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# The New Frontier of Robotics

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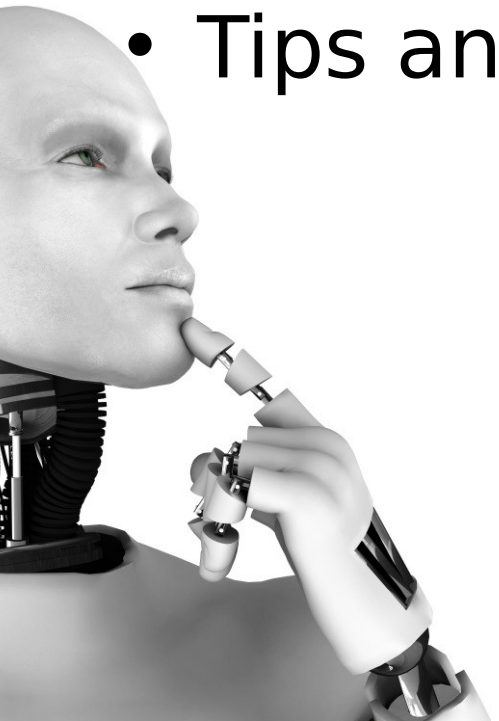
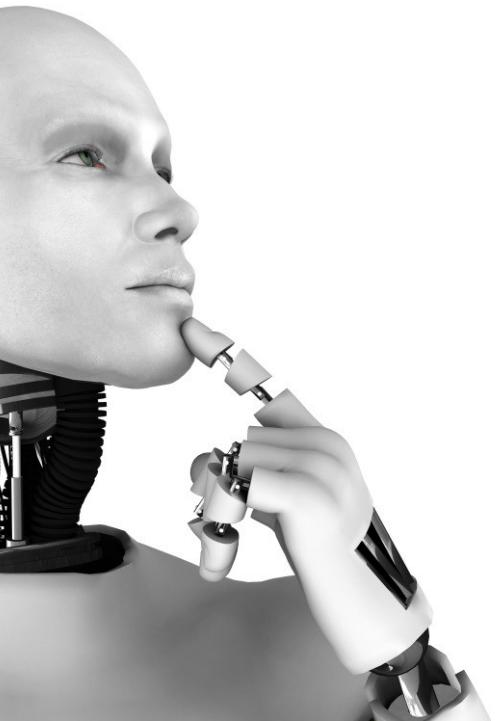
# Agenda

- What defines a robot
- Why look at robotics
- The new generation of robots
- Toolbox overview
- Tips and tricks

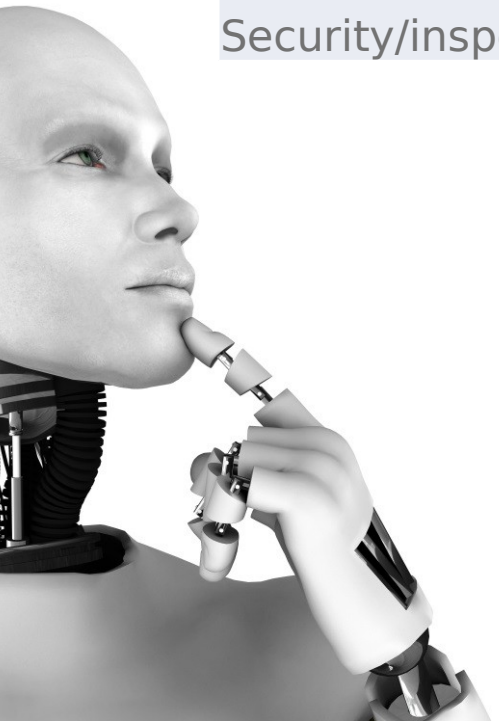


# What defines a robot?

- The Slavic word *robota* means literally worker or labour
- Many different definitions, e.g.:
  An autonomous/programmable electronic system with sensors and manipulators

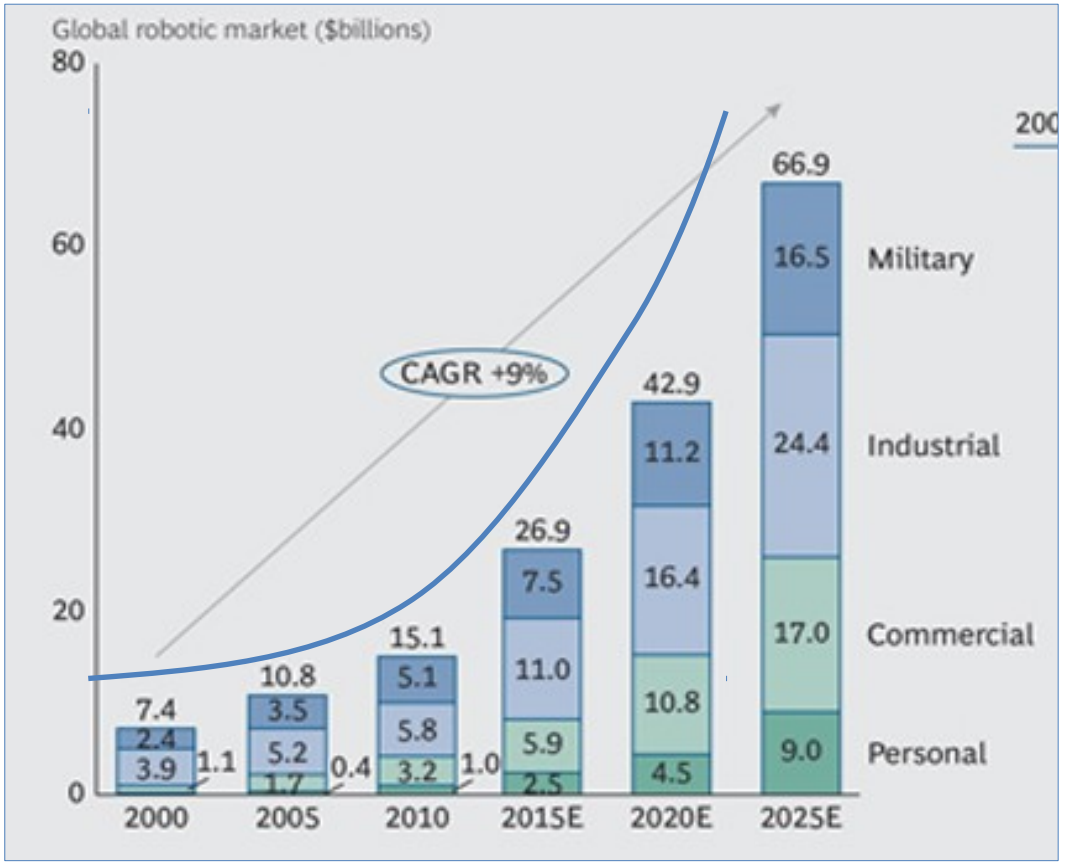


| | UAV | AGV | Actuators | Humanoid |
|---|---|---|---|---|
| Commercial transportation | X | X | | |
| Healthcare | | X | X | X |
| Construction | X | X | X | |
| Manufacturing | | X | X | |
| Agriculture | X | X | X | |
| Leisure/Media | X | | | X |
| Security/inspection | X | X | | |



# Why look at robots?

- Robotics is the next stage of information technology
- A new wave of companies – Before Google – After Google
  - SoftBank, Amazon, Facebook, Cisco, Intel, Qualcomm, Volvo, Toyota, Samsung, Nike, **Disney** etc.

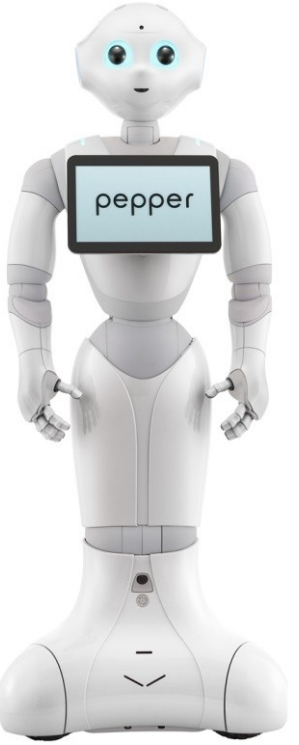


# Why now?

- AI breakthroughs
  - Analysis of unstructured data, e.g. Watson, DeepMind
  - Cloud based robotics, e.g. autonomous car
- New, cheaper sensors, e.g. lidars for driverless cars
- Better development tools
- Cheaper hardware

# Moore’s law kicks in

2005: 14.000 USD




2014: 2.000 USD

# Industrial robots

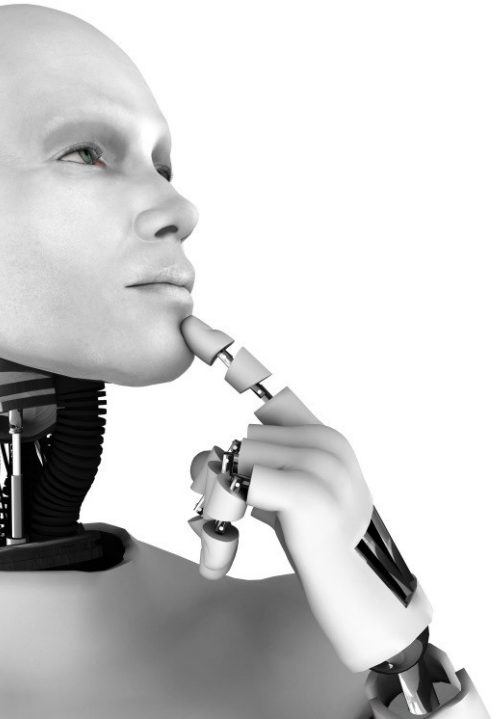
# Logistics

# Health

# Military

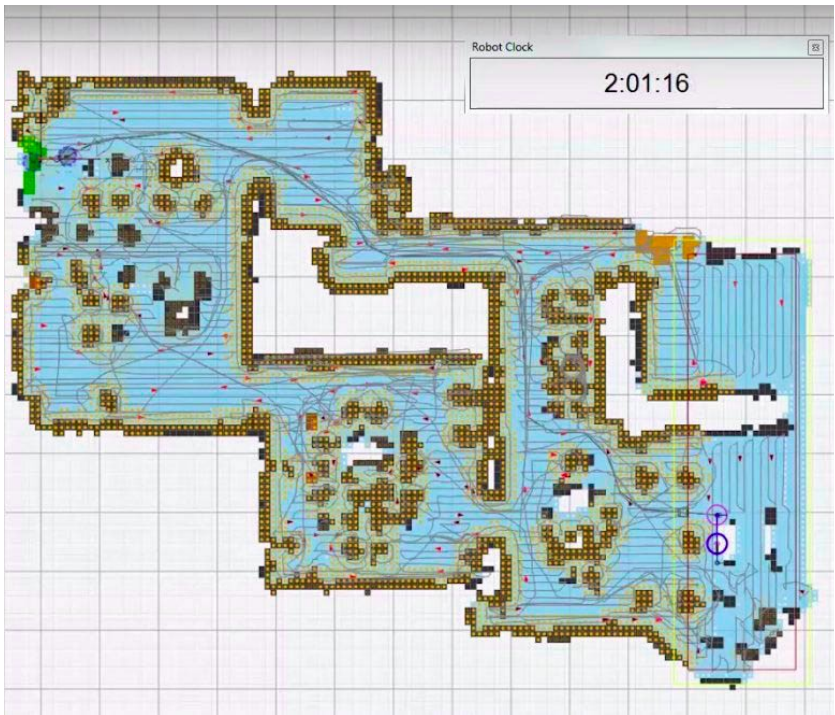
# Personal robots

# Development platforms



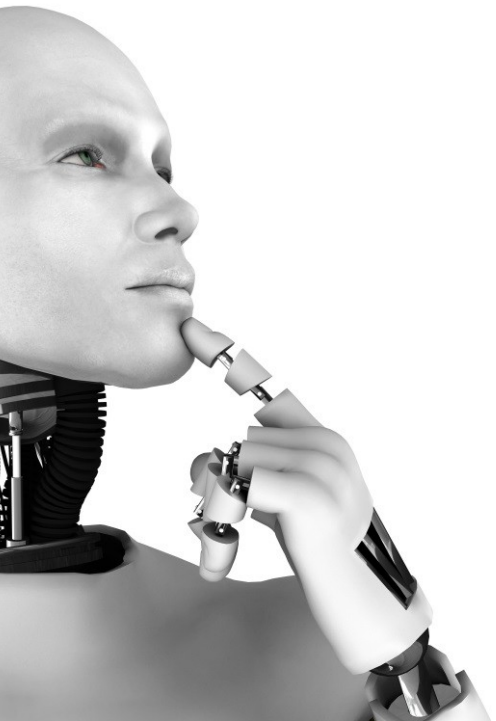
# Vacuum cleaners with lasers

- SLAM (Simultaneous Localization And Mapping)
- Modify with e.g. Raspberry Pi



# Development tools

- **Robot Operating System (ROS)**
- 2012: Microsoft Robotics Studio
- 2010: Player/Stage

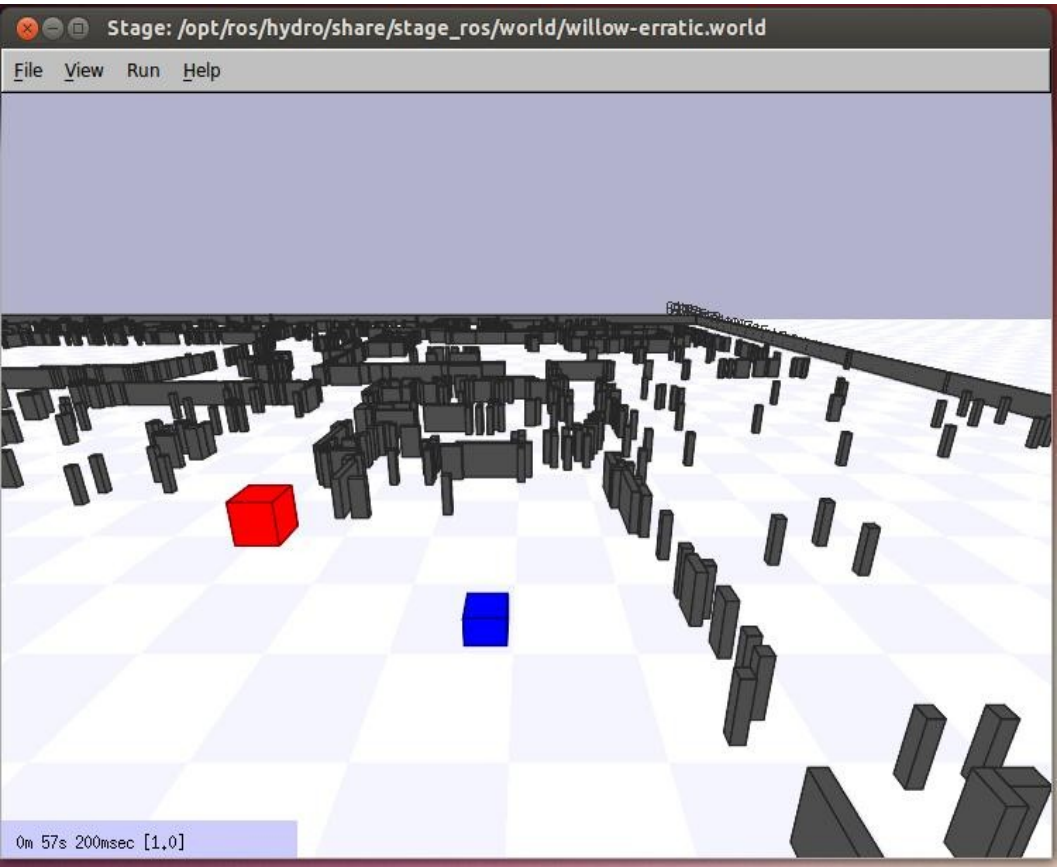


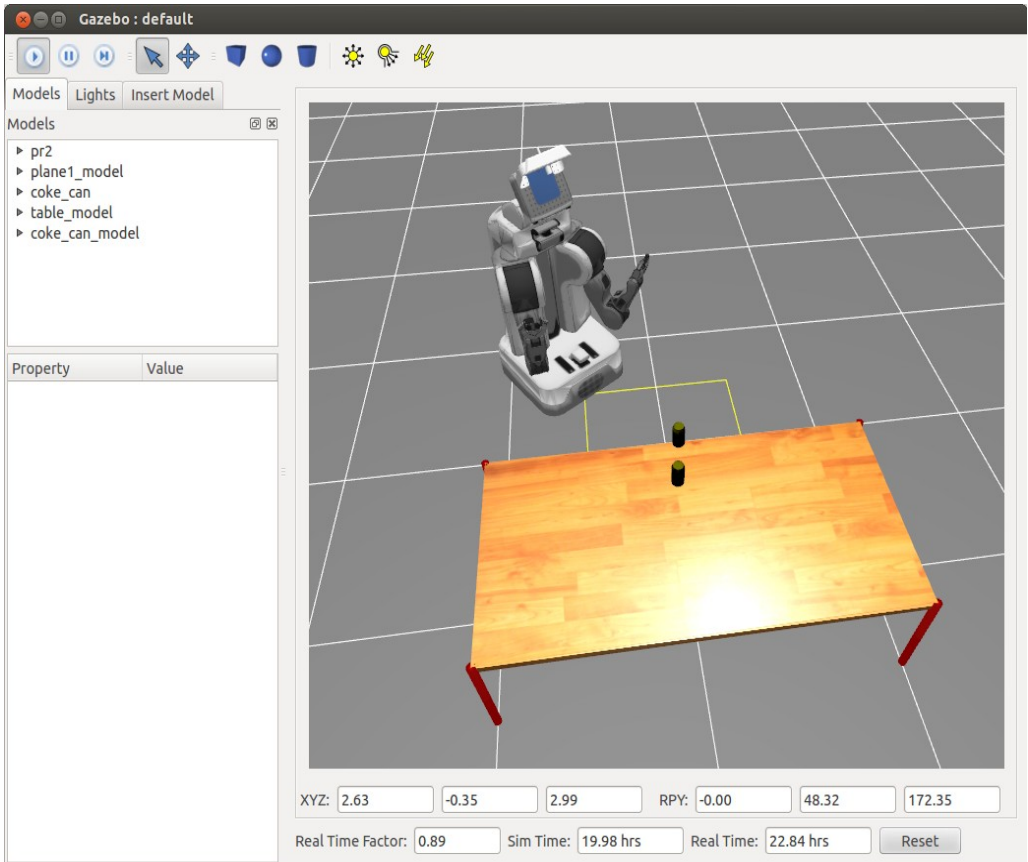
# Robot Operating System

- Founded by Willow Garage – now Open Source Robotics Foundation (http://www.ros.org/)
- Distributed, modular design
- Active eco-system
  - Supports many robots and libraries
    - Robot Geometry
    - Pose Estimation
    - Navigation

# Simulation tools

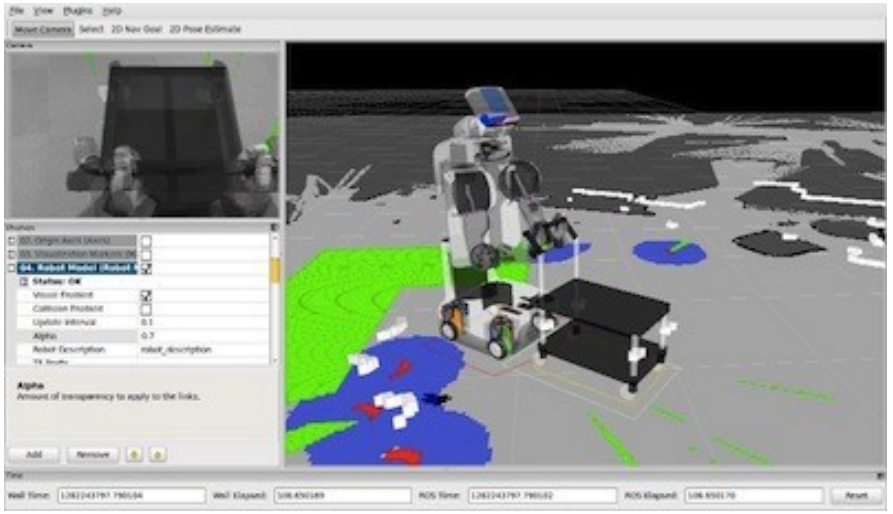
- Stage – large robot population with low fidelity
- Gazebo - small robot population high low fidelity

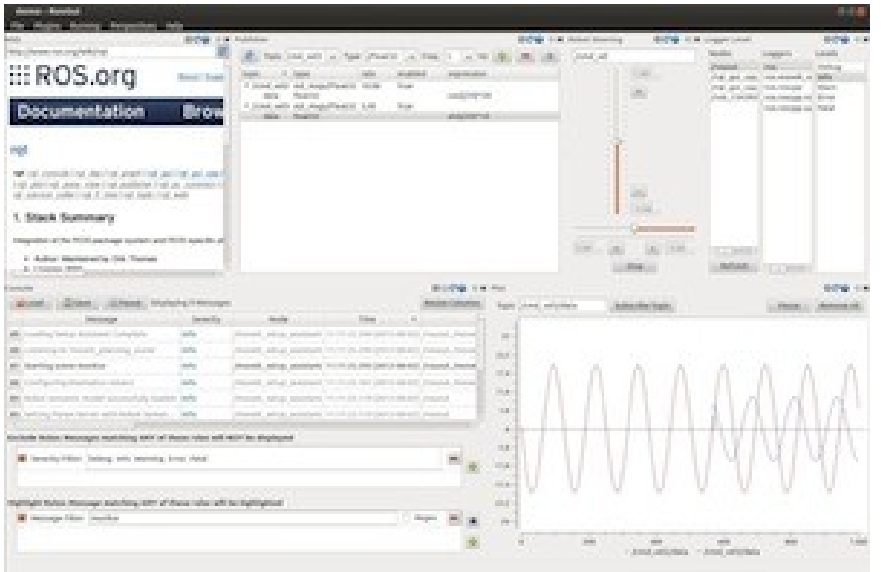


# Development interfaces

- Rviz and rqt






# ROS for App Developers

- Support for iOS/Android

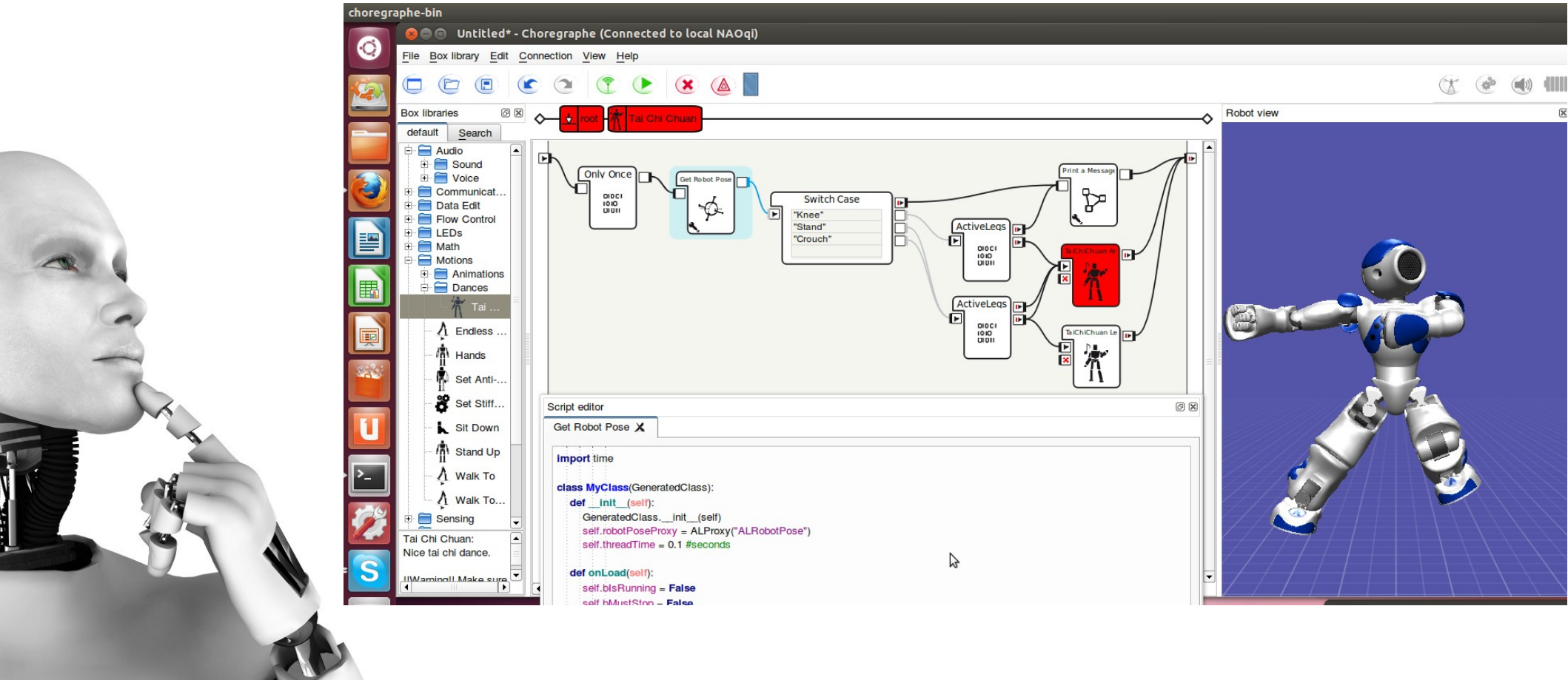
ROS.org

Java

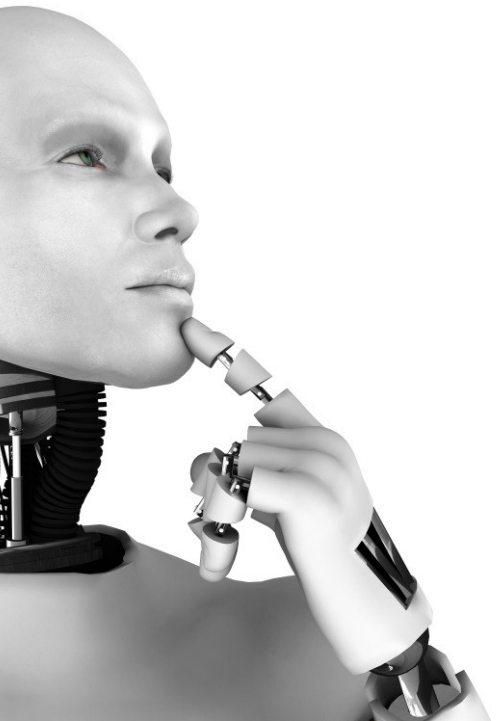
# Humanoids

# Coregraph

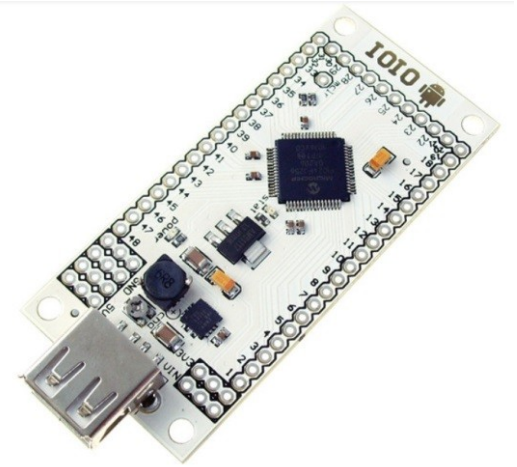
- Visual programming and scripting
- SDK for Python, C++, Java, JavaScript



# Smartphones and robotics

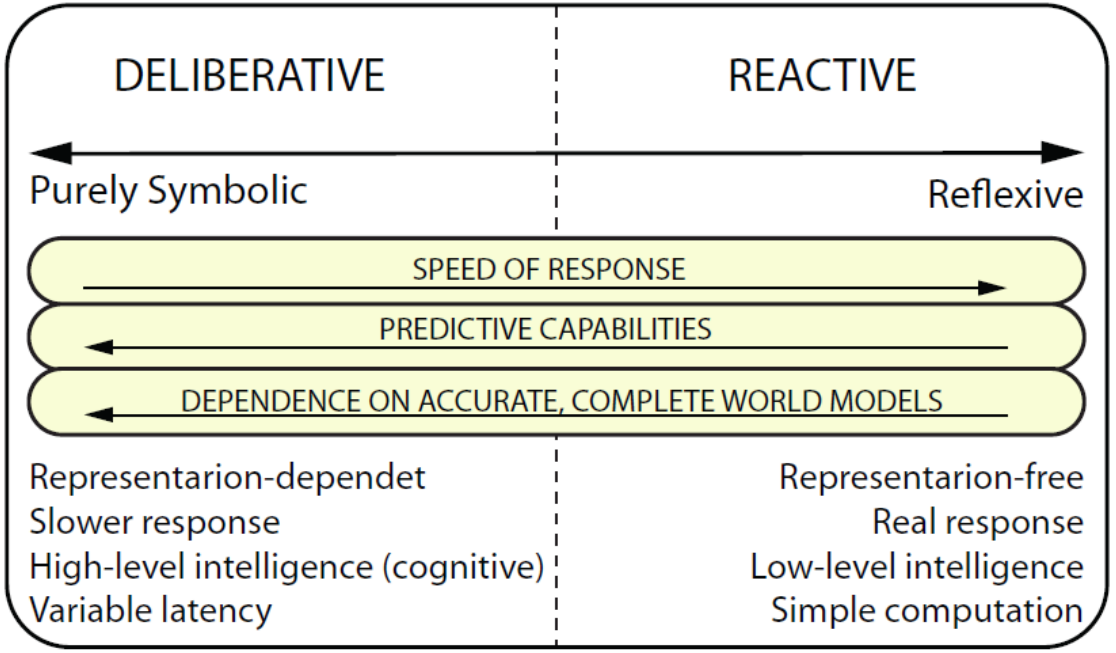


# Android Based Robotics



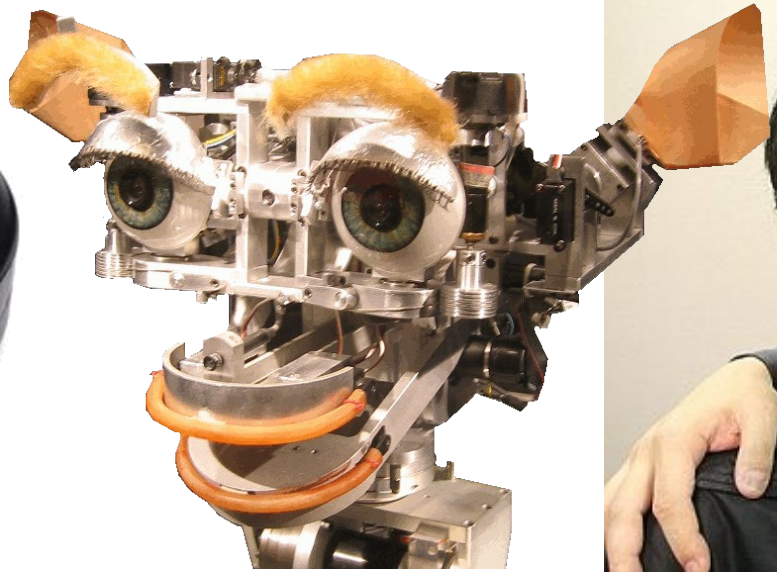
# The Robot Paradigmes

## Sense – Plan - Act




# Human-Robot Interaction (HRI)

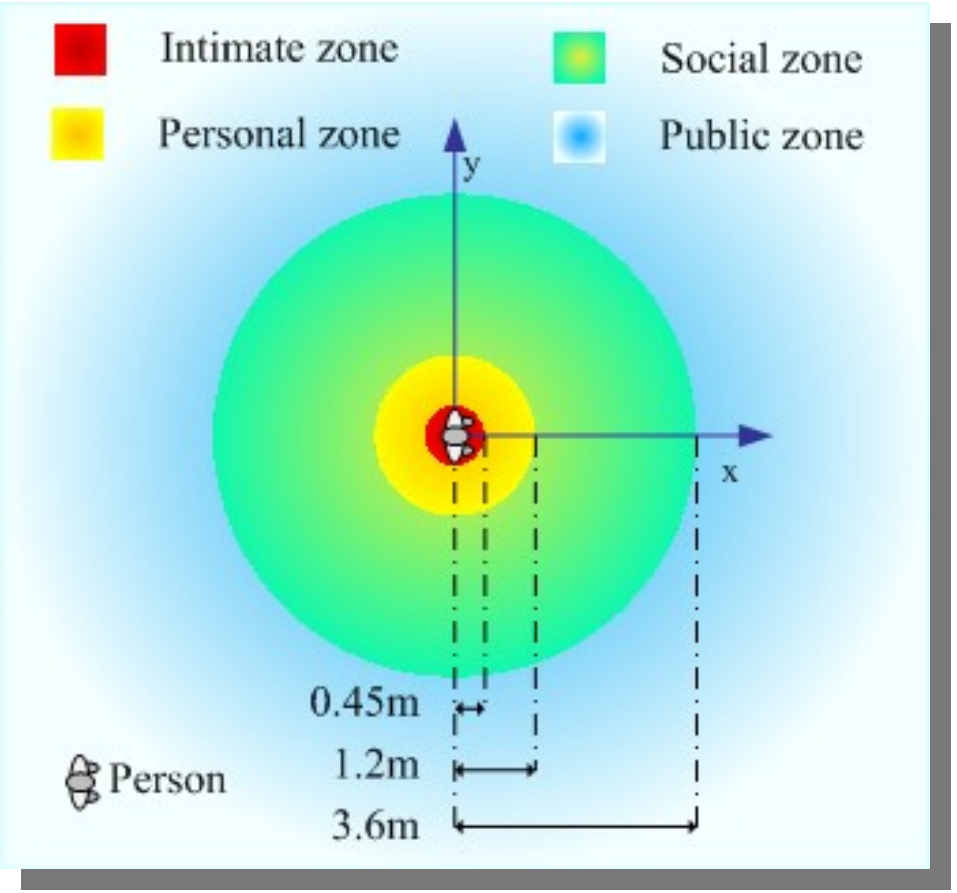
- **Human–robot interaction** is the study of interactions between humans and robots
- **Multidisciplinary field** of psychology, cognitive science, social sciences, computer science, robotics, and engineering
- Includes many types of robots (mobile, humanoid), many modalities (speech, vision, touch) and control techniques (teleoperation, AI)

# How to move around a person?

- Navigation behavior is inspired by the **proxemic zones** developed by anthropologist E. Hall in 1963

*“Like gravity, the influence of two bodies on each other is inversely proportional not only to the square of their distance but possibly even the cube of the distance between them”*



# Tips and tricks

- Ambition is good – but keep it simple
  - Moravec's paradox: “*hard problems are easy and the easy problems are hard*”
- Explore the open-source environment
- Use a tested development platform

ROS

OpenCV

pointcloudlibrary

# Good times for funding

- ”Robotics is where you should be investing in 2015” – CIO, Huntington Funds

- €700M in funding from the EU Commission for 2014 – 2020
  - SME Instrument
  - Diffrerent ICT/Robotics calls
  - FI-WARE, Echord etc.
  -
- Crowdfunding campaigns
- Many regional initiatives

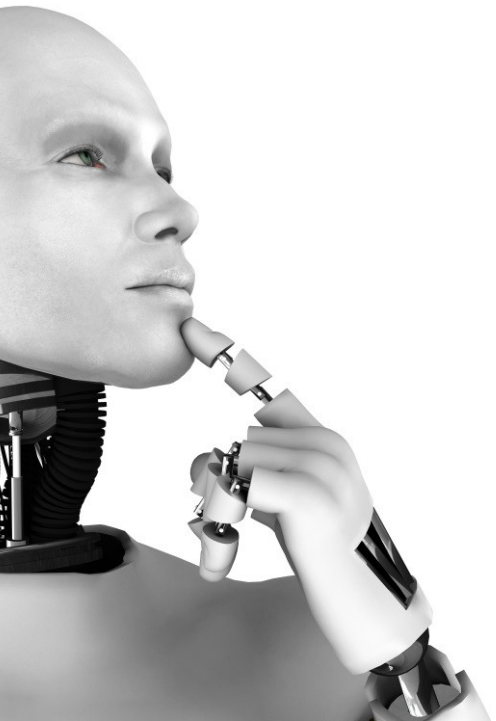
# The ROGAMO project

- Goal: Creating robot based games
  - Funded by EU/FI-WARE
- Build on Double Robotics Platform
  - Comes with SDK for iOS
  - Based on hybrid Apps using PhoneGap
    - HTML, CSS, and JavaScript - deploy on platform
    - Use Open Source vision processing software

# That’s all

Project proposals, questions, network, funding?

- Contact me at **soerent@gmail.com**
- **dk.linkedin.com/in/soerent**



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