

Welcome to the Robot Programming User Study

Ying Siu LIANG, 3rd year PhD, HAWAII

Robot Programming User Study

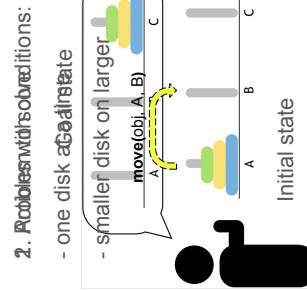
- We are **not** trying to evaluate your performance
- Evaluate and improve **our** robot programming system
- Comments & difficulties you're facing during the experiment are important!

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Overview

1. Introduction to Robot Programming
2. How to program Baxter
3. User tasks
4. Post-study questionnaire

How do we teach humans?

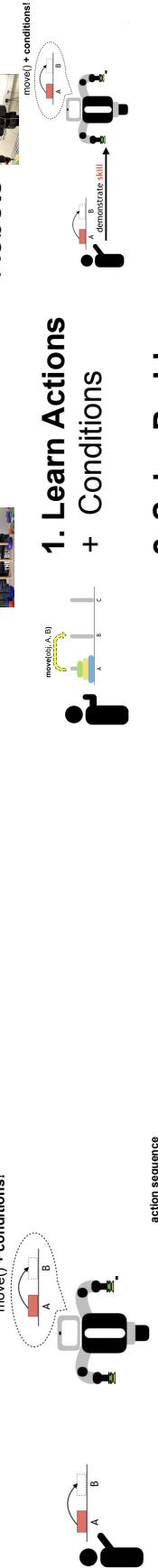


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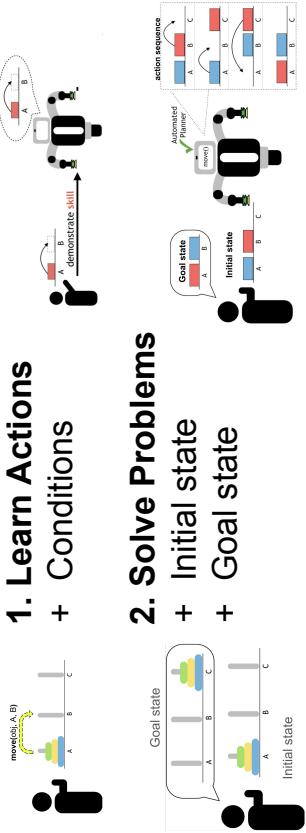
How do we teach robots?

1. Actions



Humans

1. Learn Actions
+ Conditions

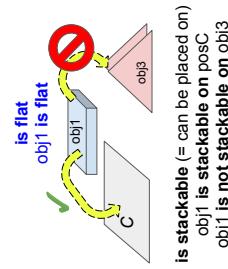


Robots

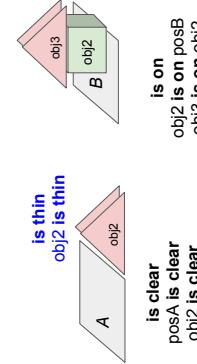
2. Solve Problems



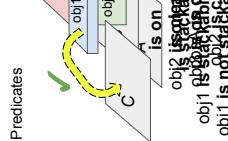
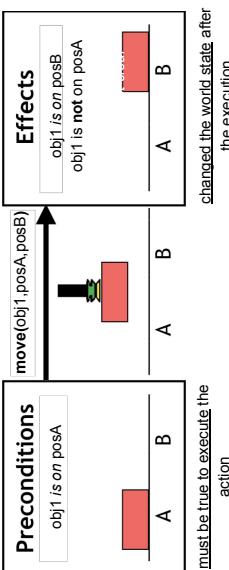
Predicates



is stackable (= can be placed on)
obj1 is stackable on posC
obj1 is not stackable on obj3



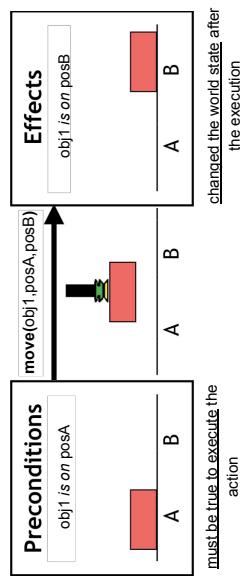
is on:
obj1 is on posB
obj3 is on obj2



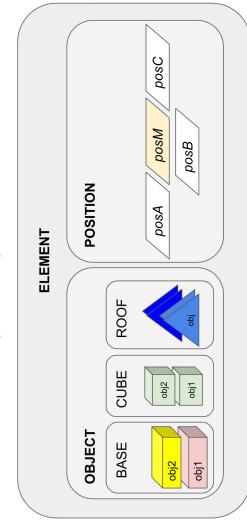
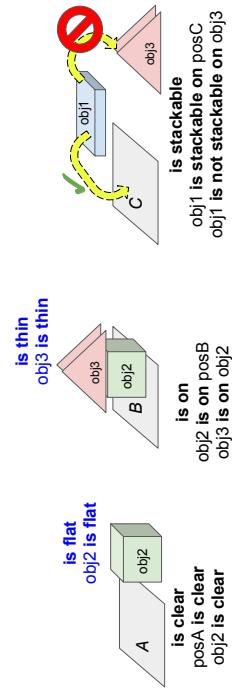
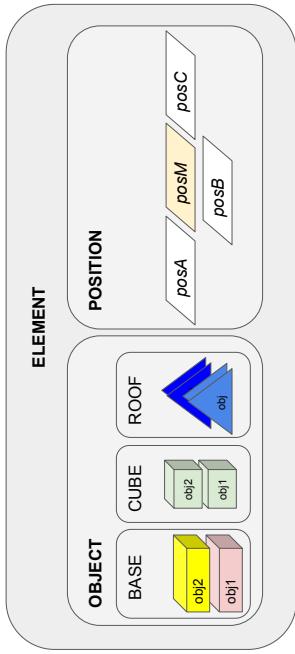
Types

action(ELEMENT, ELEMENT, ...)

move(CUBE, POSITION, POSITION)



move(BIGCUBE, POSITION, POSITION)



Questions?

<https://goo.gl/forms/or7W6gZeM1kVT92>

Experimental Context

- Production line (positions A,B,C,M)
- Object types Roof Cube

- Baxter does not know how to pick up objects
- Baxter grippers Electric
- Vacuum

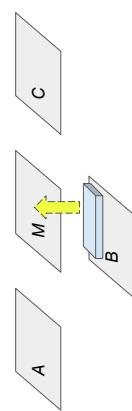
- Press

Manipulating Baxter

<https://youtu.be/oD9DE0HIMM4?t=28>

Move a BASE object

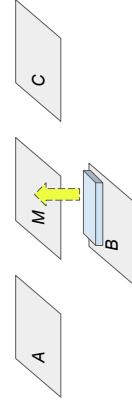
Program Baxter to move the BASE from position B to position M



Note start time: _____

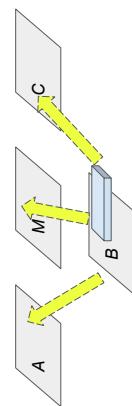
Move a BASE object

Program Baxter to move the BASE from position B to position M



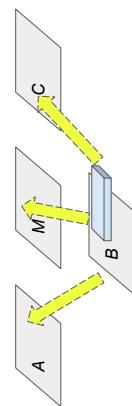
Note start time: _____

What if we want to move to any position?



Note start time: _____

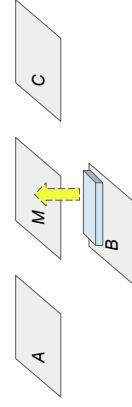
What if we want to move to any position?



1. Create Problem
Initial states step
a. Click on DETECT
2. Perception step
a. Click on DETECT
3. Demonstration step
a. Verify all detected objects and their types
4. Conditions step
a. REPLAY action at least once
5. Generated Plan step
a. Add goal states
b. Verify action sequence
6. EXECUTE plan
a. Detect effects
7. Rename problem "move-base" & Save

Move a BASE object

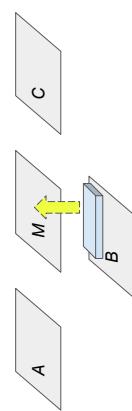
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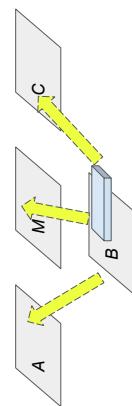
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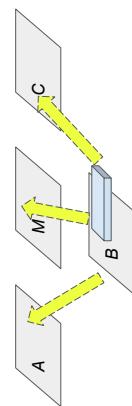
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What if we want to move to any position?



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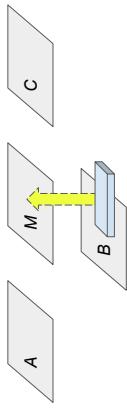
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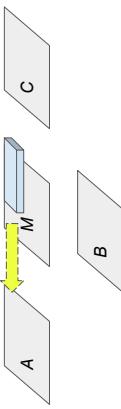
Experiment tasks

Teach Baxter an Action to move a BASE object

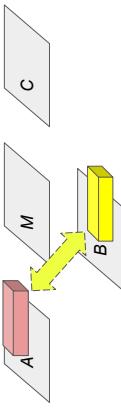


move-vacuum

Move BASE object to any position (e.g. A)

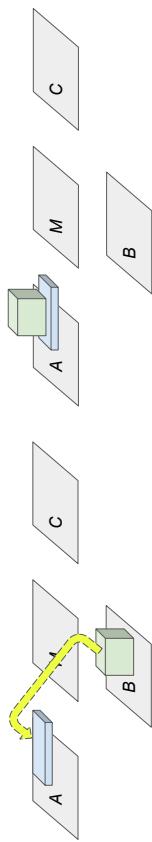


Generate a plan to swap positions of two BASE objects

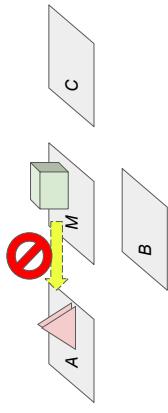


Define the goal states and let Baxter figure out the action steps
Hint: How can Baxter come up with the right steps?
(NO EXECUTION)

Stack CUBE object on BASE

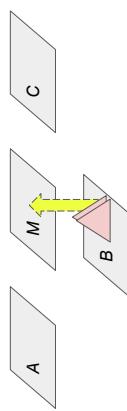


Modify the existing move action



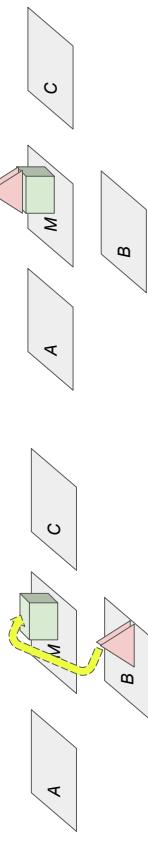
Modify the existing move action so that Baxter would not stack the CUBE object if it is a ROOF (NO EXECUTION)

Move ROOF object to position M

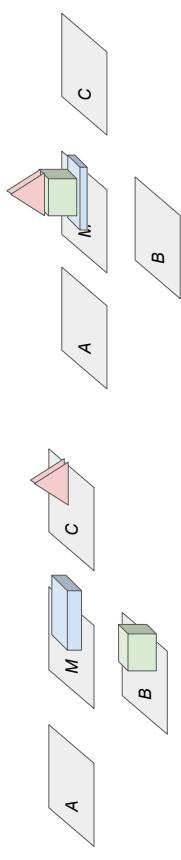


move-grip

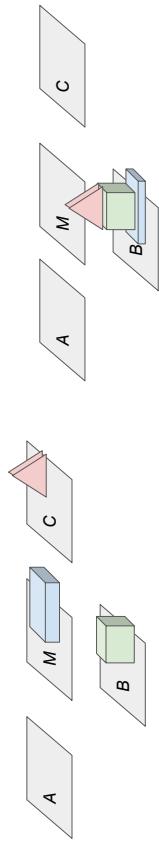
Stack ROOF object on CUBE



Final task: Build a house from all objects



Final task: Build a house from all objects - part 2



Bonus task: Have BASE and ROOF on position M

