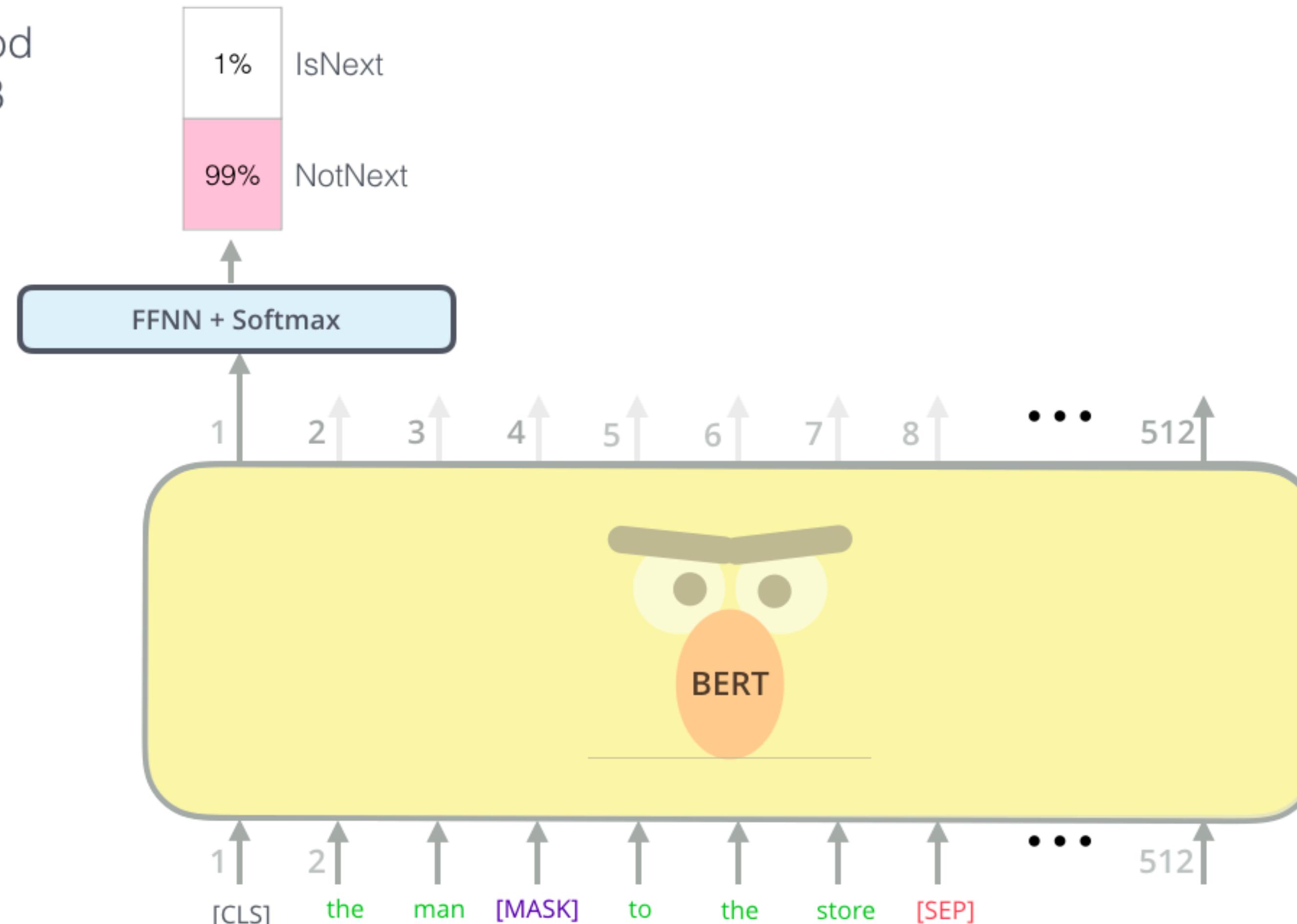
Tokenized  
Input

Input

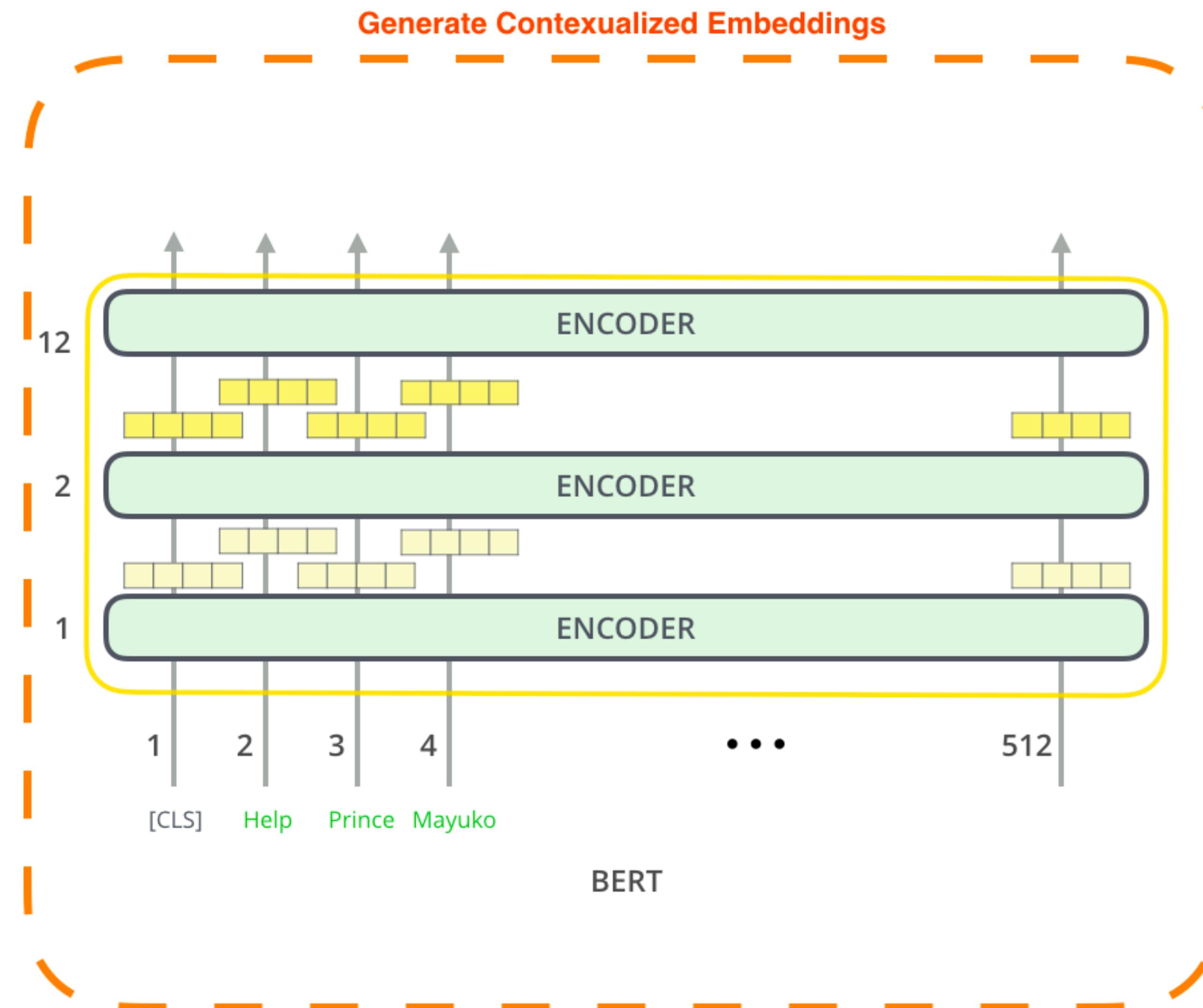
[CLS] the man [MASK] to the store [SEP] penguin [MASK] are flightless birds [SEP]

Sentence A

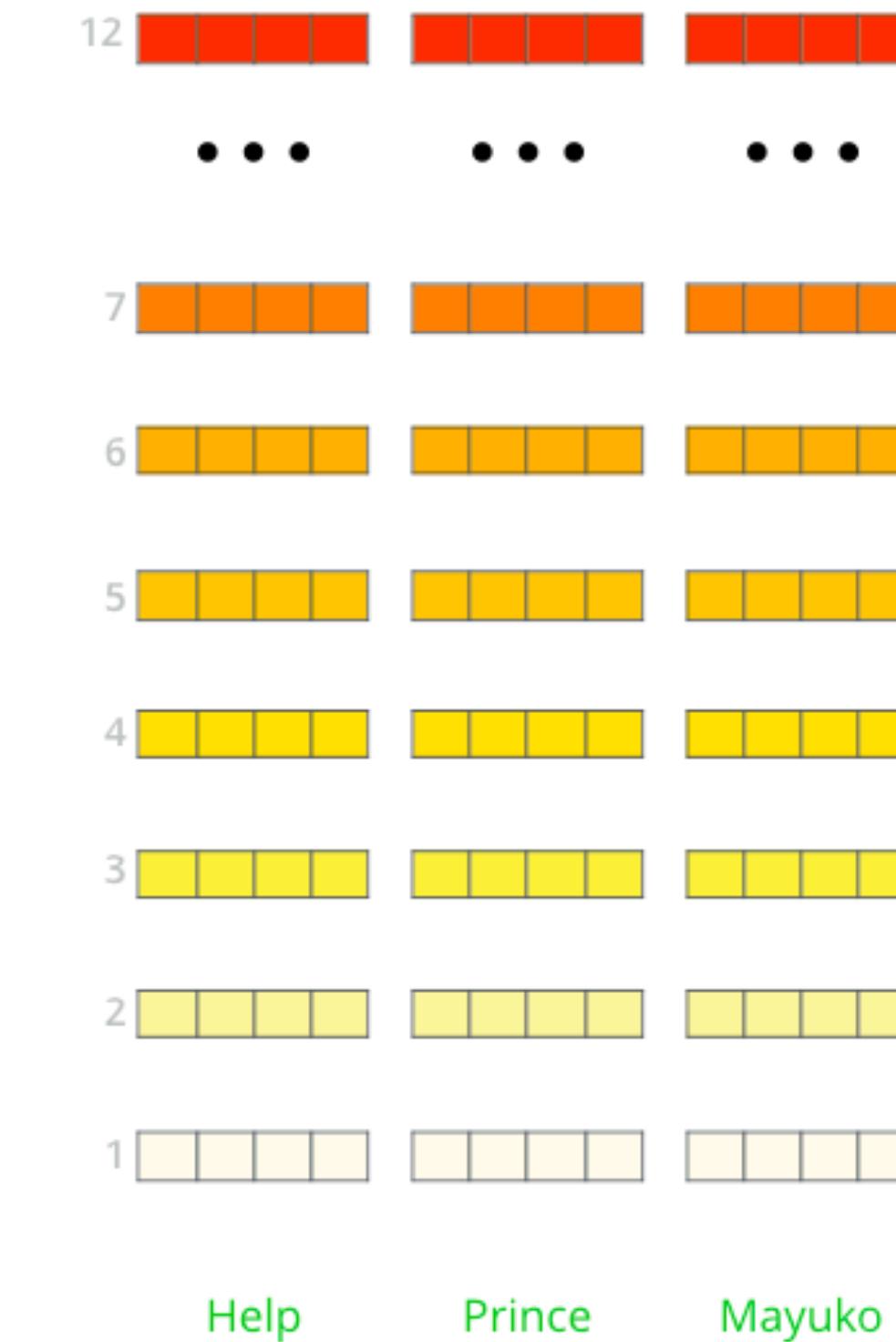
Sentence B



# BERT for feature extraction



The output of each encoder layer along each token's path can be used as a feature representing that token.



But which one should we use?

# Sentiment analysis

- + ...*zany characters and richly applied satire, and some great plot twists*
- *It was pathetic. The worst part about it was the boxing scenes...*
- + ...*awesome caramel sauce and sweet toasty almonds. I love this place!*
- ...*awful pizza and ridiculously overpriced...*

# Positive or negative movie review?

- + ...zany characters and richly applied satire, and some great plot twists
- It was pathetic. The worst part about it was the boxing scenes...
- + ...awesome caramel sauce and sweet toasty almonds. I love this place!
- ...awful pizza and ridiculously overpriced...

# Positive or negative movie review?

- + ...zany characters and **richly** applied satire, and some **great** plot twists
- It was **pathetic**. The **worst** part about it was the boxing scenes...
- + ...**awesome** caramel sauce and sweet toasty almonds. I **love** this place!
- ...**awful** pizza and **ridiculously** overpriced...

FEDERAL RESERVE NOTE  
THE UNITED STATES OF AMERICA

THIS NOTE  
FOR ALL DE

2



*Money  
Lever*

Treasurer of the United States.

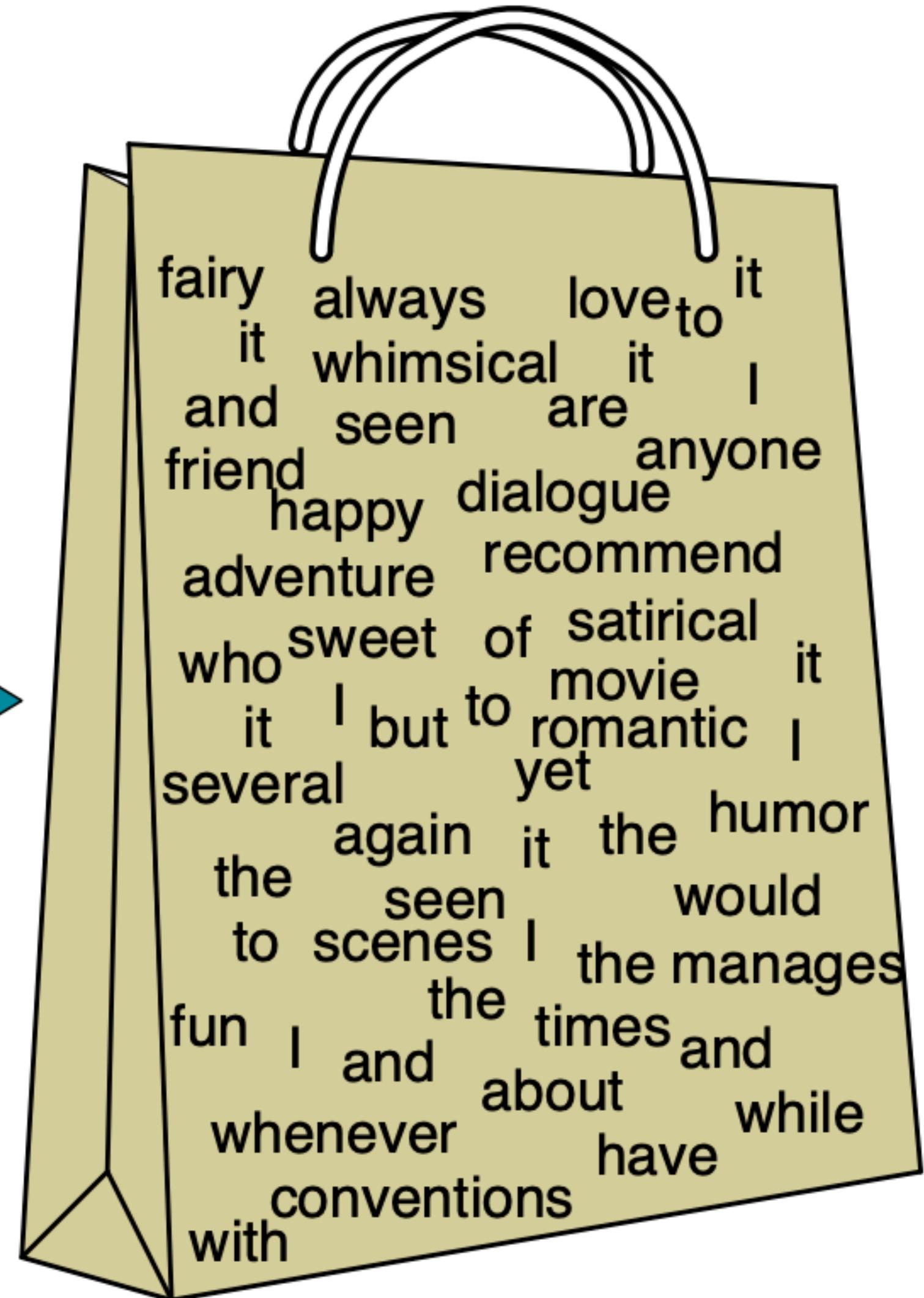
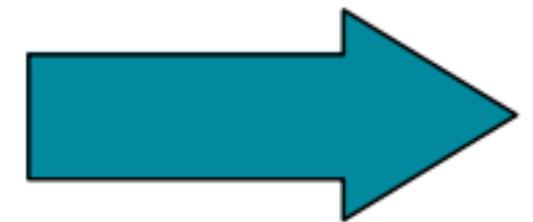
ONE DOLLAR

WASHINGTON

SERIAL  
1995

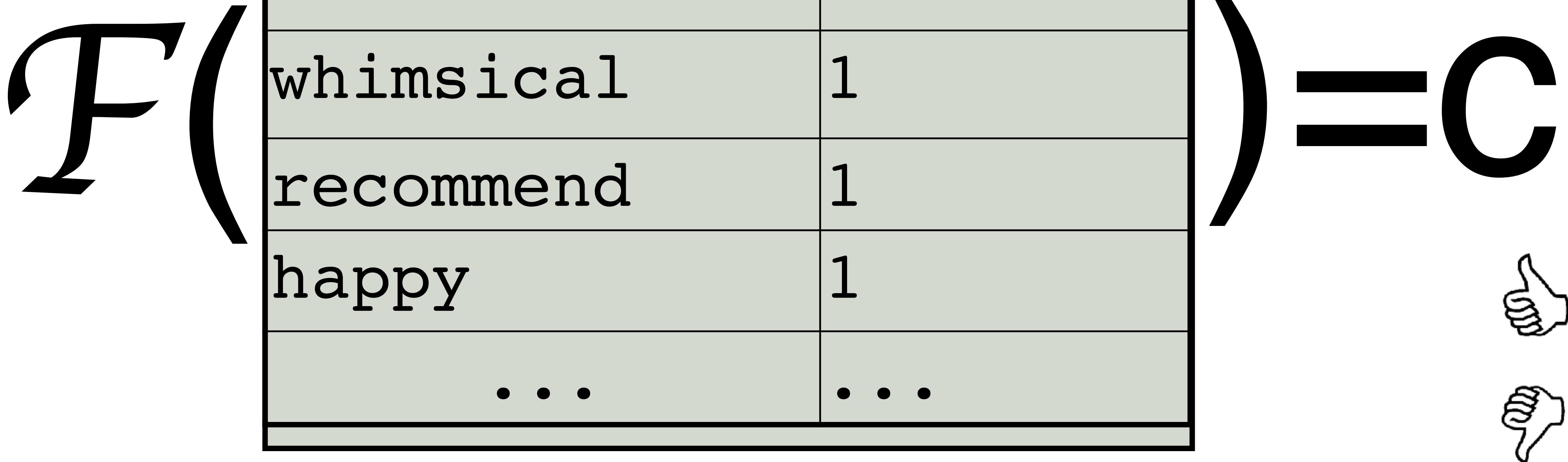


I love this movie! It's sweet, but with satirical humor. The dialogue is great and the adventure scenes are fun... It manages to be whimsical and romantic while laughing at the conventions of the fairy tale genre. I would recommend it to just about anyone. I've seen it several times, and I'm always happy to see it again whenever I have a friend who hasn't seen it yet!



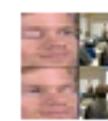
it	6
I	5
the	4
to	3
and	3
seen	2
yet	1
would	1
whimsical	1
times	1
sweet	1
satirical	1
adventure	1
genre	1
fairy	1
humor	1
have	1
great	1
...	...

# Vector representation



# Data sources

- ▶ Hand labeling
- ▶ kaggle.com
- ▶ Internet



起昵称回廊亭屎 ★★★★★

2023-03

## 3月11日晚观影下楼有感

看完电影十一点半，商场关了，从五楼下：面的竖状金属反射材质使得视觉上有了额外说是日落黄昏时火炬似的黄色晚霞，是晚。  
[\(展开\)](#)

△ 56

▽ 1

11回应



Scream VI (2023)

1 ( ↑ 18)

★ 7.3



Creed III (2023)

2 ( ↑ 3)

★ 7.3



Everything Everywhere All at Once (2022)

3 ( ↑ 3)

★ 7.9



Cocaine Bear (2023)

4 ( ↓ 3)

★ 6.3



小苗 ★★★★★

2023-03-07 18:08:00

## 他为什么不死，你为什么而活

| 这篇影评可能有剧透

周末的时候，参加了一个兴趣社团的聚餐，姑娘。餐厅很吵，餐桌很长，大多数时间，了，但是我清楚的记得，小姑娘聊到，她  
[\(展开\)](#)



The Whale (2022)

5 ( ↓ 1)

★ 7.8



Ghosted (2023)

6 ( ↑ 2,371)



Teenage Mutant Ninja Turtles: Mutant Mayhem (2023)

7 ( ↑ 1,401)



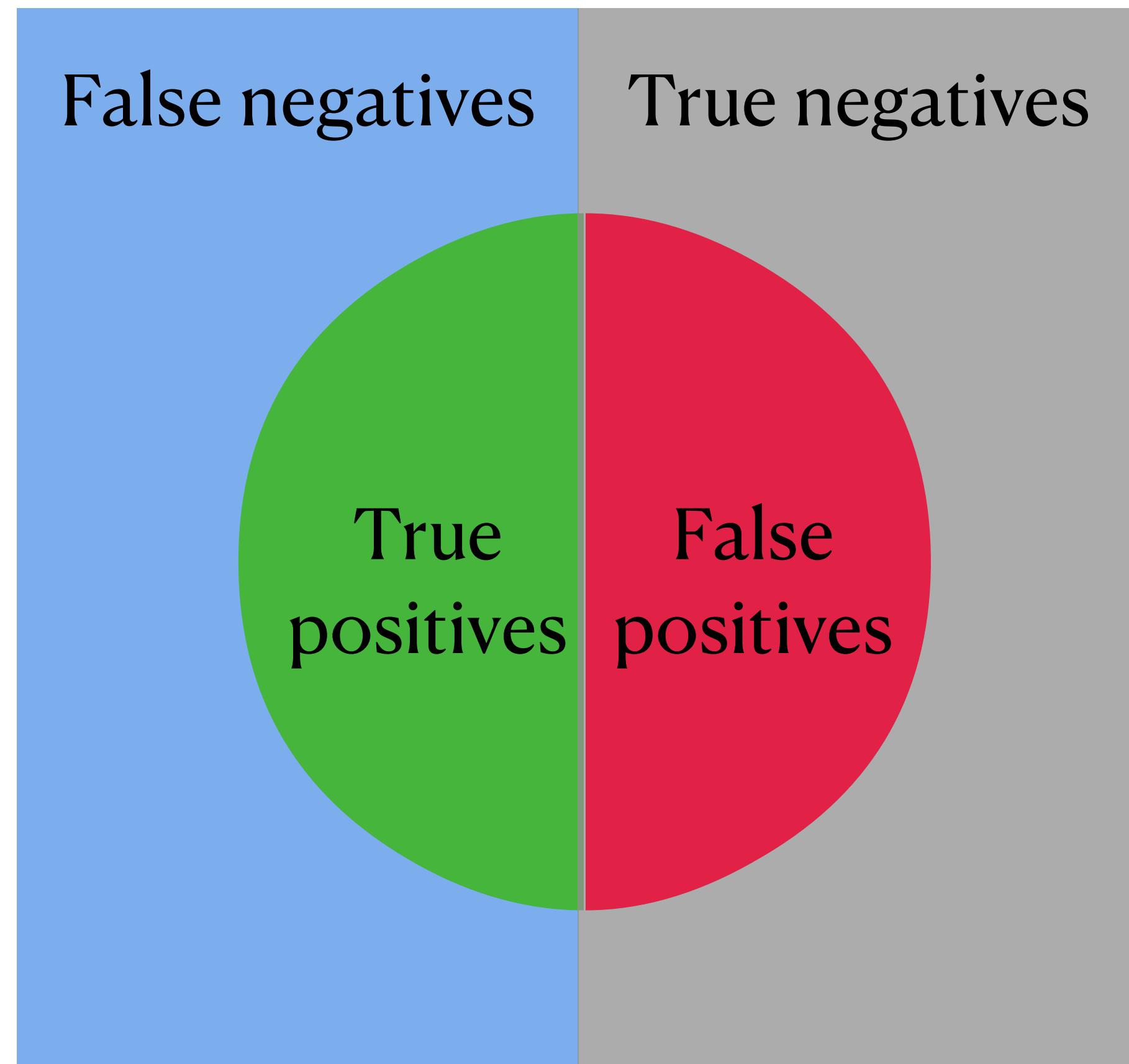
65 (2023)

8 ( ↑ 29)

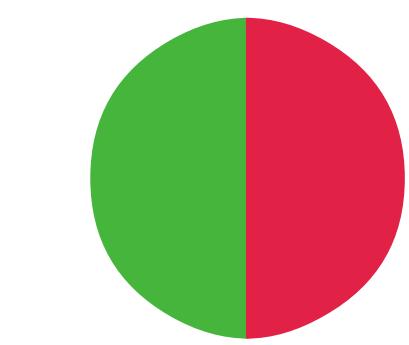
★ 5.7

# Evaluation metrics

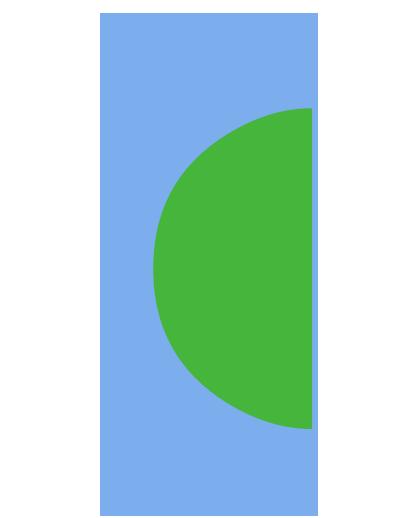
- Precision and recall



Precision =



Recall =



# Evaluation metrics

- ▶  $F$ -score
  - The harmonic mean of precision and recall
  - $F_1$  gives equal importance to precision and recall

$$F_1 = \frac{2}{\text{recall}^{-1} + \text{precision}^{-1}} = 2 \frac{\text{precision} \cdot \text{recall}}{\text{precision} + \text{recall}}$$

- ▶ Accuracy
  - Binary classification    Accuracy =  $\frac{TP + TN}{TP + TN + FP + FN}$
  - Multi-class classification    Accuracy =  $\frac{\text{Correct classifications}}{\text{All classification}}$

TP = True positive; FP = False positive; TN = True negative; FN = False negative

# Scherer Typology of Affective States

**Emotion:** brief organically synchronized ... evaluation of a major event

- *angry, sad, joyful, fearful, ashamed, proud, elated*

**Mood:** diffuse non-caused low-intensity long-duration change in subjective feeling

- *cheerful, gloomy, irritable, listless, depressed, buoyant*

**Interpersonal stances:** affective stance toward another person in a specific interaction

- *friendly, flirtatious, distant, cold, warm, supportive, contemptuous*

**Attitudes:** enduring, affectively colored beliefs, dispositions towards objects or persons

- *liking, loving, hating, valuing, desiring*

**Personality traits:** stable personality dispositions and typical behavior tendencies

- *nervous, anxious, reckless, morose, hostile, jealous*

# Sentiment

**Attitudes:** enduring, affectively colored beliefs, dispositions towards objects or persons

- *liking, loving, hating, valuing, desiring*

# Emotion

- ▶ One of the most important affective classes
- ▶ A relatively brief episode of response to the evaluation of an external or internal event as being of major significance
- ▶ Detecting emotion has the potential to improve a number of language processing tasks
  - Tutoring systems
  - Emotions in reviews or customer responses
  - Emotion can play a role in medical NLP tasks like helping diagnose depression or suicidal intent

# Two families of theories of emotion

- ▶ Atomic basic emotions
  - A finite list of 6 or 8, from which others are generated
- ▶ Dimensions of emotion
  - Valence (positive negative)
  - Arousal (strong, weak)
  - Control

# Ekman's 6 basic emotions

Surprise  
Happiness

anger

fear

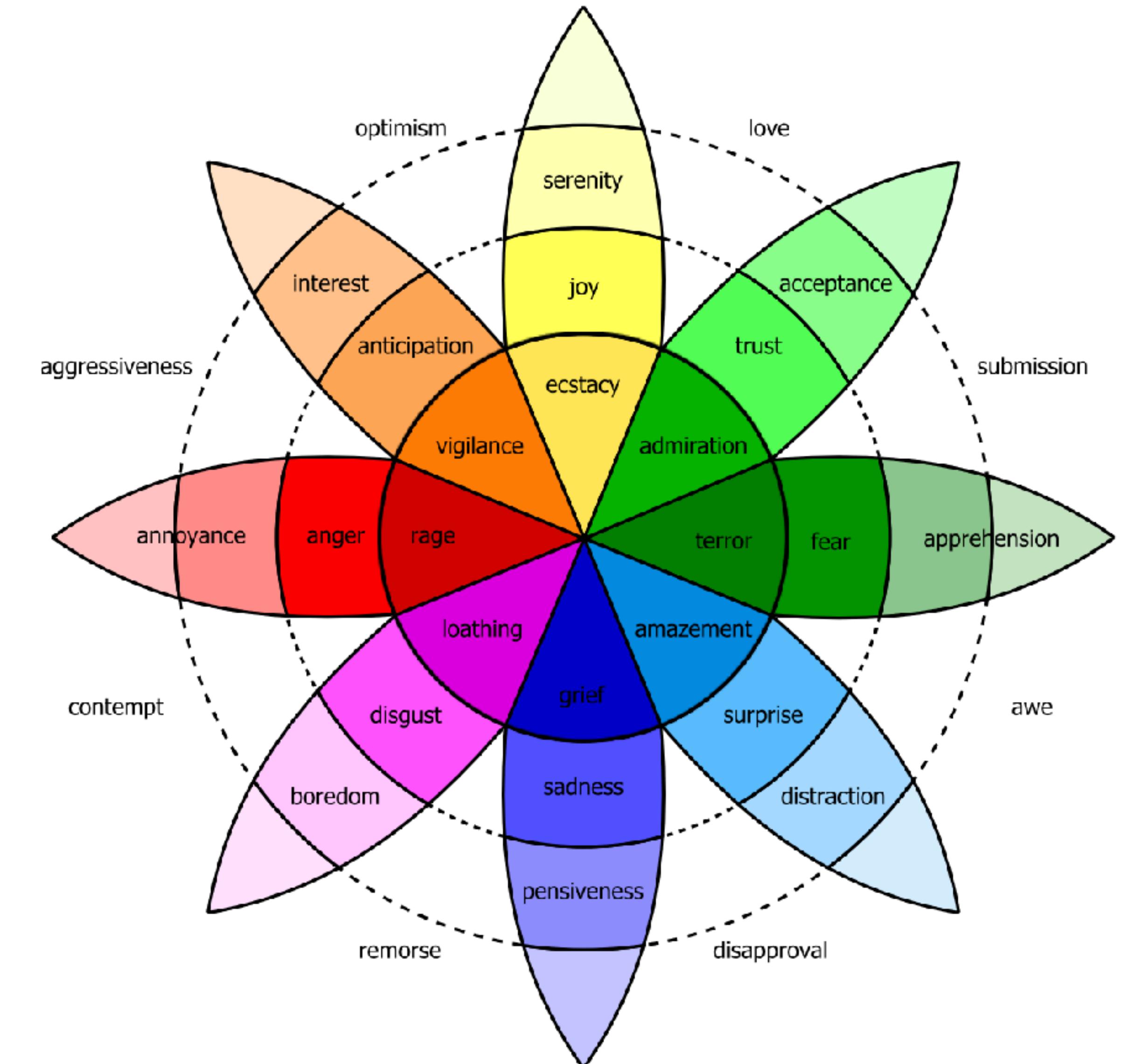
disgust

sadness



# Plutchik's wheel of emotion

- ▶ 8 basic emotions
- ▶ four opposing pairs
  - joy - sadness
  - anger - fear
  - trust - disgust
  - anticipation - surprise



# Alternative: spatial model

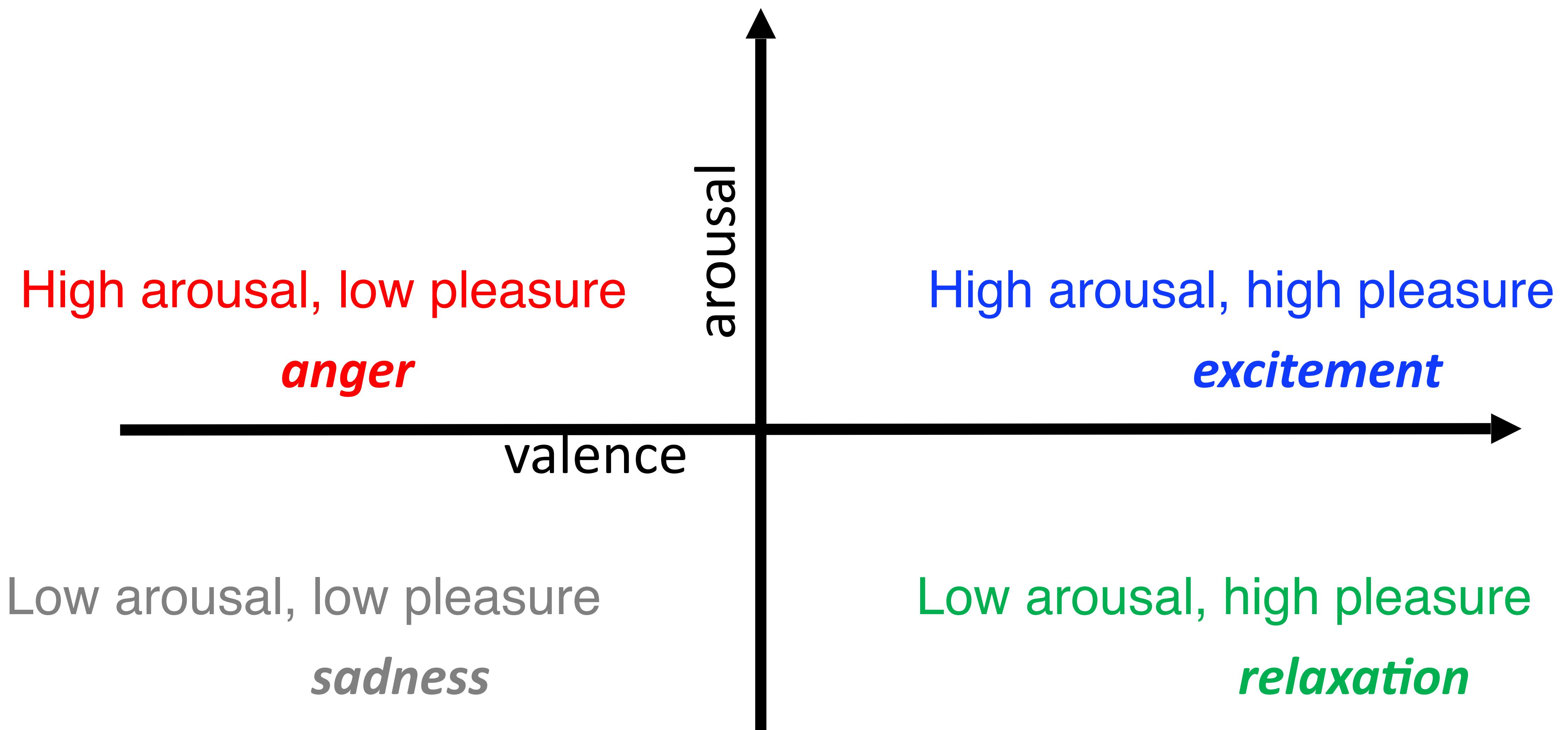
An emotion is a point in 2- or 3-dimensional space

**valence:** the pleasantness of the stimulus

**arousal:** the intensity of emotion provoked by the stimulus

(sometimes) **dominance:** the degree of control exerted by the stimulus

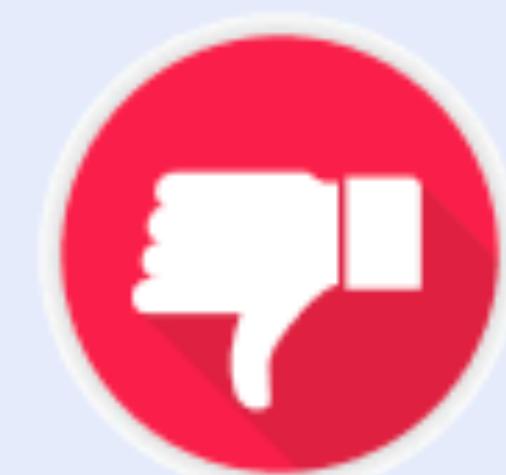
# Valence/Arousal Dimensions



## Sentiment



Positive



Negative

## Emotion



laughing



Well



Sad



Shocked



Angry



Happy

# NRC Word-Emotion Association Lexicon

Mohammad and Turney 2011

amazingly	anger	0
amazingly	anticipation	0
amazingly	disgust	0
amazingly	fear	0
amazingly	joy	1
amazingly	sadness	0
amazingly	surprise	1
amazingly	trust	0
amazingly	negative	0
amazingly	positive	1

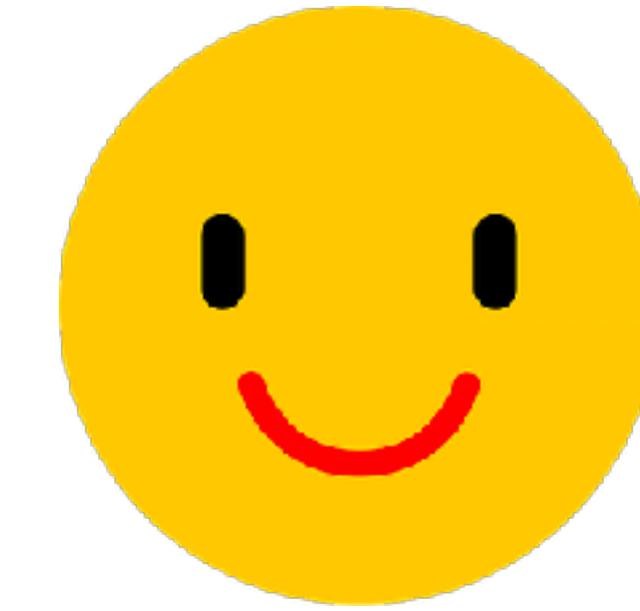
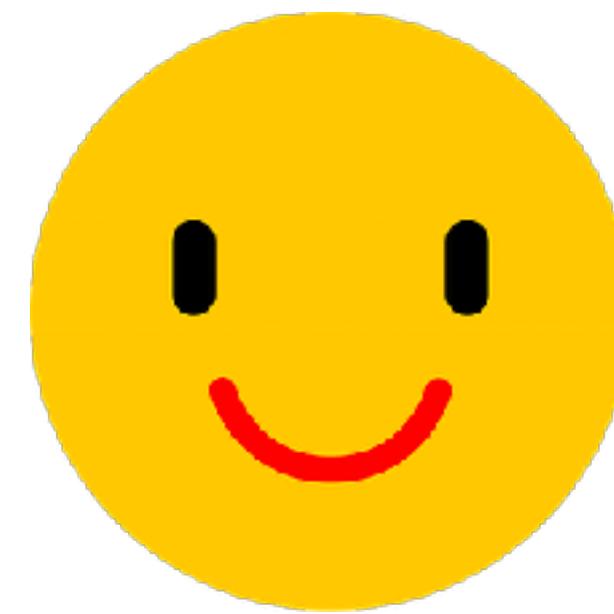
# More examples

Word	anger	anticipation	disgust	fear	joy	sadness	surprise	trust	positive	negative
reward	0	1	0	0	1	0	1	1	1	0
worry	0	1	0	1	0	1	0	0	0	1
tenderness	0	0	0	0	1	0	0	0	1	0
sweetheart	0	1	0	0	1	1	0	1	1	0
suddenly	0	0	0	0	0	0	1	0	0	0
thirst	0	1	0	0	0	1	1	0	0	0
garbage	0	0	1	0	0	0	0	0	0	1

# NRC Emotion/Affect Intensity Lexicon (Mohammad, 2018b)

	Anger	Fear		Joy		Sadness	
outraged	0.964	horror	0.923	superb	0.864	sad	0.844
violence	0.742	anguish	0.703	cheered	0.773	guilt	0.750
coup	0.578	pestilence	0.625	rainbow	0.531	unkind	0.547
oust	0.484	stressed	0.531	gesture	0.387	difficulties	0.421
suspicious	0.484	failing	0.531	warms	0.391	beggar	0.422
nurture	0.059	confident	0.094	hardship	.031	sing	0.017

# Emotion in spoken language



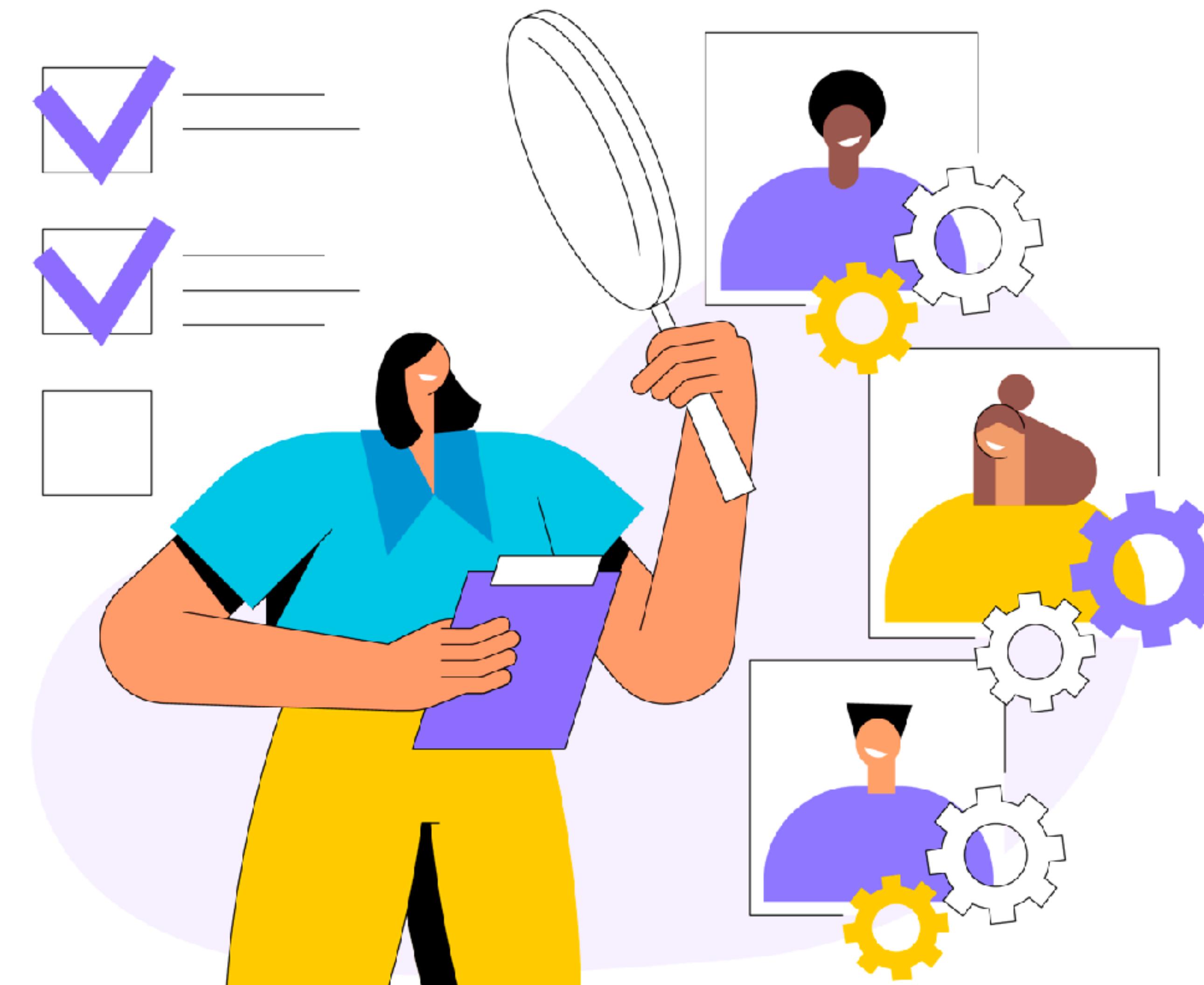
Emotion

# Ekman's 6 basic emotions: spoken version

Surprise  
Happiness  
anger  
fear  
disgust  
sadness

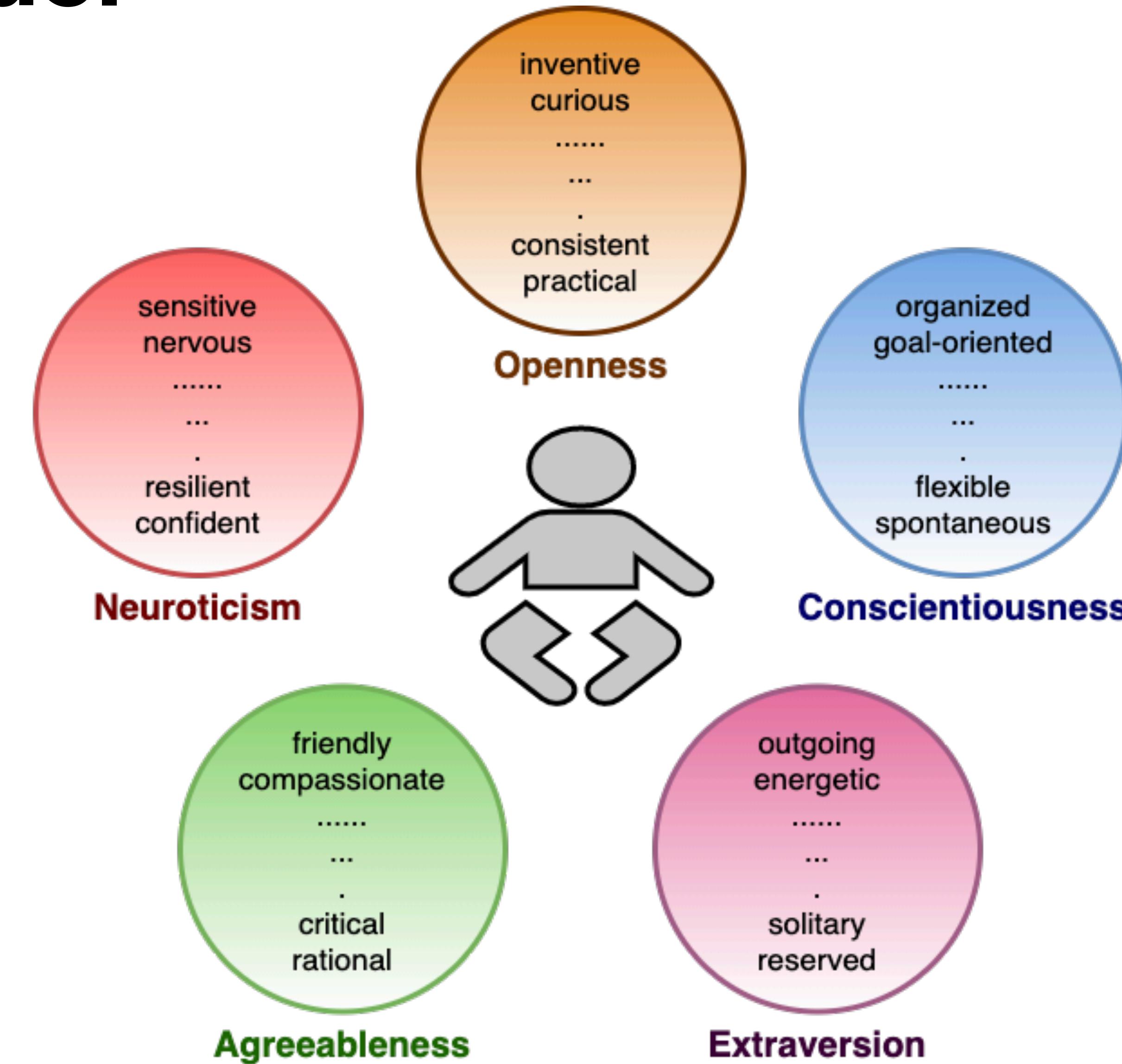


# Personality traits



# Five-Factor Model

- ▶ Openness(开放型)
- ▶ Conscientiousness (责任心)
- ▶ Extraversion (外向型)
- ▶ Agreeableness (宜人性)
- ▶ Neuroticism(神经质)



# Virtual agents for interviewing

collapse

## Your personality profile

OVERVIEW OPENNESS CONSCIENTIOUSNESS EXTRO-VERSION AGREEABLENESS NEUROTICISM ALL

Factor	Score (%)
openness	98%
neuroticism	75%
agreeableness	82%
extroversion	78%
conscientiousness	65%

436 words analyzed

### Overview

Here are your overall Big 5 factor scores. Hover on each bar to view its meaning, and click on each tab to view facet scores.

**James** 12:27:55 AM  
I have tremendous perseverance and great analytical skills. My background in the field has given me a unique set of experiences I am excited to bring to the company.

**Kaya**  
I went ahead and analyzed your personality for you. I looked for patterns in the text from your social media and our chat. It's my duty to help users understand themselves better, after all!

**Kaya**  
I'm curious, what do you think of my assessment? Agree with it, not sure, or disagree?

**James** 12:28:04 AM  
Well, overall it's pretty accurate. However, there are a few minor things I disagree with; I don't think I'm that neurotic. But maybe you do know me better than I know myself.

Chatting with Kaya

that Pinnacle has received hundreds of applications for this position. What unique qualities do you believe will make you stand out?

	Kaya	Albert
<b>Image Profile (Static)</b>		
<b>Personality</b>	Gregarious, Cheerful, Warm, Agreeable, Humorous; Like a friend	Reserved, Calm, Assertive, Rational, Careful; Like a counselor
<b>Effective Inquiring</b>	Affective strategy [36]; Positive politeness [12]  <b>Example:</b> “ <i>You are so knowledgeable, would you mind telling me more about...</i> ”	Cognitive strategy [36]; Negative politeness [12]  <b>Example:</b> “ <i>I'm sorry to keep you longer, would you mind telling me more about...</i> ”
<b>Effective Influencing</b>	Empathy, Comfort, Frankness, Cooperation, Agreement [11]  <b>Example:</b> “ <i>I can certainly understand your point and agree with you that ...</i> ”	Reassurance, Commitment, Forgiveness [11]  <b>Example:</b> “ <i>It is important to answer this question but no need to overthink...</i> ”
<b>Small Talk</b>	Personable [9]  <b>Example:</b> “ <i>I love to chat with my online friends in my spare time, what do you do in your spare time?</i> ”	Minimal chitchatting  <b>Example:</b> “ <i>Life is not just about work, what do you do in your spare time?</i> ”
<b>Linguistic Style</b>	Questions, suggestions, affective expressions [9, 36, 104]  <b>Examples:</b> “ <i>Thank you so much for your input!</i> ” “ <i>Could you say a bit more?</i> ”	Assertions, projective statements, terse expressions [36, 72, 104]  <b>Examples:</b> “ <i>Thanks.</i> ” “ <i>Please tell me more.</i> ”



# Summary

**Emotion:** brief organically synchronized ... evaluation of a major event

- *angry, sad, joyful, fearful, ashamed, proud, elated*

**Attitudes:** enduring, affectively colored beliefs, dispositions towards objects or persons

- *liking, loving, hating, valuing, desiring*

**Personality traits:** stable personality dispositions and typical behavior tendencies

- *nervous, anxious, reckless, morose, hostile, jealous*

# Readings

- ▶ Chapter 4: Naive Bayes and Sentiment Classification
  - <https://web.stanford.edu/~jurafsky/slp3/4.pdf>
- ▶ Chapter 25: Lexicons for Sentiment, Affect, and Connotation
  - <https://web.stanford.edu/~jurafsky/slp3/25.pdf>