Background Music and Sound Effects in Human-Robot Interaction

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INTRODUCTION

- Background music, which can improve learning ability, promote longer engagement, and heighten cognitive monitoring tasks, is already prevalent in movies, advertisements, and video games.
- Previous studies have shown children with autism spectrum disorder (ASD) can be positively influenced from interaction with a robot, and hence improve human-human social interaction.
- The use of music has been found to be an effective tool to increase interaction with peers in young children with ASD (Kern & Aldridge, 2006), but few have studied the use of music in human robots interaction (HRI) in ASD.

AIMS

- Explore a new modality to facilitate child-robot interaction for children with ASD
- Compare measures of engagement obtained from human-robot dialogues with and without background music and sound effects
- Evaluate the added value of music and sound effects in the performance of game-based tasks.

Figure 1. Video Game and movie with background music.
The sound effects and background music used in the Super Mario Brothers video game, and the movie, Titanic, are well-known examples of the overall impact background music and sound effects can provide. Can music and sound effects also improve HRI for children with autism?

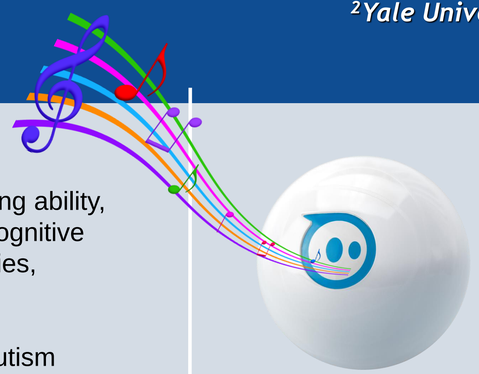

Figure 2. Sphero robot, experiment room design, and eye tracker

METHODS

- We will invite 12 children with ASD and 12 typically developing (TD) children (age between 4 – 10 years old) in our experiment, and they will be randomized into six groups.
- The participants will be asked to play with a Sphero robot and an experimenter in a predefined 3-section game, each lasting approximately 10 minutes. Another experimenter, who will not be able to hear the sounds inside experiment room, will monitor the activity and control the movements of Sphero outside the room .

Section A	Section B	Section C
Sphero without sounds	Sphero with sound effect	Sphero with sound effect and background music

Table 1: Experiment Design

- The order of these three sections will be randomized and counterbalanced for each participant.
- The sound effects, played by the Sphero robot, will correspond to robot actions, collisions, and movements, and background music will consist of Mozartian-style music which will be played through speakers in the room.
- Movement speed, distance, gestures, eye gaze, and verbal responses will be recorded using two video cameras mounted in opposite corners of the experiment room and a microphone.

Engagement Measures

- While human to human interaction might be difficult for some children with ASD, HRI can facilitate social interaction.
- HRI proxemics will be analyzed (Feil-Seifer and Mataric 2011) using recorded video of each interaction.
- Participants' gestures and interactions with experimenter will also be manually coded from recorded video.
- Head Mounted Eye Tracking device will be used. Eye gaze fixation and area of interest (AOI) will be analyzed.
- Features of participants' verbal responses including frequency, pitch, and volume will also be analyzed.
- These engagement measures will be compared across all groups to determine whether sound effects and background music contribute to improved HRI for children with ASD.

.	Section 1			
	Frequency of Speech	Reaching Gesture	Raise Gesture	…
Participant 1				
…				
Participant 12				

Table 2: Sample Manual Code Table

CONCLUSIONS

Background music and sound effects can convey mood, fill awkward conversational gaps and promote increased engagement to contribute to more productive HRI for children with ASD.

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