

Multimodal Interaction & Face based Games @ ITU

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Istanbul Technical University

- Oldest technical university in Turkey (1773)
- One of the most prominent educational institutions in Turkey
- The Faculty of Computer & Informatics accepts students from the top 1% of central university entrance exam
- Hosts National High Performance Computing Center



Overview

- **Multimodal imitation based interaction games with Robots**
 - Robotic Sign Language Tutor Project
 - Multimodal Drumming games
 - Multimodal Scene Analysis
- **Face analysis based games**



Robotic Sign Language Tutor Project

- **Sign Language (SL):** a visual language composed by different sets of hand and upper-torso movements combined with facial gestures
- **Language acquisition:** An important process in the social and cognitive development of children
- Robots used for **educational/therapeutic purposes** may be very helpful in the developmental process of a child
- **Game playing:**



- to handle different objects,
- to improve social and cognitive skills,
- to adopt an appropriate behavior,
- important for development and creativity

Robotic Sign Language Tutor Project

- Main focus:
 - ✓ to design an **assistive** and **social** robotic system
 - ✓ to design a **multimodal interaction** game scenario to work with the robot
- Different modalities are used to adapt the game to different levels of hearing impairment and SL acquisition
 - Child:
 - Flashcards, gestures (sign),
 - Robot
 - Child-like voice, gestures (sign), facial gestures
 - LEDs, sound
- In our study:

Humanoid Robots + Multimodal Interaction Games
→ Sign Language



Research Questions

- The effect of a **humanoid robot** on the learning performance and motivation of participants,
- The effect of **multimodal interaction games** on participants' encouragement, performance and motivation
- Physical vs. virtual **embodiment**: Any effect on sign language tutoring?
- Nao vs. R3: effect of different physical embodiments



Robovie R3

Our specially modified version of R3:

+ additional DOF in wrists and fingers:

29 DOF in total,

+ LED mouth,

+ ASUS RGB-D camera,

+ 2 cameras in eyes

+ Modules:

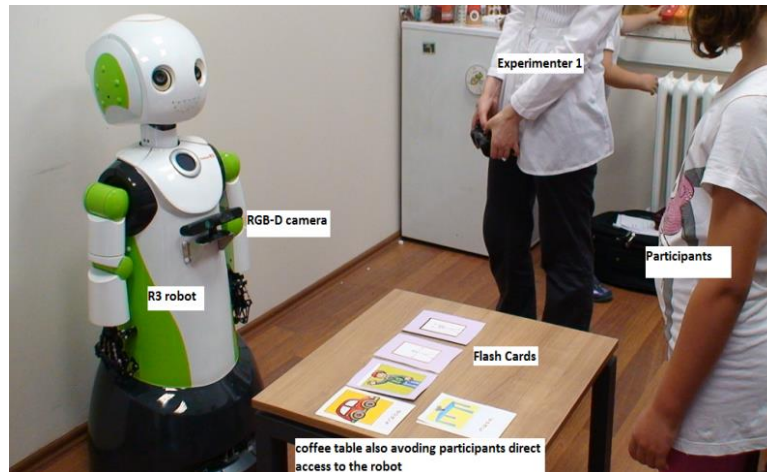
- HMM-based gesture recognition
- OpenCV-based computer vision

→ Children consider it as a peer



Case study- Effect of Embodiment

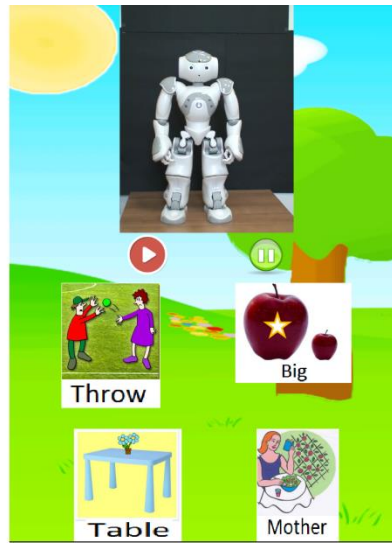
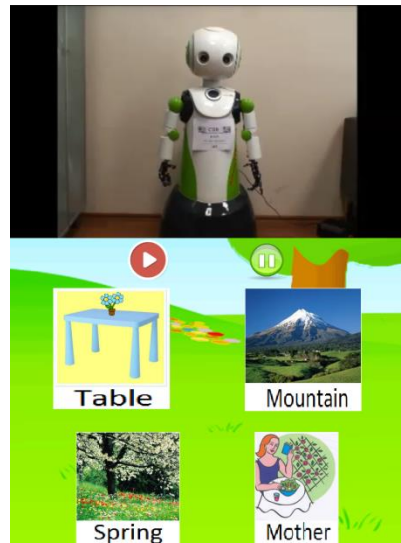
- To test the effect of embodiment:
 - 2 different experimental setups:
 - Virtually embodied robot (Robot videos)
 - Physically embodied robot



Virtual Interaction Game

The game with virtual robot:

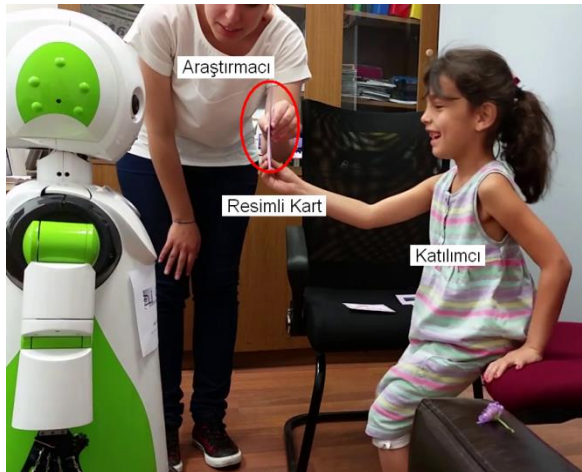
1. introductory session: video of Robovie R3 robot demonstrating TSL in a pre-defined order



Interaction Game

The game with physical robot:

- Introduction of signs and robots
 - ✓ each child shows cards to the robot to initiate the robot's action



araba



arkadaş

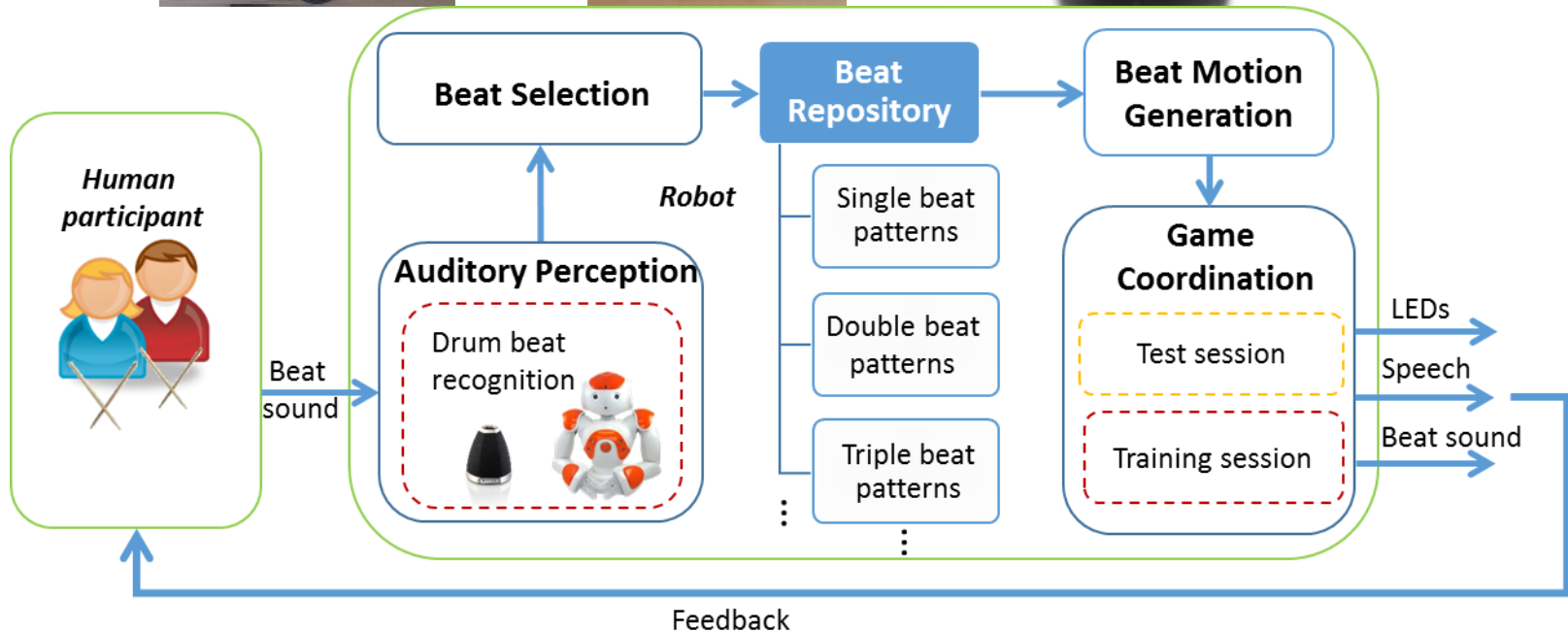
Interaction Game

- Game session,
 - ✓ each child plays with robot one-to-one: active contribution of child in the game
 - ✓ robot generates signs and the child is asked to show the relevant card to the robot
 - ✓ feedback given with LED lights:

- correct card
- wrong card



Multimodal Interactive Drumming Game



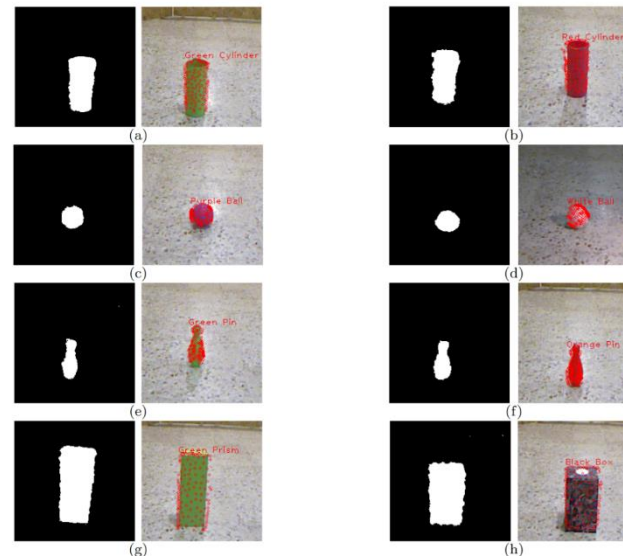
Gökhan İnce in collaboration with Hatice Köse

Interactive Drumming Game via different modalities

- 1) <http://www.youtube.com/watch?v=7Jc5pnk85rU>
- 2) <http://www.youtube.com/watch?v=fc90cDX7E28>
- 3) <http://www.youtube.com/watch?v=liZGMgJ25q0>

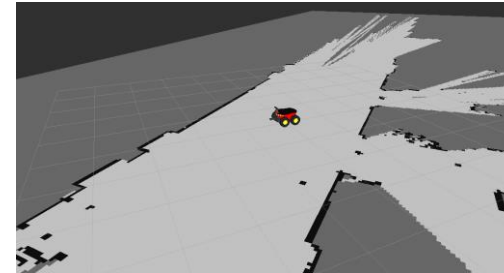
Scene Analysis for Object Manipulation

- An integrated planning, execution and learning framework for cognitive robots to ensure their safe action execution.
- The framework ensures that robots detect their failures in runtime and learn from real-world experimentation.
- The temporal scene interpretation unit integrates different sensory modalities to maintain a consistent world model and continually monitor execution.

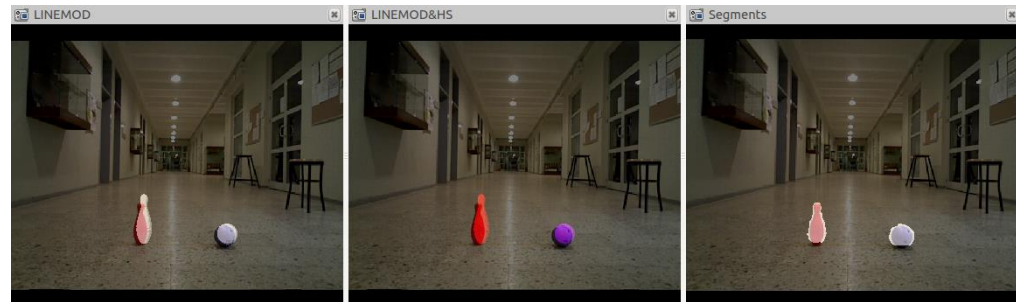


Sensory Modalities used for Scene Analysis

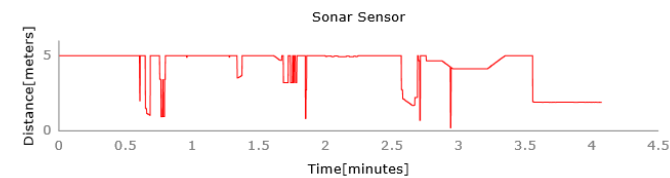
Laser Range finders for mapping and localization



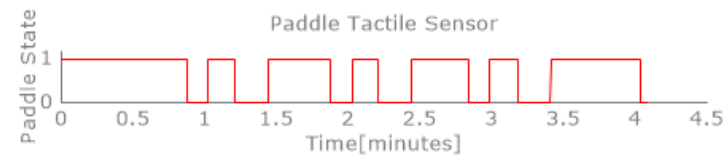
RGB-D camera for 3D Object recognition and segmentation



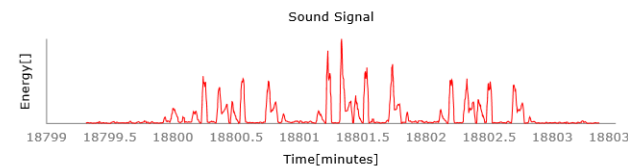
Sonar sensors for continual execution monitoring in manipulation tasks



Tactile sensors for execution monitoring in manipulation tasks



Microphones for execution monitoring by audition



Face Recognition-based Multiplayer Mobile Game

- <http://vimeo.com/100890130>

Facial Expression Imitation Game

- <http://vimeo.com/100890301>

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