



## **Assessing Listening and Speaking Skills through Play with the Humanoid Robot NAO**

### **Type of Project** **Ongoing research project**

#### **Summary**

This study investigates the potential of using the humanoid robot, NAO, as a playful tool for assessing the listening and speaking skills of seven hearing-impaired students who use cochlear implant(s) and sign language as their main communication modality. NAO does not have a human mouth and therefore, students cannot do lip-reading; we considered this to be a unique characteristic of the technology that can help make the assessment of listening and speaking skills efficient and accurate. Three game-like applications were designed and deployed on NAO for the purpose of this study. Results demonstrated how NAO was successfully used in this context. Our results, although preliminary, should encourage future research in the area of listening and speaking assessment for hearing impaired children, as well as speech enhancement via play with social robots.

#### **Low-tech, high-tech products, services and contexts for play**

This study investigates the potential of using the humanoid robot NAO by Aldebaran Robotics, as a playful tool for assessing the listening and speaking skills of seven hearing-impaired students who use cochlear implant(s) and sign language as their main communication modality. NAO does not have a human mouth and therefore, students cannot do lip-reading; we considered this to be a unique characteristic of the technology that can help make the assessment of listening and speaking skills efficient and accurate. Three game-like applications were designed and deployed on NAO for the purpose of this study. Initially students played the "Shapes game" which involved listening and following spoken instructions. Two shape images were positioned in front of the student for each piece of instruction. The participant listened to NAO's instructions, selected an image and positioned it within NAO's hands. Later on the "Emotions game" followed which involved the recognition of everyday emotions, derived from sounds. NAO asked "How do I feel now?" while he played the sound of an emotion and demonstrated the respective gesture or bodily movement. For each emotion, two images were positioned in front of the student as visual clues to help them decide on the correct emotion and say it loud. Finally students played the "Shopping game" which involved understanding of spoken instructions; recognition of everyday sounds in the environment; familiarity with vocabulary linked to everyday routines; and speaking. For each piece of instruction, a total of six different products were placed in front of the student so that she/he could select the ones NAO needed and say them loud. Results demonstrated how NAO was successfully used in this context. Our results, although preliminary, should encourage future research in the area of listening and speaking assessment for hearing impaired children, as well as speech enhancement via play with social robots.

#### **The context of use**

The study took place in a class at the School for the deaf in Nicosia, Cyprus

#### **Type of play in this play system**

### **Cognitive**

Practice
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### **Social**

Solitary
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### **Objectives related to play according to ICF-CY**

#### **Play for the sake of play: Major life areas - d880 enagement in play**

d8800 solitary play
d8808 enagement in play, other specified

### **Play-like activities: Therapeutic and educational objectives**

b3 Voice and speech functions
d3 Communication

### **Number of participants**

5-10
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### **Chronological Age**

3-6 years
6-12 years
12-18 years

### **Development Age**

3-6 years
6-12 years
12-18 years

### **LUDI Categories of disabilities**

Hearing impairments:
Partially hearing impaired
Deaf
Communication disorders (speech and language disorders):

### **Explanation on the use of low-tech, high-tech devices, services or contexts**

#### **Explanation**

Verbal instruction, language and communication fitting to chronological age
Hand over hand: therapist/researcher leads the actions of the participant
Guided discovery: therapist/researcher coaches the participant so s/he discovers how to use the assistive technology

### **Involvement**

Adult: therapist/educator/researcher
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### **Role**

After the instruction, providing supervision during play
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## Evaluation of objectives and outcome measures

### Description of outcome measure(s)

Observation by professional/researcher providing the play experience
Video analysis

### Information about availability of outcome measure: publisher, website, contact person

Contact person: Panayiota Polycarpou, e: yiota.polycarpou@cut.ac.cy Website: <a href="http://cyprusinteractionlab.com/nao-in-play-with-hearing-impaired-children-short-scientific-mission-of-cost-action-ludi-td1309-play-for-children-with-disabilities-ludi-2015/">http://cyprusinteractionlab.com/nao-in-play-with-hearing-impaired-children-short-scientific-mission-of-cost-action-ludi-td1309-play-for-children-with-disabilities-ludi-2015/</a> Conference: HCII 2016 (to be published)
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### Summary of achieved effects

Data were collected in three forms: (i) an attitudinal questionnaire administered to the students right after the completion of the activity; (ii) video recordings of the activity; and (iii) interview sessions with the special education teachers of the School, the sign language interpreter and the technology (IT) teacher who had the opportunity to observe the study.
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In regard to students' performance, all students responded to the activities, often beyond the expectations of their teachers. Video analysis focused on recording the number of correct answers (on their 1st try), the correctly pronounced emotions or products, and times the participant sought help, either in the form of sign language (SL) interpretation or verbal language (VL) repetition of instructions. The results provided evidence of the most and least competent students in performing each activity.
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With regards to the attitudinal questionnaire data on the participants' experience, the use of NAO and associated game-activities were positively endorsed by the participants, while there was some variation in students' responses about hearing and understanding. The questionnaire also included an open-ended question for additional comments; here, two high performing students reported that they would like NAO to speak at a slower pace, in order to clearly hear his instructions.
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### References to the intervention or research project

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### Website

<a href="http://cyprusinteractionlab.com">http://cyprusinteractionlab.com</a>
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### Publication

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### Keywords

NAO· humanoid robot · social robot · robotics · special education · listening skills · speaking skills · speech assessment · hearing impairment · deaf
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