



**POLITECNICO**  
MILANO 1863

Department of Electronics,  
Information, and Bioengineering

**AIRLAB**  
ARTIFICIAL INTELLIGENCE AND ROBOTICS LAB

# Achieving empathic relationships with low cost robots: a need to get market leading positions

Andrea Bonarini

# A multi-million robot market

- Millions of robots entering this market every year,  
... most of them on the same week
- None of them is used in industry
- None of them costs more than 199€
- All of them are intended to play an interactive role with "critical" people
- Empathy is fundamental to achieve their purpose and satisfy customers



# Today's key factors

- Evolution of traditional plushes:
  - Shape
  - Material
  - Manipulation
  - Shelf
- Now they can move...
  - Quality of movement
  - Noise/sound of movement
- ... and react
  - Simple sensors
  - Simple reactions



Market issues

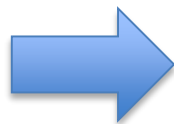


# Tomorrow's key factors

Single way interaction



Two ways interaction



The robot

- should react to non-explicit signals
- can take initiative
- should be believable
- should make the right actions



Market



... but microprocessors  
are coming!



# Empathy issues

## Emotional state **detection**

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

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

## Emotional state **expression**

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



# Research issues

- **Emotion detection/expression with poor and cheap tools:** sensors, actuators, computation.
- Definition of **non-traditional, cheap tools**, e.g., capacitive sensors, soft actuators, fluid-filled body parts, ...
- Definition of effective **algorithms** and methods to detect non-explicit signals from interaction, e.g., from manipulation
- Deep **analysis of signals** to be expressed and detected: what is relevant? What is perceived?
- **How to evaluate performance?** A wrong performance can cost millions on Xmas sales

*These research issues are relevant also for other products, and the "new" tools could be integrated (or substitute) other tools, such as, e.g., artificial vision and NL, which rise computation, reliability, cost, and privacy issues*

