



HI-FIDELITY PROTOTYPE REPORT

Presentation of Hi-Fidelity Prototype and Evaluation
April 7, 2014

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Kinova Robotics recently launched MICO, an innovative wheelchair-mounted robotic manipulator arm with a two-fingered hand. However, its current control mechanisms are severely lacking in usability and learnability. Possible users of the MICO robotic arm include people with limited mobility caused by spinal cord injuries, spina bifida, multiple sclerosis, cerebral palsy, among others.

Our preliminary research led us to ask three primary design questions:

- How much of the arm experience should be controlled by automated movements?
- How might we allow people to switch between automated movements?
- How might we keep people in control while using automated movements?

In this report, we define manual movements to refer to control of the arm by low level commands, such as “move down”, “move left”, “close fingers.” Automated movements refers to control of the arm by comparatively high level commands, such as “grasp the door handle,” or “bring the glass to my mouth.”

To answer this first design question, we created a simple study to evaluate people’s experiences in controlling a robotic arm through both manual movements and automated movements. Our study demonstrated that most people preferred the use of automated movements because of their high efficiency gains, despite contrasting conclusions from our preliminary research. However, we found that people are also somewhat skeptical and distrusting of highly automated movements, which will prove to be a challenge moving forward. We also learned that automated movements would likely have to be programmed by end users because of how customized they need to be a user’s environment.

To answer the second two design questions, we created over fifty unique design visions. Based on a set of evaluation metrics, we limited this set to the ten most promising ideas and created storyboards from them. Our visions explored everything from using context awareness to suggest certain automatic movements to using vibration to increase the user’s perceived connectedness to the arm.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY (CONTINUED)

Informed by discussions with our client, we decided to move forward and design a screen-based control interface that allows end users to record their own automated movements and refine them over time. To test this, we created an interface that allowed a user to record, name, and replay movements of their choosing.

With our created interface, we performed a study to answer the following questions:

- Do users find recorded movements useful?
- Do users find recorded movements easy-to-use?
- Do users feel in control while playing back recorded movements?
- Are users able to complete tasks using the user interface?

In our study, five participants controlled the MICO robotic arm to pour water from a bottle into a cup from two different starting positions. In each position, the user had to complete the task once using only the joystick, and once using the joystick combined with the movements they recorded earlier in the trial. The order of the positions and the type of controller used (with or without recorded movements) were randomized such that there were four trials, one for each possible combination of position and controller type.

From our study, there were four major findings:

- Users relied on the joystick rather than the recorded movements they created using our interface.
- Users found our implementation of recorded movements challenging
- Users did not feel as in control using recorded movements compared to the joystick.
- Users didn't use the screen to complete tasks since they only used manual control with the joystick.

Informed by the results of our two studies, we plan to redesign both our prototype as well as the method in which we evaluate our prototype. For our prototype design, we plan to use the joystick as a means of progressing through a recorded movement and return to a one-handed interface design. For our evaluation, we plan on running a longitudinal study with a small quantity of users to eliminate the confound of a learning curve that exists with learning how to use the robotic arm.

INTRODUCTION

HUNT STATEMENT

We aim to research, design, and evaluate usable interfaces for the MICO robotic arm to enable people with neuromuscular disorders to more easily perform activities of daily living.

RESEARCH RECAP

The specific activities that each person needs assistance with vary from person to person. *Therefore, designing a control interface with some level of customization options would be beneficial.* Activities like pouring a glass of water and getting dressed tend to be among the most common difficult tasks for people with limited mobility. These are the tasks that people would most appreciate being able to perform on their own.

Our research revealed that physical control devices or touchscreen-based input devices may be a strong solution for people with increased mobility. People with very limited mobility may instead benefit most from gestural or voice control based interfaces.

The major takeaways from market research were:

- All people have individualized needs

- Different input methods have distinct strengths and weaknesses, and combining multiple methods may be advantageous

- A great majority of current robotic arms require too many commands for small adjustments

- Pre-defined modes are useful in providing more efficient ways to complete certain tasks, but people often have trouble keeping various functions in mind

- Ergonomics of the controller are very important, specifically where different controls are located on the physical interface.

INTRODUCTION

LO-FIDELITY PROTOTYPE RECAP

SUMMARY OF DESIGN

In order to answer the question, “What is the good balance between automation and manual control?”, we conducted user studies.

We gave our participants a fake interface and had them control the fictional robot arm enacted by one of our team members to complete a water pouring task three times, each with different levels of automation. They were asked to give verbal commands to the fictional robotic arm, actually a team member’s real arm, so as to complete the task at hand.

We performed our study with 9 users intercepted from around Newell-Simon Hall. All were able-bodied users and of college-age.

LO-FIDELITY PROTOTYPE FINDINGS

This study guided us towards a solution that relies mostly on automated movements, but also allows manual control and the ability to make small adjustments to the path of automated movements.

In order to incorporate automated movements, we decided to have users teach the arm via demonstration, since each user is so different and the tasks that they perform can vary greatly from person to person.

The solution we came up with consists of:

- Self-defined automated tasks, through which users determine the tasks they would like automated and teach the arm by recording the movements.

- The option to manually control if needed, to make sure that users are in control of their movements.

- An interface that requires little attention so that users can focus on the actual tasks they want to complete using the arm.

HI-FIDELITY PROTOTYPE

INTRODUCTION

SUMMARY OF DESIGN

Our hi-fi prototype implements the ability to record and replay arm movements for the purpose of reducing the amount of manual control the user needs to perform to carry out everyday tasks. The core idea behind the design is that there are certain, sometimes complex tasks that people must do each day, so pre-recording the movements required to perform those tasks and allowing users to replay those recordings would save them time and effort using the arm.

The primary control for our prototype is still the same joystick that the robotic arm currently uses. In addition, there is a touchscreen interface (currently displayed on a mobile phone) that is meant to be mounted on the user's wheelchair, and includes the controls for creating, recording, and managing the different recorded movements for the user. Therefore, the current design requires users to either have some mobility in both hands or to switch back and forth between the touchscreen interface and the joystick in order to use the prototype. The motivation behind the touchscreen interface is that it can effectively display a lot of information, but can be designed such that a user with limited hand mobility can still use it. The opportunity exists for different interfaces for managing tasks, but we find that the touchscreen is very effective.

The prototype works in the following way. The user creates and names a new task, records the task by using the joystick to manually perform the movement, and then replays the task whenever they want. During task playback, the user must keep their finger on the touchscreen interface pressing a button on the screen, so if they release their finger, the playback pauses. One reason for this is so that if the arm trajectory is incorrect, the user can pause the playback by releasing their finger, manually adjust the arm's path using the joystick, and then continue the task playback. The other reason is so that, in the situation where the arm's trajectory causes a safety issue or risks damaging the arm, the user can stop the arm's movement instantaneously. Also, our research has shown that people want to feel in control of the task they are performing, so we thought that making the user hold a button on the interface would make them feel more in control than just watching the recorded arm movements.

HI-FIDELITY PROTOTYPE

INTRODUCTION (CONTINUED)

PERSONA

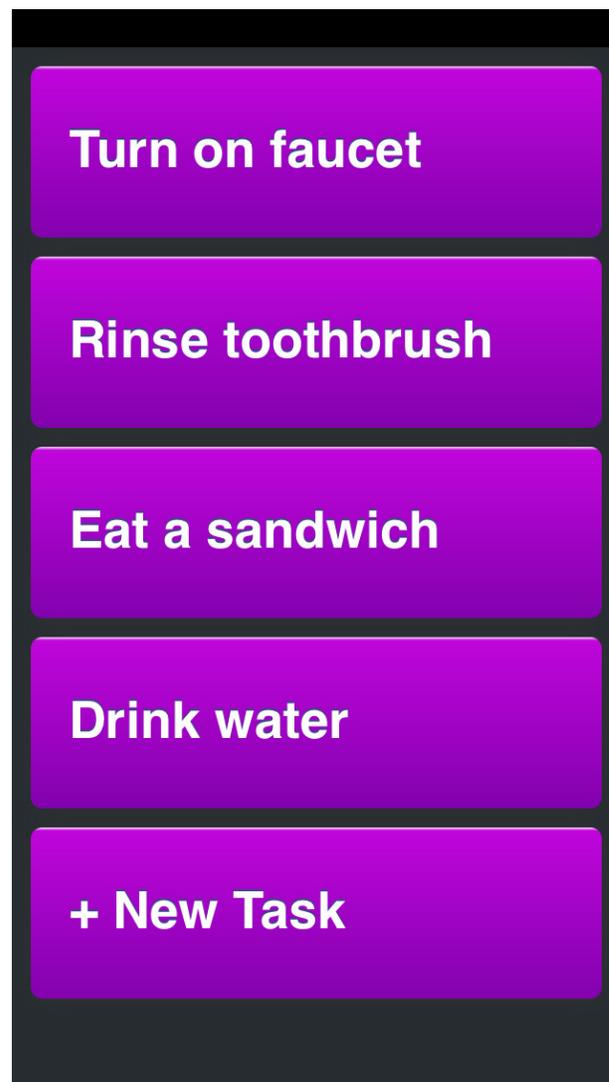
Based on our research, we created a persona named Neil, a fictitious character who is a good representative of our prospective users, and kept him in mind as we worked on our design and prototype.

Neil is a 40-year-old male who had an accident during college that injured his spinal cord at T10 leaving him paralyzed. Because of where his spinal cord was injured, Neil has no nerve sensation from the abdomen down. Since then, he has been reliant on other people to perform activities that he could once do without any help. With the help of MICO, he hopes to regain independence.

Throughout the design process of our hi-fi prototype, we kept Neil in mind to when making major design decisions. The following is an example of how Neil would use our prototype in real life.

HI-FIDELITY PROTOTYPE

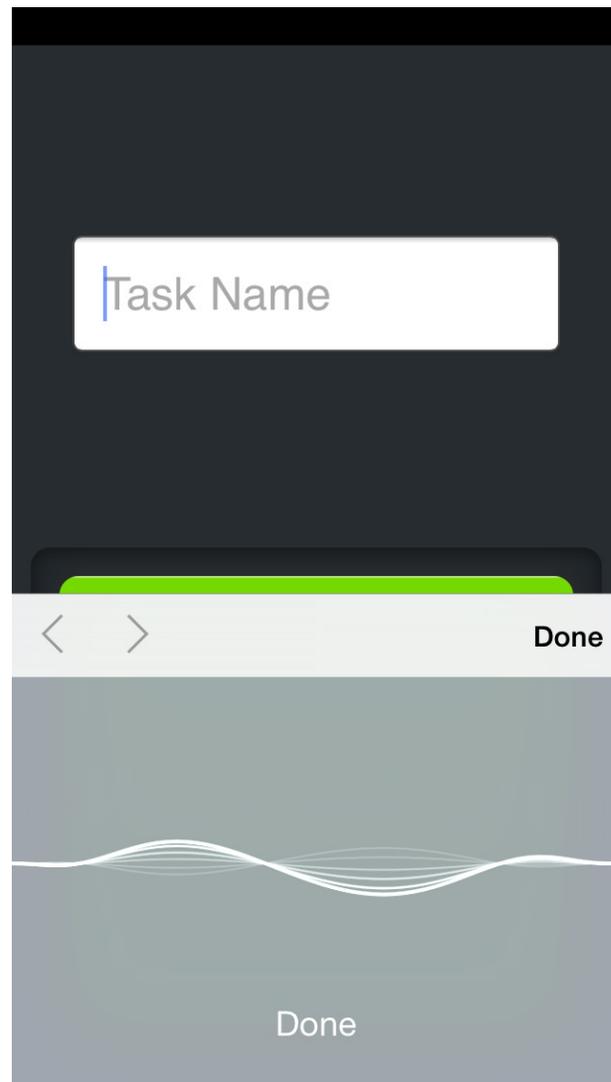
PROTOTYPE WALKTHROUGH



Neil powers on the MICO arm. He is greeted on the touch screen by four tasks he had previously programmed: turn on faucet, rinse toothbrush, eat a sandwich, and drink water. Today, he decides he wants to teach MICO to flush the toilet. So he taps "New Task."

HI-FIDELITY PROTOTYPE

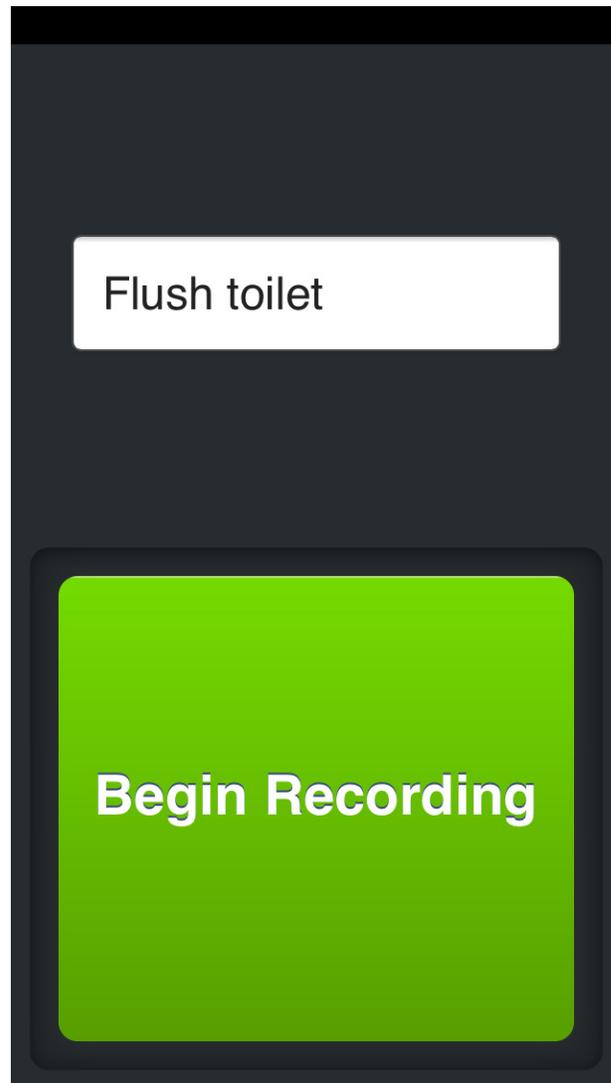
PROTOTYPE WALKTHROUGH (CONTINUED)



Neil is taken to a new screen that brings up a keyboard to enter the name of the task he would like to record. He also has the option of using voice input, as shown here. He speaks aloud "Flush the toilet."

HI-FIDELITY PROTOTYPE

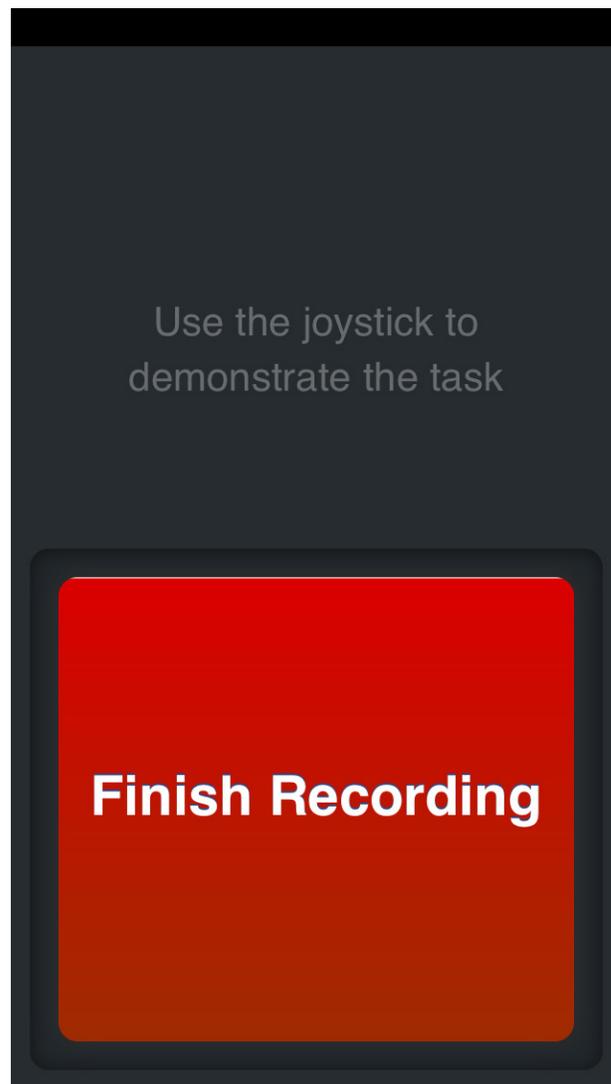
PROTOTYPE WALKTHROUGH (CONTINUED)



After inputting a name, the keyboard automatically dismisses. As soon as the arm is ready to begin recording, the "Begin Recording" button lights up - allowing Neil to begin. He taps "Begin Recording."

HI-FIDELITY PROTOTYPE

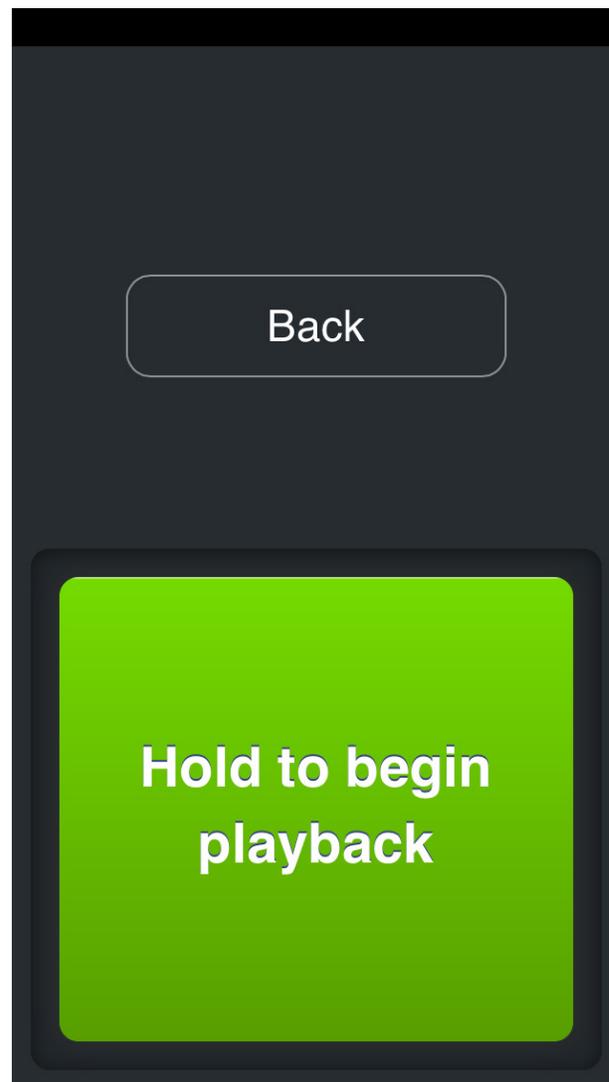
PROTOTYPE WALKTHROUGH (CONTINUED)



On this screen, Neil is prompted to use his wheelchair mounted joystick to demonstrate how to perform the task. He uses the joystick to direct the arm to flush the toilet.

HI-FIDELITY PROTOTYPE

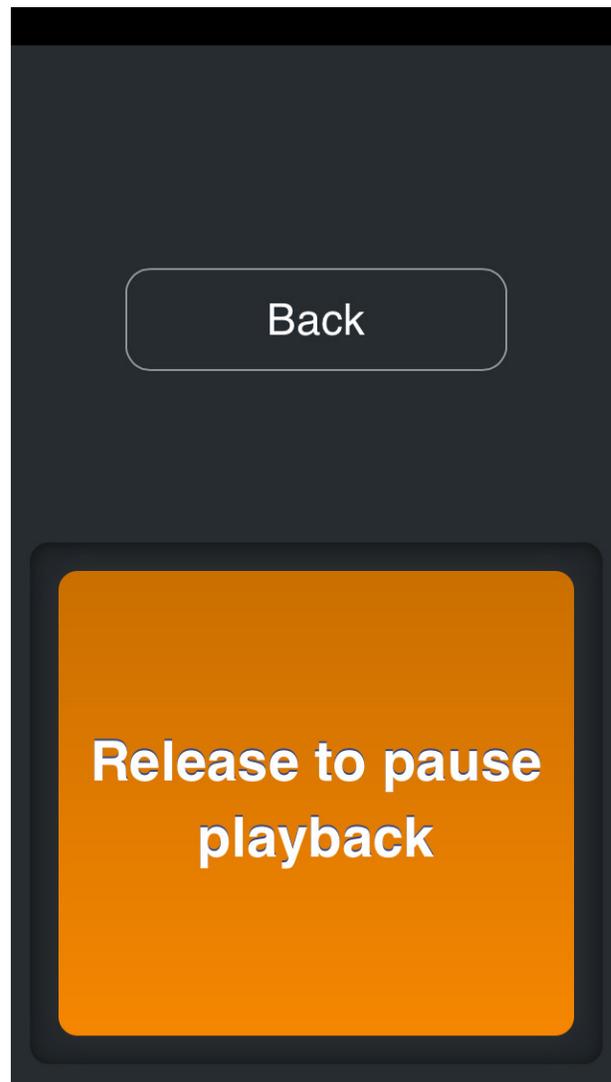
PROTOTYPE WALKTHROUGH (CONTINUED)



To playback a recorded task, Neil selects it from the home screen. He is then taken to this screen, that instructs Neil to hold the green button to begin playback.

HI-FIDELITY PROTOTYPE

PROTOTYPE WALKTHROUGH (CONTINUED)



As Neil holds the button to begin playback, it turns orange and begins pulsing. This reassures him to know the arm is continuing to perform his task - even if it takes a brief pause.

If Neil releases his finger from the button, the playback pauses. This allows Neil to make slight adjustments to the arm's position using the joystick. After he has adjusted the arm's position, he can continue playback just where he left off.

HI-FIDELITY PROTOTYPE EVALUATION

PILOT STUDY DESIGN

STUDY GOALS

The purpose of our pilot study was to answer the following questions:

Do users find recorded movements useful?

Do users find recorded movements easy to use?

Do users feel in control while playing back recorded movements?

Are users able to complete tasks using the user interface?

PARTICIPANTS

For this first round of pilot studies with the hi-fi prototype, we recruited participants from the Carnegie Mellon University campus. All participants were able-bodied users. We believed that testing with the able-bodied users first would give us insight into the idea of using recorded movements. We wanted to determine whether or not recorded movements would be an effective way to complete tasks. We also wanted to see how users would take advantage of recorded movements, and see what sorts of difficulties would arise.

TASK

The task given to our participants was to use the MICO arm to pick up an open bottle of water and pour its contents into a cup.

Participants had to perform the basic water pouring task in four different versions based on two variables: the location of the bottle and whether or not the participant was allowed to use recorded movements. We tested with these two variables in order to determine how effective using a recorded movement for a task would be, to see how well participants could deal with variation in the task, given that the recorded movement would have to be adjusted slightly, and so that we would have a control task (using manual control to perform the task).

HI-FIDELITY PROTOTYPE EVALUATION

PILOT STUDY DESIGN (CONTINUED)

STUDY SETUP

We designed each study to take about 40 minutes in total. There were at least two study facilitators present to run and record each study.

The studies took place in the Robotics Lab, where the MICO arm is mounted on a table. We marked the table with two default locations for the water bottle (Position A and B) as well as a location for the cup, so that the coordinators are consistent with the placement of the objects throughout the studies. Before the start of each study, the cup was emptied and the water bottle was filled with about half an inch of water.

Also, at the beginning of each study, we asked our participants of their dominant hand, and mounted the joystick in front of their dominant hand and the phone in front of their non-dominant hand accordingly. We also instructed them to limit their movement (i.e. no moving their chair around so as to simulate being in a wheelchair and having limited movement and vision past the arm).

After having the participants read and sign the consent form (see Appendix), we conducted the study in the following order:

1. TRAINING

Participants were given approximately 15 minutes (less if they were able to get comfortable with the arm quickly) to learn how to use and practice controlling the arm. We provided them with a sheet indicating all the modes of movement and commands for the arm (see Appendix). For training, participants practiced moving objects around, including the target water bottle.

2. RECORDING

The next step was to have participants record the actual task of picking up the target water bottle, pour its contents into cup, and placing the bottle back on the table. This recorded movement would be used later in the study during the four main task performance tests.

HI-FIDELITY PROTOTYPE EVALUATION

PILOT STUDY DESIGN (CONTINUED)

3. TASK PERFORMANCE (4 VERSIONS)

For the actual task performance, we randomized the order of the four versions of the water pouring task that participants would perform. The two variables were the location of the bottle (position A, where it was when the participant recorded the task, or position B, another position on the table) and the control mode (only joystick or recording and joystick). We named each version of the task based on the location and whether it was only performed with manual joystick movement (JOY) or with recorded playback as well (REC). The four versions were:

MANUAL CONTROL, POSITION A (AJOY)

We reset the set up to the original placement, A. The participant uses the joystick to complete the task.

MANUAL CONTROL, POSITION B (BJOY)

We reset the set up to the new placement, B. The participant uses the joystick to complete the task.

PLAYBACK, POSITION A (AREC)

We reset the set up to the original placement, A. The participant attempts to play back the task and use the joystick only for adjustments.

PLAYBACK, POSITION B (BREC)

We reset the set up to the new placement, B. The participant attempts to play back the task and use the joystick only for adjustments.

HI-FIDELITY PROTOTYPE EVALUATION

PILOT STUDY DESIGN (CONTINUED)

4. FOLLOW-UP INTERVIEW

After participants finished all four version of the task (or ran out of time), we asked some follow-up questions to ask about their perspective on how it felt to use the arm, how useful they found the recorded movements, how in control they felt while using the recorded movements, etc. Specifically, we asked:

- What overall impressions did you have about using the arm?
- What were the biggest challenges you faced?
- Did you prefer using the joystick or the recorded movements?
- How in control did you feel during playback of recorded movements?
- Did the ability to correct the path of the arm help you complete the task the second time?
- Would you have preferred to just redo the task entirely or use the recorded task and then modify the path if necessary?

PILOT STUDY RESULTS

Due to some technical issues with our prototype, we had to cancel the last few studies we were planning to conduct, but the five studies we were able to conduct provided us with a great deal of insight into how to improve our prototype and the direction of our next design iteration.

Video recordings and detailed notes of all five pilot studies can be accessed in the appendix, but below is a summary of our major findings.

One problem we noticed is that the different control modes of the arm are extremely confusing, especially wrist mode, and switching between them given the current two-button interface is difficult. Plus, people have a lot of trouble keeping track of which mode they are in. To fix this, we plan to eliminate the unlabeled physical buttons from the joystick and introduce mode buttons on the touch screen. This will allow users to see which mode they are currently in, rather than relying on memory.

HI-FIDELITY PROTOTYPE EVALUATION

PILOT STUDY RESULTS (CONTINUED)

Through our follow up questions, none of our participants said they preferred using recorded movements over the joystick. Further questioning revealed that participants felt the recorded movements didn't give them enough control over playback. They didn't feel that they were capable of make corrections to playback to deal with variations in the environment. One specific feature that was lacking from the prototype that led to this belief was the ability to rewind playback, to re-attempt a movement. Further, some technical bugs in our prototype led users being distrustful of recorded movements.

Another significant reason we believe that no participants preferred using recorded movements was due to our study design. We noticed that most participants saw the arm almost as a novelty and had a lot of fun using it. The difference between the participants we had and the actual users of the arm is that people who have to use the arm daily would not be as affected by the novelty factor of the arm, so their view on the usefulness of a feature like recorded movements could be different. For example, someone who has to use the arm for the same task every day might find recorded actions more useful than someone who is performing a task just a couple times. We plan to take this into account when designing or next study by potentially making the task very repetitive and boring and asking participants to complete the task as many times as possible within a given interval of time. We hope that this would reveal whether or not recorded movements are actually useful for carrying out the same task repeatedly, since performing the task so many times would presumably be tiring.

In addition to these large findings, we identified a large number of low-level usability issues with the design of the on-screen interface. Below are a sample of these findings:

1. Pauses in recorded movements make users worry that they haven't started playback.
2. Unnecessary interface sounds confuse users.
3. Users often poorly record movements and wish to re-record.
4. Users didn't expect the arm to return to its home position before each playback.

NEXT STEPS

NEXT STEPS

Based on our findings from user testing, we plan to redesign our prototype to better support people's need to feel in control of recorded movement playback. In our redesign, we plan to address the specific issues listed below.

SPECIFIC ISSUES THAT WILL BE CORRECTED IN THE REDESIGN

Pauses in playback make people worry that playback isn't working.

Fix: Shorten the initial pause.

Arm control mode switching with the joystick is awful.

Fix: Add buttons to playback/record UI that allow users to see which mode they're in.

Users confused by ding sound before Start Recording is tapped.

Fix: Eliminate ding in this part.

Users confused by auto-dismissing keyboard.

Fix: Eliminate the auto-dismissing keyboard.

Users often accidentally trigger delete alert.

Fix: Increase the time taken to trigger the delete.

There is novelty in using the arm's joystick. People get bored using recorded movements.

Fix: Design the task to be more monotonous. Make the session time longer.

Users have no way to "rewind" the movement playback - so they often fall back to joystick.

Fix: "Blocked" 1-2 second timeline that lets users move back and forward in time.

Users often record bad movements and want to re-record

Fix: "Blocked" 1-2 second timeline that lets users move back and forward in time.

Users didn't expect the arm to return to Home position before each playback.

Fix: Re-evaluate this after our next trial.

NEXT STEPS

NEXT STEPS (CONTINUED)

Further, we plan to redesign our evaluation study completely. We plan to run a much longer study by recruiting a small number of users that are interested in using the arm numerous times over the rest of the semester. From this, we plan to better learn from the needs of expert users, rather than the complete beginners that our first study unintentionally targeted.

APPENDIX

MICO CHEAT SHEET

Commands

Press and hold both buttons for 3 seconds - go to Home position

Click left button once - Cartesian mode

Click right button once - Wrist mode

Click both buttons at once - Gripper mode

Modes

Cartesian mode - move forward, left, right, and backward with joystick, and twist to move up and down

Wrist mode - move arm relative to wrist as reference point

Gripper mode - open and close arm by moving joystick left and right, twist to rotate wrist

VIDEO RECORDINGS

<https://drive.google.com/?tab=co&authuser=0#folders/OB0qlq1fBo6LOQ2FnRF81b1NnMDA>

STUDY NOTES

PARTICIPANT 1, M, (1, 2, 3, 4)

Joystick Training

"Wrist Mode is complicated - not so intuitive"

"Cartesian & Gripper Modes are REALLY easy to use"

but seemed to be still confused with the left & right for the Gripper Mode
Didn't read cheat sheet - maybe we should read the cheat sheet aloud to them.

"I'm still confused about the Wrist Mode. I don't understand what it does."

Just playing around with it, cartesian and gripper would be enough but I understand why wrist mode could be useful.

Buttons on joystick easy to use as long as you get used to it at first - twisting left/right for up/down is complicated.

Recording Training

"I guess it'd be hard to record the whole task at once because of the different positions and all."

"If I were to use this I would only use the arm to set the position then use the task."

"It'd be nice if I had the top view because I can't see where the arm is relative to the object."

"Whenever you're recording tasks, it goes back to the home position - it's a problem."

Tried simulating the task before he began recording.

APPENDIX

STUDY NOTES (CONTINUED)

Manual Control, Position A

"It's actually hard to see where its heading."

Poured water from very high up.

Was able to pour water in ~2 minutes.

Playback, Position A

Didn't expect every playback will start from the Home position.

Subtasks less effective because not from the place he recorded from.

Got rid of the bottle out of his way to see how the playback works started re-recording tasks.

User believes its not playing back tasks correctly - maybe because of slow or not enough feedback?

BUG: if there are 2 tasks with the same name and the user deletes one of them, both tasks are deleted.

BUG possibly?: task doesn't delete if it doesn't contain any movement.

Follow-up Questions

What overall impressions did you have about using the arm?

Arm itself is really well build, really easy to use, programming part is more complex and takes more time - be nicer to have camera on top so I can see down and know where its going to land.

Other than that, I guess recording from home position useful if recorded from the same spot.

Small tasks separated out would be nice.

Pouring motion, grabbing motion, down and grab would be nice as a simple function.

"Other than that everything was really nice."

What were the biggest challenges you faced?

Seeing where the arm was when i bring it down relative to wherever the object is.

When you're moving the arma round and trying to set arm at a specific angle because when you move the arm the angle changes.

Supposed to be complicated but relative positioning of stuff is complicated.

Where is the object going to land when you try to put it down?

I think it would really help if there was a camera or something.

Did you prefer using the joystick or the recorded movements - when the bottle was in the same position as you trained it in, when the bottle was in a different position, and overall?

Joystick much easier to use.

APPENDIX

STUDY NOTES (CONTINUED)

Would answer change over the course of weeks?

I don't think so - I would rather perform the task.

How in control did you feel during playback of recorded movements?

Seems to work pretty well

Using the joystick it feels like i'm doing something, using the playback it's not as trustworthy as yourself using the arm.

Thoughts regarding the interface?

Responds slower when playing back the interface.

Pretty simple to understand everything quickly.

Maybe making different compartments for different tasks.

PARTICIPANT 2, F, (3, 1, 2, 4)

Joystick Training

Pretty quickly picked it up, took a lot of time to make the movements but was able to perform the task.

Spilled a little bit.

Wrist mode seems to be a big issue, hard to use and understand.

"This is so cool!"

BUG: ding sound before the user taps on Start Recording.

BUG: there's just no way to go back once you start creating a task.

Recording Training

Did a good job recording the task, not too many extra unnecessary movements.

Manual Control, Position B (BJOY)

Definitely understands how to use the arm well, but still mixing up/confusing the directions of movements (which way to twist the joystick to twist the arm left/right).

Manual Control, Position A (AJOY)

Still mixing up/confusing the directions of movements.

Playback, Position A (AREC)

Confused about whether the interface is recording the movements she performs while playing back the recorded movement.

Having a tough time using the automated movement + manual control - seems like the recorded movement didn't work so she started using manual control instead.

APPENDIX

STUDY NOTES (CONTINUED)

Follow-up Questions

Did you prefer using the joystick or the recorded movements?

Joystick - my movements were in control versus the recording, knew I could do it in a smoother.

How in control did you feel during playback of recorded movements?

It was fine but could have been done faster or in a better way.

Wasn't complete lack of control.

Did the ability to correct the path of the arm help you complete the task the when it was in a new place?

In one case - second one.

Would you have preferred to just redo the task entirely or use the recorded task and then modify the path if necessary?

Joystick.

What overall impressions did you have about using the arm?

Interesting to use, basic controls down its really straight forward.

Visualizing human arm while doing it but it doesnt work the same way.

What were the biggest challenges you faced?

Angling the bottle correctly.

PARTICIPANT 3, F, (2, 3, 4, 1)

Joystick Training

"I have no idea [what mode I'm in]"

Having a lot of problems figuring out what mode the arm is in, how to switch modes.

We had to intervene to reset to home and put it in Cartesian mode.

Recording Training

Unsure how to record the task, interface maybe not clear?

Playback, Position A (AREC)

"Am I doing this right?"

Very hesitant.

Task did not get completed properly, dropped the bottle.

Manual Control, Position B (BJOY)

Completed the task

"Did I do that right?"

Manual went much better this time around than any previous attempt.

APPENDIX

STUDY NOTES (CONTINUED)

Playback, Position B (BREC)

Stopped using the recording and just went completely manual.
“I thought the first time I messed up too many times.”

Manual Control, Position A (AJOY)

Performed smoothly.

Follow-up Questions

Did you prefer using the joystick or the recorded movements?

Preferred to use the joystick. Felt like she had more control.

How in control did you feel during playback of recorded movements?

Felt like they could be in control, but wasn't until they stopped it. “I felt like I was watching someone else do it for me.”

Did the ability to correct the path of the arm help you complete the task the when it was in a new place?

Yes it was helpful.

Would you have preferred to just redo the task entirely or use the recorded task and then modify the path if necessary?

Would prefer to have a gold standard recording.

What overall impressions did you have about using the arm?

Couldn't remember what mode the arm was in.

What were the biggest challenges you faced?

Remembering the arm control modes.

“Had trouble remembering which mode I was in.”

PARTICIPANT 3, M, (3, 1, 2, 4)

Joystick Training

Seems to have picked up the controls pretty well, has a good grasp of how they work.

Recording Training

Very careful when approaching the bottle with the arm.

Is very precise with his movements.

Very quickly and accurately records the task.

Seems to have a little trouble interpreting how wrist mode should work (has to make the most adjustments back and forth in wrist mode vs. any other mode).

APPENDIX

STUDY NOTES (CONTINUED)

Manual Control, Position B (BJOY)

Very quick.

Everyone has trouble figuring out which way to twist the hand (not obvious which direction the wrist will rotate when you twist the joystick).

Manual Control, Position A (AJOY)

Again, quick and accurate.

Follow-up Questions

What overall impressions did you have about using the arm?

Would wish the cartesian control z-axis movement was reversed.

Wrist movement is confusing.

What were the biggest challenges you faced?

Didn't face many challenges.

CONSENT FORM

Consent Form for Participation in Research

Study Title: Hi-Fidelity Robotic Arm Controller for Recording Movements

Principal Investigator: Siddhartha Srinivasa
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Email: siddh@cs.cmu.edu

Faculty Advisor: Siddhartha Srinivasa

Other Investigator(s): Laura Herlant

Purpose of this Study

The purpose of the study is to evaluate a touch screen controller in conjunction with a joystick to further improve the interface for the MICO robotic arm by Kinova Robotics.

Procedures

You will be asked to perform a series of tasks with the MICO robotic arm using a joystick and touch screen controllers. In some cases, you will solely use the joystick to control the MICO arm to pick up and move items. In other cases, you will program movements to the arm and use these programmed movements through the touch screen controller as well as the joystick.

You will answer questions related to your experiences performing these tasks after the study.

The study and subsequent questions will take about 40 minutes.

Participant Requirements

You are required to not have any prior experience interacting with the MICO arm. You must be between the ages of 18 and 65.

Risks

The risks and discomfort associated with participation in this study are no greater than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests. There will be no risk in interacting with the robotic arm as the experimenter will be present during the entire duration of the experiment and can stop the robot at any time.

Benefits

There may be no personal benefit from your participation in the study but the knowledge received may be of value to Robotics research at Carnegie Mellon University.

Compensation & Costs

You will not be compensated for the completion of the study. There will be no cost to you if you participate in this study.

APPENDIX

CONSENT FORM (CONTINUED)

Consent Form for Participation in Research

Confidentiality

By participating in the study, you understand and agree that Carnegie Mellon may be required to disclose your consent form, data and other personally identifiable information as required by law, regulation, subpoena or court order. Otherwise, your confidentiality will be maintained in the following manner:

Your data and consent form will be kept separate. Your consent form will be stored in a locked location on Carnegie Mellon property and will not be disclosed to third parties. By participating, you understand and agree that the data and information gathered during this study may be used by Carnegie Mellon and published and/or disclosed by Carnegie Mellon to others outside of Carnegie Mellon. However, your name, address, contact information and other direct personal identifiers in your consent form will not be mentioned in any such publication or dissemination of the research data and/or results by Carnegie Mellon.

The researchers will take the following steps to protect participants' identities during this study: (1) Each participant will be assigned a number; (2) The researchers will record any data collected during the study by number, not by name; (3) Only members of the research group will view collected data in detail; (4) Any recordings or data files will be stored in a secured location accessed only by authorized researchers.

Optional Permission

I understand that the researchers may want to use any video or audio recording for illustrative reasons in presentations of this work online, in print for scientific or educational purposes, or as part of a publically available database.

Please check only one box:

- I grant full permission. (Please initial here _____)
- I grant permission provided that my face is de-identified. (Please initial here _____)
- I decline permission. (Please initial here _____)

Rights

Your participation is voluntary. You are free to stop your participation at any point. Refusal to participate or withdrawal of your consent or discontinued participation in the study will not result in any penalty or loss of benefits or rights to which you might otherwise be entitled. The Principal Investigator may at his/her discretion remove you from the study for any of a number of reasons. In such an event, you will not suffer any penalty or loss of benefits or rights, which you might otherwise be entitled.

Right to Ask Questions & Contact Information

If you have any questions about this study, you should feel free to ask them now. If you have questions later, desire additional information, or wish to withdraw your participation please contact:

Siddhartha Srinivasa
4300 NSH
Pittsburgh, PA 15213
Email: siddh@cs.cmu.edu

APPENDIX

CONSENT FORM (CONTINUED)

Consent Form for Participation in Research

If you have questions pertaining to your rights as a research participant; or to report objections to this study, you should contact:

Regulatory Compliance Administration
Carnegie Mellon University
5000 Forbes Avenue
Warner Hall, 4th Floor
Pittsburgh, PA 15213
Email: irb-review@andrew.cmu.edu
(412) 268-1901 or (412) 268 4727

The Carnegie Mellon University Institutional Review Board (IRB) has approved the use of human participants for this study.

Voluntary Consent

By signing below, you agree that the above information has been explained to you and all your current questions have been answered. You understand that you may ask questions about any aspect of this research study during the course of the study and in the future. By signing this form, you agree to participate in this research study.

PARTICIPANT SIGNATURE

DATE

I certify that I have explained the nature and purpose of this research study to the above individual and I have discussed the potential benefits and possible risks of participation in the study. Any questions the individual has about this study have been answered and any future questions will be answered as they arise.

SIGNATURE OF PERSON OBTAINING CONSENT

DATE