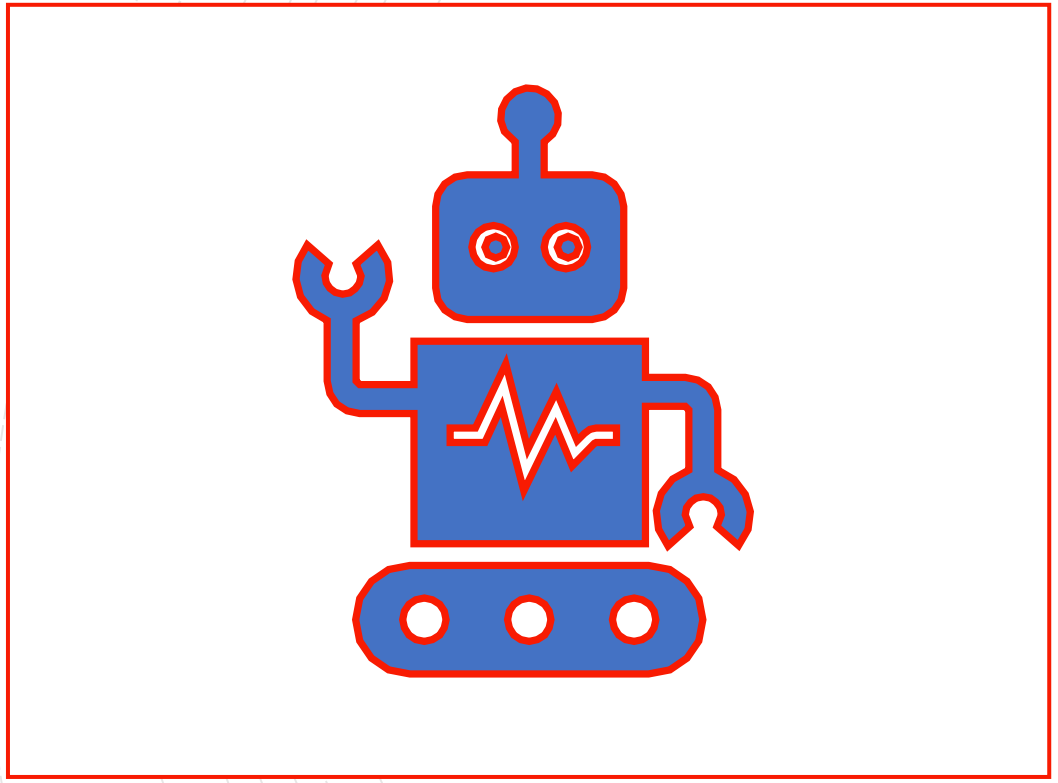
Section 8

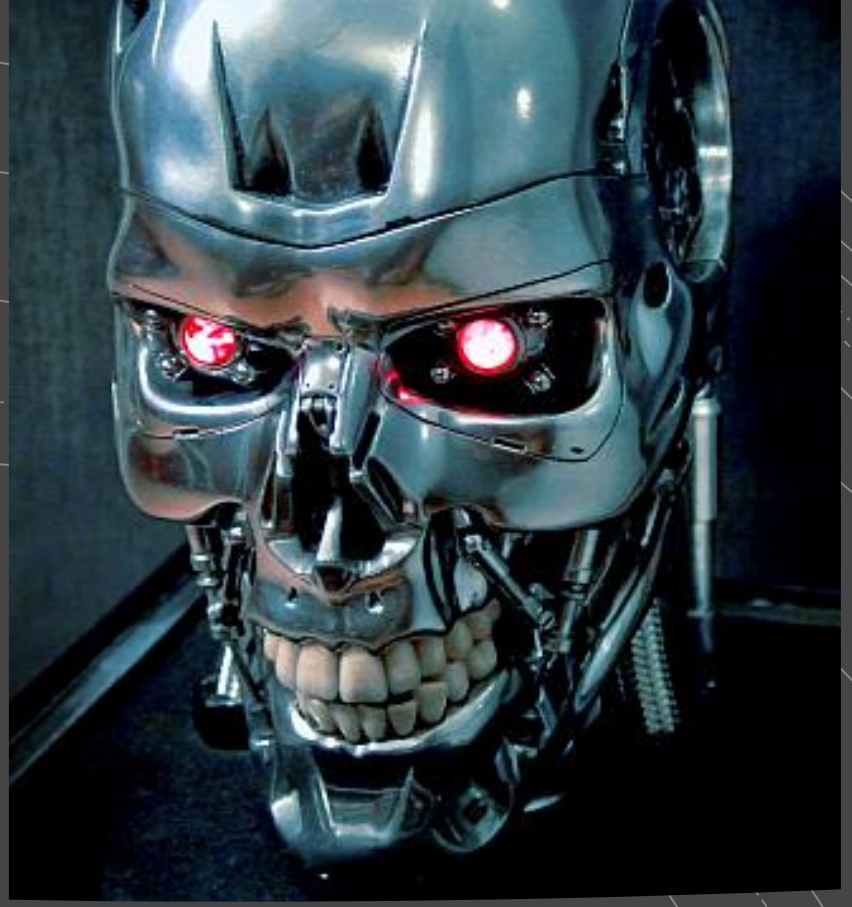
Design Considerations for Human Engagement

sinead.barton@mu.ie

Making a Machine Likeable

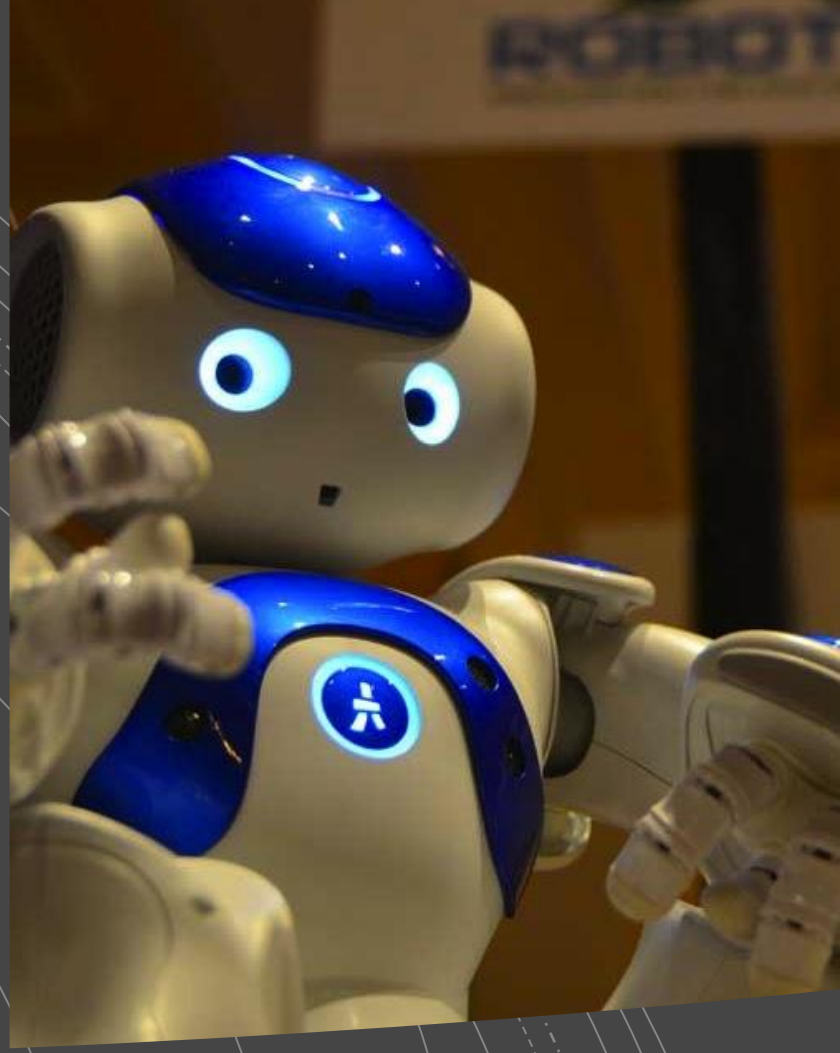


- For robots to become accepted as part of society they must be likable
- Humans must want to engage with and enjoy engaging with the robots
- You may already unconsciously understand some of the design rules listed in this section but here we will formally define what it takes to make a machine likeable



Robots that illicit a negative emotional response

- Skeletons and horror movies
- Despite your best intentions, emulating life-like creatures and generating resembles to skulls, exposed muscles and veins, not a good idea



Robots that illicit a more positive emotional response

Design Considerations for Human Engagement

1. How the Robot Looks
   - Visual Shape
   - Facial Features
2. How the Robot Moves
3. How the Robot Sounds
4. How the Robot Interacts
   - Character Development
   - Cues to internal Processes

How the Robot Looks

1. Design Aesthetics

The Uncanny Valley

- The uncanny valley phenomenon was put forth in an article in "Energy" in 1970 by Japanese robotics expert Masahiro Mori. But before that, Ernst Jentsch wrote about "**the uncanny" in a 1906 essay**, and Sigmund Freud followed up 13 years later. It has been sinced been backed up with psychological and medical studies.

- When there are elements that are both human or nonhuman, this mismatch can produce an eerie sensation in the brain," MacDorman said. "It's when different parts of the brain are coming to different conclusions at the same time."

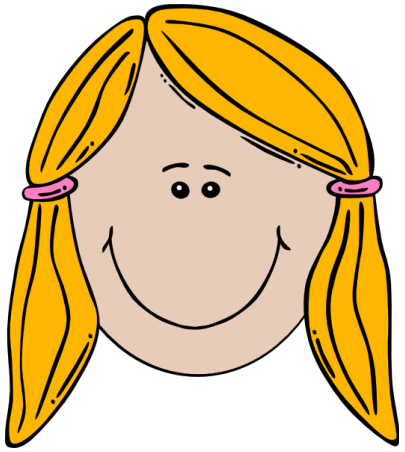
The Uncanny Valley

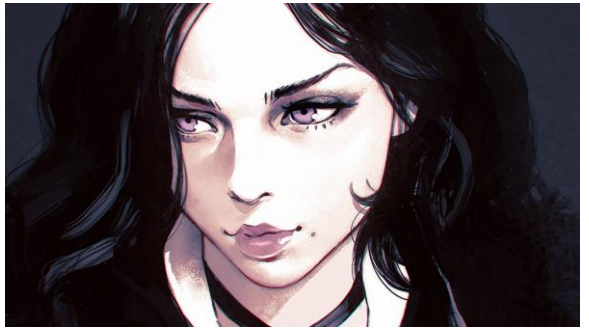
- From an evolutionary perspective, humans have developed an aversion to sickness, and a creepy-looking almost-human might tap into our internal system that warns us against sources of disease. In relation, we evolved to choose mates who are healthy, and weird robots may set off the same warning bells that told our ancestors to stay away from unfit mates.

- The "uncanny valley" effect is a challenge for making things friendly but it is excellent if you want to make some creepy – as for a horror movie

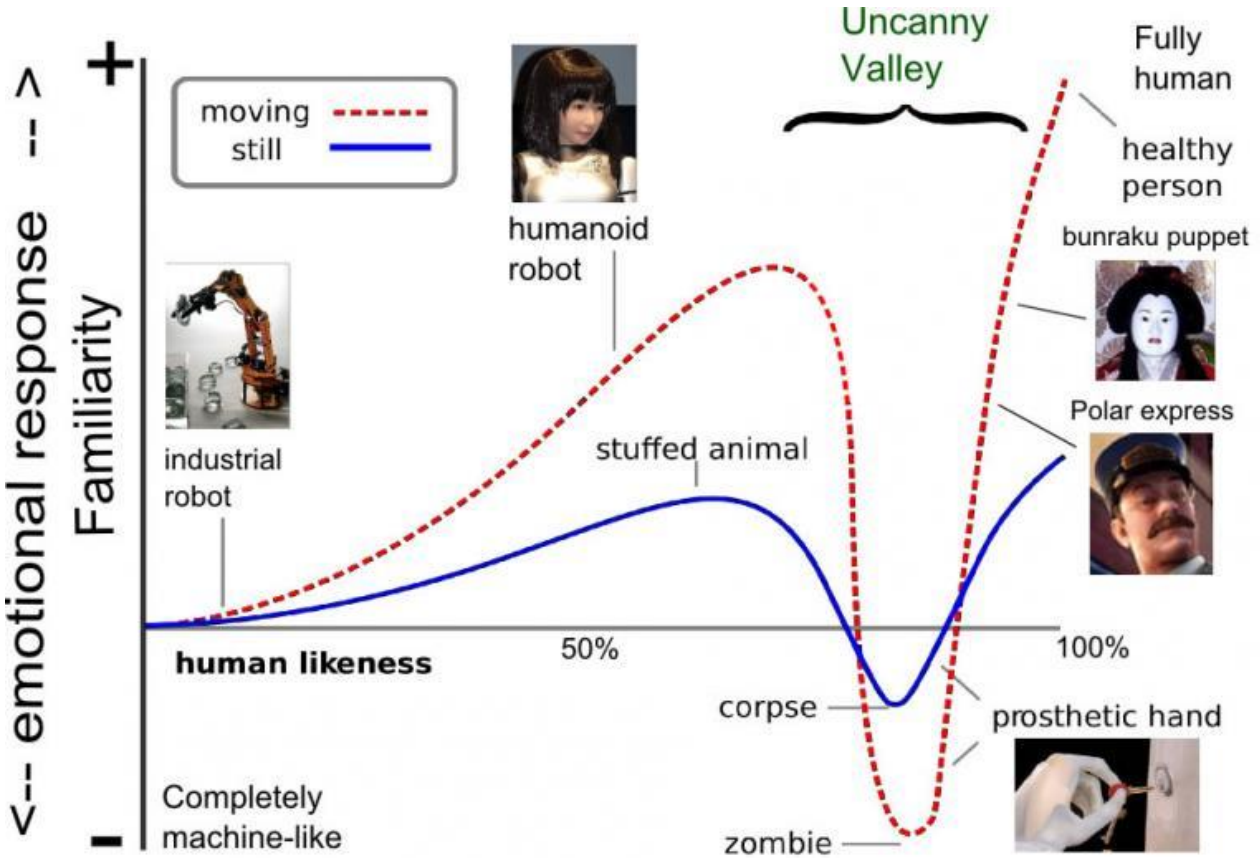
The Uncanny Valley

Which pictures are the easiest for you to relate to as being realistic?

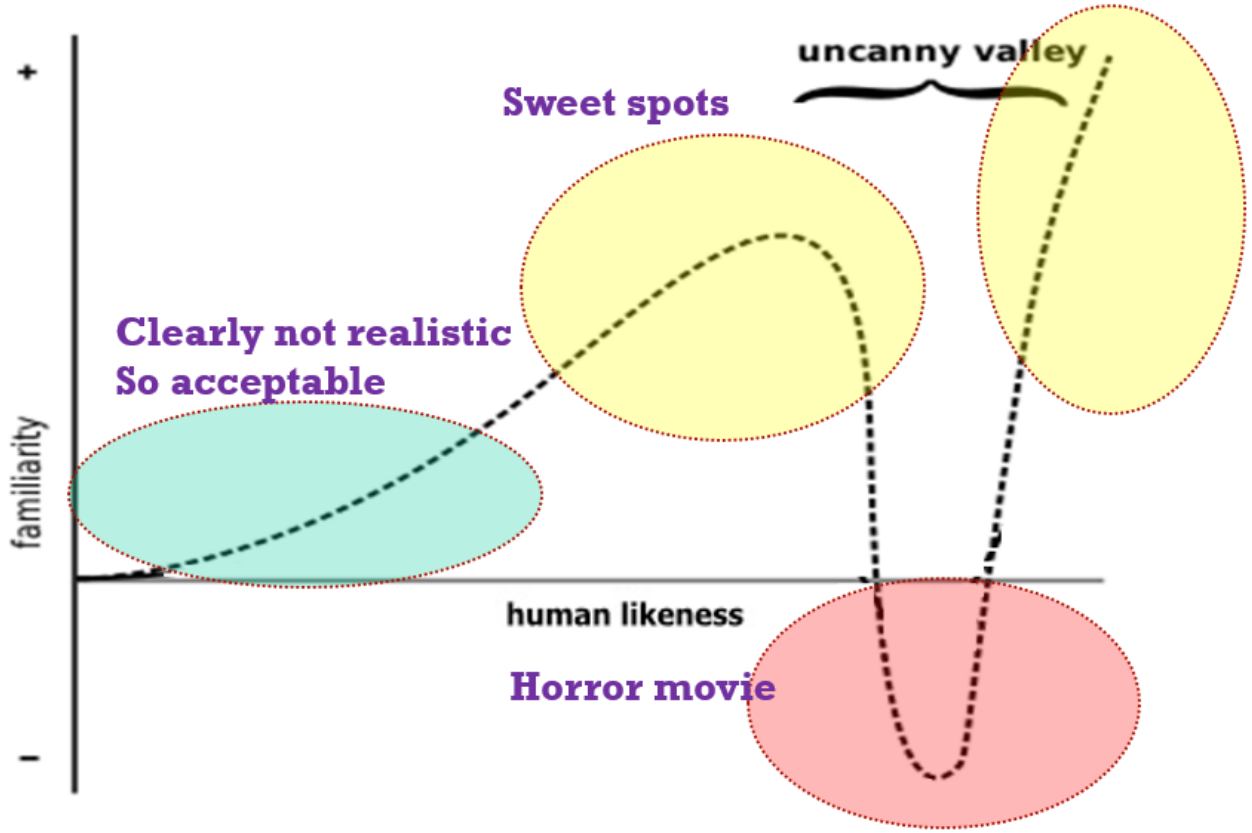




The Uncanny Valley



The Uncanny Valley



When its close enough to trick our mind to be "real" but our subconscious expectations say it is not

Avoiding the valley

We’re not expecting the “alien” to be human

Avoiding Uncanniness - Resolution

- For more realistic faces with photorealistic textures and more polygons, participants pursued the "best" face by tweaking the eye separation and face height until they were very close to the actual, real face the images were based on. For less realistic faces with lower polygons and less detailed textures, the ranges of acceptable eye separations and face heights were much larger.

- In a follow-up experiment the researchers asked the participants to adjust the sliders to produce "the most eerie" face instead of the best one. Again, when faces were more realistic looking, it didn't take much tweaking to make them look creepy, but when the faces were more stylized and less detailed, a wider amount of facial distortion was acceptable before things looked eerie.

Contour Bias

- Contour bias is a tendency to favor objects with curved contours over objects with sharp angles or points. If you think about it on a subconscious level this makes a lot of sense.

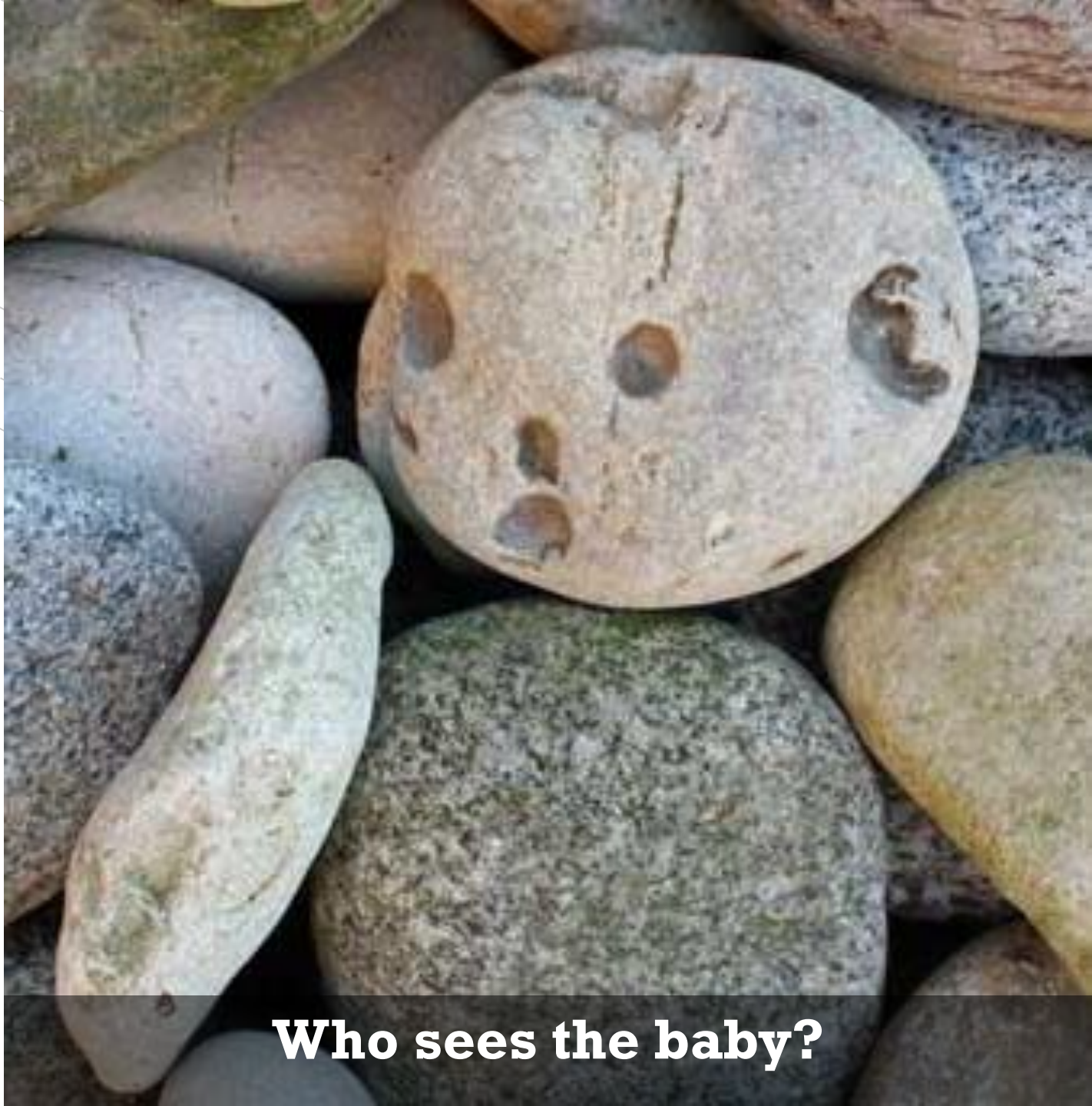
- Sharp and pointed objects can be used to stab and cut. They are potential threats to us physically. They lead to a subconscious processing of fear in a region of the brain called the **amygdala.**

- In contrast softer curves aren't seen as a threat and so are preferred. They aren't going to hurt us. There is no fear associated with them, no defense mechanism activated when viewing them.

http://vanseodesign.com/web-design/anthropomorphic-forms-part-ii/

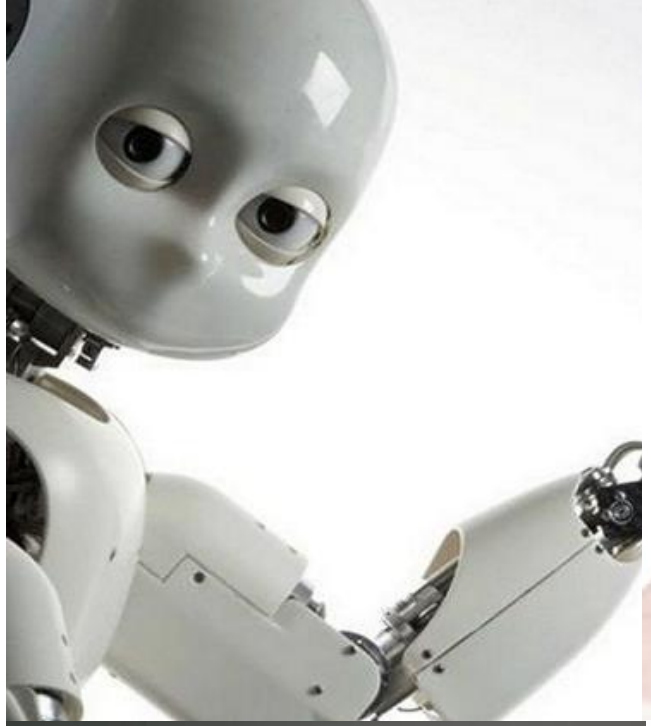
Anthropomorphic Shapes

Using visual cues to spot familiar shapes in unusual places



Baby Like Shapes

- Big Round eyes
- Bright eyes
- Round face
- Pudgy arms and fingers
- Big open mouth
- **NO teeth**
- White (I know, biased)



Colors


COLOR EMOTION GUIDE
OPTIMISM CLARITY WARMTH
FRIENDLY CHEERFUL CONFIDENCE
EXCITEMENT YOUTHFUL BOLD
CREATIVE IMAGINITIVE WISE
TRUST DEPENDABLE STRENGTH
PEACEFUL GROWTH HEALTH
BALANCE NEUTRAL CALM
DIVERSITY

Color	Positive	Negative
RED	Physical courage, strength, warmth, energy, basic survival, 'fight or flight', stimulation, masculinity, excitement.	**Defiance, aggression**, visual impact, strain, danger
BLUE	Intelligence, communication, trust, efficiency, serenity, duty, logic, coolness, reflection, calm.	**Coldness**, aloofness, lack of emotion, unfriendliness
Yellow	Optimism, confidence, self-esteem, extraversion, emotional strength, friendliness, creativity.	Irrationality, fear, emotional fragility, depression, anxiety, suicide.
Green	**Harmony, balance, refreshment**, universal love, rest, restoration, reassurance, environmental awareness, equilibrium, peace.	stagnation, blandness, enervation (**and evil if your Disney**)
Purple	Spiritual awareness, containment, vision, luxury, authenticity, truth, quality.	Introversion, decadence, suppression, inferiority
Orange	Physical comfort, food, warmth, security, sensuality, passion, abundance, fun	Deprivation, frustration, frivolity, immaturity
Pink	Physical tranquillity, nurture, warmth, **femininity**, love, sexuality, survival of the species	Inhibition, emotional claustrophobia, emasculation, physical weakness
Grey	Psychological neutrality.	Lack of confidence,, depression, hibernation, lack of energy
Black	**Sophistication, glamour**, security, emotional safety, efficiency, substance.	**Oppression, coldness, menace**, heaviness
White	sterility, clarity, **purity, cleanness, simplicity, sophistication, efficiency**	**Sterility, coldness**, barriers, unfriendliness, elitism
Brown	Seriousness, warmth, Nature, **earthiness**, reliability, support.	**Lack of humour, lack of sophistication**

Colors

http://www.colour-affects.co.uk/psychological-properties-of-colours

Design Rules

- Use feminine body proportions to convey nurturing and vitality
- Use round forms to convey **babylike impressions and non-threatening physiques**
- Use angular forms/points to convey aggression or to attract attention to something
- Pick colours that resonate with your message, or are calming

Friendly Corporate Logo?

Male or female?

How the Robot Moves

2. Design Aesthetics

Add Movement

- We expect movement.
- Life-like characters that do not move look like "corpses"
- We will not react well to them.
- There is a reason store mannequins unsettle people and often they are left without heads and arms.

The Expectation of Movement

- The researchers hooked study participants up to the fMRI so that they could examine brain activity while looking at three video clips: an android with its exterior shell stripped away so that it was obviously a robot, the realistic looking Repliee Q2 android, and the actual human woman upon whom the android's appearance was based. They found that the "**movement perception system**" in the **parietal cortex of the brain** were much more active when looking at the realistic android.

- A robot moving like a robot? No problem.
- A human looking all human-like? No problem.
- Something they thought would move like a human instead moved like something non-human causes a very different reaction.

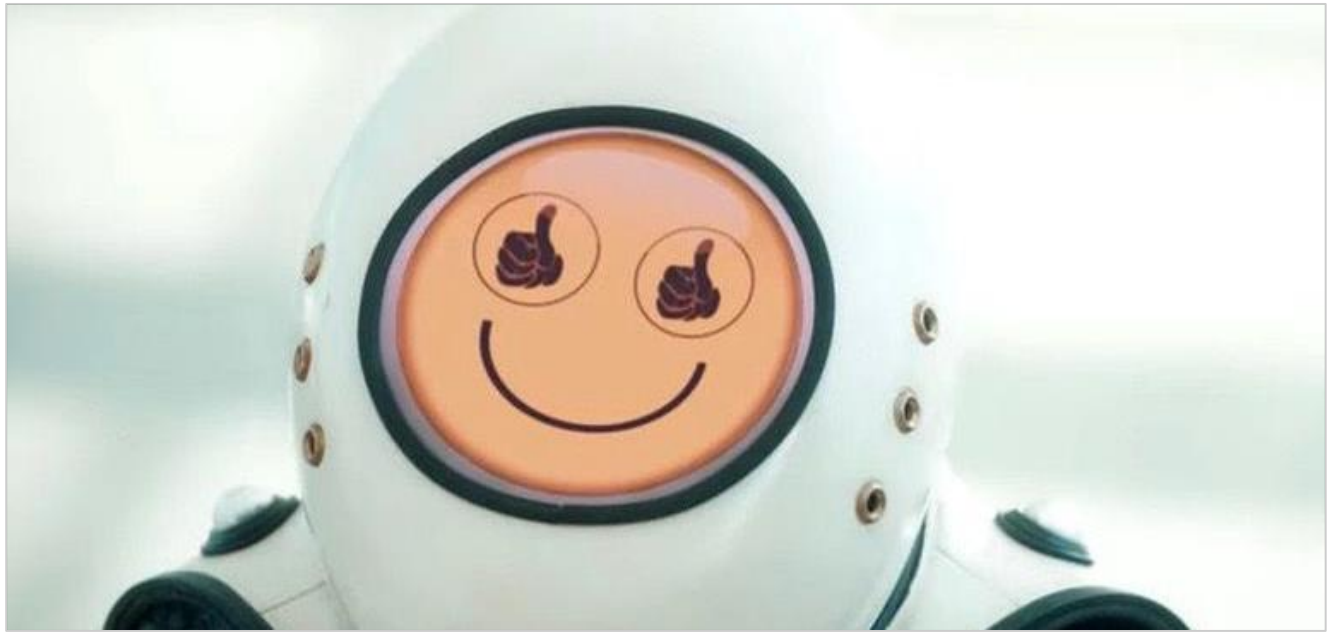
Movement - Visual cues

- *If the robot does something and they didn't expect it, that's uncomfortable and not very appealing," he said. "The head motion is extremely important. You really need to have that anticipation before the action or it gets creepy."*

- We do not like the idea of machines doing things without us having some idea on whether they are working or not.

  - We don't want to be surprised when something happens
  - We don't want to feel powerless – through lack of knowledge

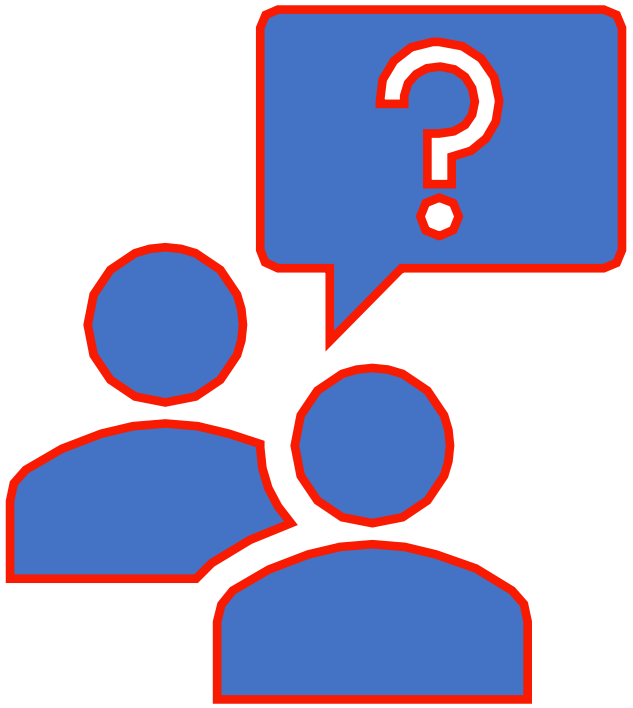
Movement - Visual cues



- So this can be as simple as:
  - LEDs to show when it is on
  - Different sounds or lights for when it is working or about to start
  - A face showing different emojis or symbols
  - Some movement to give you a cue.

Cues - Misunderstanding

"If you have any kind of cue in there that isn't correct, people will misread it." He compared this to the different ways that people smile: If you smile but not with your eyes, people will perceive it as insincere; if you smile very broadly, it can appear sarcastic. "Everything that's there has to play perfectly together, or people are going to start reading the wrong body cues."



Cues - Misunderstanding

01

Cues that are un-lifelike, eg LEDs, clearly artificial sounds are clearly understood as such and you have a lot of freedom to use them.

02

If you get realistic and the human subconscious starts doing the processing – sound or visual or movement – then it is very easy to become "creepy" or send the wrong message.

03

Warning: Movement that is wrong is picked up much more quickly than errors in a picture – very hard to get right!!! Movement analysis uses more of our evolutionary brain processes.

Making a likeable Machine - Animation

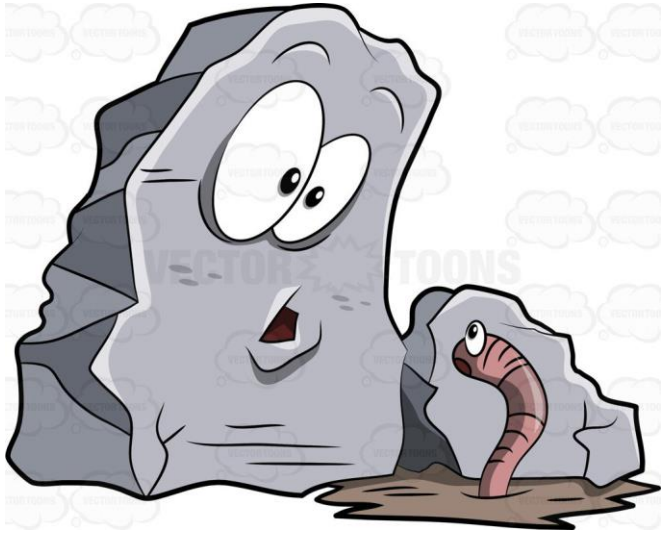
- Animation is all about the sparsest way to communicate intention," he says. "We weren't saying 'this is a human.' We were saying, 'this is a machine that gives you some of the cues we [as humans] use to understand social beings in the world.'" *https://qz.com/958335/why-do-rethink-robotics-robots-have-eyes*

- Its about simplifying down to the minimum required – body shape, expressions. We accept imperfection when its clear that we are not trying to be perfect.

- Knowledge of the cues makes it easy to "trick" us into getting the right message

Animation

This works with inanimate objects as well as animate



How the Robot Sounds

3. Design Aesthetics

Sound

- Often an appealing voice is more about pitch and intonation than what words are said.
- There are certain characteristics of human communication that can be reflected in artificial sounds
  - A higher tone often means a positive response
  - A lower tone often means a negative one
- Sound is also useful as a means of interaction as it is a global effect. You do not need to be looking at the machine/robot to capture the interaction.

http://www.dcs.gla.ac.uk/~stephen/grants/ToolkitCFS.PDF

Things to be aware of

- Certain sounds are “creepier” than others. Usually due to odd-harmonics being introduced and voice distortion
  - Feedback and metallic noises
- Unnatural Pauses
  - This can be difficult to listen to for long periods of time
- Monotone
  - This is boring and does not convey emotion
- Accents
  - Some accents are less liked than others

How the Robot Enages

4. Design Aesthetics

Ethology

Ethology: the study of a species behaviour and social organization from a biological perspective

The following example was for a dog and came from the SONY AIBO ROBOT DOG

Main behavioral subsystems of the dog

Investigative (searching/seeking)
Sexual
Epimeletic (care and attention giving)
Eliminative (excretion and urination)
Et-epimeletic (attention getting or care soliciting)
Ingestive (food and liquids)
Allelomimetic (doing what others in group do)
Comfort-seeking (shelter-seeking)
Agonistic (associated with conflict)
Miscellaneous motor
Play
Maladaptive

http://www.sciencedirect.com/science/article/pii/S0921889002003755
http://ieeexplore.ieee.org/abstract/document/1400763

Ethological Perspective

You can break down behaviours to a set of weighted decisions – do this if you get these inputs

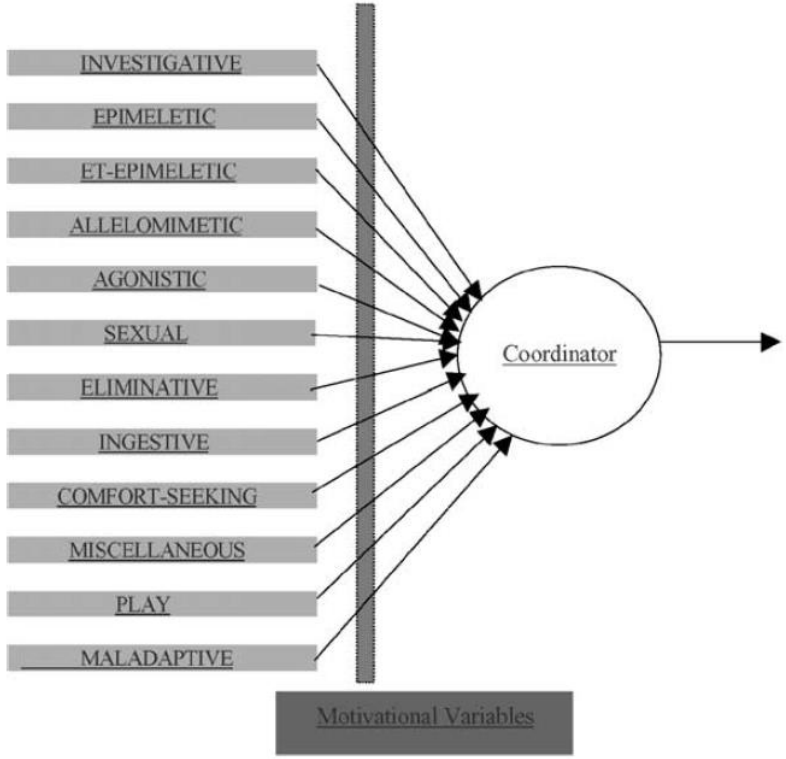
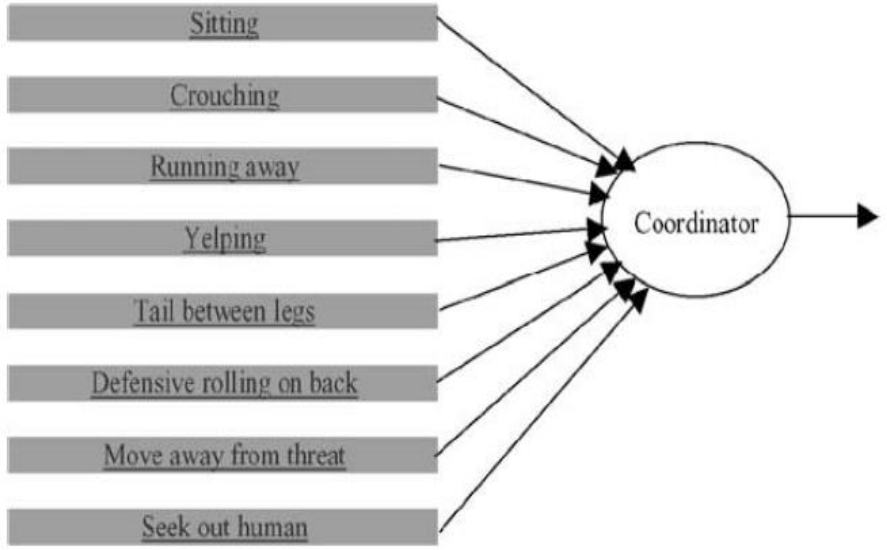


Fig. 3. Modes comprising agonistic subsystem.



http://www.sciencedirect.com/science/article/pii/S0921889002003755
http://ieeexplore.ieee.org/abstract/document/1400763

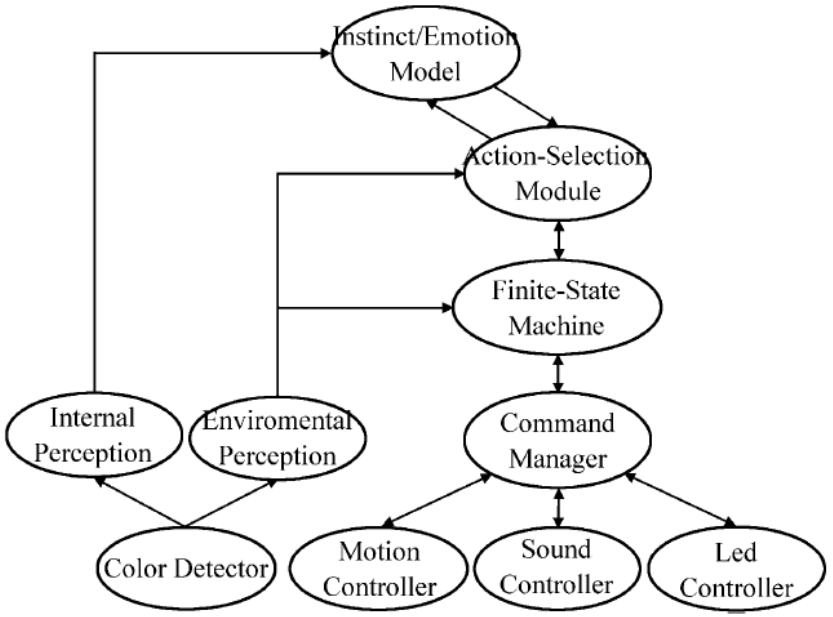


Fig. 8. Software architecture.

- Only three partial subsystems, as shown in Fig. 11, are realized.
- Only three environmental objects, WATER, FOOD, and MASTER, can be discerned using visual color classification.

Ethological Perspective

- **Then you can start replicating behaviours and actions. The more detailed and representative the structure, the more realistic it will become**

Engagement

- *Engagement (in the sense of human-computer interaction) is defined as having cognitive components, but it is primarily understood as an emotion. User interaction is defined as any physical action of a user with a designed object or environment." Brenda Laurel.*

- More prosaically, we want our users to interact with our devices – we do not want them to shy away or feel repelled.

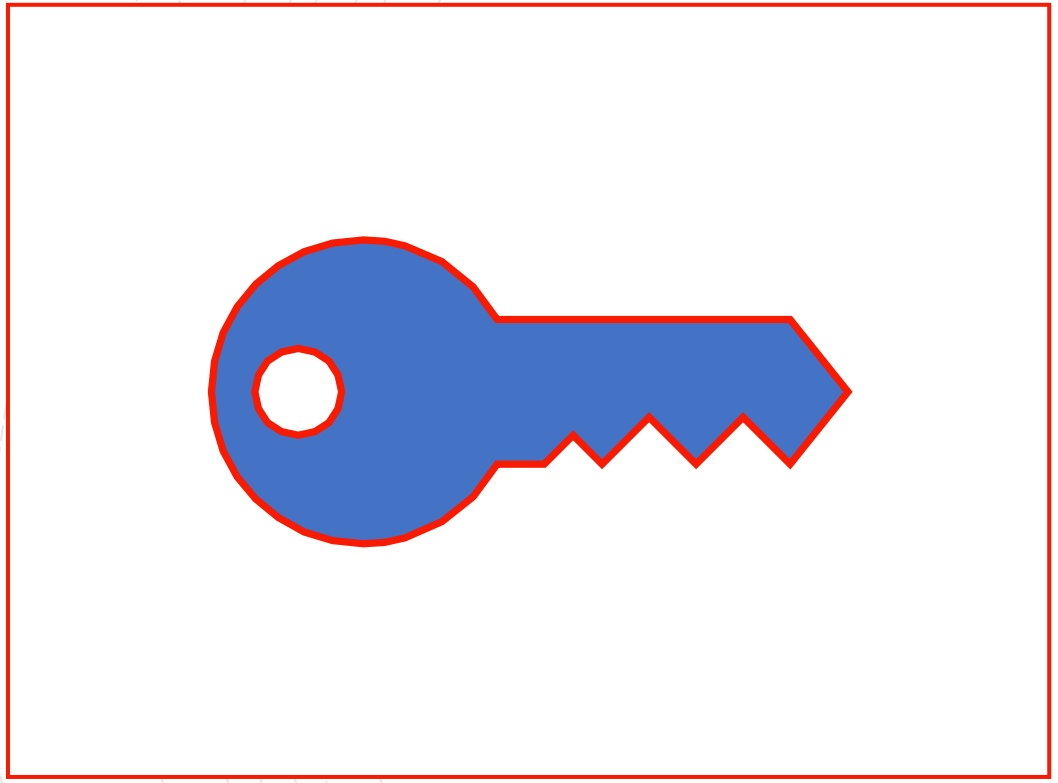
    - When people start engaging – they give personalities to objects
    - They accept the objects and are more comfortable around them

Engagement

- Personalities can be defined by
  - Prior experiences or branding (e.g. Barbie dolls, star wars BB8, Terminator)
  - The shape of the object
  - Sounds and movements

- With pre-defined personalities/characters, it is hard to go against the trend - cuddly/friendly terminator robots.

Key Characteristics



https://qz.com/se/machines-with-brains/1019711/what-makes-a-robot-creepy-versus-friendly-companies-are-hiring-pixar-engineers-to-figure-it-out/

- If you want to produce an engaging personality for your bot/robot, the 3 key characteristics
- **Humility:** a modest or low view of one's own importance; perhaps easier understood in the robot context – of not being pushy, arrogant, domineering. Don't make the humans feel weak.
- **Earnestness**: sincere and intense conviction, wanting to do something, to give the sense they want to do more, like an "earnest student"
- **Curiosity:** a strong desire to know or learn something
- So these can be combined to create different personalities. You can imagine a young child – not pushy, eager to learn, eager to please.
- You can imagine the dedicated servant: always there to help, eager, no conflict.