

Personality, Emotions and Conversational Agents

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What are Conversational Agents ?

“Non human” agents that can converse with humans in “Natural Language”

Did you have dinner yet?

Nah, not yet.

Oh dear. How do you feel about skipping meals?

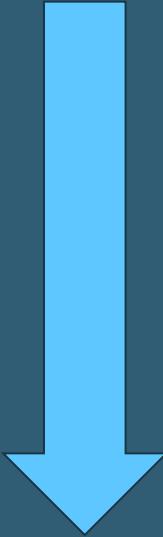
Ok. Had a heavy lunch.



When humans don't give their bodies fuel every 3-6 hours, their blood sugar can drop, making them feel tired and cranky. Let's keep your spirits and your energy up today - remember to make time for a healthy snack soon!

Here is a good resource on healthy vs unhealthy food [Food and nutrition Guide](#).

Eliza – 1964 – MIT AI Labs Joseph Weizenbaum



*Bots Landscape: 170+ companies,
\$4 billion in funding, thousands
of bots. 2016 – VentureBeat**

The screenshot shows a window titled "File Edit Options Buffers Tools Help" with various icons above the menu bar. The main area displays a text-based conversation:

```
I am the psychotherapist. Please, describe your problems.  
Each time  
you are finished talking, type RET twice.  
  
I have a terrible headache.  
  
Maybe you should consult a doctor of medicine, I am a psychi  
atrist.  
  
Okay, I'll do that then.  
  
Can you elaborate on that?  
  
What are you talking about? No I cannot elaborate. See you l  
ater.  
  
Why do you say that?  
  
Now you're just talking nonsense!  
  
What makes you believe now I am just talking nonsense?  
  
You are not making any sense.  
  
Perhaps your plans have something to do with this.  
-u:** *doctor* (Doctor Fill)--L1--Top-----  
X
```

Factors impacting rise of conversational agents

Business

1. Provide personalized interaction in user's medium of choice
2. Handle traditional human-human interactions e.g. customer care

Technological

1. Advances in Natural Language Understanding
2. Advances in our understanding of human-human conversations

Outline

1. The Technology - How to build an effective conversational agent
2. The Science – What is an effective conversational agent.

THE TECHNOLOGY



Natural Language

Yikes ! Internet not working again !



Content

Internet not working



Expression

Sadness

Natural Conversations



Please help get my ETF payment handled.
I'm really tired of talking to your consumer
affairs folks.

You came to the right place! Please DM the
phone tied to the account to better assist.
So glad you reached out !



Human agent understands the sadness of user and tries to reassure.

Natural Conversations



Can anyone explain this *** ? <http://.....>

It could be because of what is available to you in your package. You can view your account here.



Then why send me the damn message ! Or add me to package first !!!!



My apologies for the frustration. We would be happy to review your account & advise if 4K TV is included with your service

Human agent understands the rising frustration and anger and then apologizes

Watson Developer Cloud Services - Conversations

With the IBM Watson™ Conversation service you can create virtual agents and bots that combine machine learning, natural language understanding, and integrated dialog tools to provide automated customer engagements.

Watson Conversation provides an easy-to-use graphical environment to create natural conversation flows between your apps and your users.

Watson Developer Cloud Services - Conversations

- I am unable to login into your billing system.
- And yet again! Cannot connect to billing system. Might have forgotten my password.
- Need to reset my password.

Intent: password lost

Entity: billing system

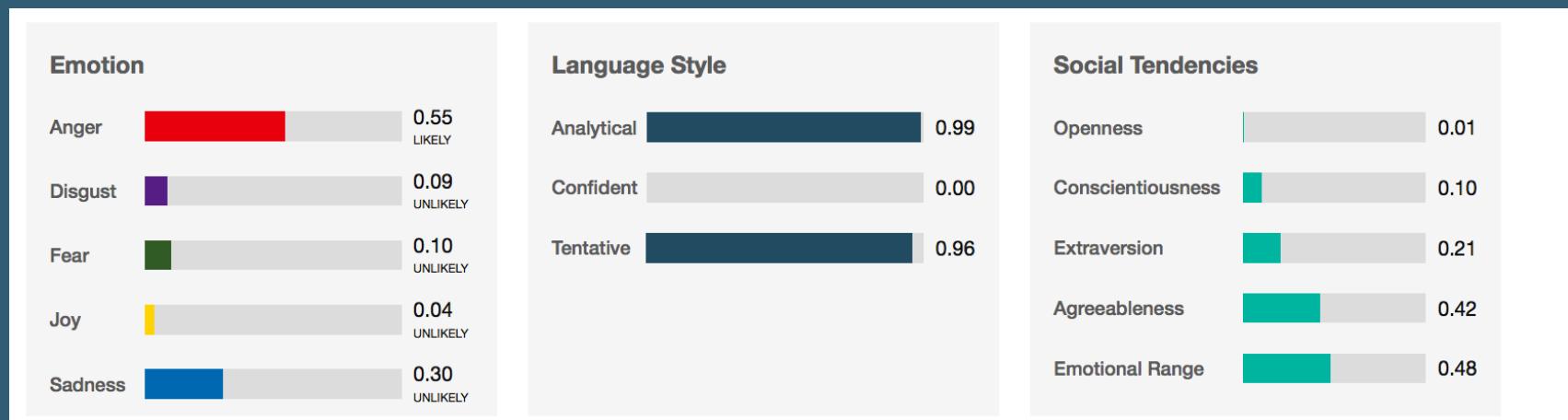
Action: Use this link: <http://xxx> to reset password.

Watson Developer Cloud Services - Tone Analyzer

The IBM Watson™ Tone Analyzer Service uses linguistic analysis to detect three types of tones from written text: emotions, social tendencies, and writing style. Emotions identified include things like anger, fear, joy, sadness, and disgust. Identified social tendencies include things from the Big Five personality traits used by some psychologists. These include openness, conscientiousness, extraversion, agreeableness, and emotional range. Identified writing styles include confident, analytical, and tentative.

Watson Developer Cloud Services - Tone Analyzer

- And yet again ! Cannot connect to billing system. Might have forgotten my password.



Natural Language

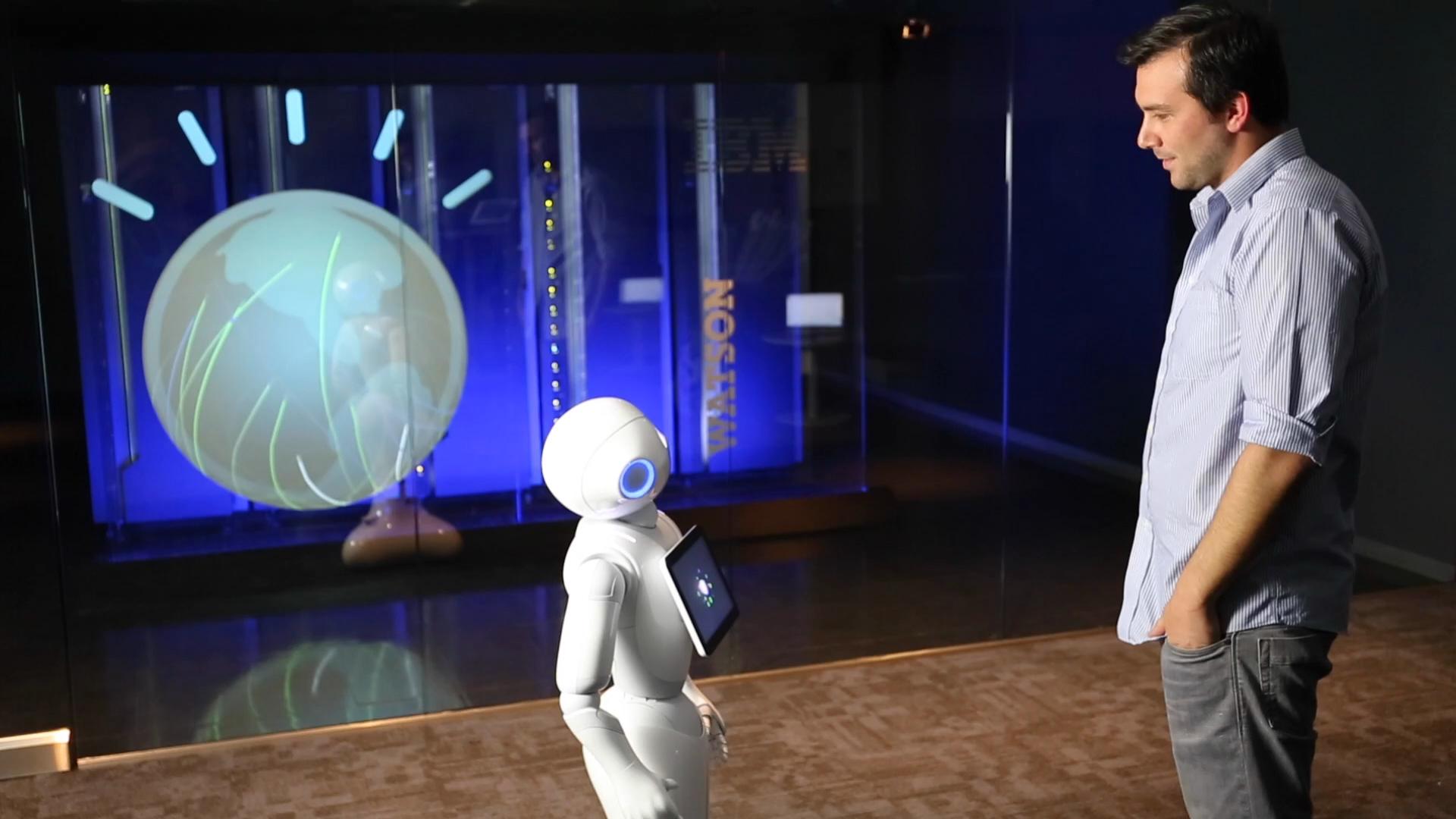
Content

*Watson
Conversation*



Expression

*Watson Tone
Analyzer*



Did you have dinner yet?

yes



Intent

Can you tell me about what you ate today?

I had a bacon sandwich



Entity

Hmm...bacon. How do you feel about what
you ate?

Wonderful ! I am sooo satisfied.

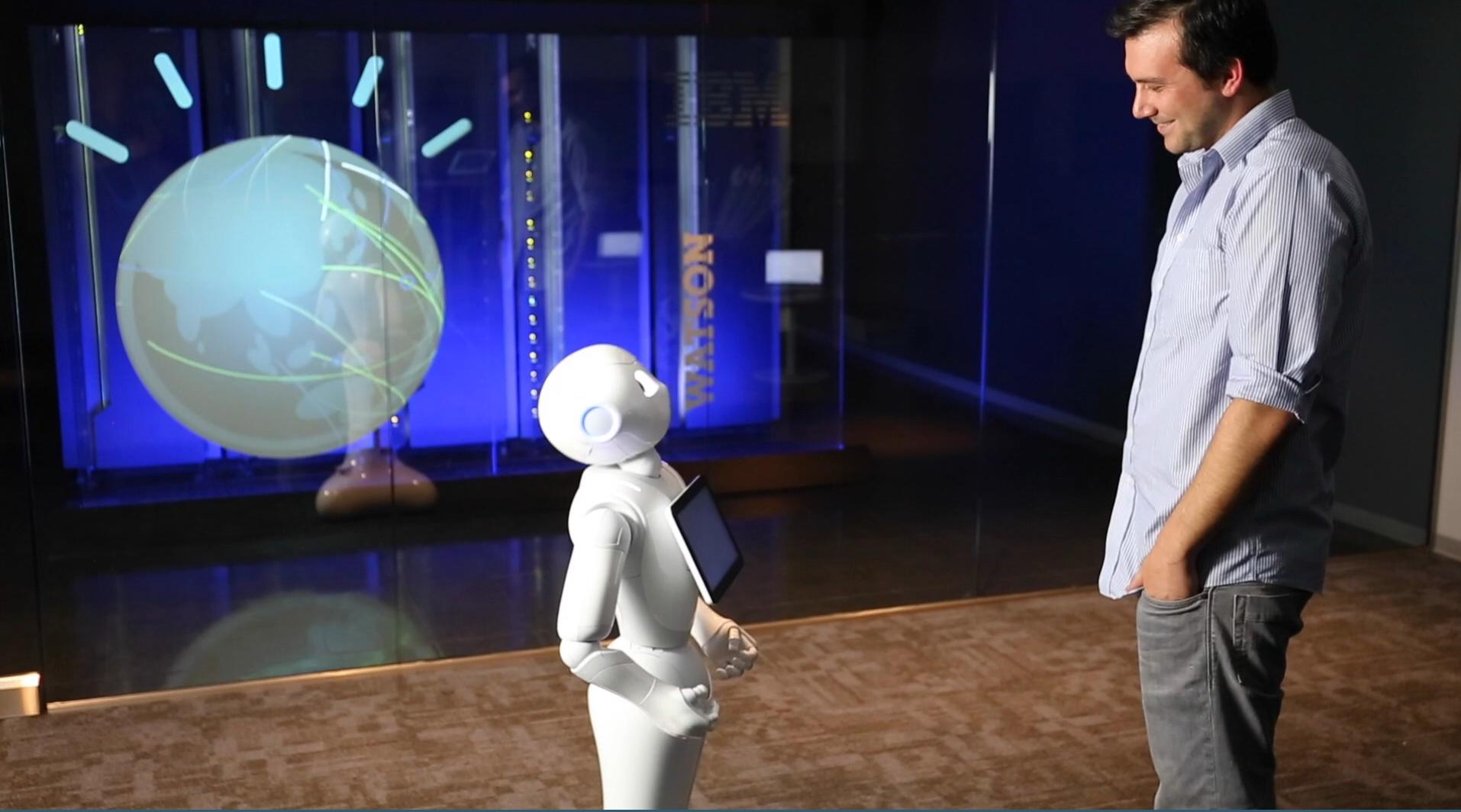


Tone

I detected joy

🏃 Hey now, that was a big splurge! Make
sure to reduce or burn more calories to offset
times you spoil yourself!

Here is a good resource on healthy vs
unhealthy food [Food and nutrition Guide](#).



Did you have dinner yet?

yes. Had bacon sandwich.

Intent and entity

Hmm...bacon. How do you feel about what you ate?

Kind of feel guilty about indulging myself.

Tone

| *I detected sadness*

 Don't worry, indulging from time to time is okay – especially if it brings you joy! It's only a problem when we make a habit of it. Don't let it put you off track for the rest of the day!

Did you have dinner yet?

yes

Can you tell me about what you ate today?

bacon sandwich

Hmm...bacon. How do you feel about what you ate?

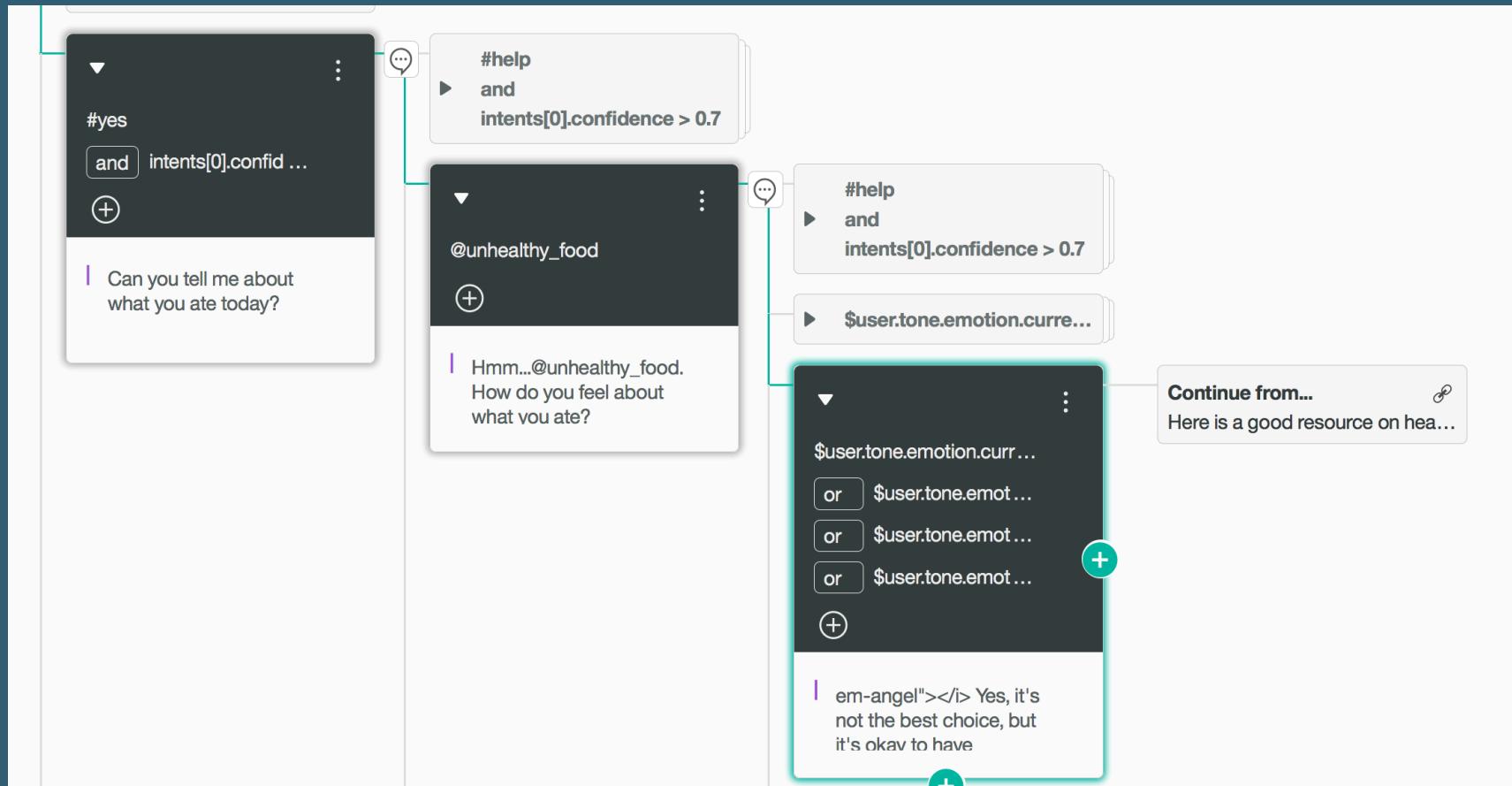
wonderful !!!

I detected joy

🏃 Hey now, that was a big splurge! Make sure to reduce or burn more calories to offset times you spoil yourself!

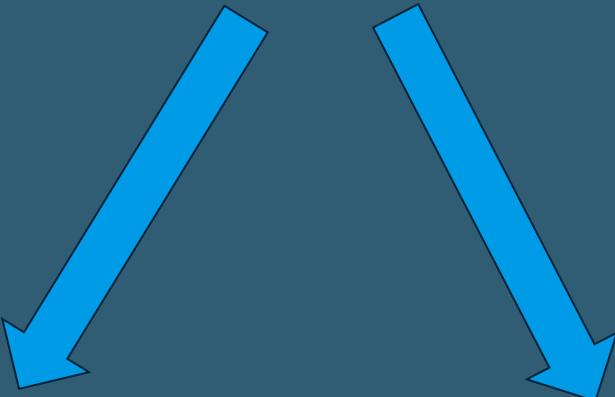
Here is a good resource on healthy vs unhealthy food [Food and nutrition Guide](#).

```
22     },
23     "context": {
24       "time": "dinner",
25       "user": {
26         "tone": {
27           "emotion": {
28             "current": "joy"
29           },
30           "language": {
31             "current": []
32           },
33           "social": {
34             "current": [
35               "openness_low",
36               "conscientiousness_low",
37               "emotional_range_low"
38             ]
39           }
40         }
41       },
42     },
43   },
44 }
```



Response Personalization

Message: Get 5% off



Because you are our valued customer, get 5% off on this booking

Discover the French culture and traditions, 5% off on your Paris tickets



Understand user and generate personalized responses

Contextual Data:

- Demographics
- Historic Interactions
- Location
- Current situation
- Personality

Watson Developer Cloud Services - Personality Insights

Personality Insights extracts and analyzes a spectrum of personality attributes to help discover actionable insights about people and entities, and in turn guides end users to highly personalized interactions. The service outputs personality characteristics that are divided into three dimensions: the Big 5, Values, and Needs.



@Oprah (EN)

High on Agreeableness, Conscientiousness, Openness
Needs Harmony, Curiosity, Self Expression. But low on Practicality
Values Tradition, Helping Others and Stimulation

Summary

You are helpful and analytical.

You are emotionally aware: you are aware of your feelings and how to express them. You are empathetic: you feel what others feel and are compassionate towards them. And you are altruistic: you feel fulfilled when helping others, and will go out of your way to do so.

Your choices are driven by a desire for well-being.

You consider both tradition and independence to guide a large part of what you do. You highly respect the groups you belong to and follow their guidance. And you like to set your own goals to decide how to best achieve them.

[How did we get this?](#)

You are likely to_____

- prefer resale value when buying automobiles
- prefer style when buying clothes
- be influenced by online ads when making product purchases

You are unlikely to_____

- be sensitive to ownership cost when buying automobiles
- prefer quality when buying clothes
- prefer comfort when buying clothes

Personality and healthy versus unhealthy eating behavior

- Shepherd and Sparks (1994) developed the relationship between personality and food choice. Their study reveals that people with high scores in emotional range (neuroticism), especially in the facet immoderation, tend to consume high-fat food.
- Elfhag and Morey (2008) revealed that conscientiousness is positively related to a preference for low-fat food. Specifically, the self-discipline and dutifulness facets of the conscientiousness dimension positively influence the consumption of low-fat food and (because weight management is closely related to food choice) regular weight control.

Based on personality, user is likely to indulge in unhealthy eating

Please enter your twitter handle (e.g.,) for a more personalized experience. If you prefer not to share your twitter handle, please respond with 'no'.

@justinbieber

Thank you for providing your twitter handle, @justinbieber. We have been able to infer your eating preferences.

Did you have dinner yet?

yes

Can you tell me about what you ate today?

bacon sandwich

Hmm...bacon. How do you feel about what you ate?

pretty good

I detected joy

🏃 Hey now, that was a big splurge! Make sure to reduce or burn more calories to offset times you spoil yourself!

Here is a good resource on healthy vs unhealthy food [Food and nutrition Guide](#).

```
32         "current": [
33             "tentative_high"
34         ],
35     },
36     "social": {
37         "current": [
38             "openness_low",
39             "conscientiousness_low",
40             "emotional_range_low"
41         ]
42     },
43 },
44 "personality": {
45     "conscientiousness": 0.7024126709447054,
46     "immoderation": 0.8581797778672462,
47     "dutifulness": 0.5722323295220554,
48     "neuroticism": 0.2870719663252216,
49     "self_discipline": 0.26437969049351046,
50     "likely_to_eat_unhealthy": "true",
51     "likely_to_eat_healthy": null
52 },
53     "twitter_handle": "@justinbieber"
54 },
55 "conversation_id": "ffb363d0-6d65-4f6a-8526-6cde4dee73aa",
56 "system": {
57     "dialog_stack": [
58         "root"
59     ],
60     "dialog_turn_counter": 5,
```

Based on personality, user is likely to prefer healthy eating

Please enter your twitter handle (e.g.,) for a more personalized experience. If you prefer not to share your twitter handle, please respond with 'no'.

@adele

Thank you for providing your twitter handle, @adele. We have been able to infer your eating preferences.

Did you have dinner yet?

yes

Can you tell me about what you ate today?

Had a bacon sandwich

Hmm...bacon. How do you feel about what you ate?

pretty good :)

I detected joy

🎉 Hope you enjoyed the treat! Sometimes it's better to cure cravings with a taste of what you want. Good health and happiness is all about balance and moderation.

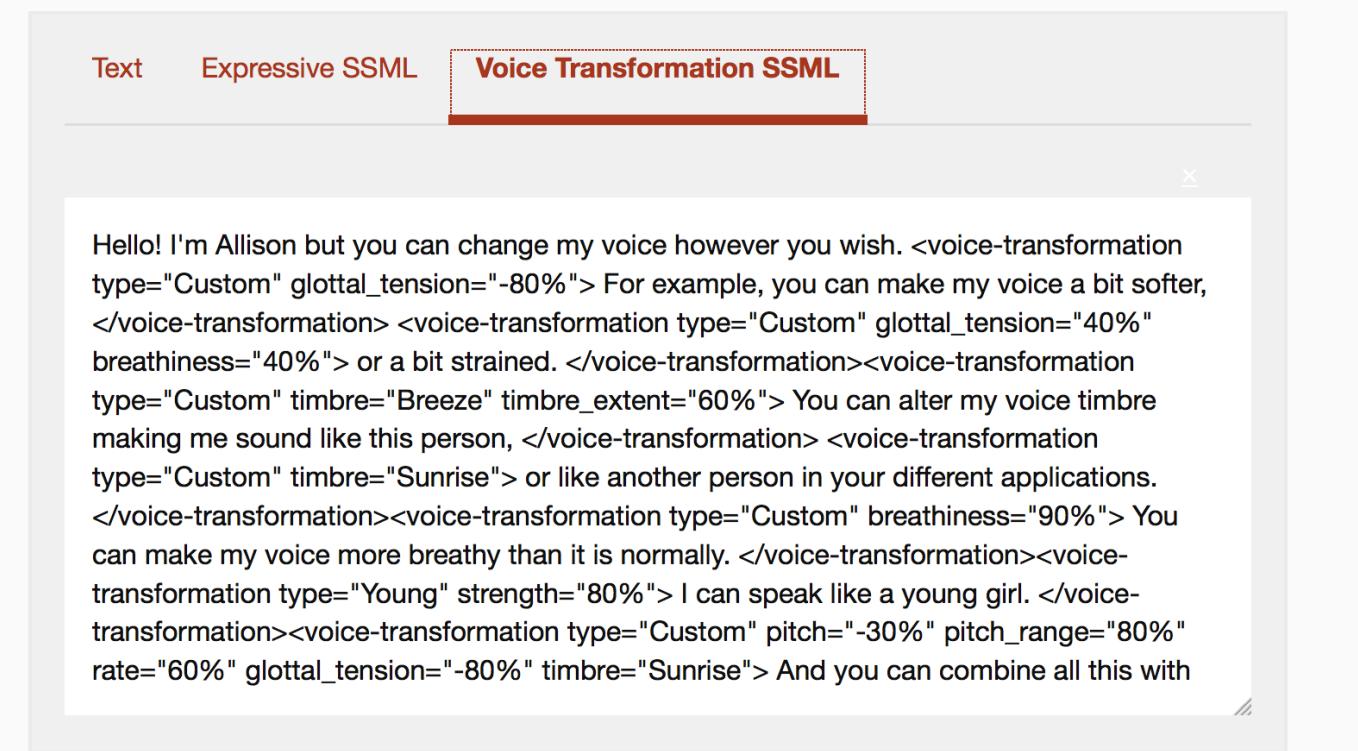
Here is a good resource on healthy vs unhealthy food [Food and nutrition Guide](#).

```
26     "user": {
27         "tone": {
28             "emotion": {
29                 "current": "joy"
30             },
31             "language": {
32                 "current": [
33                     "tentative_high"
34                 ]
35             },
36             "social": {
37                 "current": [
38                     "openness_low",
39                     "conscientiousness_low",
40                     "emotional_range_low"
41                 ]
42             }
43         },
44         "personality": {
45             "conscientiousness": 0.5357756136934353,
46             "immoderation": 0.5567901310507413,
47             "dutifulness": 0.7378265857070887,
48             "neuroticism": 0.372444885971305,
49             "self_discipline": 0.7733999645352176,
50             "likely_to_eat_unhealthy": null,
51             "likely_to_eat_healthy": "true"
52         },
53         "twitter_handle": "@adele"
54     },
55     "conversation_id": "2edd6427-429a-49cb-9925-bbea55f3c025",
56     "system": {
```

Watson Developer Cloud Services - Text to Speech

Designed for streaming low-latency synthesis of audio from written text. The service synthesizes natural-sounding speech from input text in a variety of languages and voices that speak with appropriate cadence and intonation.

Watson Developer Cloud Services - Text to Speech



The screenshot shows a user interface for Watson Developer Cloud Services. At the top, there are three tabs: "Text", "Expressive SSML", and "Voice Transformation SSML". The "Voice Transformation SSML" tab is highlighted with a red border. Below the tabs, there is a large text area containing a sample of generated SSML code. The code describes how to transform a voice using various parameters like glottal tension, breathiness, and timbre.

Hello! I'm Allison but you can change my voice however you wish. <voice-transformation type="Custom" glottal_tension="-80%"> For example, you can make my voice a bit softer, </voice-transformation> <voice-transformation type="Custom" glottal_tension="40%" breathiness="40%"> or a bit strained. </voice-transformation><voice-transformation type="Custom" timbre="Breeze" timbre_extent="60%"> You can alter my voice timbre making me sound like this person, </voice-transformation> <voice-transformation type="Custom" timbre="Sunrise"> or like another person in your different applications. </voice-transformation><voice-transformation type="Custom" breathiness="90%"> You can make my voice more breathy than it is normally. </voice-transformation><voice-transformation type="Young" strength="80%"> I can speak like a young girl. </voice-transformation><voice-transformation type="Custom" pitch="-30%" pitch_range="80%" rate="60%" glottal_tension="-80%" timbre="Sunrise"> And you can combine all this with

This is a simple conversation to demonstrate how a user's emotional tone can be used to provide more tailored and empathetic responses by integrating Watson Conversation and Watson Tone Analyzer. If you get stuck, type 'help'. 

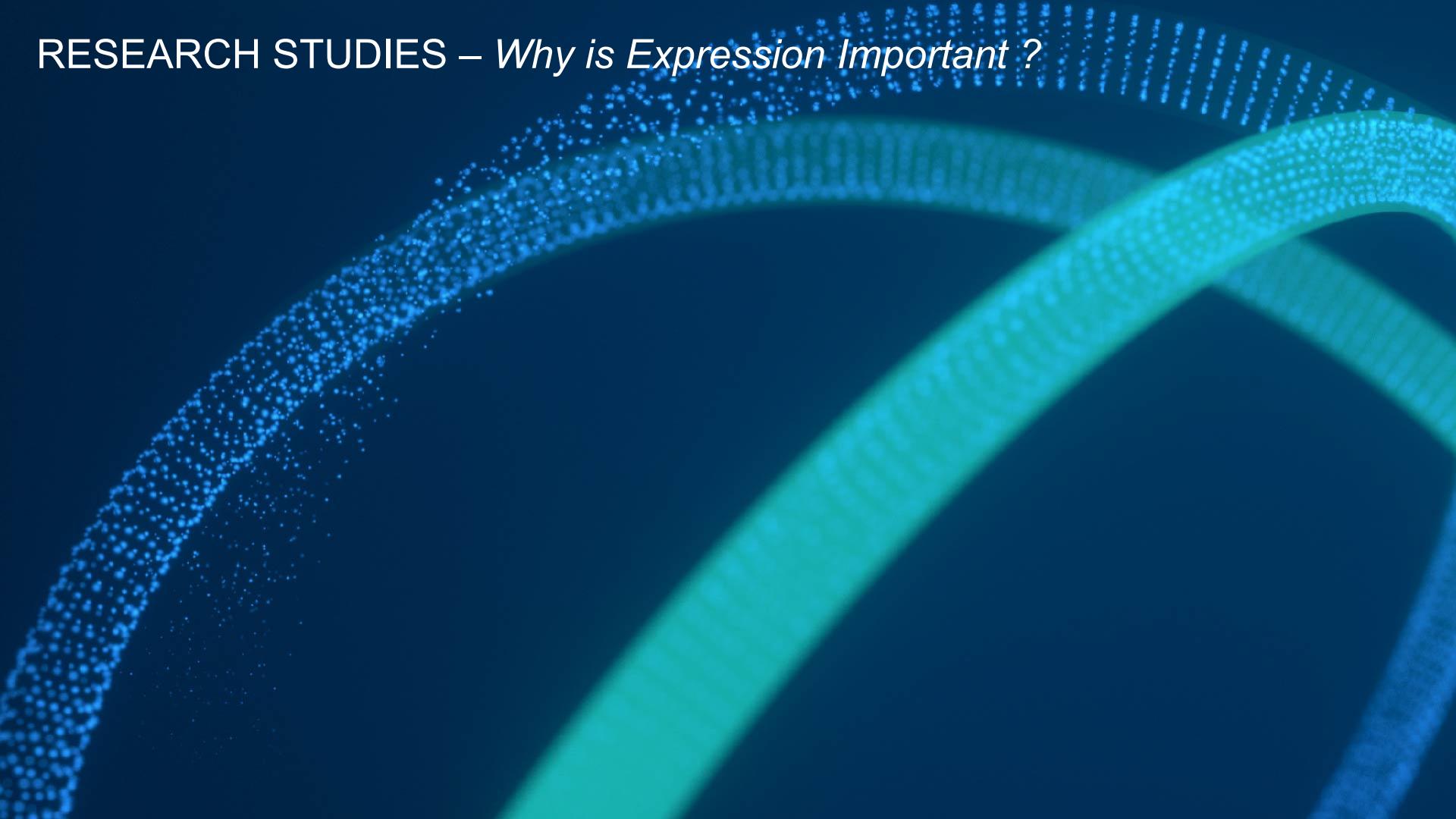
Please enter your twitter handle (e.g.,) for a more personalized experience. If you prefer not to share your twitter handle, please respond with 'no'.

```
{  
  "output": {  
    "text": "<speak><express-as  
type=\"GoodNews\">@food seems like a  
good choice - it's not on my current list of  
unhealthy foods. How do you feel about what  
you ate?</express-as></speak>"  
  }  
}
```

In Summary ...

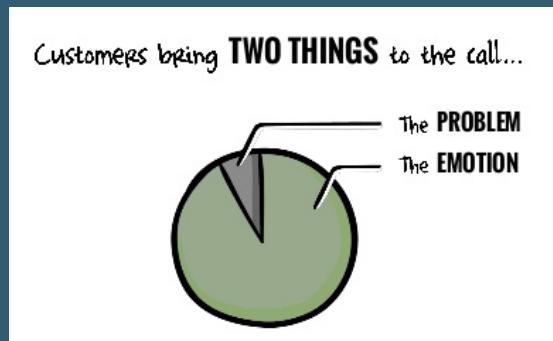
Use intent + tone + user attributes in conversations, to provide appropriate responses (text, speech, other actions)

RESEARCH STUDIES – *Why is Expression Important ?*



Why is detecting tone important ?

- Forrester has found that negative emotions have a much bigger impact than positive ones. Make a customer angry and they're not only likely to stop doing business with you, they'll tell everyone they can about their negative experience.
- Positive experiences can go a long way when it comes to creating the coveted “promoter” customer.
- 88% of customers will take positive action if they have a good experience with your business.



Tone and Virtual Agents

Research shows that even when customers know that they are interacting with virtual agent, they still expect this agent to behave like human.

- Nass, C., Moon, Y.: *Machines and Mindlessness: Social Responses to Computers*. *Journal of Social Issues* 56(1), 81-103 (2000)
- Nicole C. Krämer, *Social Effects of Virtual Assistants. A Review of Empirical Results with Regard to Communication*, *Proceedings of the 8th international conference on Intelligent Virtual Agents, September 01-03, 2008, Tokyo, Japan*

Automated conversation agents to be able to detect and express tone (affect).

Our studies: Impact of tone

Analyze real customer support dialogs with humans

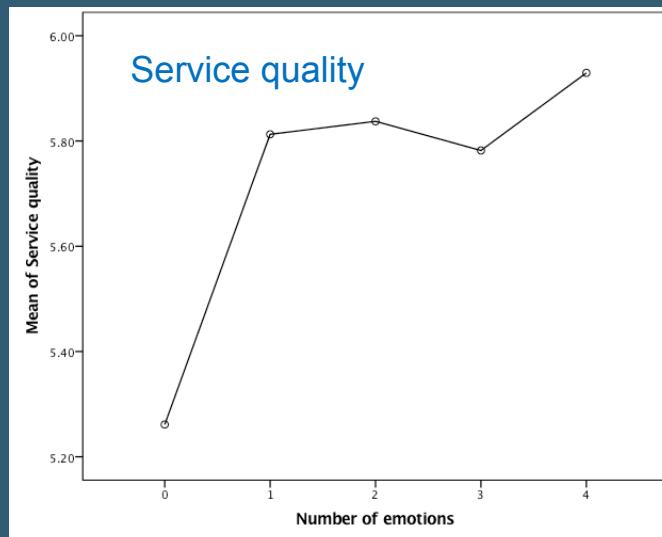


Show the influence of emotions on customer satisfaction

Predict customer satisfaction at the end of the interaction (UMAP 2016)

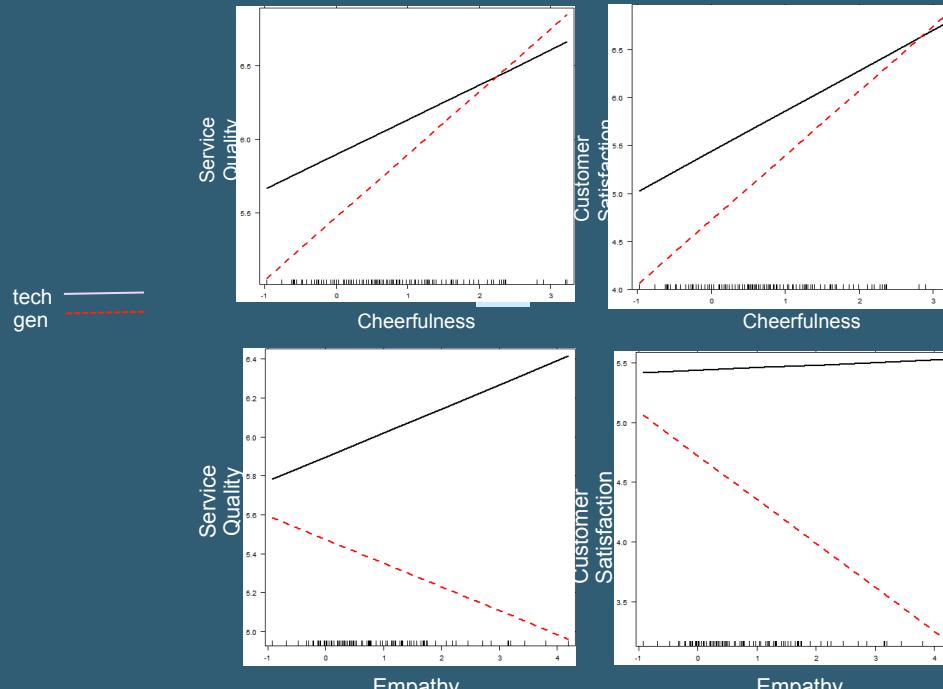
1. Companies utilize dedicated Twitter accounts which provides real-time support.
2. We gathered data for two North America based customer support services Twitter accounts that provide support for customers from North America (tweets are in English):
 - general customer care service (denoted as *Gen*).
 - technical customer support service (denoted as *Tech*).

Study 1: Influence of Emotions on Conversation Outcomes



Study 2: Impact of Agent Expression on Conversation Outcome

Agent Expressing cheerfulness and empathy impacts outcomes



- In both cases, **Cheerfulness** improves **Service Quality** and **Customer Satisfaction**.
- In **Tech**, expressing **Empathy** relates to **increase in perceived Service Quality** but has no significant relation to **Customer Satisfaction**
- In **Gen**, expressing **Empathy** either **hinders** (decrease in **Customer Satisfaction**) or doesn't help (no relation to **Service Quality**).

Results depend of the type of the company (tech/gen)

Study 3: Impact of Agent, Customer personality interaction on outcome

- Train a classifier that predicts user satisfaction in a conversation, using following features:
 1. Text of first customer utterance
 2. Agent and customer personality
 3. Emotion in first utterance: frustration, disappointment, confusion, politeness and anger
- Classifier trained on: 333 conversations, 50 agents, 240 conversations ended with “satisfied” and 93 with “not-satisfied”

Study 3: Impact of Agent, Customer personality interaction on outcome

Model	Features
M_t	Textual
Aff_{t+p}	Textual, personality
Aff_{t+e}	Textual, emotional
Aff_{t+e+p}	Textual, emotional, personality

Model	Satisfied			Not-Satisfied		
	P	R	F	P	R	F
Random	0.721	0.5	0.590	0.279	0.5	0.358
M_t	0.781	0.833	0.806	0.481	0.398	0.435
Aff_{t+p}	0.803	0.833	0.818	0.524	0.473	0.497
Aff_{t+e}	0.809	0.863	0.835	0.571	0.473	0.518
Aff_{t+e+p}	0.827	0.858	0.843	0.595	0.538	0.565

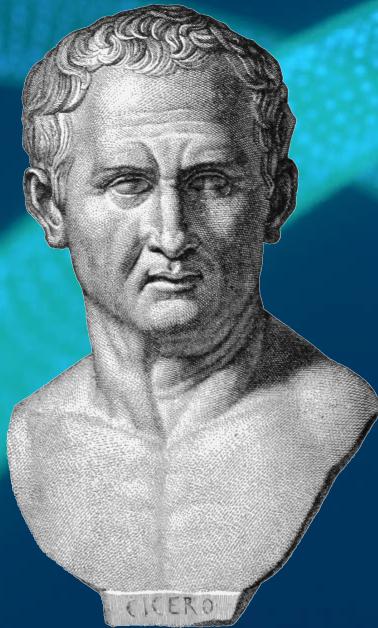
1. Improvement of 30% in F1-score for the “Not-Satisfied” class.
2. Improvement of 5% in F1-score for the “Satisfied” class.

In Summary ...

- Emotions are important in customer care dialogs
- It is possible to learn agents' tone expression practices from existing dialogs
- It is possible to use emotions and personality traits to predict success of interactions and optimize future ones

“If you wish to persuade me, you must think my thoughts, feel my feelings, and speak my words”

— Marcus Tullius Cicero (c. 106-43 B.C.)



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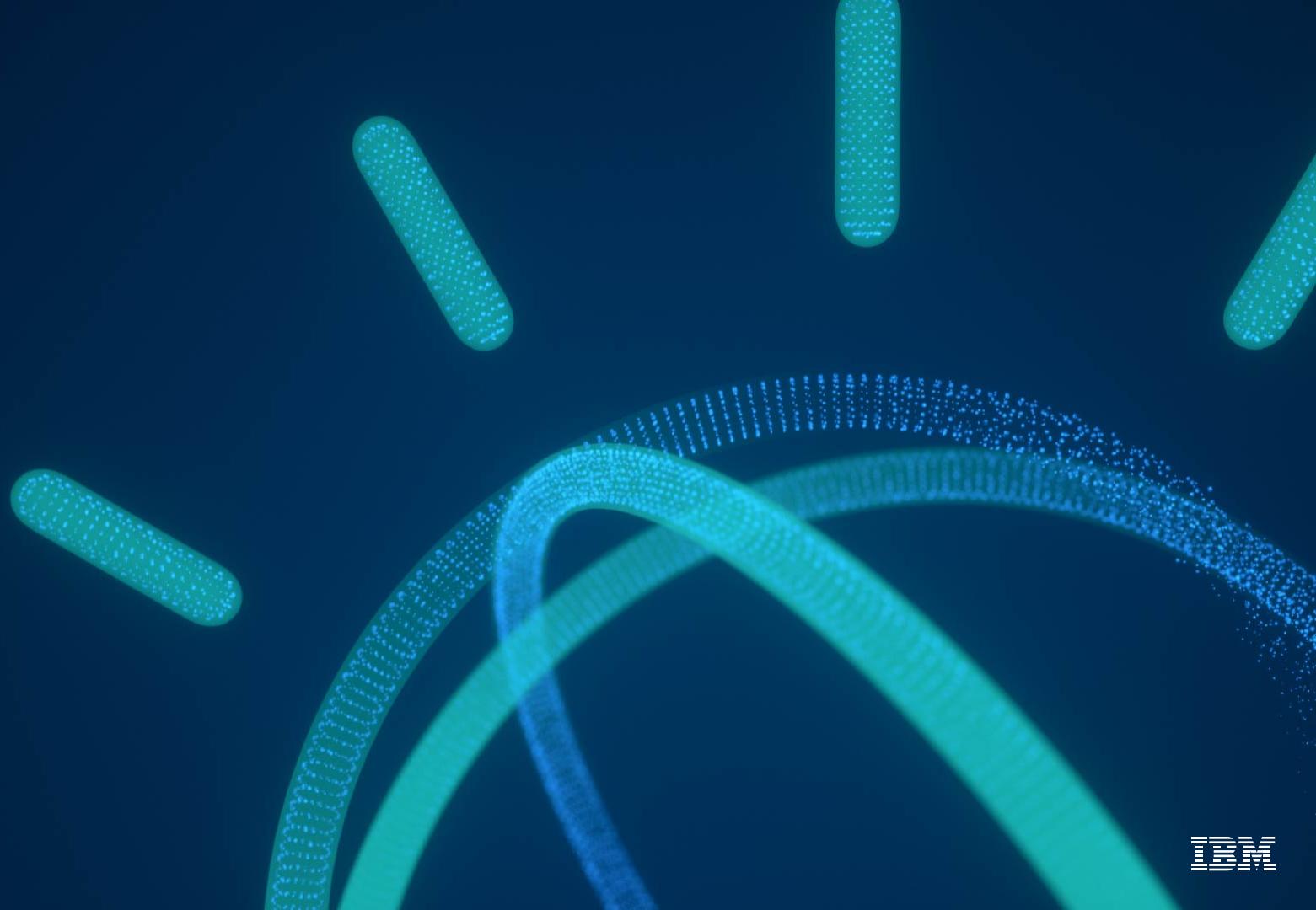
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