HUMAN-ROBOT INTERACTION
(NO NATURAL LANGUAGE)

7. TOYS

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PHYSICAL TECHNOLOGICAL TOYS

Physical, technological toys have:

- Embodiment – physical, tangible

- Actuators – to perform actions

- Sensors – to perceive physical entities in their environment

- Decison system – to react or decide what to do

BODY FEATURES

Many features analogous to non-technological toys

- Shape and affordance - what can be done
- Material (hard, soft, cold, warm, ...)

Some features possibly critical due to movable or delicate parts

- Technical solutions (elastic joints, coverage, ...)
- Precautions may be required, if the issue is not addressed in the design phase
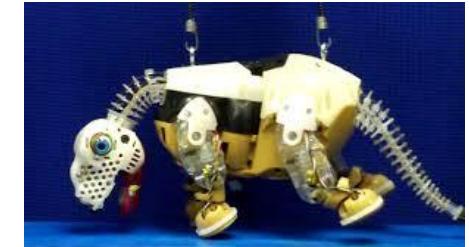
SENSORS

Perceive signals from the environment

- Sound (microphone) – intensity, frequence, words
- Distance/presence (infrared (IR) sensor, magnetic sensor.
- Color (color sensor, color camera)
- Touch (switch, pressure sensor, capacitive sensor, ...)
- Movement (IR, capacitive sensor, ...)
- Shape (camera, thermocamera, 3-D camera, ...)
- …

Most sophisticated signals require computational power to be interpreted as useful for the interaction.

THE TECHNOLOGICAL TOY CAN BE ACTIVE

It can propose activities

It can react to activity

It can play a social role

It has a personality

It exploits specific interaction channels

SHIFT OF PARADIGM

Single way interaction

Two ways interaction

PROPOSING ACTIVITY

Activity can be proposed by:

- Affordance – the way the toy is done and (re)acts

  The player can explore the toy, and the way the toy moves and reacts may trigger more or less expected activity

- Direct, autonomous proposal

  The device can ask or induce to perform some specific activity, engage in turn-taking, ...

- Remotely driven actions

  The co-player can drive the device to trigger and control interaction, without a direct involvement

AUTOMATIC, IMMEDIATE REACTION

Reaction can be used to:

- Establish a safe, shared code based on causal relationships
  one action -> one reaction
- Stimulate exploration – *What will happen if ...?*
- ...

Need to:

- Reliably detect the signal to trigger the reaction (appropriate sensing)
- Design the proper reaction
- Select the proper reaction

No failures can be accepted!

SOCIAL ROLE

A technological device can be used to trigger a social relationship

- Multi-user games
- Device driven by companions or operators
- Physical character in a story, possibly coming with actions and emotions
- Mediated interaction: *it's a toy, not a person...*

PERSONALITY

Most toys show a personality, more or less strongly conveyed just by their body

Technological toys can add channels to convey personality:

- Movement
- Sound
- Light

EMPATHY ISSUES

Emotional state **detection**

- (Simple) data elaboration (e.g., sound intensity, manipulation, …)

Empathic **decision**: what to do in order to show/induce empathy

Emotional state **expression**

- Coherent, expressive, integrated actions (sound, movement, …)

INTERACTION CHANNELS

Signals on the principal senses: sight, sound, touch
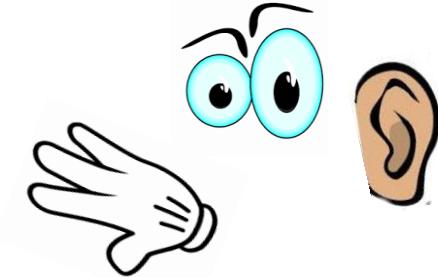
Possible activities:

- Movement
- Sound emission (clap, beep, music, speech,...)
- Lights

Expressiveness:

- Intensity
- Frequency
- Rhythm

AUTONOMY VS. REMOTE DRIVING

Autonomy

- ■ **Immediate reaction**

- ■ **Consistent repetition**

- ■ **Possible wide set of behaviors**

- ✖ **Sensor interpretation**

- ✖ **Pre-designed interaction**

Remote driving

- ✖ Reaction depending on operator

- ✖ Behaviors always different

- ✖ Difficult to activate many different behaviors

- ■ No sensor problem (operator)

- ■ Free interaction, possibly exploiting chances

Need to select/design the proper setting for the specific needs

EXAMPLE 1: TEO

Teo can:

Be remotely controlled

Show predefined beaviors

Say pre-recorded and written sentences

Move freely

Be integrated in games with screen and Kinect

Receive direct input from buttons

EXAMPLE 2: SKUNKY

Skunky can:

Eat

Show to be happy

Stay on table

Move on table

Sense touch

Sense proximity

Sense clapping

EXAMPLE 3: ROB-E

Rob-E can:

Move autonomously avoiding obstacles

Be driven remotely

Enlight with colors corresponding to that of the eated ball

Release the balls

EXAMPLE 4: ESPER

ESPer can:

Be driven by a joystick-like device

Be tuned at different difficulty levels

Be used by people with different abilities, also in competitions, once adapted at each one's ability

ESPer is a little owl–shaped alien

Flipper Bot
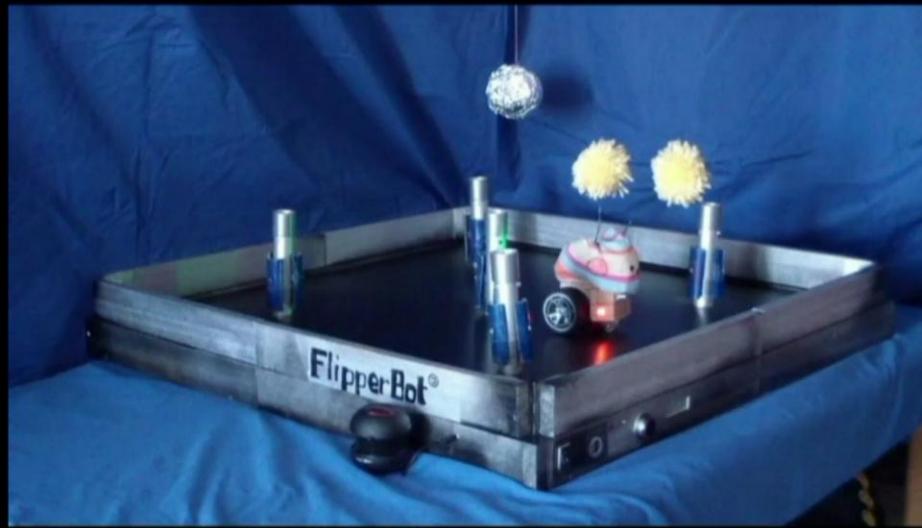
His job is to keep an
eye on some old satellites in the orbit of his planet

EXAMPLE 5: JEDI TRAINER

Jedi trainer can:

Maintain a distance from any user wearing the uniform

Challenge the user with movement

Shot laser blasts (sound)

Analyze image to evaluate score

EXAMPLE 6: ROBOTOWER

Robotower can:

Detect towers

Detect cards and act in consequence

Provide an external display of game state

EXAMPLE 7: ROBOWII

Robotowii can:

Detect targets

Detect gestures to select weapons

Detect shots

Stage 3: Robot wins, reaching home after recharging its energy at the red cone

SOME MARKETED ROBOTS

Some robots available on the market, reported as used also with kids or elderly with different abilities:

Paro **https://www.youtube.com/watch?v=bb5Png4cIS4**

- Autonomous, moving, but not displacing, making soundds and reacting to sound

Pleo **https://www.youtube.com/watch?v=uzLImB-Ckug**

- Autonomous, moving, slowly and clumsly displacing on legs, making soundds and reacting to sound and visual input

LEKA **https://www.youtube.com/watch?v=ermEmpfWtmY**

- Fast moving ball, sporting face, color LEDs, sounds, and reacting to sounds and visual stimuli

DASH

Emotional
movement