Using Socially Assistive Robots to Increase Student Curiosity

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Introduction

In the Interaction Lab, we study the intersection of humans and robots: socially assistive robotics. This relatively new field tries to understand how to make robots more effective in helping humans, primarily through social interaction [1]. I worked with my mentor Thomas Groechel who is studying to improve kinesthetic curiosity through socially assistive robot tutors [2]. My partner Annika and I worked on constructing speech and movements for Kuri to make it seem more expressive and interactive to students who are learning in augmented reality – more specifically, to see an increase kinesthetic curiosity through involvement of a Kuri robot in an augmented reality learning environment called MoveToCode.

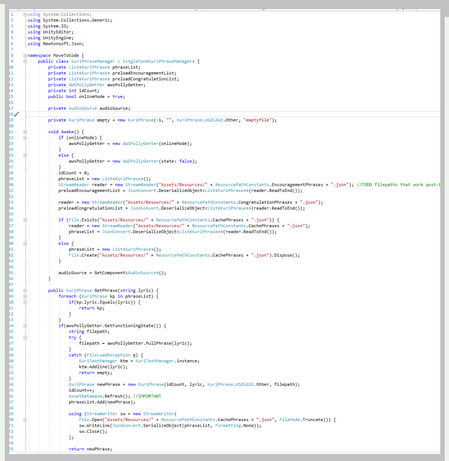
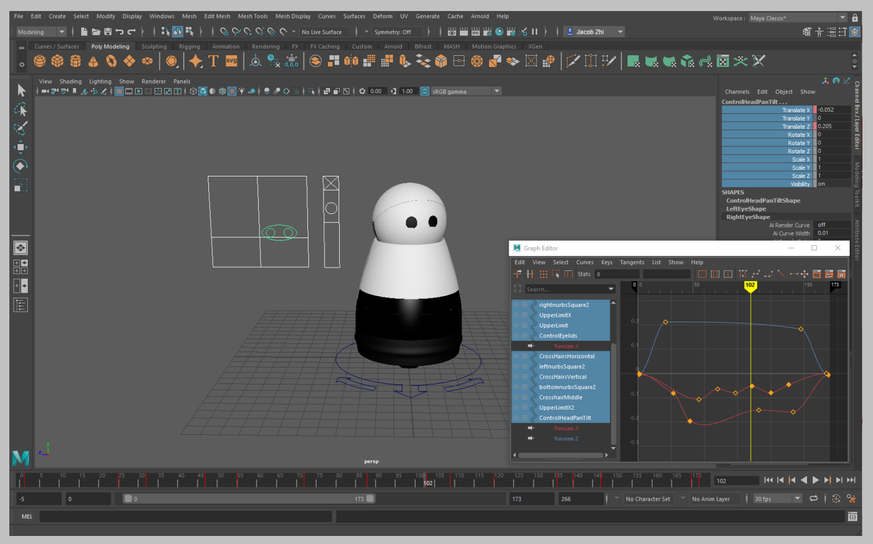


Figure one

Writing the code to give Kuri a voice using the Amazon Polly speech API

Objectives & Impact of Professor's Research

Professor Matarić's research focuses on improving society through real-world applications of robots. She researches the use of robots for help humans through social means – rather than physical. She has studied the use of various robots on infants, the elderly, those with Autism Spectrum Disorder, and students. In the Interaction Lab, researchers try to come up with solutions to better the relationship between humans and robots. These may include models for human behavior that are created from studies.



Description of Methods & Skills Learned

First, I created a "voice" for the robot that sounded friendly and encouraging so students could feel more comfortable and curious around it. This involved using Neural Text to Speech API. Then, to heighten user engagement, I read research publications on robot animation principles [3] and used Autodesk Maya to create animation packages for robot speech while working on triggering those animations from inside the program in Unity with ROS publishers. The animation packages also included light animations for Kuri's chest display.

I learned how to use advanced git features, such as branches, pull requests, etc. I also learned advanced programming and building in the Unity (C#) platform and working with online AWS services such as Polly. I have also done work inside an Ubuntu virtual machine for ROS, with some Python programming. With the online format, I also learned a lot of useful communication skills.

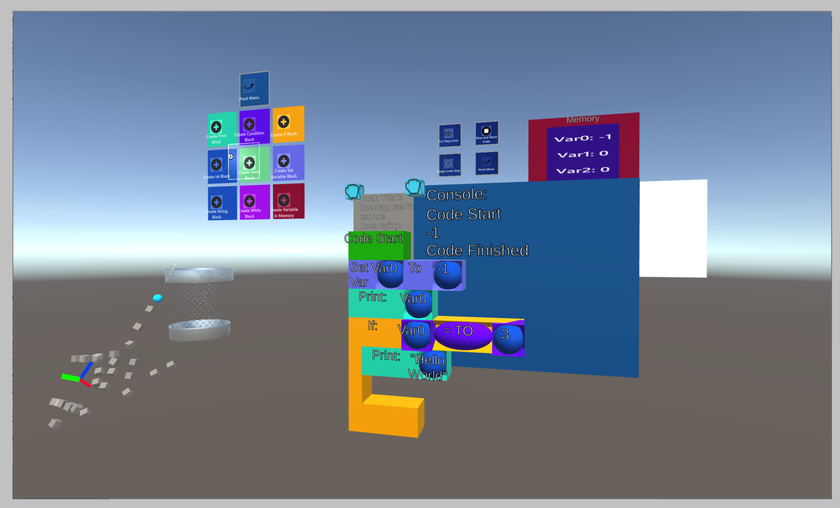


Figure two (left)

I designed talking animations for the Kuri robot using Autodesk Maya by keyframing different positions for the head and eyelids.

Figure three (above)

The AR MoveToCode project where Kuri's voice was used for hints, support, and encouragement

Figure one PC: Jacob Zhi
My own code

Figure two PC: Jacob Zhi
Model from Mayfield Robotics: https://s3-us-west-2.amazonaws.com/kuri-bridge/kuri-bridge-maya-plugin.zip

Figure three PC: Jacob Zhi
MoveToCode software: https://github.com/interaction-lab/MoveToCode

How This Relates to My STEM Coursework

Programming Courses:

- AP Computer Science A / AP Computer Science Principles
- Computer Systems / CISB 15
- Java course at Cal Poly Pomona
- Online Programming Courses

All these programming courses prepared me with the fundamentals of making robot programs. In addition, Java is very similar to C#, which helped a lot.

- FRC Robotics Team & Brahma Tech Diploma Program

These programs led me to an interest in these fields. However, SHINE has helped me develop my interests more in computer programming-based fields.

[1] Feil-Seifer, D., & Mataric, M. J. (2005, June). Defining socially assistive robotics. In 9th International Conference on Rehabilitation Robotics, 2005. ICORR 2005. (pp. 465-468). IEEE.

[2] Groechel, T., Shi, Z., Pakkar, R., & Matarić, M. J. (2019, October). Using Socially Expressive Mixed Reality Arms for Enhancing Low-Expressivity Robots. In 2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN) (pp. 1-8). IEEE.

[3] Schulz, T., Torresen, J., & Herstad, J. (2019). Animation techniques in human-robot interaction user studies: a systematic literature review. *ACM Transactions on Human-Robot Interaction (THRI)*, *8*(2), 1-22.

Advice for Future SHINE Students

I believe useful advice is to not give up – there are many research problems that take time to solve and that is what part of research is about. In addition, my advice would to be to always actively seek out opportunities to contribute to and help further your knowledge – the SHINE program provides plenty of workshops, activities, and resources to do so.

Acknowledgements

I would like to thank Professor Maja Matarić, my lab mentor Thomas Groechel, center mentor Ashley Perez, my lab mate Annika Modi, and the SHINE team: Dr. Mills, Dr. Herrold, and all other contributors to this program.

Watch the development of one Kuri action through a virtual prototype animation by scanning the QR.

Or visit: youtu.be/3EwORQs57aU