HUMAN-ROBOT INTERACTION
(NO NATURAL LANGUAGE)

5. EMOTION EXPRESSION

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EMOTIONAL OBJECTS

Since years, "emotional" experience with objects is considered as a key issue for their design

Up to now, the design focus has been on physical properties of static objects: shape, material, color …

We are ready to have the devices be active and inter-act

EMOTIONAL INTERACTION

Why?

- We expect it from any complex enough device
- It helps to build a relationship
- It makes sharing the life time more interesting

Who?

- People and "smart" devices

What?

- Show emotional signals

When?

- When "appropriate"

How?

… now comes the hard part…

LET'S START FROM THE BEGINNING…

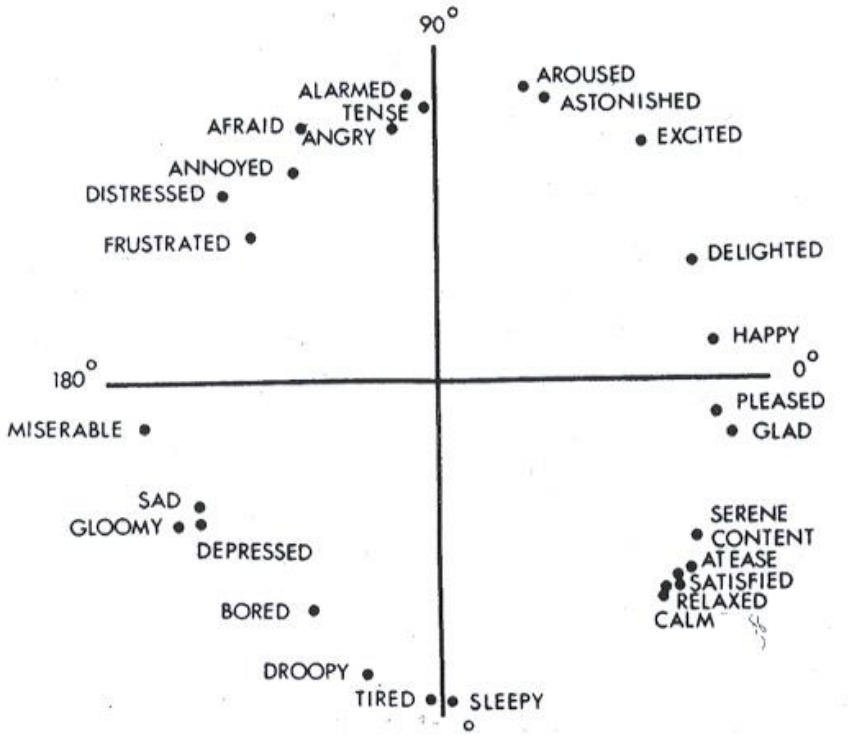
What is an emotion?

- In human beings it is a (complex) subjective physiological reaction to some external event
- For sake of communication we give names to emotions: happiness, sadness, disgust, …
- Emotions are different from other interesting, and often confused concepts:
    - Mood: a persistent state, triggered by some situation, decaying in time
    - Personality trait: a persistent attitude that pervades the activity, only in part modified by mood and emotions

FRAMEWORKS

Psychologists and philosophers proposed models to frame emotions.

One of the most used also by engineers is the circumplex model, where emotions are defined by two parameters: valence (positive <-> negative) and arousal (low <->high)



EMOTION EXPRESSION

In some fields the need for a description of emotional expression emerged

- **Cartoons: from the pioneering experiences of Disney's animators (The Illusion of life, 1981) to the need of teaching professionals**
- **Puppeteering, acting: mostly oral, qualitative tradition**
- **Dance: Laban (1946) and others defined ways to describe choreographies, so also "what" to describe, in qualitative terms**

All these refer to dynamic aspects of action, while body language (Ekman, 1984 -> Lie to me) mostly refer to posture.

Only some cartoons, some mimes (e.g., Mummenschanz), some movie-makers (e.g., R2D2) and some object designers work with non human-like objects that can show emotions

LABAN'S EFFORT

The model of emotion expression according to Laban is expressed by the dimensions of his *effort* .

- **Space** (direct or indirect). Space effort constitutes a single-focused or multi-focused approach to the environment.
- **Weight** (light and strong). Weight effort determines how I use the impact of my body weight during a movement, ranging from delicate to more forceful.
- **Time** (sustained or quick). Time effort reveals a deceleration or acceleration within movement.
- **Flow** (free or bound). Flow effort is responsible for the continuousness or ongoingness of motions, varying from uncontrolled to more controlled use of flow within movement.

HUMAN, NON HUMAN

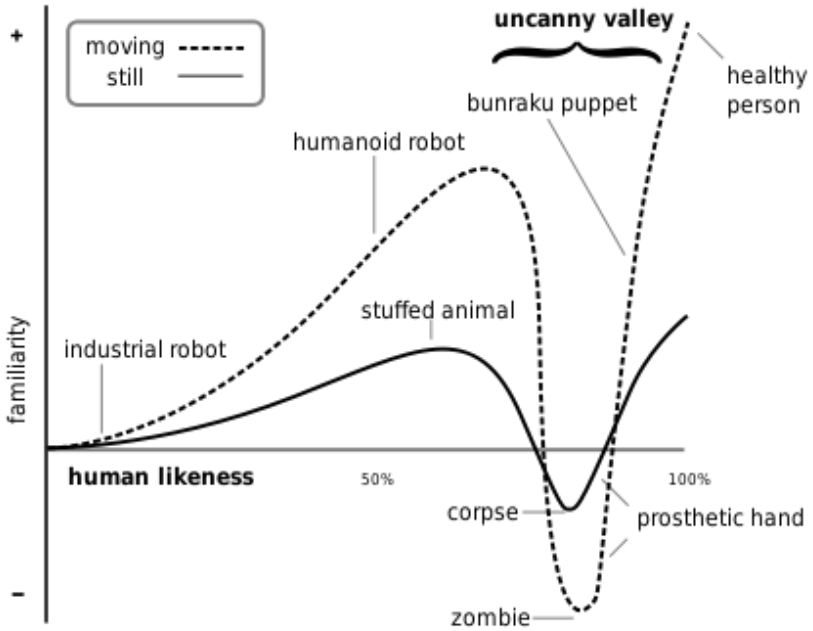
Most objects have a shape suitable for their function and no human-like characteristics

Emotion recognition and expression should be possible also for these devices, using the appropriate channels

UNCANNY VALLEY

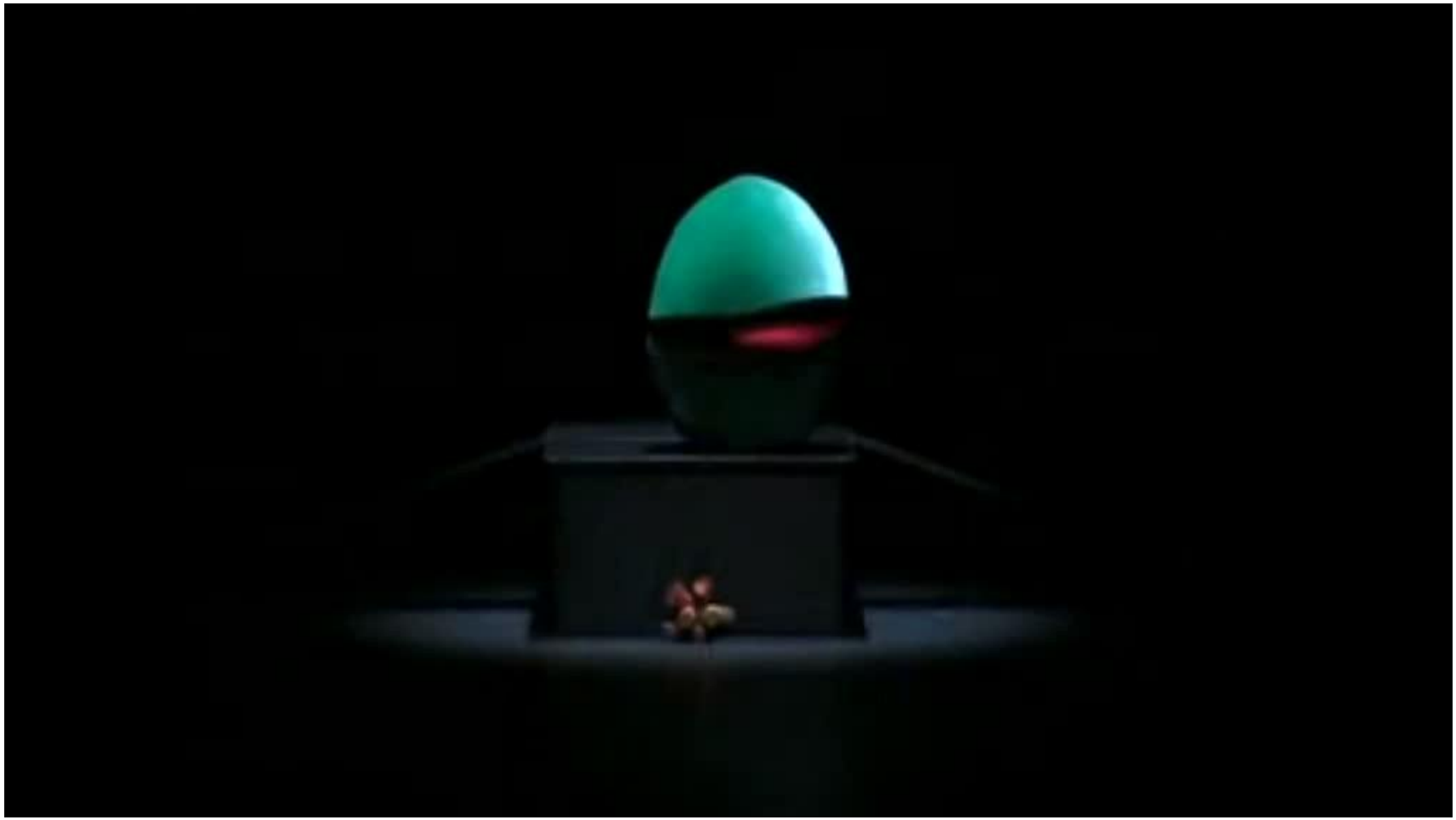
Uncanny valley conjecture (Mori,1971): familiarity with artificial objects rises with similarity with human up to a given point after which an uncanny valley opens where people feel the fake. We get out the valley when human-like features can be recognized.

This effect is stronger with moving (acting) objects than with still objects



SOME EXAMPLES

Mummenschanz



SOME EXAMPLES

Robotic lamp

THE BASIC ELEMENTS

Our aim is to investigate the basic features in objects' emotional expression

- Speed
- Acceleration
- Rhythm
- Trajectory

… but also body dimensions, and expectations coming from perceived weight or experienced movement.

EXAMPLES

The sluggish, slobbering Jabba cannot really be happy or sad: movements are irrelevant with respect to the too large body, without spoken words no emotion can be perceived

EXAMPLES

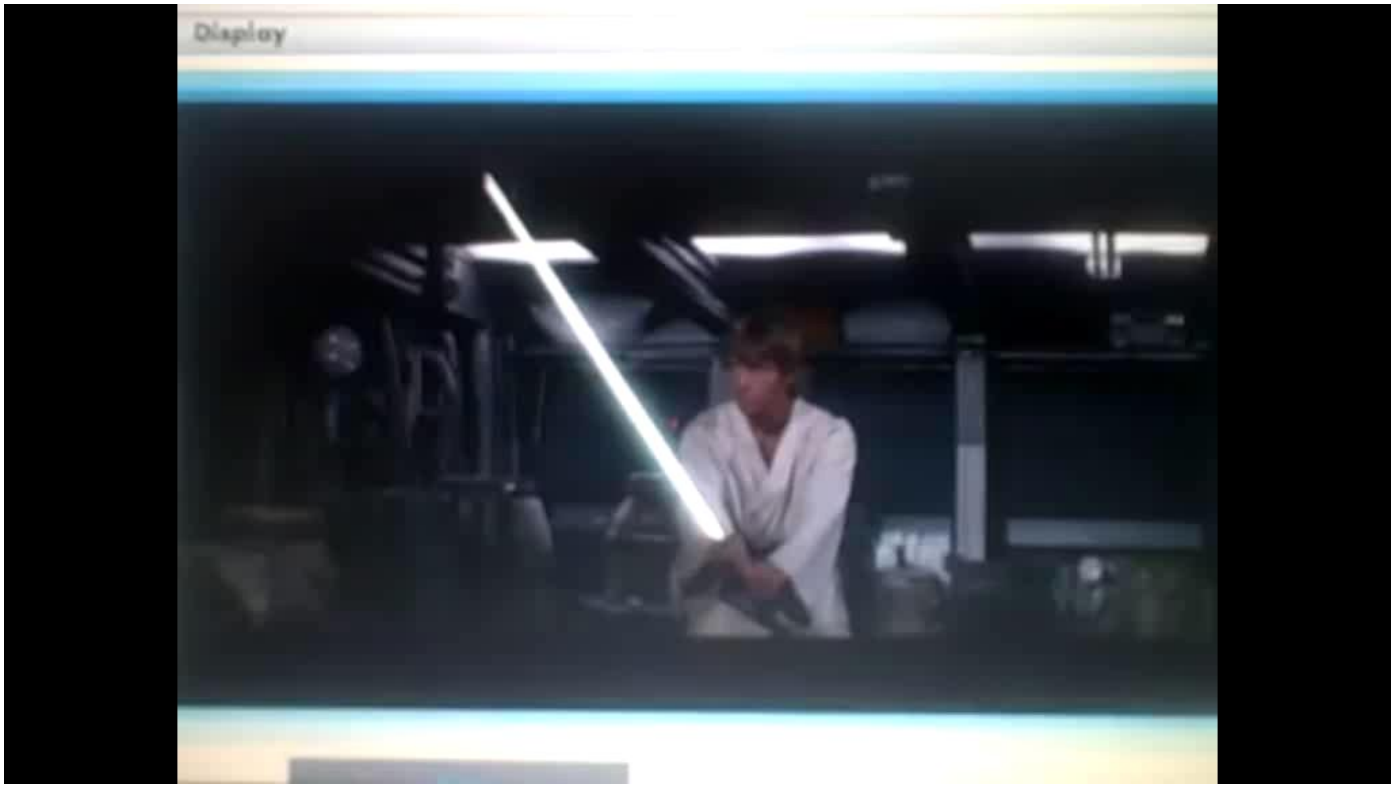
R2D2 cannot be happy or afraid without sounds, since its movement conveys signals inconsistent with emotional ones: almost constant speed, no body bending, only rotating head (sometimes used).

EXAMPLES

BB8, thanks to the "head" and tilting body, can show some emotional signals

EXAMPLES

The training drone in Star Wars is not a bad guy, just a little bit naughty…



EXAMPLES

The flying syringe in Dune is a bad guy, indeed.

EXAMPLES

We designed the drone in Jedi Trainer to be not too bad.

EMOTION ENGINEERING

The design of appropriate emotional interaction with a device requires an engineering approach.

The aims of this research are to identify the basic characteristics of a correctly perceivable, emotional signal, on any of the main available sensor channels: vision, hearing, touch.

Final goal: identify a parameterized model to express emotions, valid for any device with appropriate actuators.

A=f(speed, acceleration, rhythm, trajectory, …)

A ROBOT FOR AUTISTIC CHILDREN

(Polisocial project with Hoc Lab and Phy.Co. Lab (Design))

PUPPY

A robot recognized as an emotional pet also by ethologists

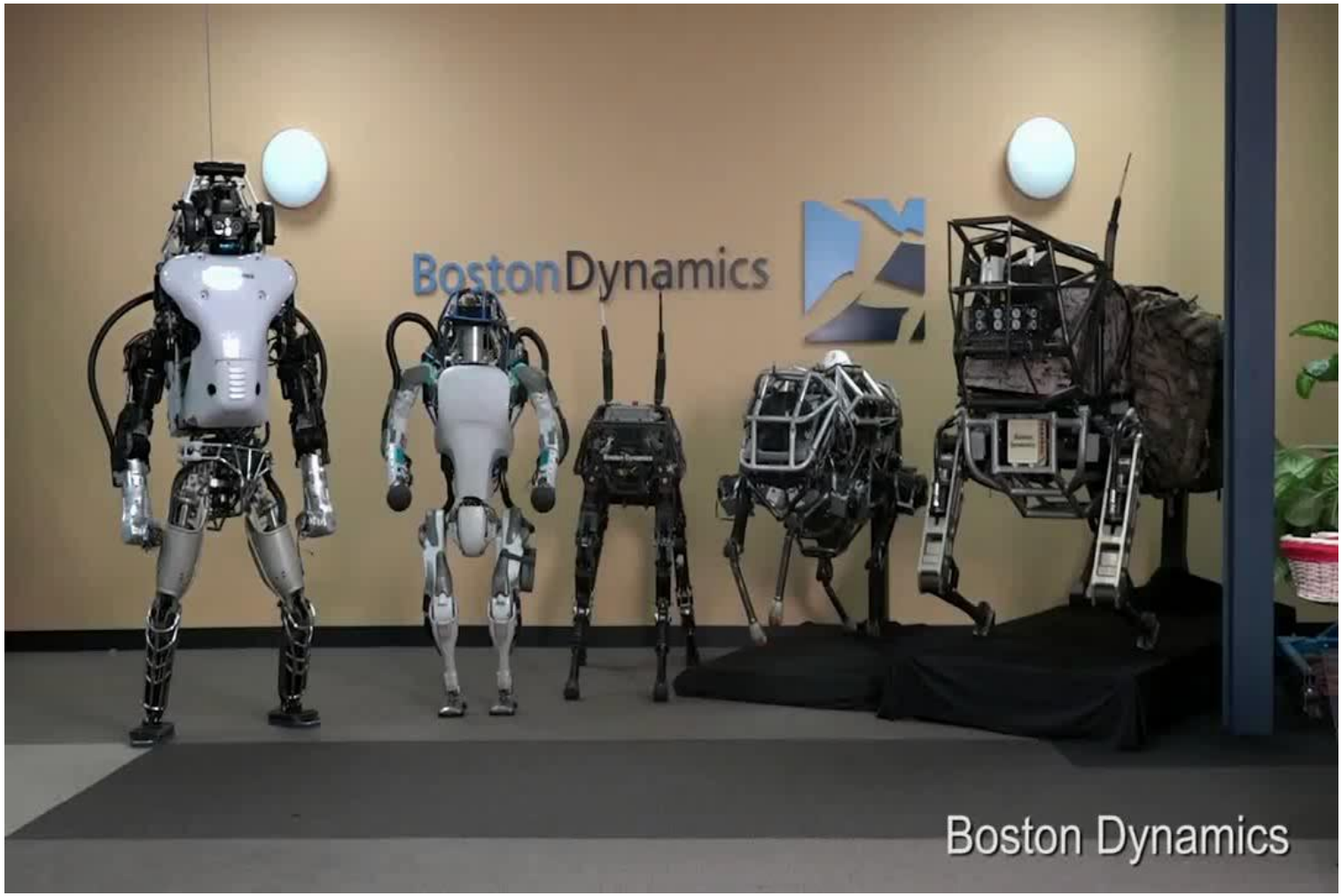
CAN A ROBOT FALL IN LOVE?

Maybe we should know what does it mean "fall in love"…

It is easy to make a movie…

Why should we make a robot that falls in love? It would be relatively easier to make a robot loved by people.

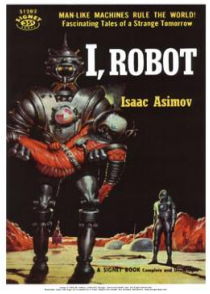
EMPATHY



ROBOT RIGHTS

Has a robot the right of self-determination?

- In the theatre piece RUR, robots get aware of their condition, rise against their human masters, and at the end all die
- As from the Asimov's Robotics Laws, robots are by construction subject to humans, execute their orders, keep them safe , and eventually act to save themselves
- Somebody is thinking to make autonomous cars liable for possible damages coming from accidents they have caused (trolley problem)



Hovever, what would a "free" robot be for?

IN CONCLUSION…

We could make **robot that understand** (at least to a certain extent)**, that seem to feel emotions, that could involve people.**

In few years we will have **interesting performances at market-compatible costs.**

In some niches (**elderly, co-working, games, disability, guidance**), we will have robot with which we will have to **establish social and emotional relationships.**

Let's **get ready**…