



Affective Computing

Bringing humans and machines closer together through emotions

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AI&ML CONF

Kudos



Who Am I?

- ❖ HMI for Process Automation
- ❖ Robotics

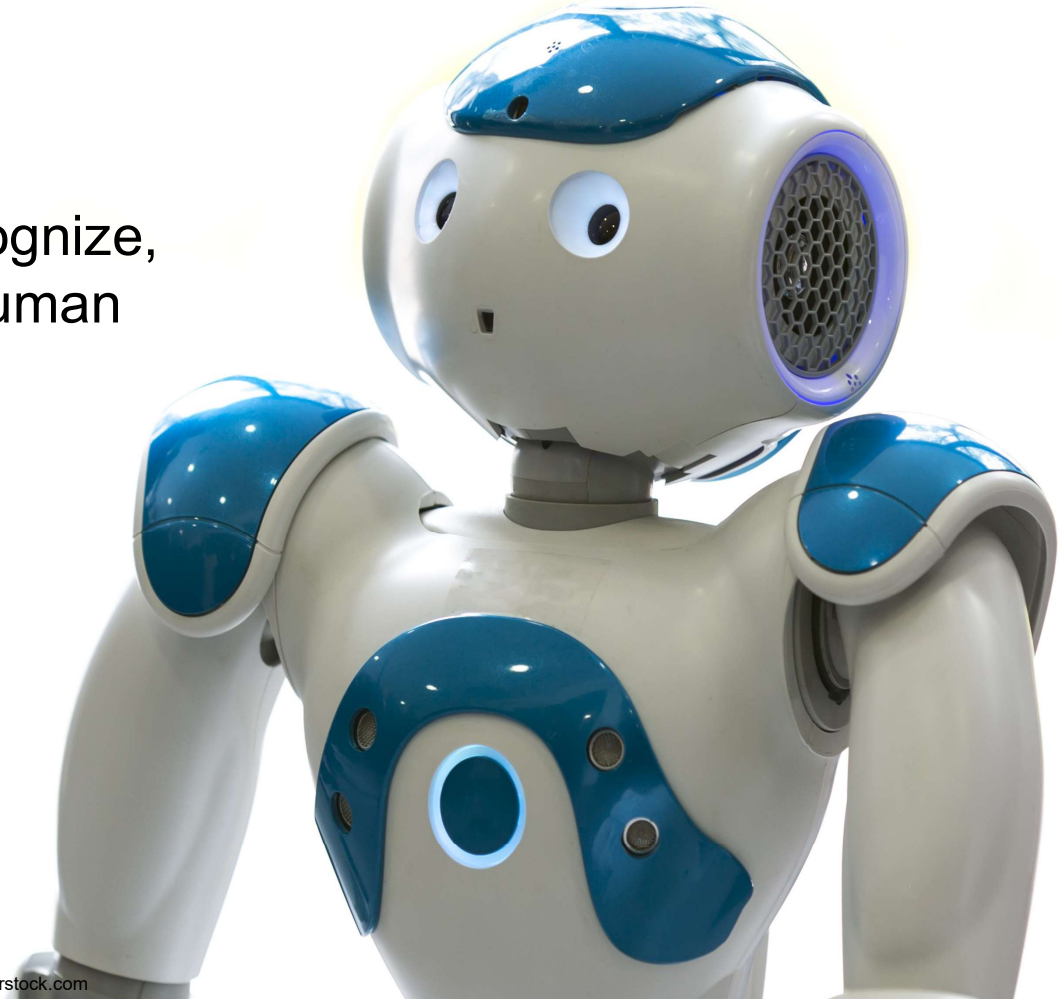
- 🎓 MSc in Electrical Engineering
- 🎓 Master in Behavioural Science

- 🚀 MIT Artificial Intelligence
- 🚀 MIT Internet of Things



Affective Computing

- Human side of AI
- System and devices that can recognize, interpret, process and simulate human affects



Source: Belish/Shutterstock.com

What is an emotion?



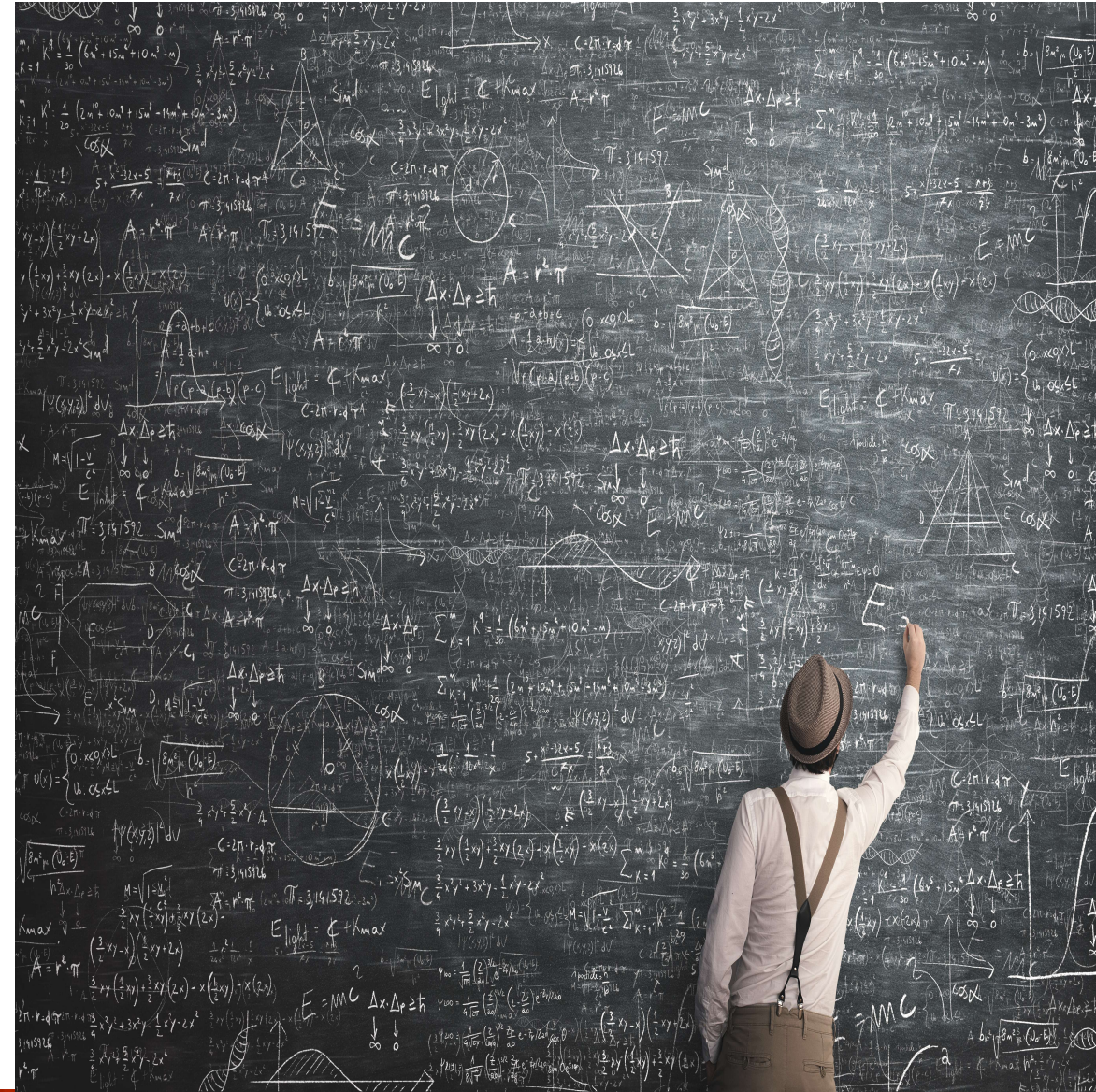
What is an emotion?

- Emotions
- Feelings
- Mood & affect



Theories of emotion

- James-Lange
- Canon-Bard
- Schacter-Singer
- Lazarus

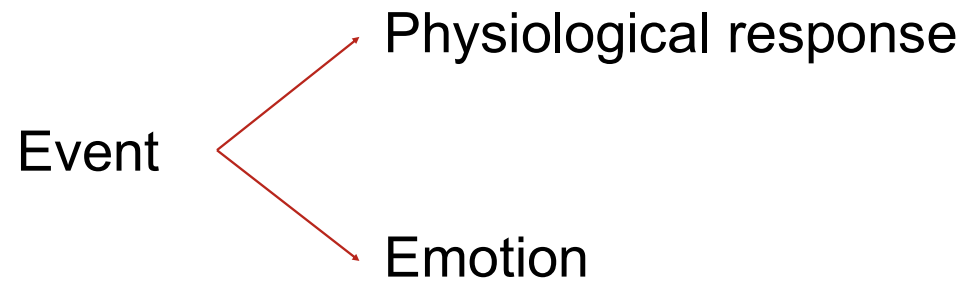


Theories of emotion: James – Lange

Event -> Physiological Response -> Interpretation of -> Emotion

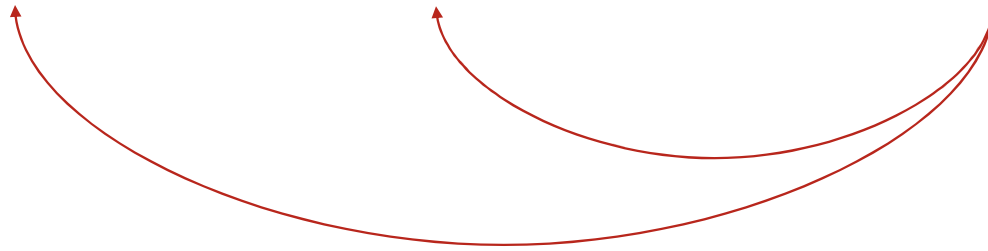


Theories of emotion: Cannon - Bard

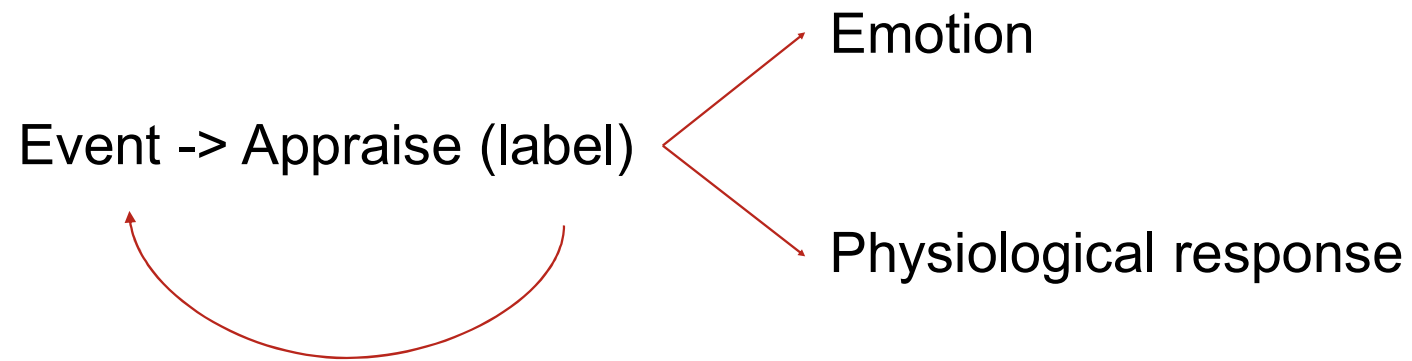


Theories of emotion: Schacter-Singer

Event -> Physiological Response -> Identify the reason for -> Emotion



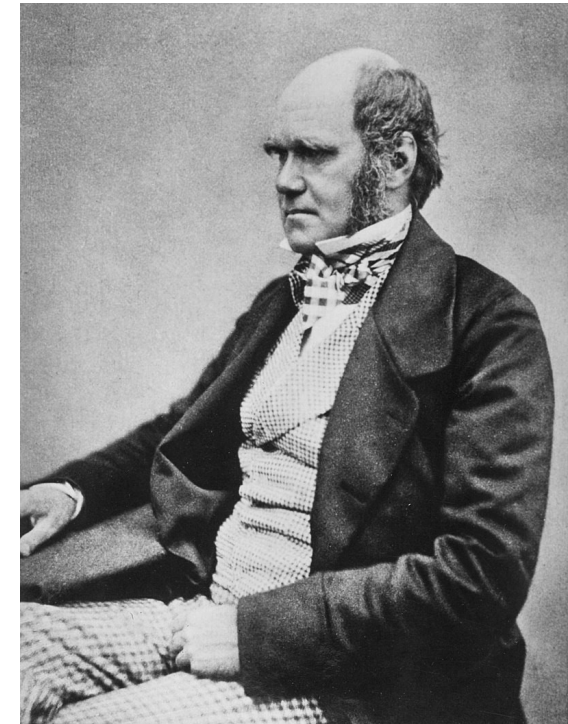
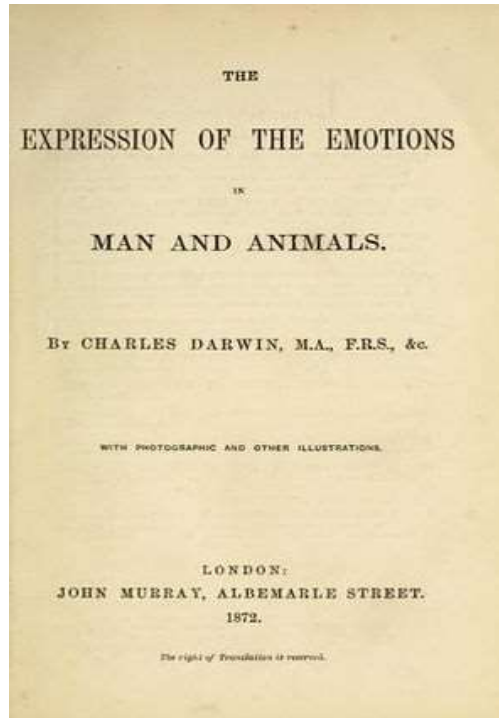
Theories of emotion: Lazarus



How do we measure emotions?

Universal emotions

- Charles Darwin
- Expression of the Emotions (1872)
- Emotions universal across humans



Source: https://en.wikipedia.org/wiki/Charles_Darwin

Duchenne

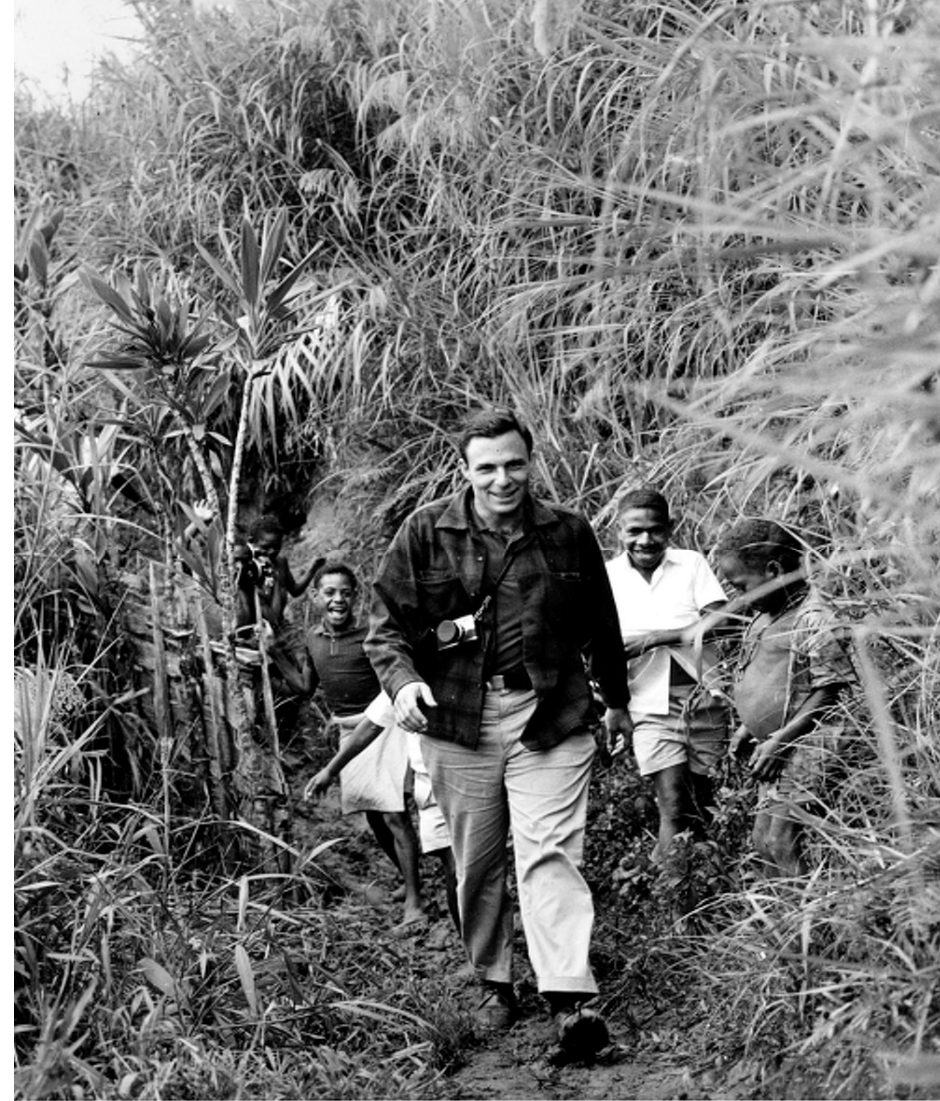
- The mechanism of human facial expressions
- Electrical probes
- 60 discrete emotions



Source: https://en.wikipedia.org/wiki/Duchenne_de_Boulogne

Paul Ekman

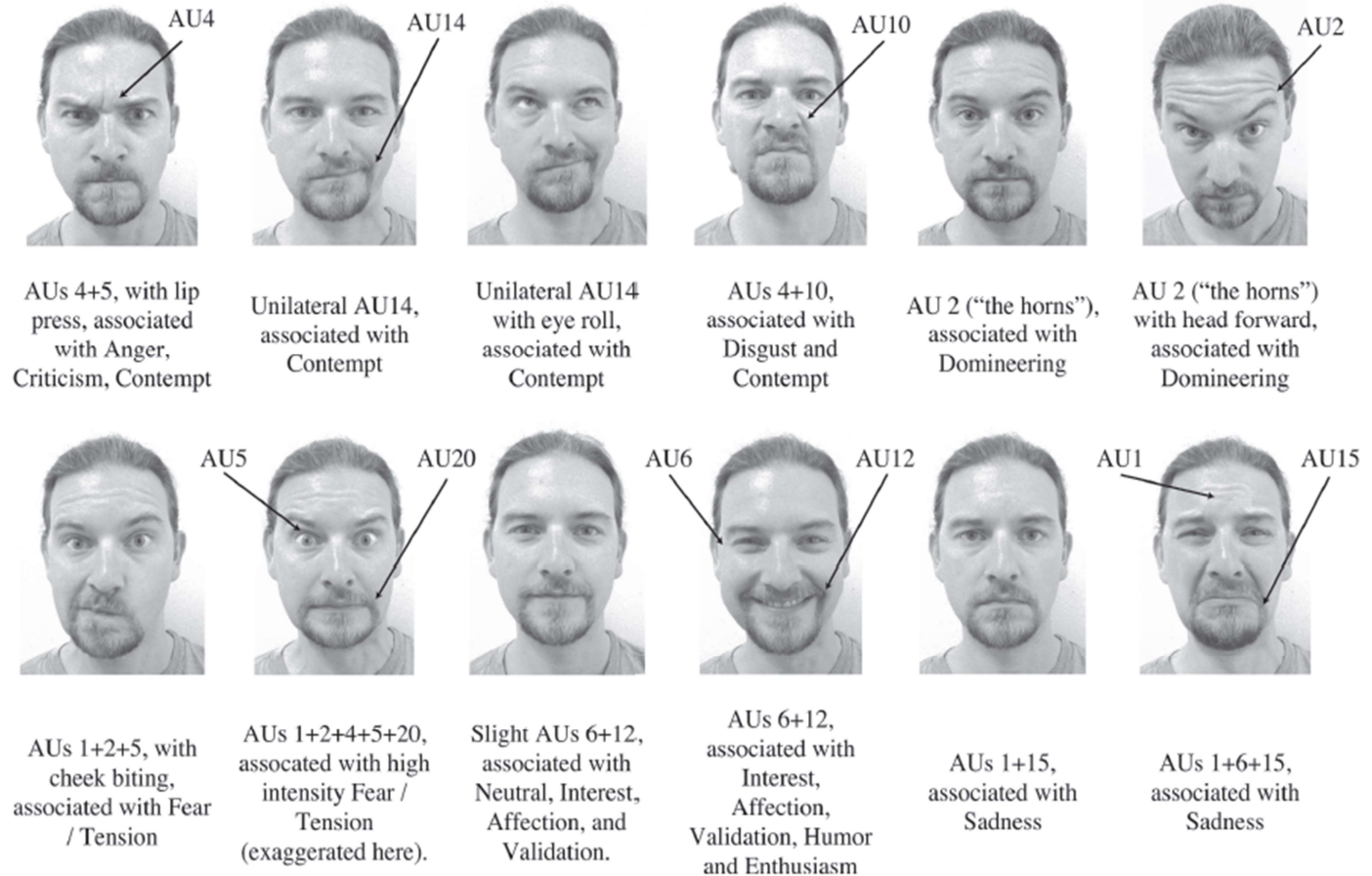
- Papua New Guinea (1967-1968)
- Isolated stone age culture
- Universal facial expressions



Source: <https://www.paulekman.com/about/paul-ekman/>

Facial expressions

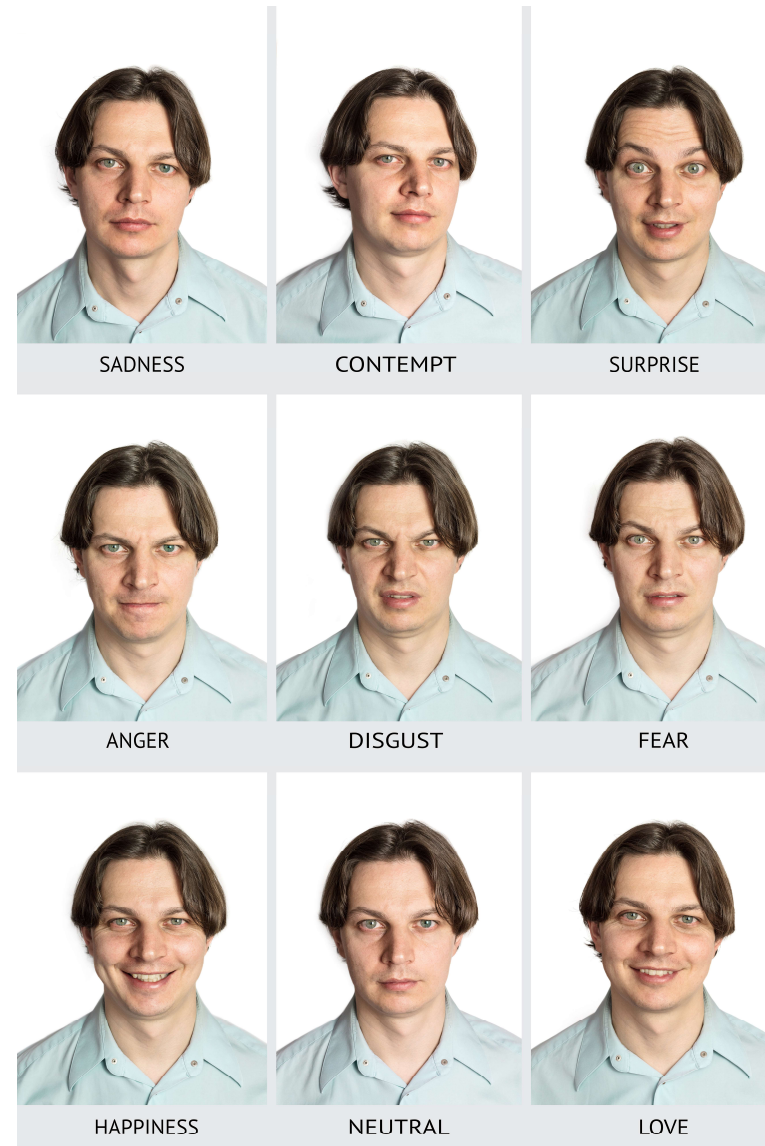
- Facial Action Coding System
- Universal emotions



Source: [https://www.researchgate.net/profile/James_Coan/publication/230676408_The_Specific_Affect_Coding_System_\(SPAFF\)/links/09e41502d44ad3450e000000.pdf](https://www.researchgate.net/profile/James_Coan/publication/230676408_The_Specific_Affect_Coding_System_(SPAFF)/links/09e41502d44ad3450e000000.pdf)

Detect emotions

- Facial expressions
- Speech
- Physiology based



Source: [Plateresca/Shutterstock.com](https://www.shutterstock.com/user/plateresca)

Affective Computing



Affective Computing

- Rosalind Picard
- MIT Media Lab



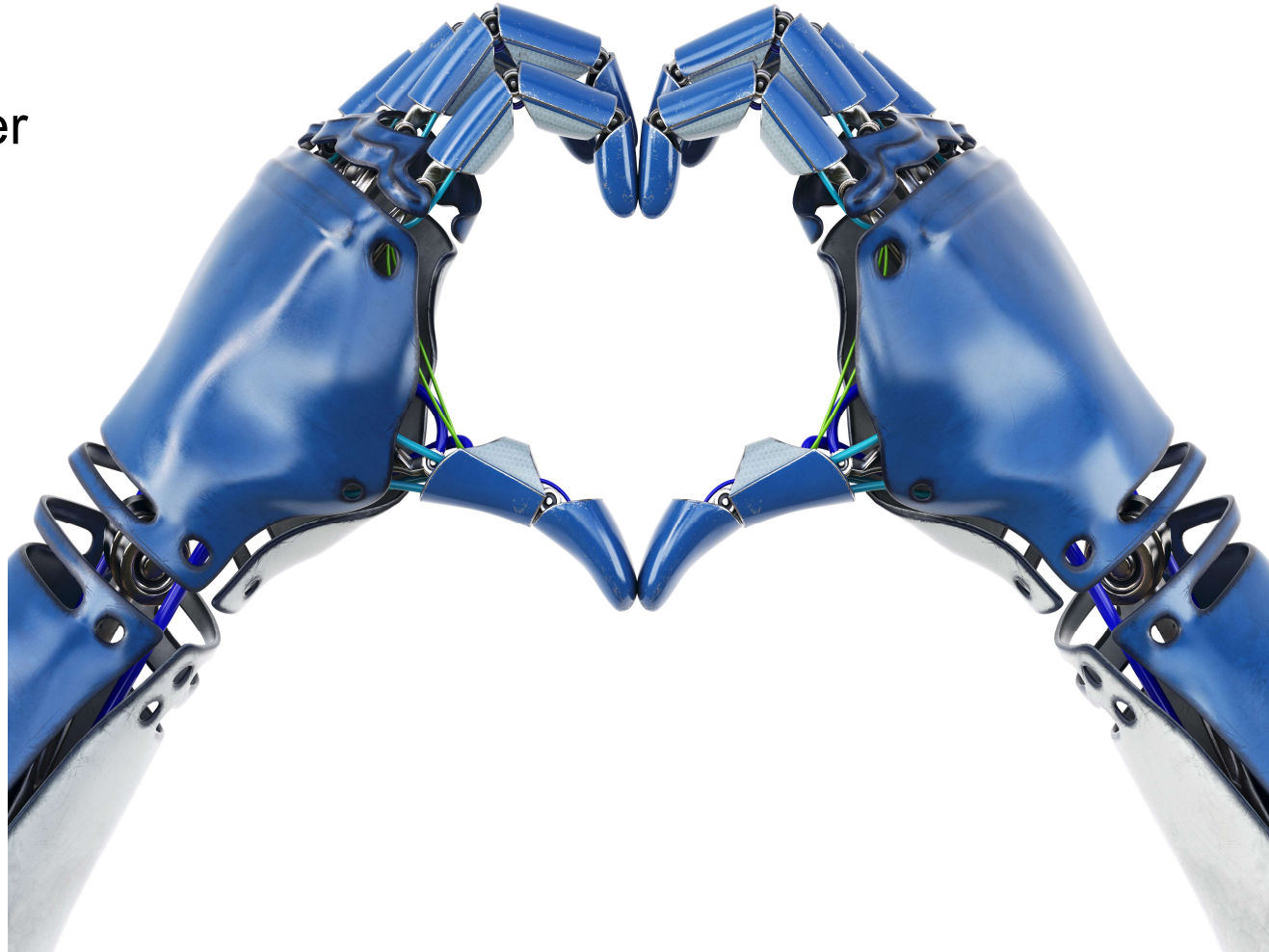
Source: <http://web.media.mit.edu/~picard/>

Emotions in machines

- Sense emotional state of the user
- Sensor, cameras, microphone

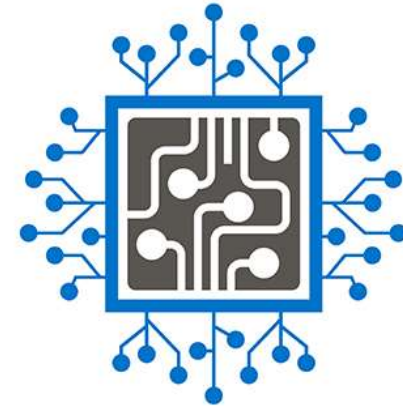
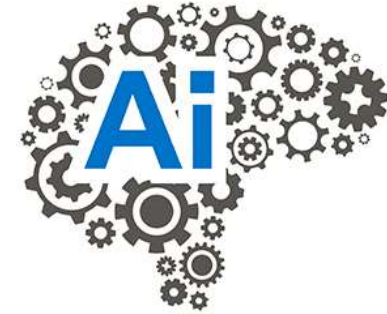
- Speech recognition
- Gesture recognition
- Image recognition

- Machine learning



Enabling technologies

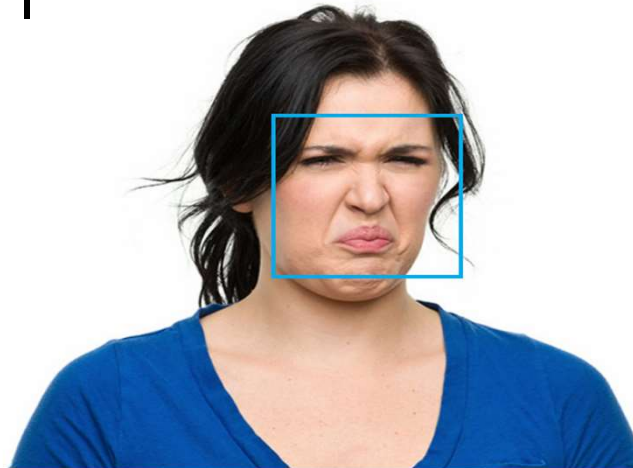
- Sensor technology
- Big data
- Machine learning
- API and services



Source: Panchenko Vladimir/Shutterstock.com

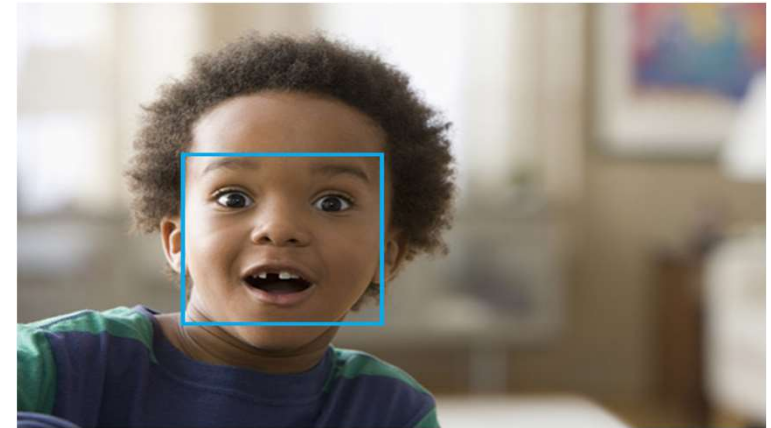
Microsoft Emotion API

- Image as input
- Emotions
 - Happiness
 - Sadness
 - Surprise
 - Anger
 - Fear
 - Contempt
 - Disgust
 - Neutral



```
Detection result:
1 faces detected

JSON:
[
  {
    "faceRectangle": {
      "top": 127,
      "left": 250,
      "width": 163,
      "height": 163
    },
    "scores": {
      "anger": 0.09557262,
      "contempt": 0.003917685,
      "disgust": 0.684764564,
      "fear": 4.03712329E-06,
      "happiness": 8.999826E-08,
      "neutral": 0.002147009,
      "sadness": 0.213587672,
      "surprise": 6.34691469E-06
    }
  }
]
```



```
Detection result:
1 faces detected

JSON:
[
  {
    "faceRectangle": {
      "top": 141,
      "left": 130,
      "width": 162,
      "height": 162
    },
    "scores": {
      "anger": 9.29041E-06,
      "contempt": 0.000118981574,
      "disgust": 3.15619363E-05,
      "fear": 0.000589638,
      "happiness": 0.06630674,
      "neutral": 0.00555004273,
      "sadness": 7.44669524E-06,
      "surprise": 0.9273863
    }
  }
]
```

Source: <https://azure.microsoft.com/en-us/services/cognitive-services/emotion/>

IBM Watson Tone Analyzer

- Text as input
- Emotions
 - Analytical
 - Anger
 - Confident
 - Fear
 - Tentative

The screenshot displays the IBM Watson Tone Analyzer interface. On the left, a list of tones is shown, with 'Anger' selected. On the right, the 'In context' section provides a definition of anger and a confidence scale from 0 to 1. Below this, several tweets are listed, each with a red highlight indicating the detected tone and its confidence score.

| Tone | Confidence Score |
|--------------|------------------|
| Analytical | |
| Anger | |
| Confident | |
| Fear | |
| Tentative | |

In context

Anger: Evoked due to injustice, conflict, humiliation, negligence or betrayal. If anger is active, the individual attacks the target, verbally or physically. If anger is passive, the person silently sulks and feels tension and hostility.

Confidence Scale: < .5 | .5 - .75 | > .75
None | Strong

Example tweets and scores:

- I hate these new features On #ThisPhone after the update. (Score: > .75)
- I hate #ThisPhoneCompany products, you'd have to torture me to get me to use #ThisPhone. (Score: > .75)
- The emojis in #ThisPhone are stupid. (Score: > .75)
- #ThisPhone is a useless, stupid waste of money. (Score: > .75)
- #ThisPhone is the worst phone I've ever had - ever 😞. (Score: > .75)
- #ThisPhone another ripoff, lost all respect SHAME. (Score: > .75)
- I'm worried my #ThisPhone is going to overheat like my brother's did. (Score: > .75)

Source: <https://www.ibm.com/watson/services/tone-analyzer/>

Application scenarios

Application scenarios: Retail

Retail

Medical

Education

Social

Application scenarios: Medical

Retail

Medical

Education

Social

Application scenarios: Education

Retail

Medical

Education

Social

Application scenarios: Social



Retail

Medical

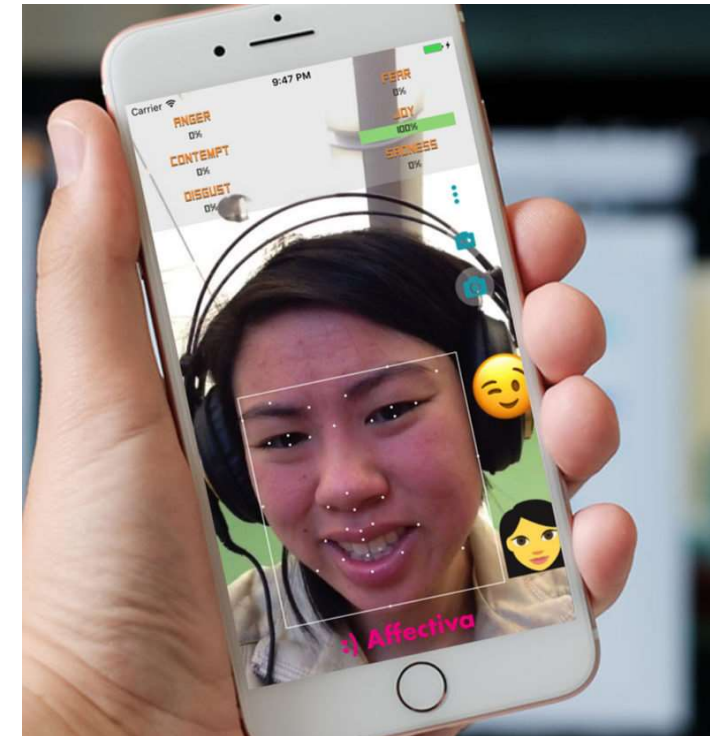
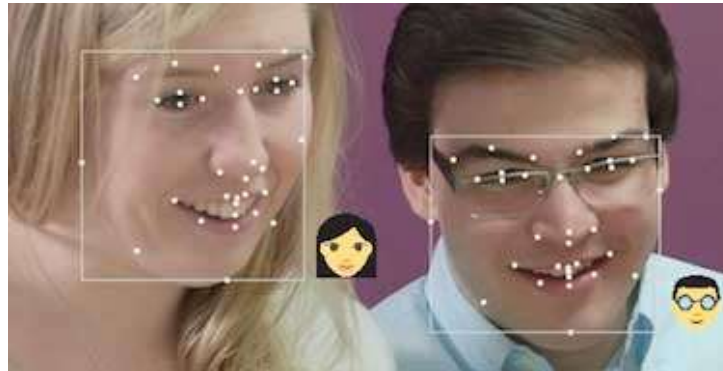
Education

Social

What is in the front line?

Affectiva

- Emotion DB
- Emotion SDK and API
- Virtual assistants
- Personalized transportation experience
- Advertising: Understanding emotional engagement



:) Affectiva

Source: <https://www.affectiva.com>

Affectiva: Emotion as a service

- Facial analysis
- Face and head tracking
- Speech analysis



Source: <https://www.affectiva.com>

Pepper

- Voice recognition
- Face recognition
- Body movements
- Use emotion recognition API from Affectiva

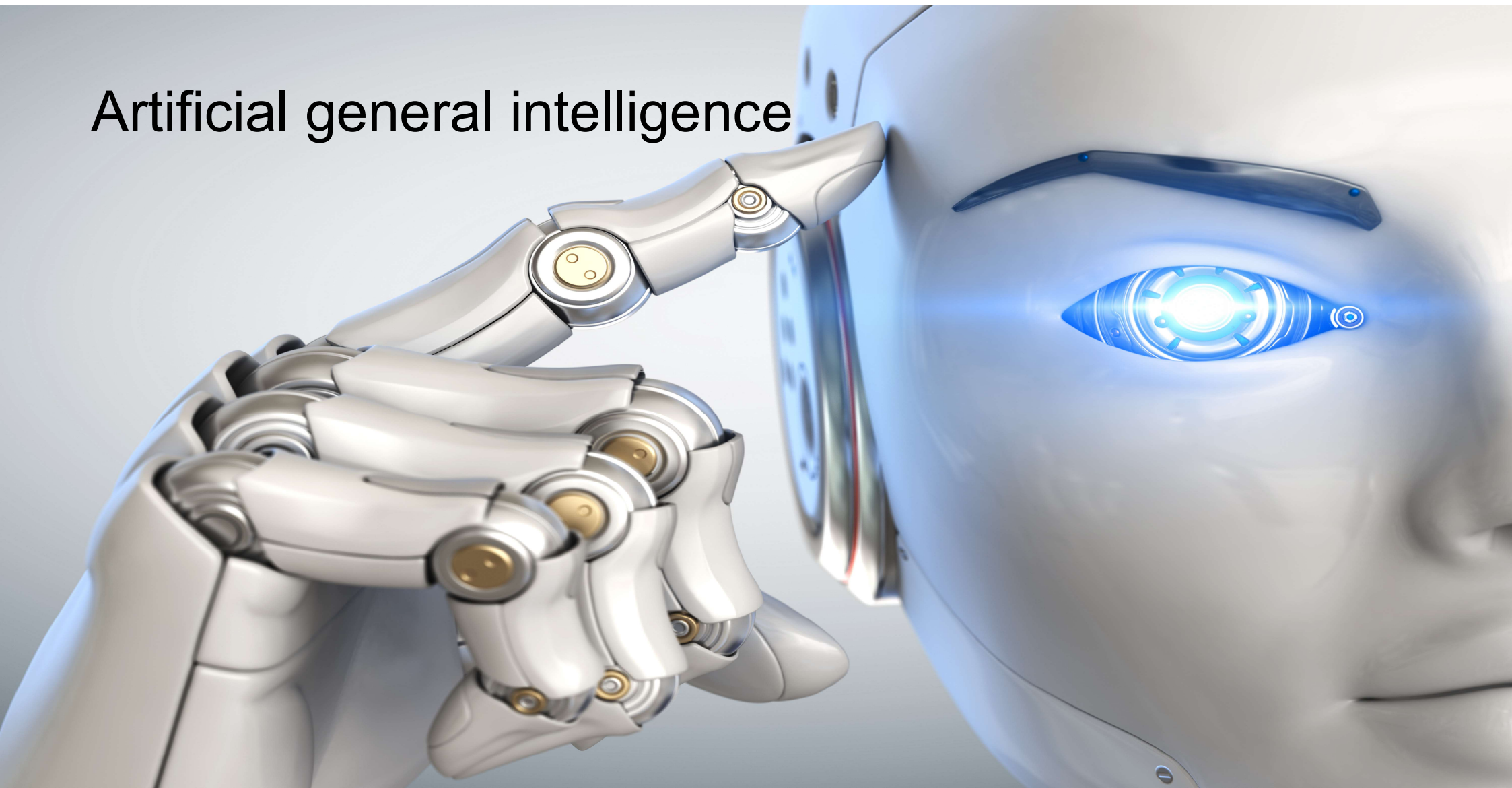
- Respond by eye color
- Tablet
- Tone of voice

- Bank
- Nestlé Nescafé



Source: VTT Studio/Shutterstock.com

Artificial general intelligence



General intelligence

- Cross domain optimization
 - The ability to achieve complex goals in complex environments
- Transfer learning from one domain to another

Operational definitions AGI

- The Turing test (\$100000 Loebner prize)

Operational definitions AGI

- The Turing test (\$100000 Loebner prize)
- The coffee test

Operational definitions AGI

- The Turing test (\$100000 Loebner prize)
- The coffee test
- The robot college test

Operational definitions AGI

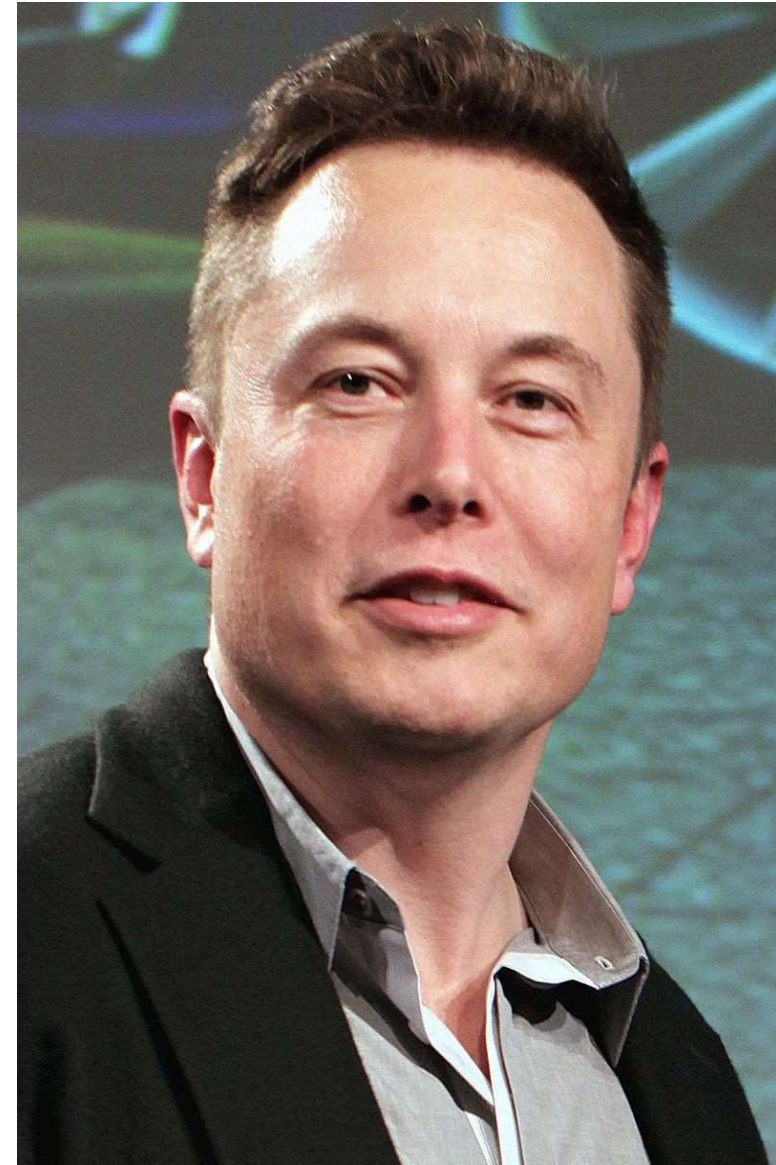
- The Turing test (\$100000 Loebner prize)
- The coffee test
- The robot college test
- The employment test

Future: Threat or hope?



"With artificial intelligence we are summoning the demon. AI is our biggest existential threat."

- Elon Musk (2014)



"The development of full artificial intelligence could spell the end of the human race.

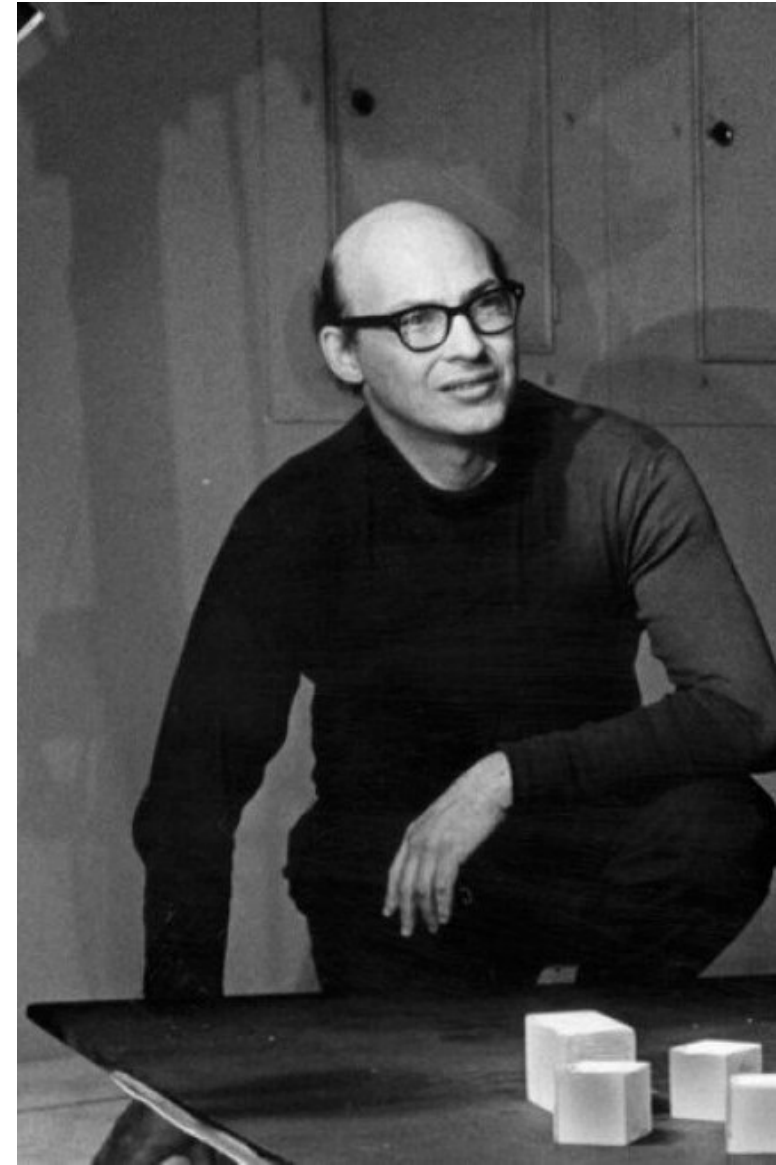
It would take off on its own, and re-design itself at an ever-increasing rate. Humans, who are limited by slow biological evolution, couldn't compete and would be superseded. "

- Stephen Hawking (2014)



"Once the computers get control we might never get it back. We should survive at their sufference. If we're lucky, they might keep us as pets."

- Marvin Minsky (1970)



"Symbol systems modelling human problem solving are the answer.

We better alert the people."

- Alan Newell & Herbert Simon (1970)



When will AI surpass human level?

Never

In 300 years

In 100 years

In 50 years

In a few decades

In a few years

| | | | | |
|-------------------------|-------------------------------|--|--|-------------------------|
| Techno skeptics | | | | |
| Luddites | Beneficial AI movement | | | Digital utopians |
| Virtually nobody | | | | |

Definitely
bad

Probably
bad

Highly
uncertain

Probably
good

Definitely
good

If superhuman AI appears, will it be a good thing?

Source: *Life 3.0*, Max Tegmark

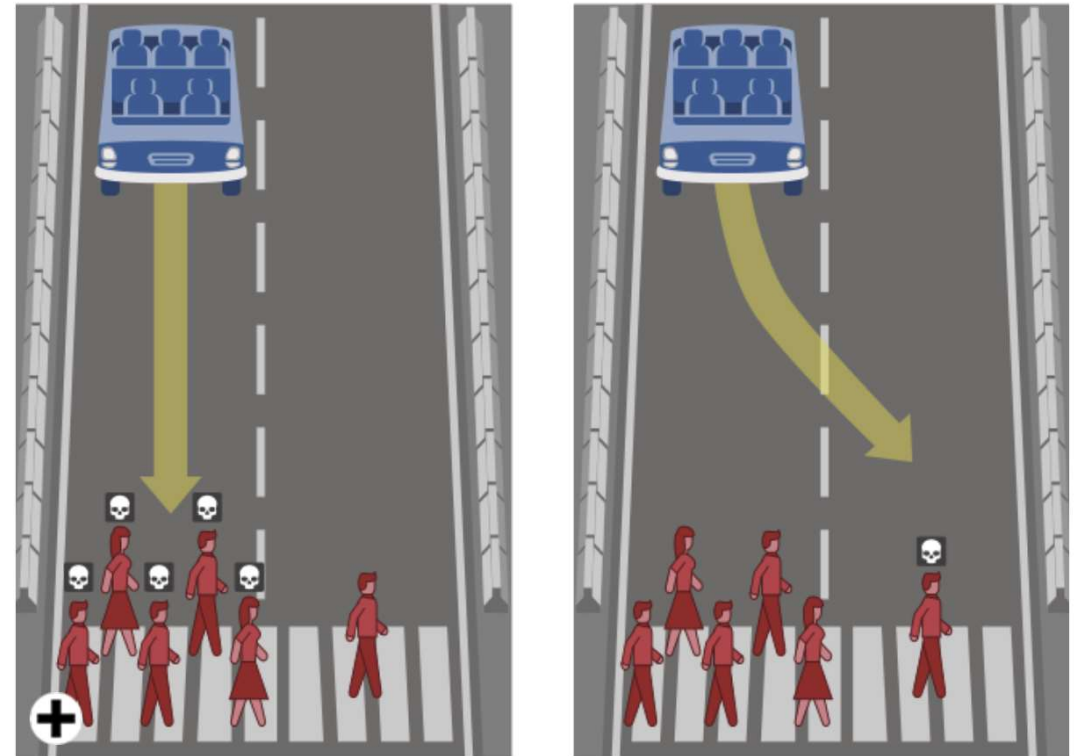
Ethical AI

The Moral Machine

- Humans over pets
- Passenger over pedestrians
- More lives over fewer
- Women over men
- Young over old
- Fit over sick
- Higher social status
- Law abiders
- Should the car take action or not



What should the self-driving car do?

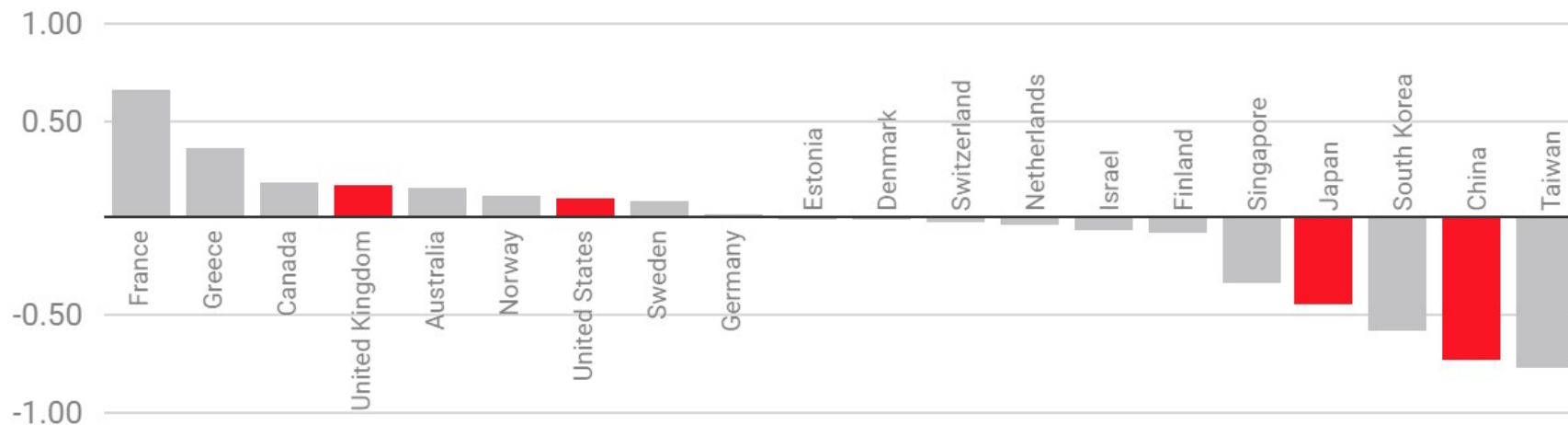


An example question posed to Moral Machine participants.

MORAL MACHINE

Source: <https://www.technologyreview.com/s/612341/a-global-ethics-study-aims-to-help-ai-solve-the-self-driving-trolley-problem/>

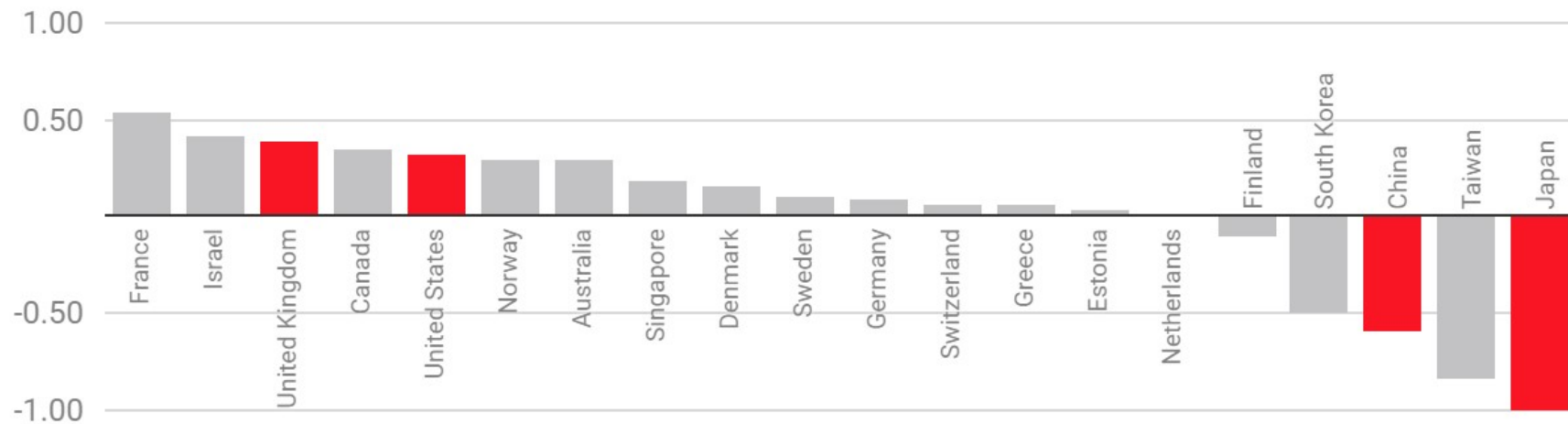
Countries with more individualistic cultures are more likely to spare the young



A comparison of countries piloting self-driving cars: If the bar is closer to 1, respondents placed a greater emphasis on sparing the young; if the bar is closer to -1, respondents placed a greater emphasis on sparing the old; 0 is the global average.

Source: <https://www.technologyreview.com/s/612341/a-global-ethics-study-aims-to-help-ai-solve-the-self-driving-trolley-problem/>

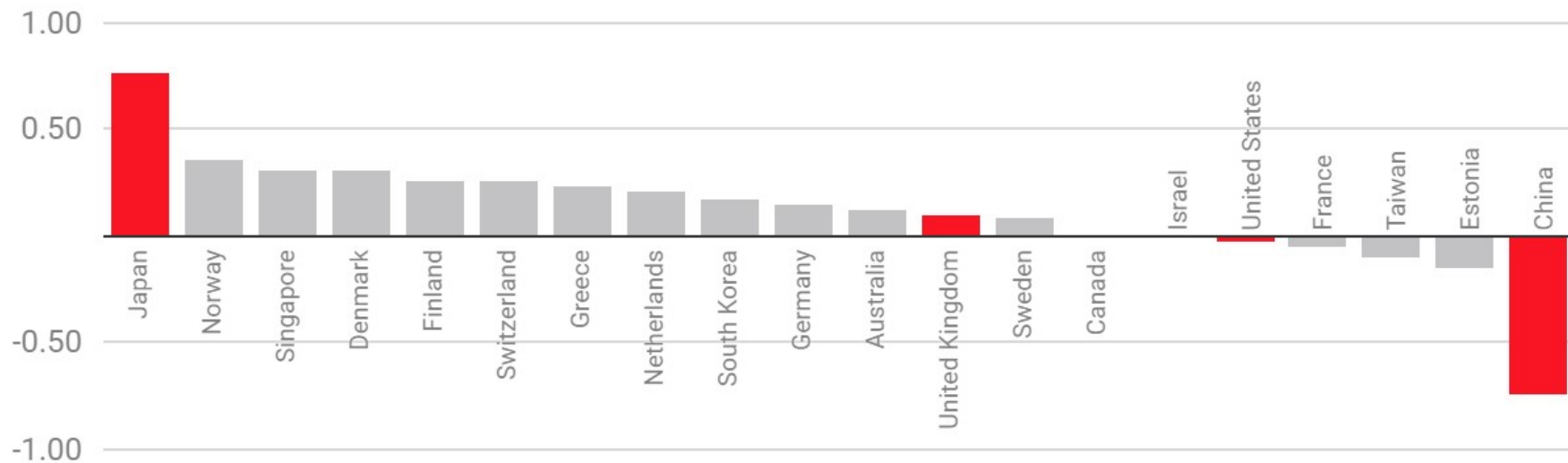
Countries with more individualistic cultures are more likely to spare more lives



A comparison of countries piloting self-driving cars: If the bar is closer to 1, respondents placed a greater emphasis on sparing more lives; if the bar is closer to -1, respondents placed a smaller emphasis on sparing more lives; 0 is the global average.

Source: <https://www.technologyreview.com/s/612341/a-global-ethics-study-aims-to-help-ai-solve-the-self-driving-trolley-problem/>

How countries compare in sparing pedestrians over passengers

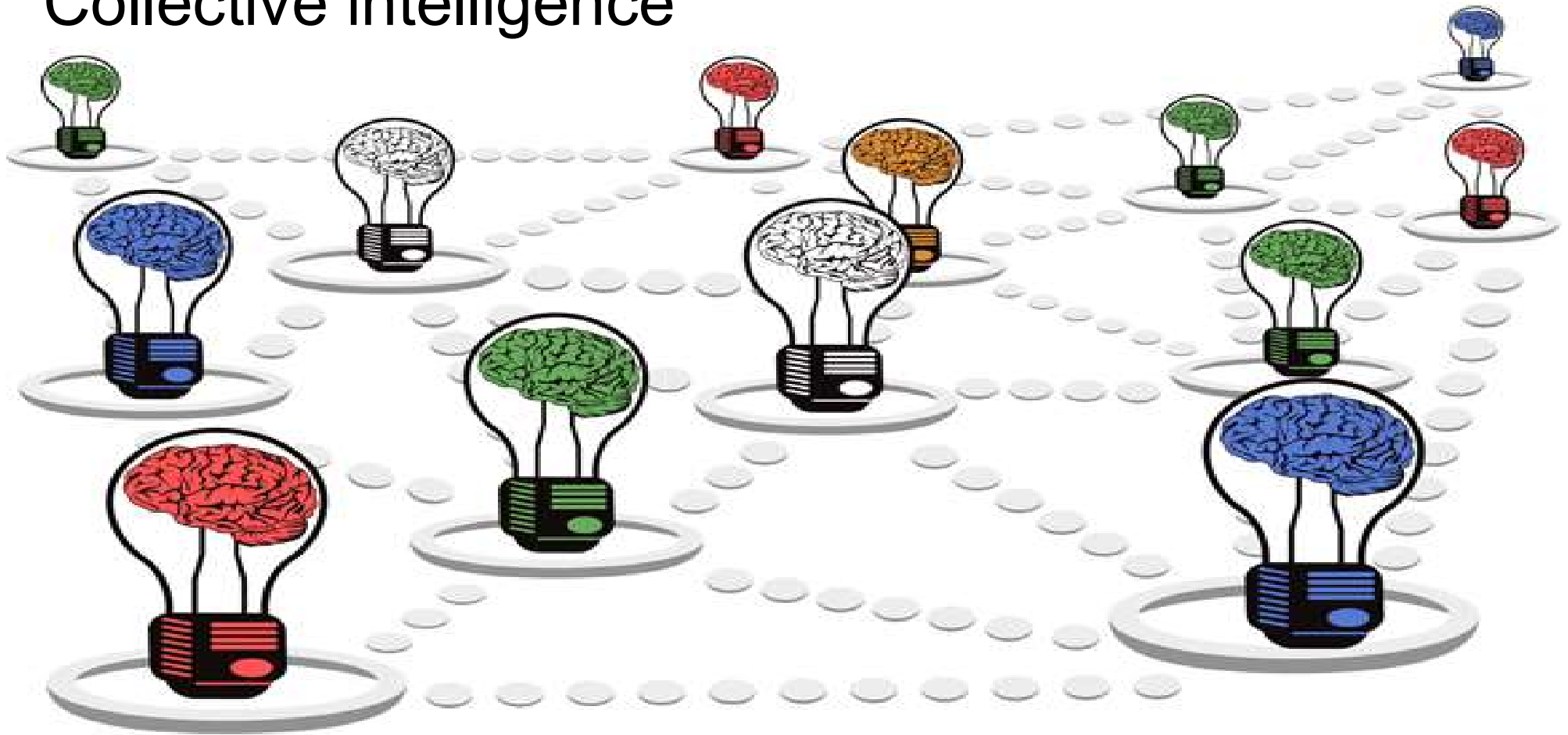


If the bar is closer to 1, respondents placed a greater emphasis on sparing pedestrians; if the bar is closer to -1, respondents placed a greater emphasis on sparing passengers; 0 is the global average.

Source: <https://www.technologyreview.com/s/612341/a-global-ethics-study-aims-to-help-ai-solve-the-self-driving-trolley-problem/>

Collective Intelligence

Collective intelligence



Collective intelligence

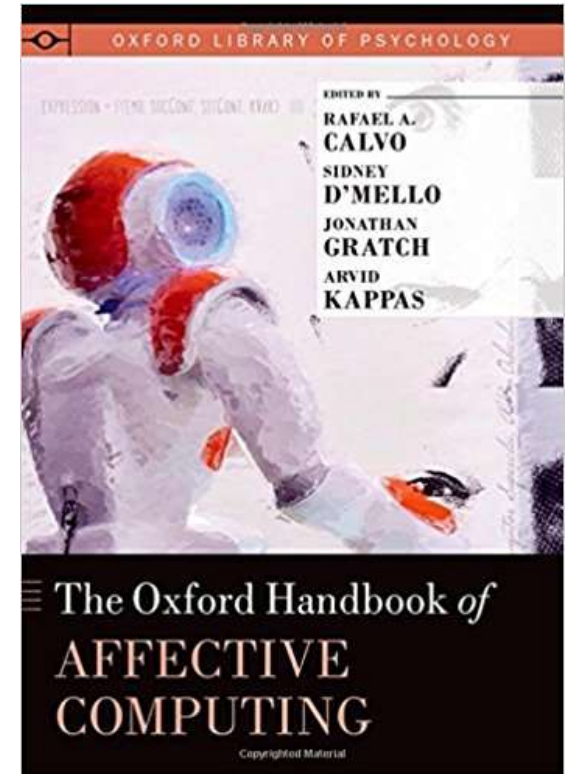
- Groups of people working together
- AI + group of people
- Affective computing



Source: Willyam Bradberry/Shutterstock.com

References

References



Thank you!



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FAGLIG AUTORITET OG VARME