Talking with socially intelligent robots

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60 YEARS OF COMPUTING AT GLASGOW

Why give robots social capabilities?

Rayna meets a "robot" – https://youtu.be/h1E-FIguwGw

“Faces in Things” (twitter.com/FacesPics)

Social robots in popular culture

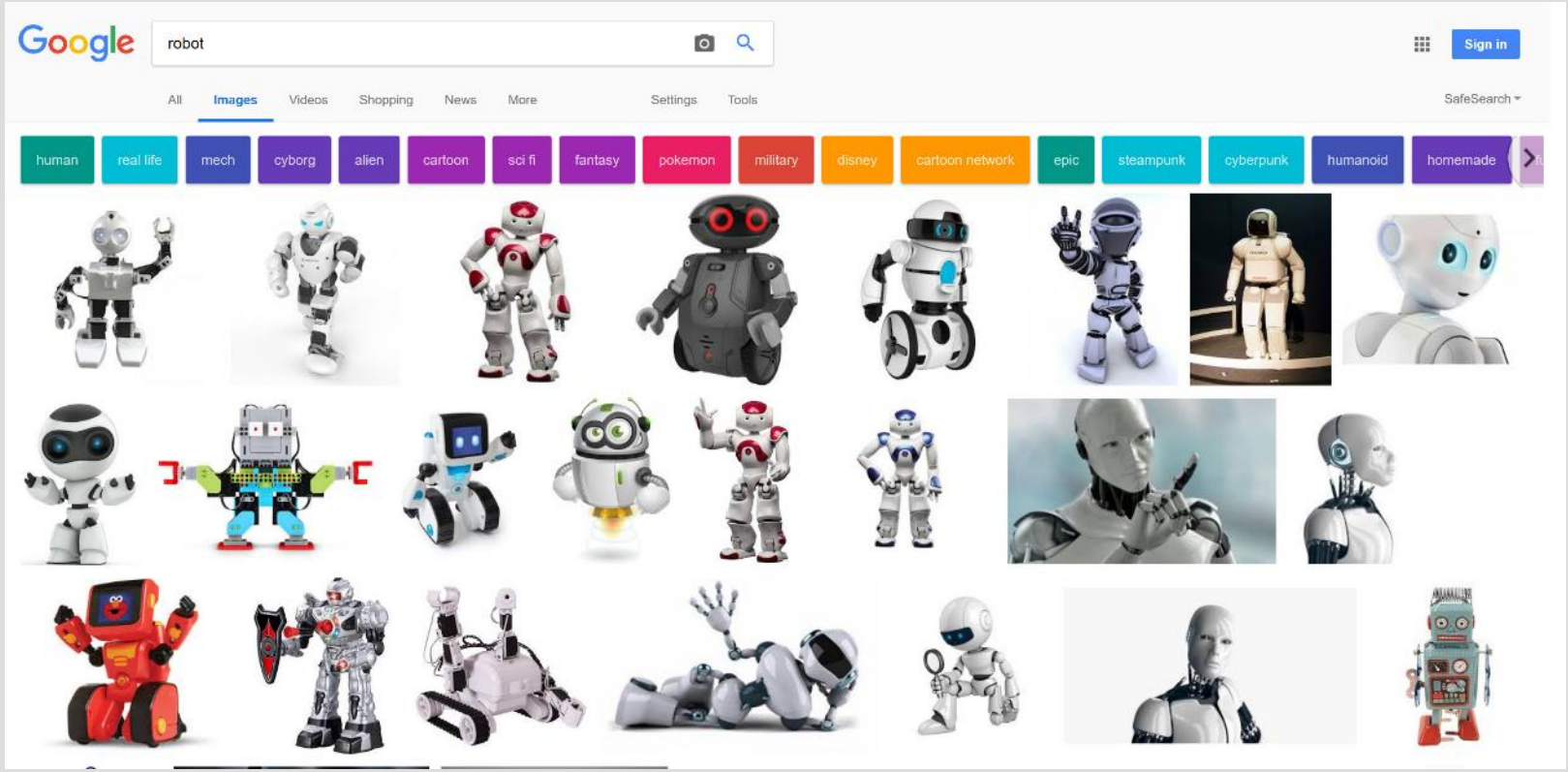
Star Wars: The Force Awakens

What is social interaction?

"**Social interaction** is the way people talk and act with each other and various structures in society. It may include interactions such as a team, family or bureaucracy that is formed out of the need to create order within the interaction itself."

Simple English Wikipedia
https://simple.wikipedia.org/wiki/Social_interaction

What is a robot?



Some definitions (Simon, 2017, Wired)

A robot is …

> "a **physically embodied artificially intelligent** agent that can **take actions** that have **effects on the physical world**" (Anca Dragan, UC Berkeley)
>
> "a **physical** machine that's usually **programmable by a computer** that can **execute tasks autonomously** or **automatically** by itself" (Kate Darling, MIT Media Lab)
>
> "a **system** that **exhibits 'complex' behavior** and includes **sensing** and **actuation**" (Hanumant Singh, Northeastern University)

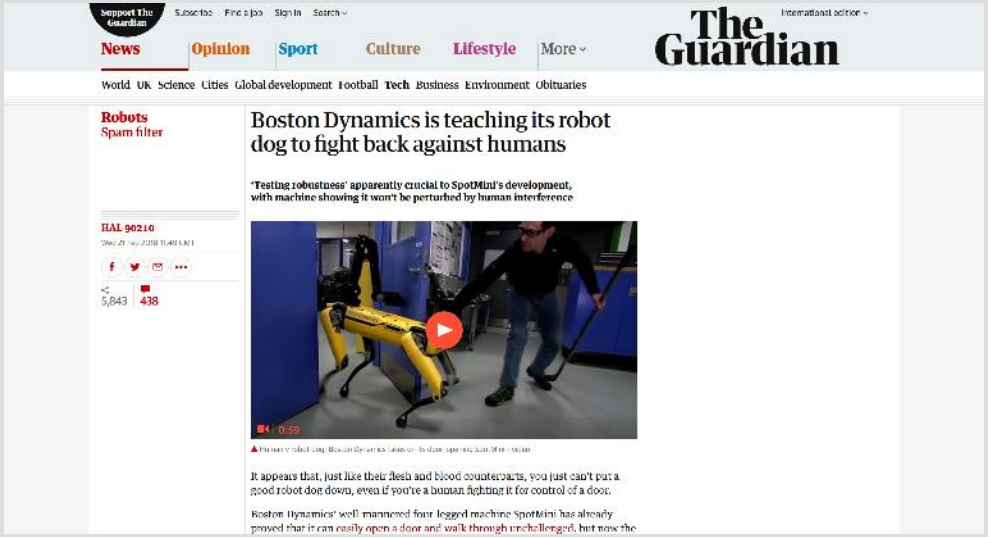
Common features:

> Physical embodiment; intelligent/complex behaviour; effects in the physical world

Anthrompomorphising a zoomorphic robot

Testing robustness -- https://youtu.be/aFuA50H9uek

“Boston Dynamics is teaching its robot dog to fight back against humans”



https://www.theguardian.com/technology/2018/feb/21/boston-dynamics-teaching-robot-dog-fight-back-humans

“this time it’s joined by a pesky human with an ice hockey stick”

“the human’s robot bullying continues”

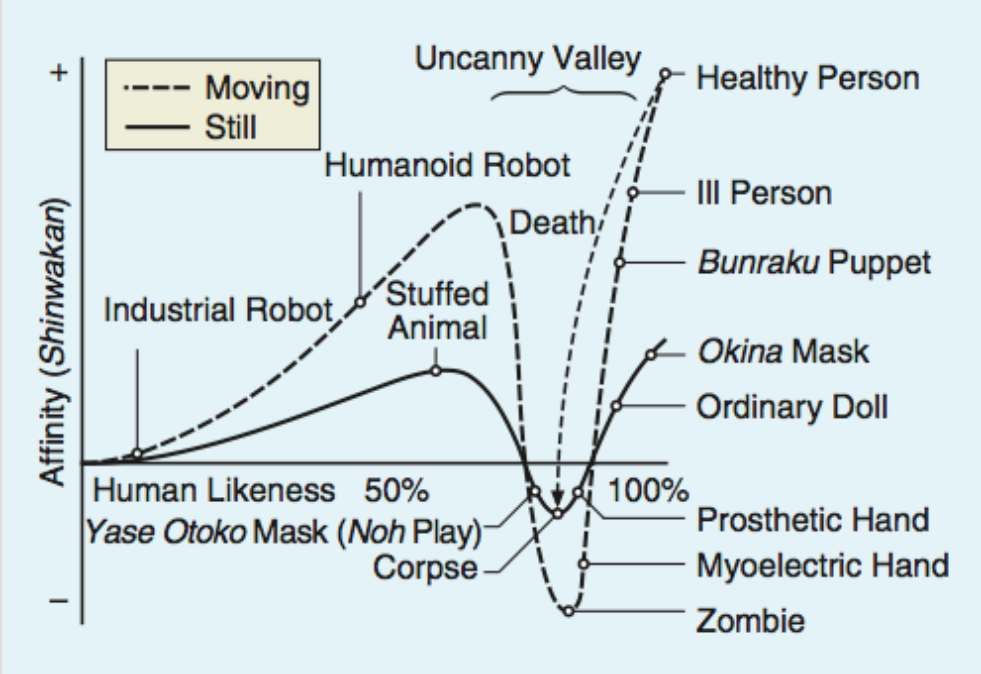
“The robot valiantly trudges forward attempting to shake off this cowardly move”

“Eventually the human gives in”

“teaching robots to fight back against humans may might end up harming us”

Uncanny Valley

Original Uncanny Valley (Mori, 1970)



"when we realize the [prosthetic] hand, which at first site looked real, is in fact artificial, we experience an eerie sensation"

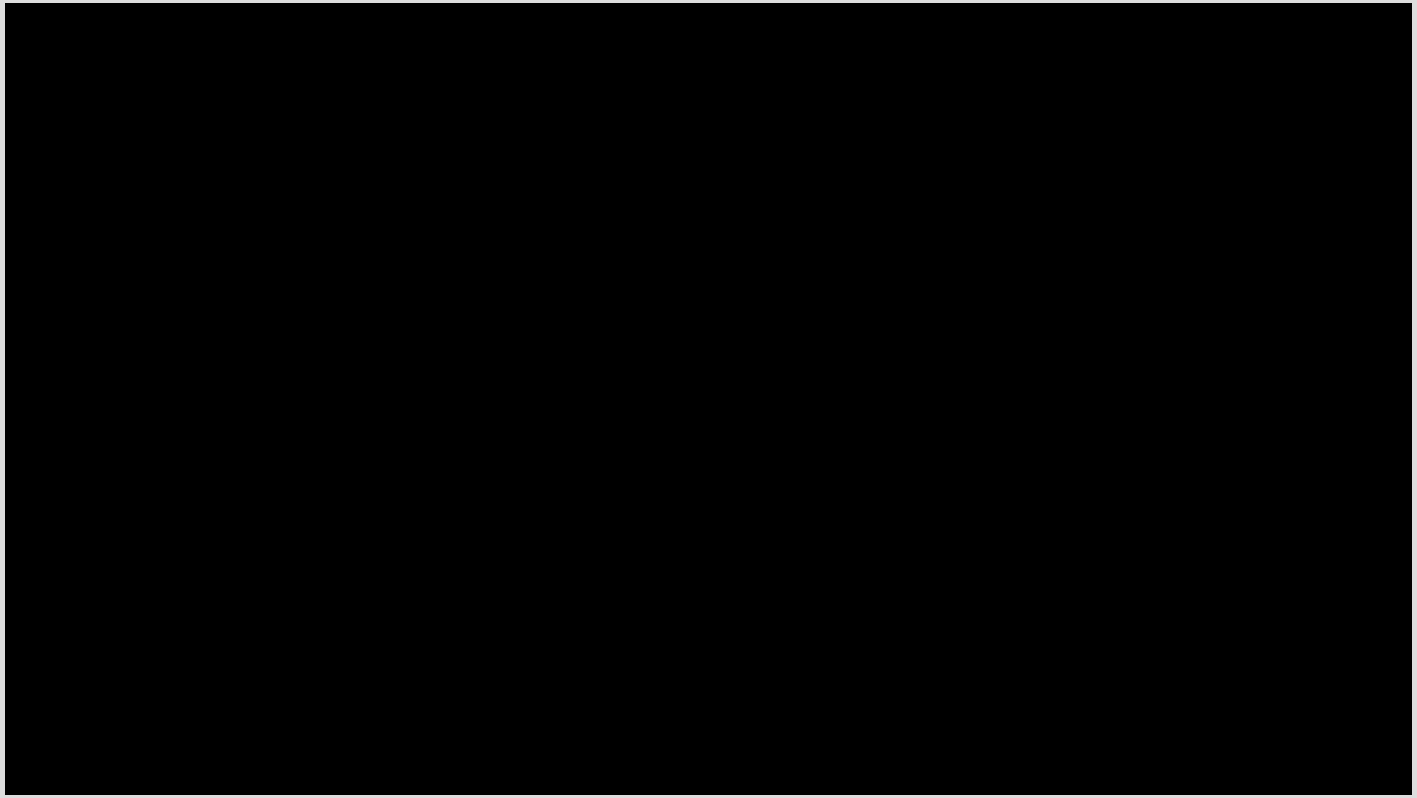
Movement amplifies the peaks and valleys

> "When the speed is cut in half in an attempt to make the robot bring up a smile more slowly, instead of looking happy, its expression turns creepy."

Theory: uncanny valley makes us think of death

Ultimate suggestion: designers should aim for the first peak

Does this fall into the Uncanny Valley?



https://youtu.be/MI9v3wHLuWI

Putting the Uncanny Valley to the test

Recent "Research Topic" of *Frontiers in Psychology:*
https://www.frontiersin.org/research-topics/2385 (October 2017)

Research in this area is shifting: goal is to understand **when**, under **what conditions**, and **why** the effects of the Uncanny Valley Hypothesis (UVH) occur

Empirical support has been inconsistent – partly because different researchers have formalised the details in different ways for experiments

Paper: discussed here (others are also worth reading!)

Kätsyri et al.: Review of studies testing the UVH; propose conditions

Investigating the evidence for the UVH

What is "human-likeness"? Issues of aesthetics (stuffed toy), morbidity (corpse)

What is "affinity"? Original Japanese term *shinwakan* is difficult to translate – "feeling of being in the presence of another human being" is one proposed explanation

Kätsyri et al. examine a number of UVH-related hypotheses and look for support

Factors

- Morbidity included as a separate factor?
- Motion included as modulating variable?
- Categorization ambiguity: category identification, perceptual discrimination
- Perceptual mismatch: inconsistency, atypical features,

Evidence in the literature

17 papers selected for analysis

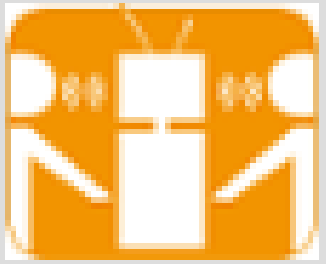
Overall, any increase in "human-likeness" modification was associated with increased positive experiences, with or without motion – no UVH in the basic conditions

- Some issues: morbidity, morphing artifacts in the stimuli, no statistical power

Categorical perception: no impaired discrimination near boundary

Perceptual mismatch: support for UVH-like results in several contexts, e.g.:

- Inconsistent realism levels (artificial eyes on a human face)
- Atypical features (enlarged eyes) on human characters



JAMES: a socially aware robot bartender

Bartending: Managing the social situation

When things go wrong …

JAMES robot bartender

Sample bartender interaction


Who needs attention?
What do they need?

Signals used by people in real bars

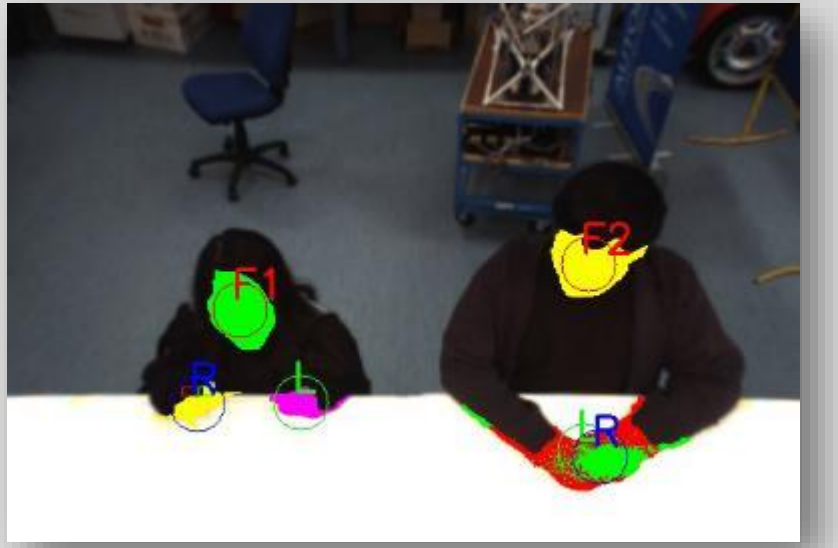
Sebastian Loth, Jan Peter de Ruiter, and Kerstin Huth. Automatic detection of service signals used in bars. Frontiers in Psychology 4(557), 2013.

{10.1007/s12369-017-0414-y}

Automatically classifying engagement

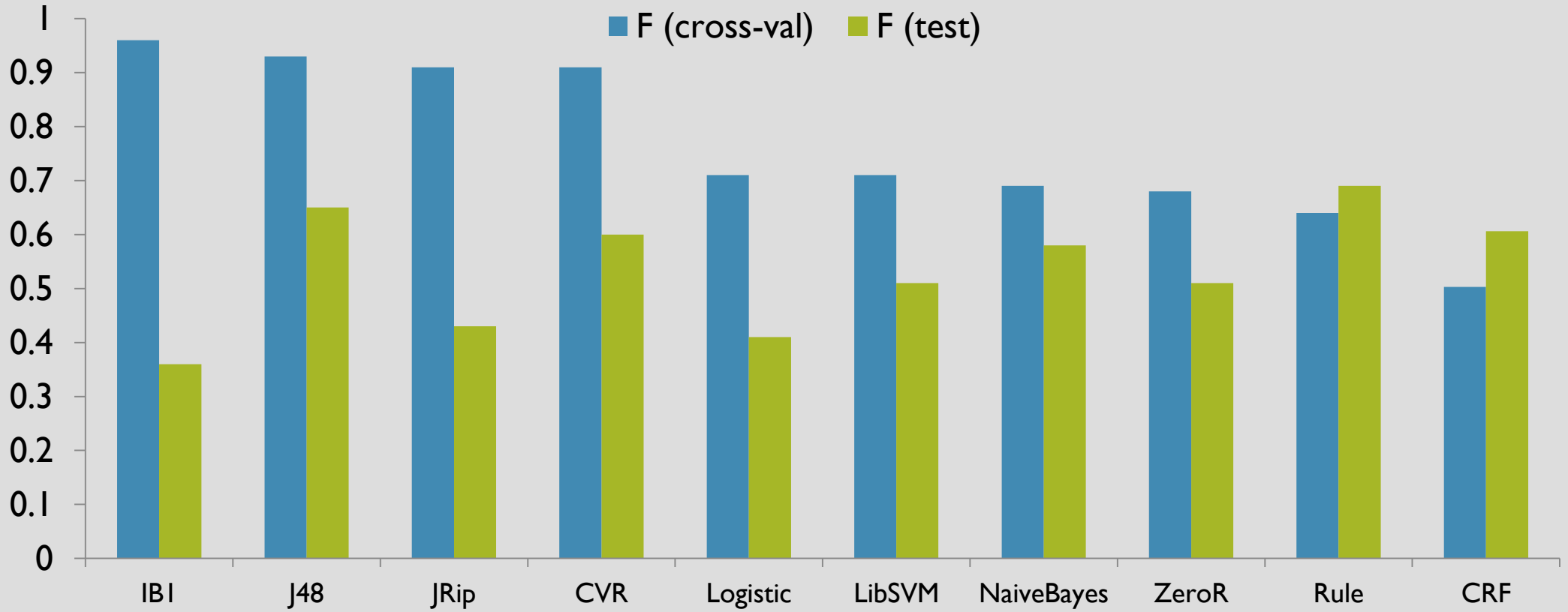
Strategies
- Rule derived from real bar data
- Supervised learning from a labelled corpus

Experiments
- Online user evaluation
- Cross-validation on training corpus
- Validation on small test corpus



Mary Ellen Foster, Andre Gaschler, and Manuel Giuliani. Automatically classifying user engagement for dynamic multi-party human-robot interaction. International Journal of Social Robotics, 2017. doi:10.1007/s12369-017-0414-y

Classifier performance (frame-by-frame)




Who needs attention?
What do they need?

JAMES system evaluations

Baseline evaluation *(Foster et al., ICMI 2012)*

95% overall success rate; ASR, vision problematic

Comparing task-based and socially aware interaction *(Giuliani et al., ICMI 2013)*

Increased dialogue efficiency with social behaviours; demographic issues

Comparing hand-coded and trained interaction policies *(Keizer et al., SIGDial 2013)*

Trained policy scored higher on objective and subjective measures of task success

In all cases: if the system heard a drink order, it would serve that drink immediately

"*cough*" »»»» "Okay, here is your Coke"

Reasoning under/about uncertainty

Include **sensor confidence** in the state representation

Interaction manager reasons about confidence, multiple hypotheses

Evaluation:

- Fewer wrong drinks served, but
- Thresholds need work

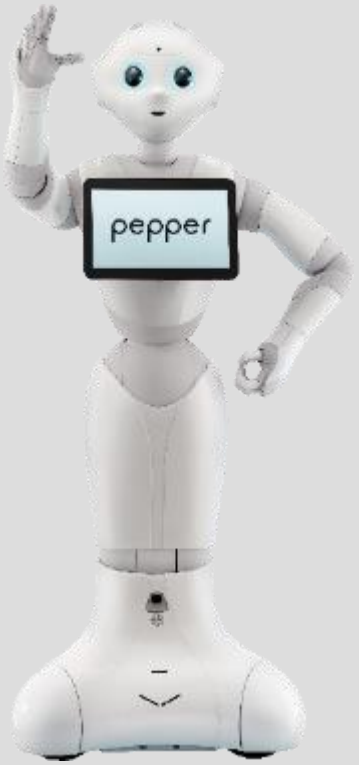
seeksAttention(A1)	True	0.75
seeksAttention(A2)	False	0.45
lastSpeaker()	A1	1.0
lastEvent()	userSpeech(A1)	1.0
drinkOrder(A1)	Green lemonade	0.677
	Blue lemonade	0.322
lastAct(A1)	Greet	0.25

Simon Keizer, Mary Ellen Foster, Andre Gaschler, Manuel Giuliani, Amy Isard, and Oliver Lemon. "Handling uncertain input in multi-user human-robot interaction". In Proceedings of the 23rd IEEE International Symposium on Robot and Human Interactive Communication (IEEE RO-MAN 2014), pages 312--317, Edinburgh, Scotland, August 2014. http://doi.org/10.1109/ROMAN.2014.6926271

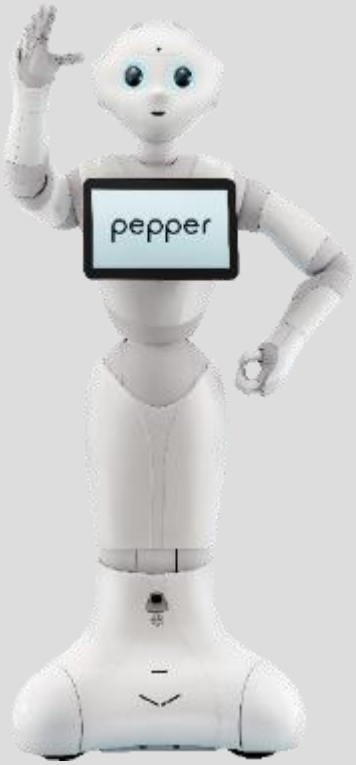
MuMMER: MultiModal Mall Entertainment Robot

MuMMER
mummer-project.eu

MultiModal Mall Entertainment Robot



MultiModal Mall Entertainment Robot



Escaping from Children's Abuse of Social Robots

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ABSTRACT

Social robots working in public space often stimulate children's curiosity. However, sometimes children also show abusive behavior toward robots. In our case studies, we observed in many cases that children persistently obstruct the robot's activity. Some actually abused the robot by saying bad things, and at times even kicking or punching the robot. We developed a statistical model of occurrence of children's abuse. Using this model together with a simulator of pedestrian behavior, we enabled the robot to predict the possibility of an abuse situation and escape before it happens. We demonstrated that with the model the robot successfully lowered the occurrence of abuse in a real shopping mall.

Figure 1. Children's abusive behavior toward the robot.

children. They frequently stood in its way and stopped it from moving (Figure 1 left). Sometimes their behavior escalated further.

Security Robot Knocks Toddler To The Ground Then Runs Him Over At Stanford Shopping Center

BY **JACK MORSE** IN **NEWS** ON JUL 12, 2016 11:40 AM

TECH —

Security guard robot ends it all by throwing itself into a watery grave

Knightscope K5 security bot shows your job is probably safe from automation. For now.

SEBASTIAN ANTHONY - 18/7/2017, 11:30

Bilal Farooqui

Enlarge / Thankfully there were still some humans on the payroll to lift the robot out of the water feature.

Robots are being used to deter homeless people from setting up camp in San Francisco

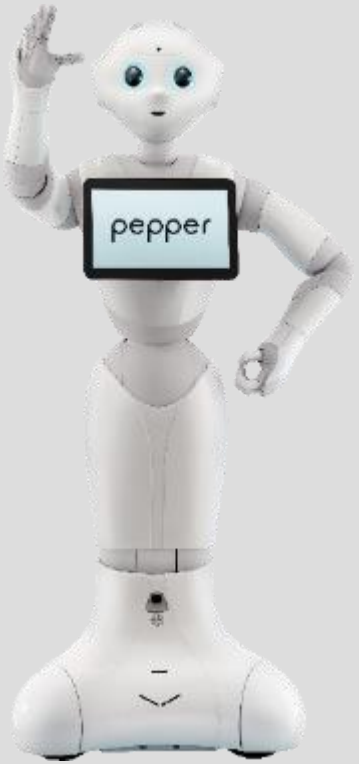
Melia Robinson

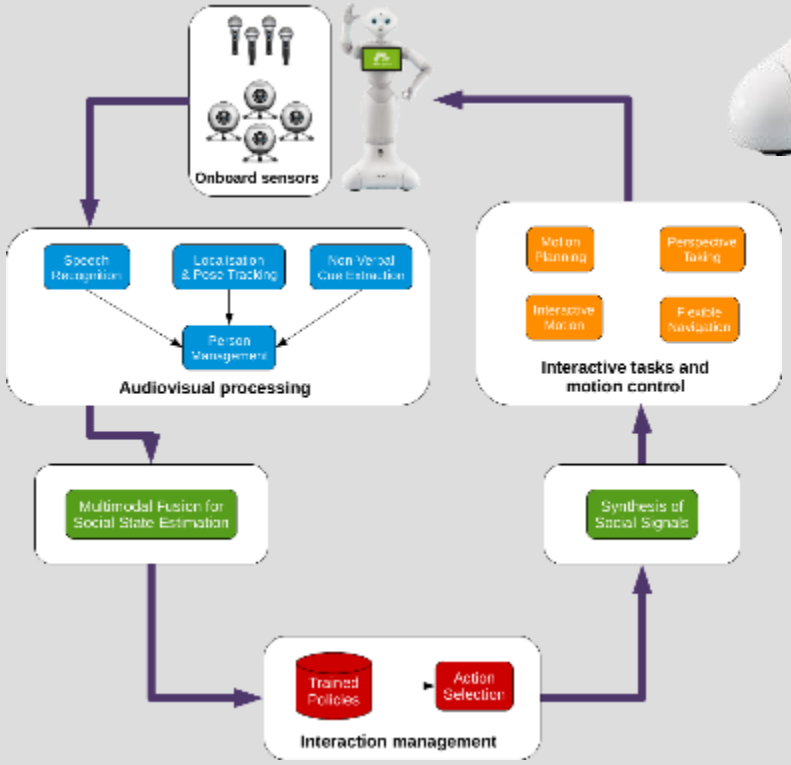
20h 2,912

Knightscope

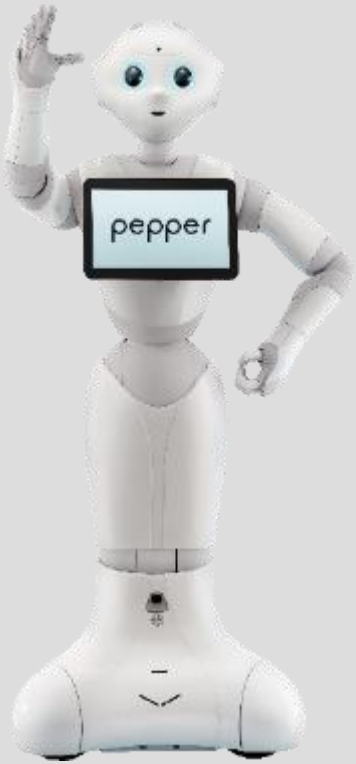
- **A security robot has been put to work in San Francisco in an attempt to deter homeless people from forming tent cities.**
- **The robot uses lasers and sensors to monitor an area for criminal activity. Rather than intervene during a crime, it alerts human authorities.**
- **The robot's owner, the San Francisco SPCA, said it has seen fewer tents and car break-ins since it deployed the robot in the city's Mission neighborhood.**

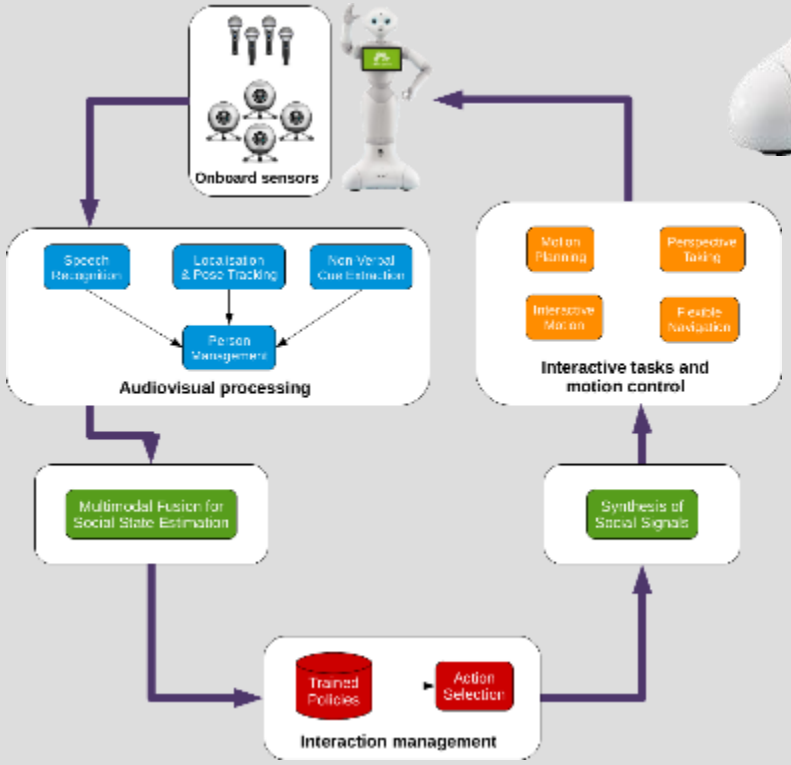
MultiModal Mall Entertainment Robot

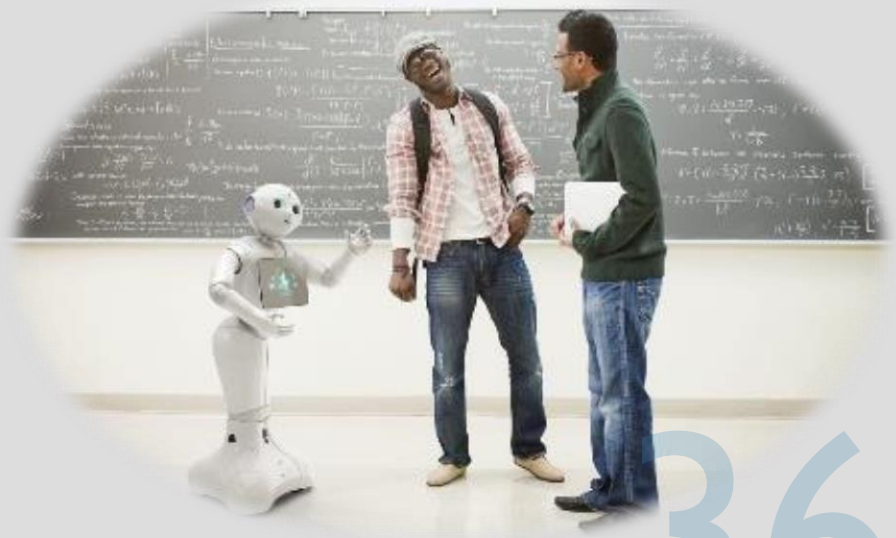




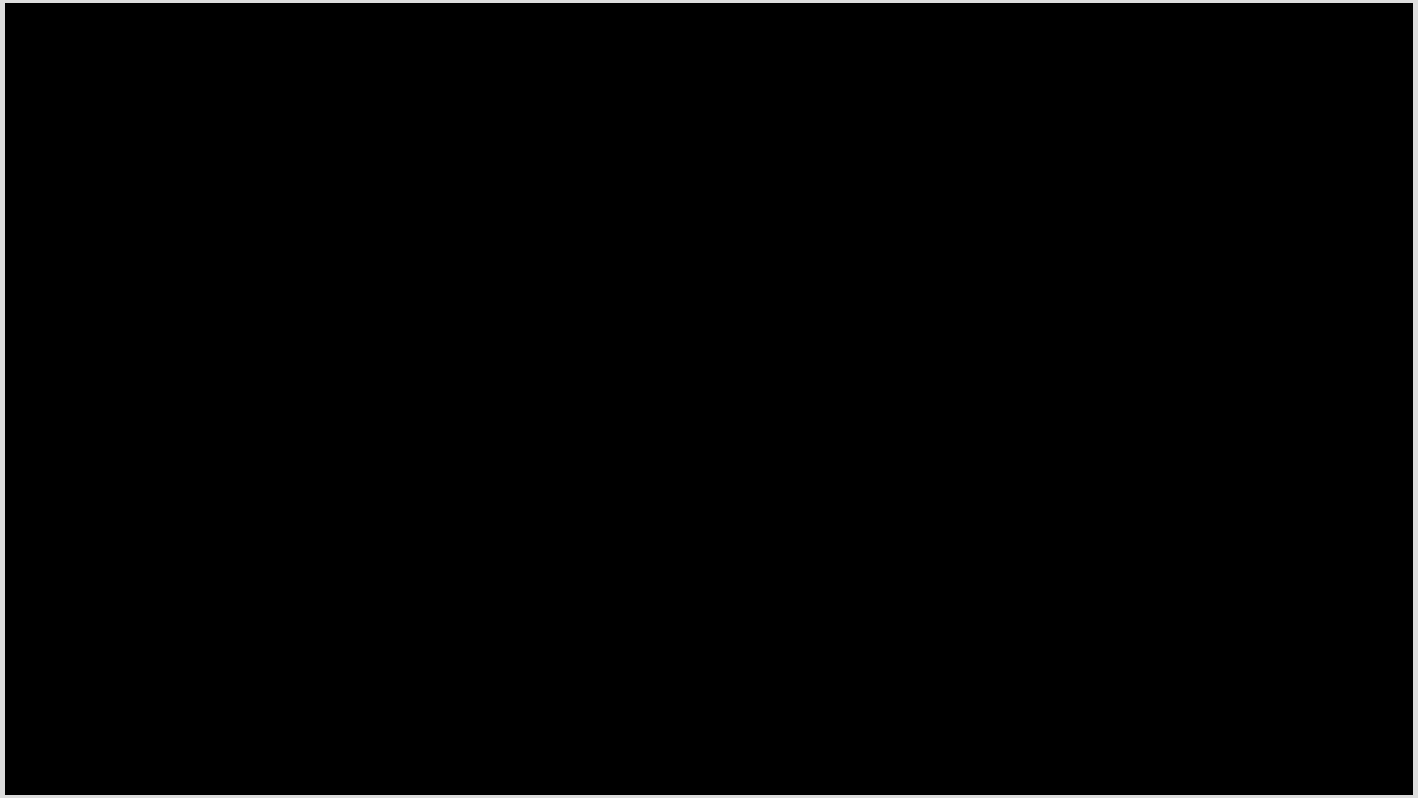
MultiModal Mall Entertainment Robot







Manipulating built-in gestures

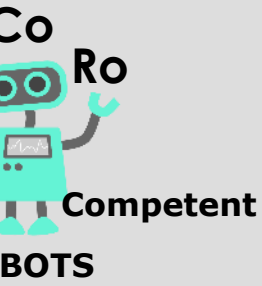


BGW Craenen, A Deshmukh, ME Foster, A Vinciarelli. **Shaping Gestures to Shape Personality: Big-Five Traits, Godspeed Scores and the Similarity-Attraction Effect.** AAMAS 2018.

A Deshmukh, B Craenen, ME Foster, A Vinciarelli. **The More I Understand it, the Less I Like it: The Relationship Between Understandability and Godspeed Scores for Robotic Gestures**. RO-MAN 2018.

B Craenen, A Deshmukh, ME Foster, A Vinciarelli. **Do We Really Like Robots that Match our Personality? The Case of Big-Five Traits, Godspeed Scores and Robotic Gestures**. RO-MAN 2018.

B Craenen, A Deshmukh, ME Foster, A Vinciarelli. **Shaping Gestures to Shape Personalities: The Relationship Between Gesture Parameters, Attributed Personality Traits and Godspeed Scores**. RO-MAN 2018



SoCoRo: A Socially Competent Robot Training Buddy

(Based on slides from Frank Broz, Heriot-Watt University)

Autism and work

In the UK, Autism Spectrum Disorder (ASD) affects 547,000 people over the age of 18 (1.3% of working age adults) [2011 Census]

Unemployment among adults with ASD is over 85%

- Almost double the rate for overall disabled population

Why? What can be done?

Autism, expression, and intention

People with ASD have trouble interpreting social signals

- Facial expressions
- Vocalisations
- Gestures

Cues about intentions

Can't correctly interpret co-worker or supervisor behaviour

- Leads to workplace conflict

"Oh, yeah? Lewis, you're fired! You apparently forgot this is a cartoon, and I can read every word you think!"

Robot job training

Train high-functioning ASD adults

Roleplay employer-employee office-based scenarios

- Focus on expressions of approval/disapproval

Gradually increase "human-likeness"

- Dynamics and magnitude of expressions

Transfer learning from human-robot to human-human

Identifying robot facial expressions







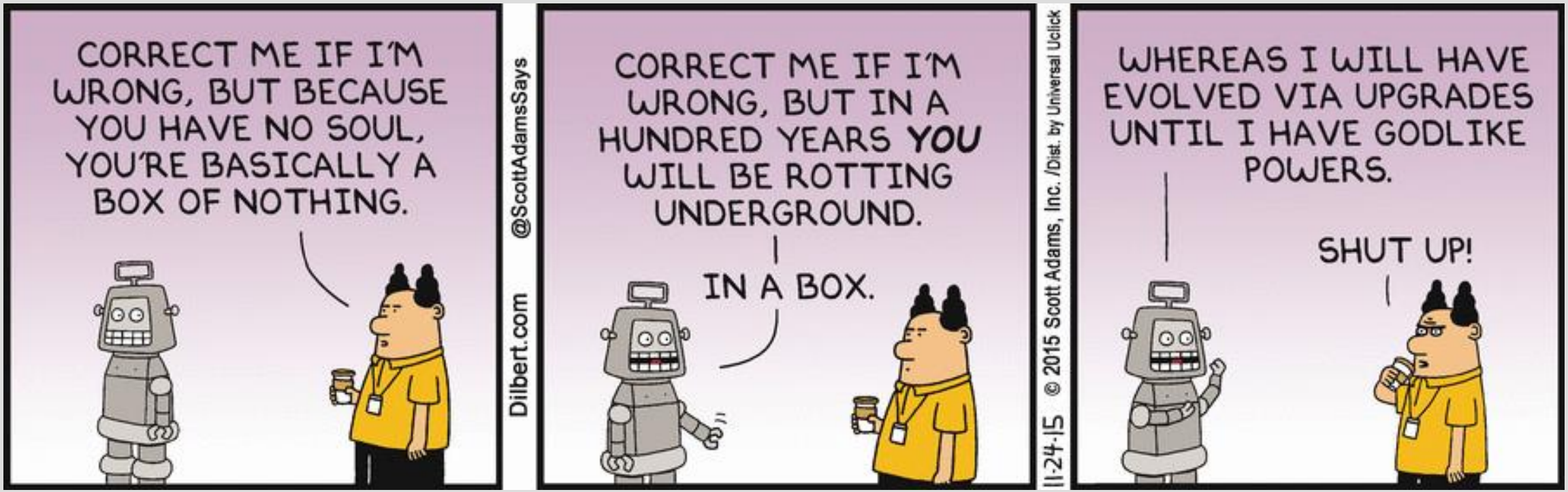

Ruth Aylett, Frank Broz, Ayan Ghosh, Mei Yii Lim, Peter Edward McKenna, and Gnanathusharan Rajendran. Do you think I approve of that? Designing facial expressions for a robot. Proceedings of the 9th International Conference on Social Robotics (ICSR 2017). Tsukuba, Japan, November 2017.
https://doi.org/10.1007/978-3-319-70022-9_19

Next steps for SoCoRo

Pilot of realistic office-based scenario involving robot interruptions

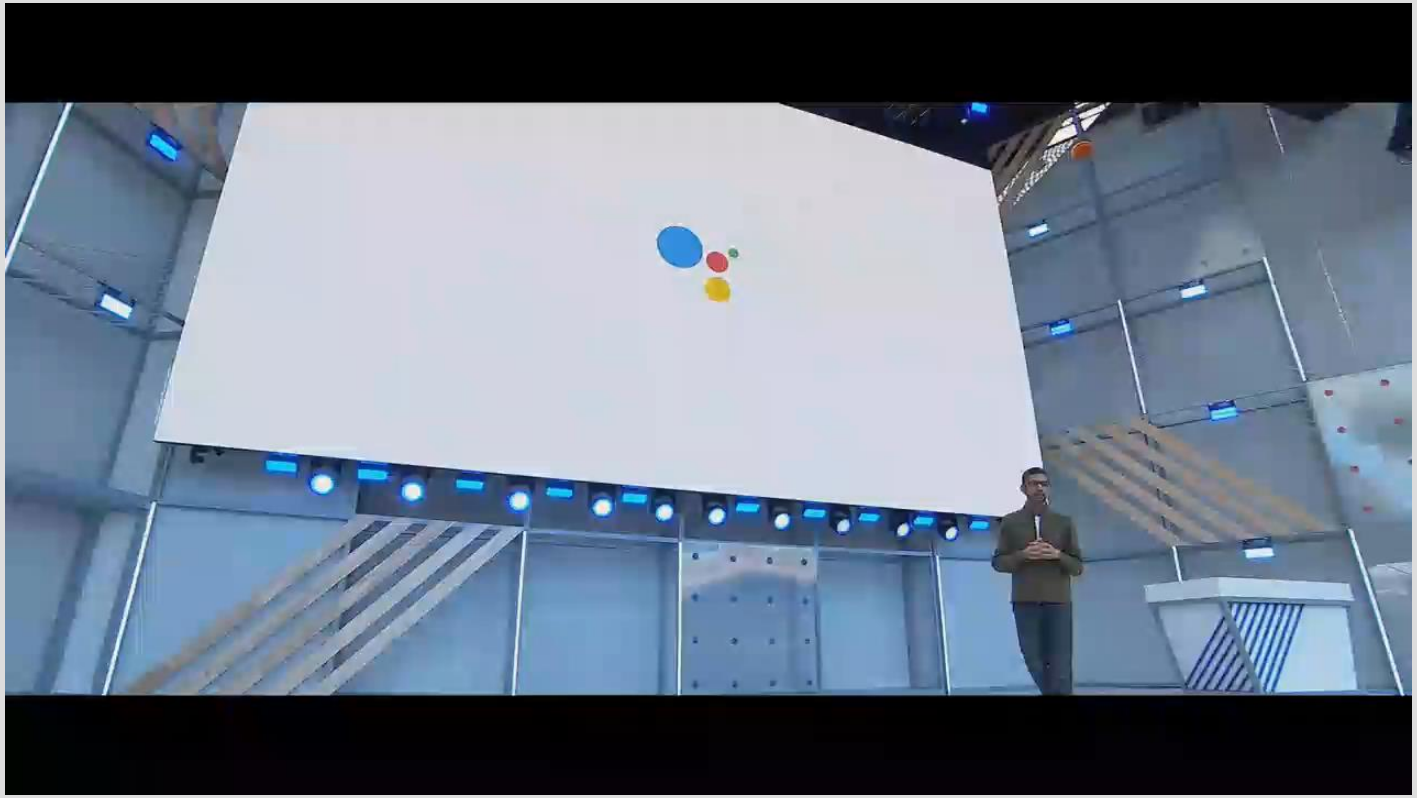
Development and integration of social signal processing components

Image from Kim and Mutlu (2014).
https://doi.org/10.1016/j.ijhcs.2014.05.005



http://dilbert.com/strip/2015-11-24

Google keynote speech, 8 May 2018



https://youtu.be/pKVppdt_-B4

GOOGLE | TECH | ARTIFICIAL INTELLIGENCE

Google's AI sounds like a human on the phone — should we be worried?

106

By James Vincent | @jjvincent | May 9, 2018, 11:12am EDT

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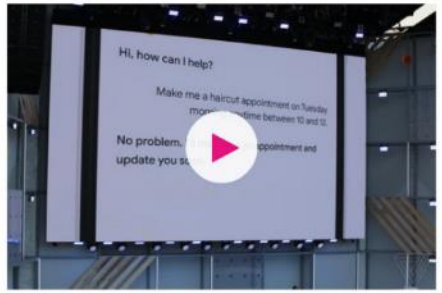

Google just gave a stunning demo of Assistant making an actual phone call

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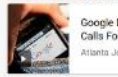

Google Duplex AI Can Make Calls For You
Atlanta Journal Constitution

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Google statement, 11 May 2018

"We understand and value the discussion around Google Duplex — as we've said from the beginning, transparency in the technology is important. We are designing this feature with disclosure built-in and we'll make sure the system is appropriately identified. What we showed at I/O was an early technology demo and we look forward to incorporating feedback as we develop this into a product."

Deactivating Janet

https://youtu.be/etJ6RmMPGko

EPSRC Principles of Robotics

Robots **are not** responsible parties under the law

Users **should not** be deceived about their capacities or status

People are eager to anthropomorphise robots – can lead to confusion about robots' nature

Opens the door to all sorts of manipulation by government and private enterprise

Another perspective (Prescott, 2017) "Robots are not just tools"

"We are entering an era where there will be new kinds of entities that combine some of the properties of tools with psychological capacities that we had previously thought were reserved for complex biological organisms such as humans."

Robot companions: major research effort currently underway

- Companions – reciprocal relationship marked by an emotional bond
- Could robots be tools **and** companions?

Can robots ever possess "real" emotions and intelligence?

- Nature of emotions/intelligence hotly debated in neuroscience
- No *a priori* reason these capabilities could not be shared by machines

Tony J. Prescott (2017) Robots are not just tools, Connection Science, 29:2, 142-149, DOI: 10.1080/09540091.2017.1279125

Take-home messages

Humans are inherently social creatures and want to interact with everything

Physical embodiment influences people's interactions

"Uncanny valley" – may be due to perceptual mismatches

Examples:
- JAMES, SoCoRo (lab-based interaction)
- MuMMER (real-world interaction)

What if we succeed in building truly social robots?
- Practical implications
- Ethical/societal implications

(My opinion) social robots are useful (and fun to work with!), but we need to be extremely clear about their robot nature!

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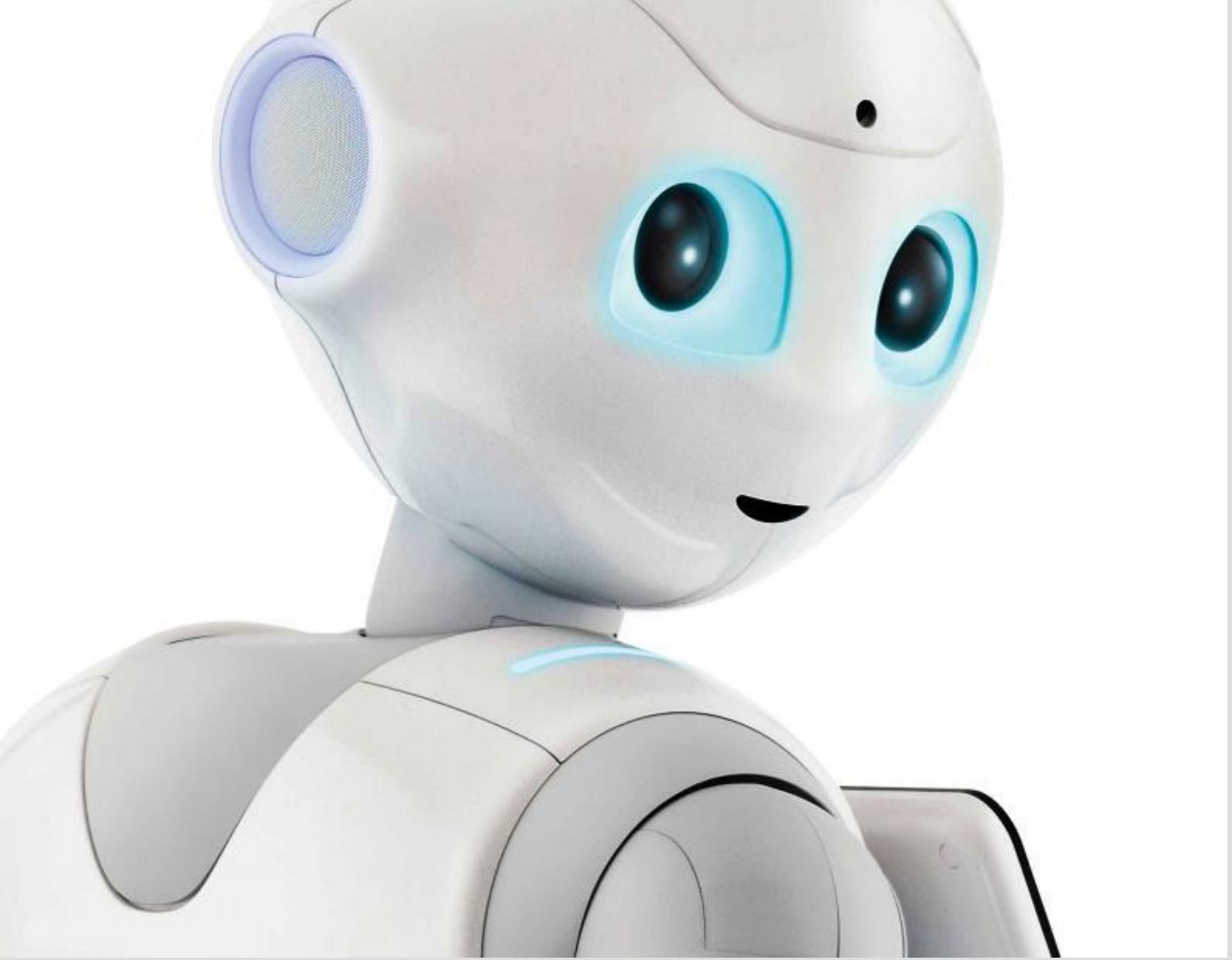
Centre for Doctoral Training: "SOCIAL" http://social-cdt.org/



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