# Music Therapist Robot for People Suffering from Dementia: Longitudinal Study

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The Interaction Lab

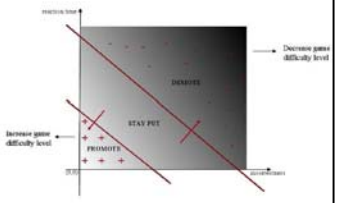
Our approach presents a new methodology based on *Socially Assistive Robotics (SAR)*. The robot plays the role of a music therapist and tries to provide a customized protocol through motivation, encouragements, and companionship to users suffering from cognitive changes related to aging and/or Alzheimer's disease.

## Research Questions

- Can elderly individuals with dementia and/or cognitive impairments maintain attention to music with the help of a robot in an intervention specifically designed to promote active listening?
- How does user performance and responses compare to hose of well elderly who participated in the study and elderly how have not participated in the study?
- What if any short-term effects are there of attention training with the elderly who are suffering from dementia and/or other cognitive impairments?
- Does the music-based cognitive game with the robot help the elderly individuals with dementia and/or cognitive impairments to increase desirable "positive behavior" (smiling, speaking, and participating in group activities)?

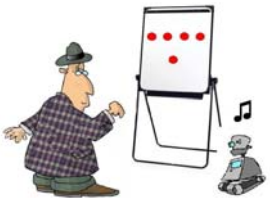
## Learning and Adaptation Methodology

- Supervised Learning: A new algorithm for supervised learning is presented. An Accepted Variation Band (AVB) is defined as the band that contains most of the inliers; it is calculated as a function of the mean and standard deviation of the user's task performance.
- Adaptation: The adaptation system is activated after the supervised learning phase in order to enable the robot to adapt its behavior so as to minimize the user's reaction time and maximize answer correctness.




## Experimental Design

- Cognitive Music Game: "Name That Tune"
- Baseline: Our system determines the user's reaction time and correctness when the robot is not present. The Standardized Mini-Mental State Examination (SMMSE), an instrument for cognitive assessment, is used to determine the participant's level of cognitive impairment.
- Duration: 12 months
- Robot Behavior: The robot uses its body and arms to encourage/discourage the user's correct/incorrect answers. The game levels are easy, medium, and difficult, initialized based on the user's level of impairment. The robot adapts the game level dynamically based on the user's performance (i.e., reaction time and correctness).



## Experimental Platform


Bandit II

- Biomimetic anthropomorphic robot: expressive humanoid robot torso mounted on a Pioneer mobile base
- 19 DOF and expressive face: 7 DOF in each arm, 2 in the neck, 2 in mouth, and 1 in each eyebrow

## Publications:

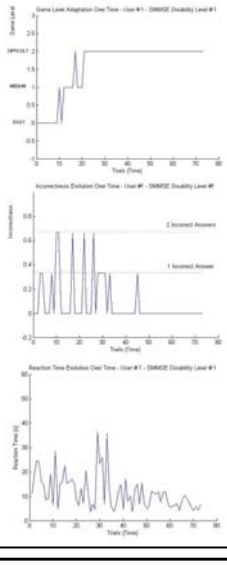
Adriana Tapus and Maja J Matarić (2008) "Socially Assistive Robotic Music Therapist for Maintaining Attention of Older Adults with Cognitive Impairments", In *Proceedings of AAAI Fall Symposium AI in Eldercare: New Solutions to Old Problems*, Washington, DC, USA, November 7-9, 2008.

Adriana Tapus, Eric Wade, and Maja Matarić (2008) "Using a Socially Assistive Robot in Gait Recovery and Training for Individuals with Cognitive Impairments", In *Proceedings of AAAI Fall Symposium AI in Eldercare: New Solutions to Old Problems*, Washington, DC, USA, November 7-9, 2008.

Adriana Tapus, Juan Fasola, and Maja Matarić (2008) "Socially Assistive Robots for Individuals Suffering From Dementia", In Robotic Helpers: User Interaction, Interfaces and Companions in Assistive and Therapy Robotics Workshop, *Proceedings of the 3rd ACM/IEEE HRI Conference*,, Amsterdam, The Netherlands, March, 2008.

Adriana Tapus, Cristian Tapus, and Maja J Matarić (2008) "User-Robot Personality Matching and Robot Behavior Adaptation for Post-Stroke Rehabilitation Therapy", *Intelligent Service Robotics Journal*, Special Issue on Multidisciplinary Collaboration for Socially Assistive Robotics, 1(2):169-183, April 2008

## Pilot Experimental Results



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