To Understand Indicators of Robots' Vision Capabilities

Hong Wang

Tam Do

Zhao Han

UNIVERSITY of SOUTH FLORIDA

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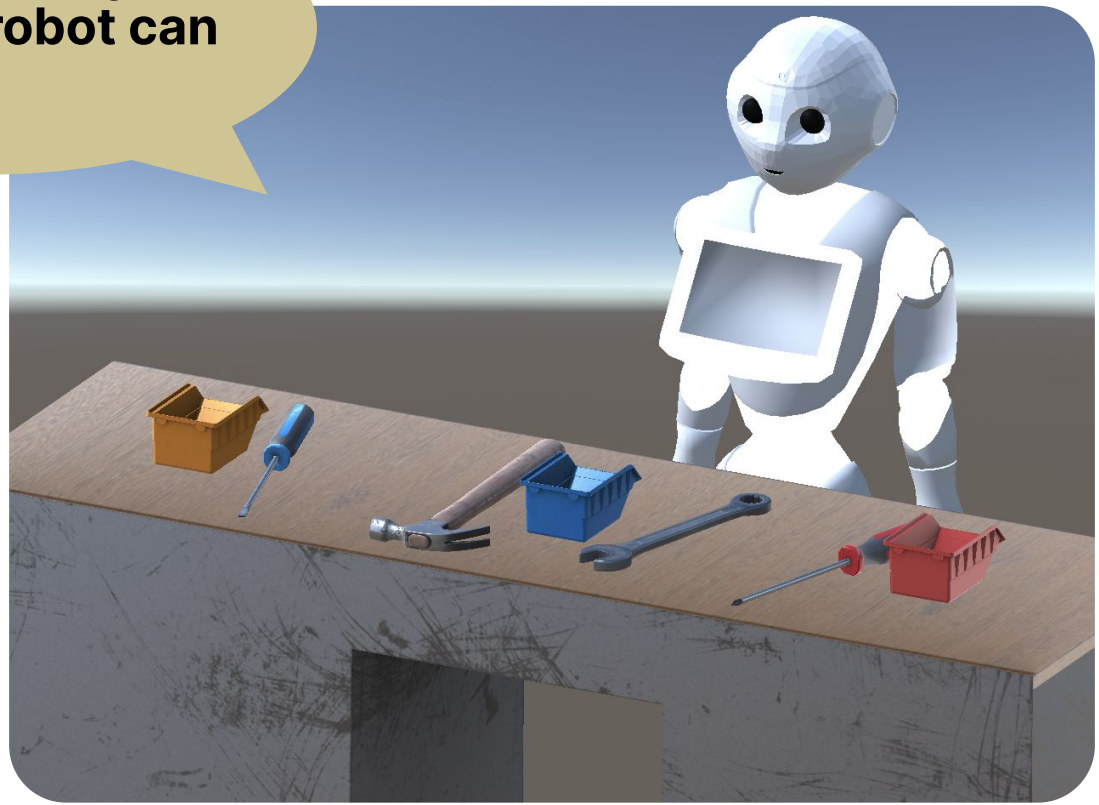
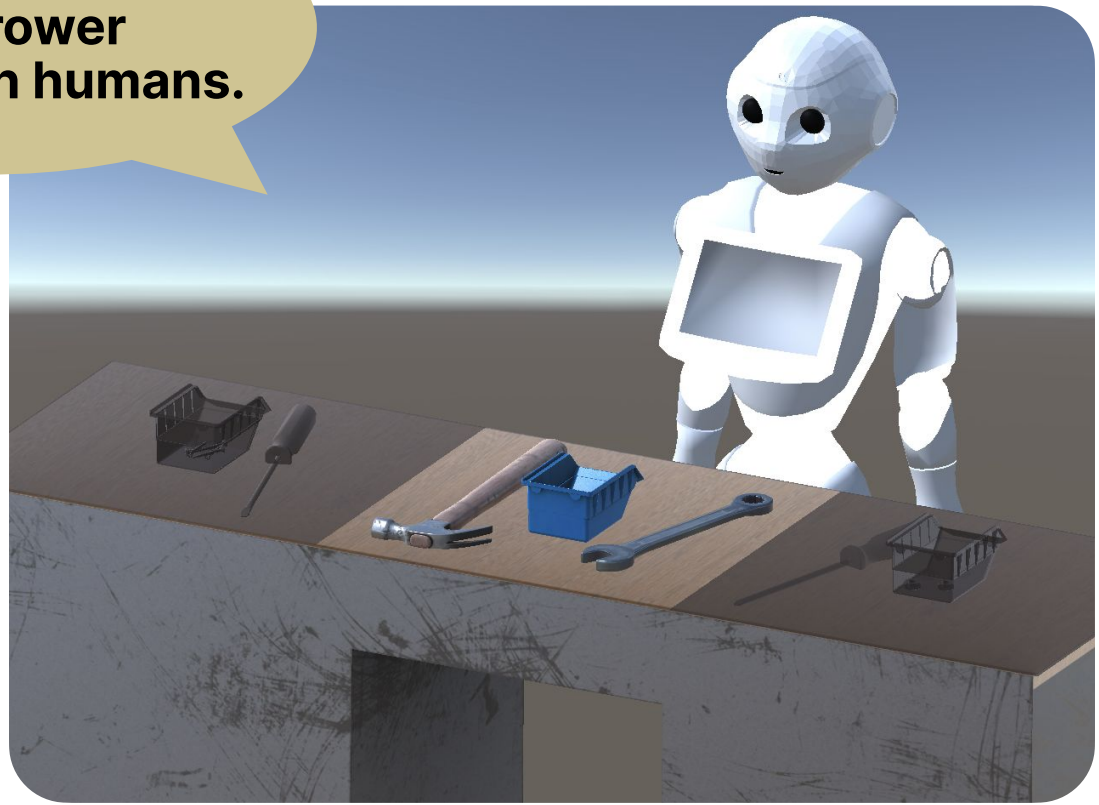
RARE LAB

What tools do you think the robot can see?



In fact, robots have much narrower views than humans.



Background

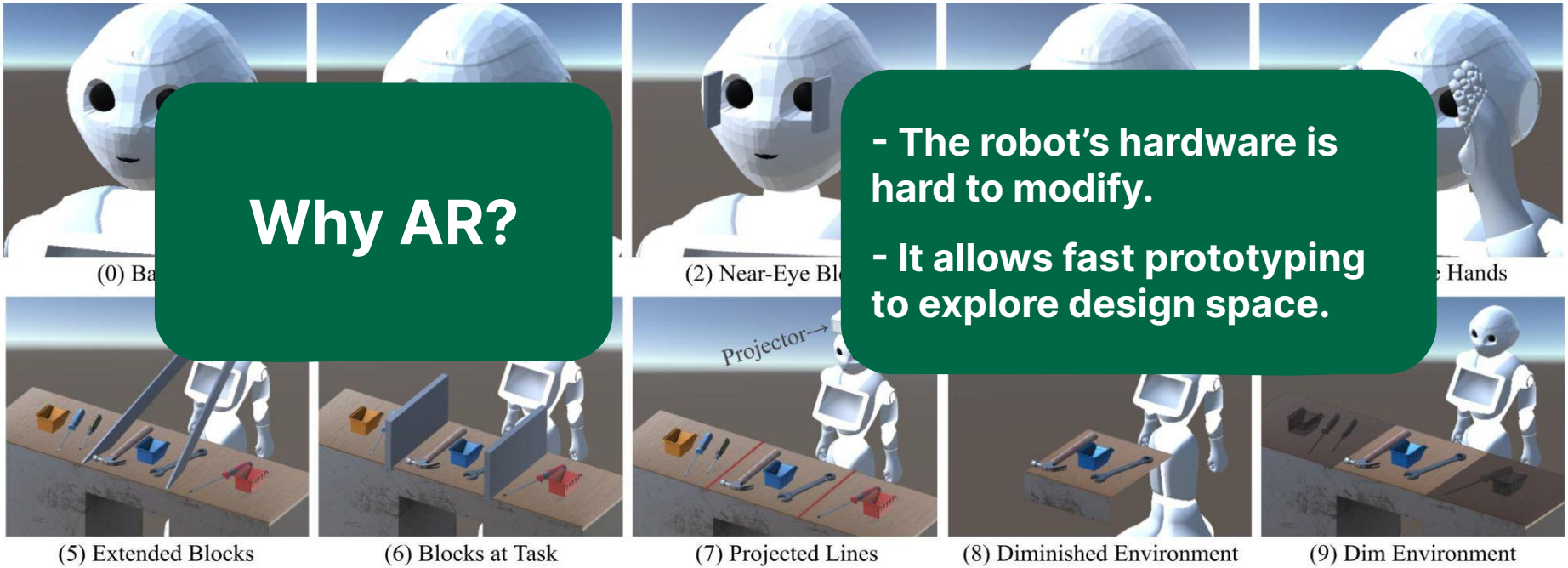
Study shows that we can mistake a **robot's field of view (~60°)** the same as **ours (>180°)**.

This is problematic!

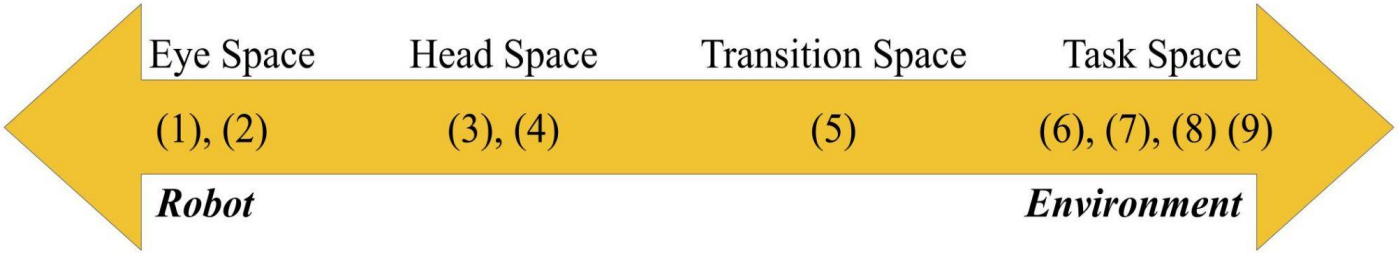
We will ask robots to do impossible tasks about out-of-view objects!

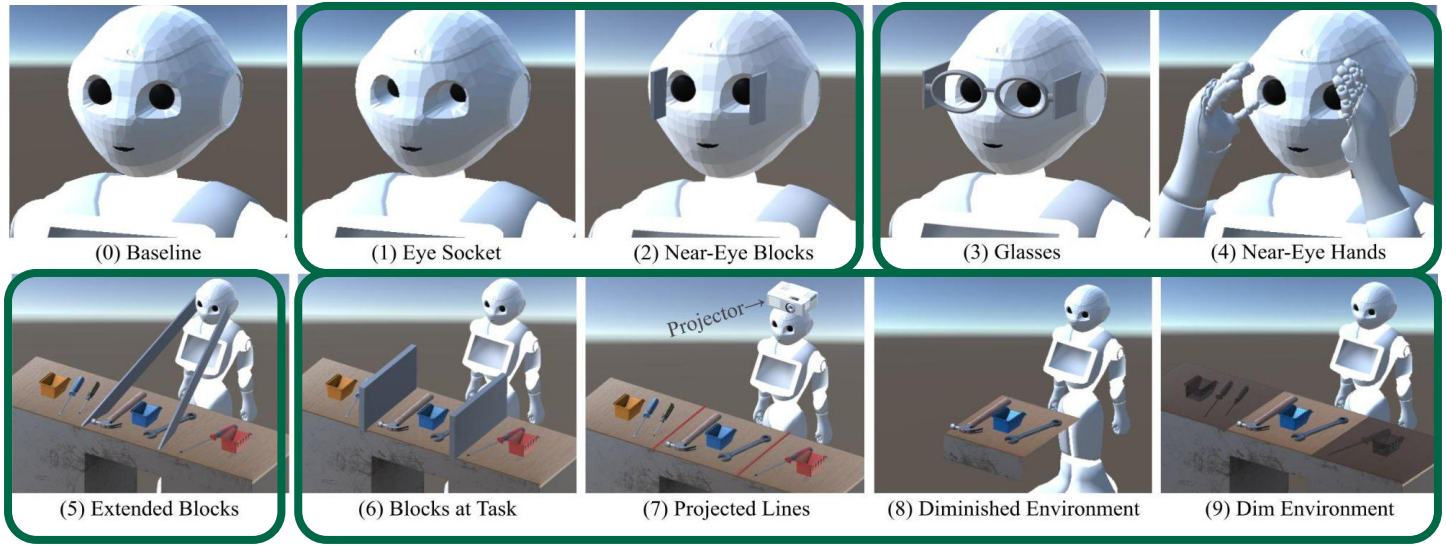
It is crucial to align our mental models of robots.

Designs: Strategies to Indicate FOV



Design Taxonomy and Spectrum





Hypotheses - Task Related

1. Participants will develop a **more accurate mental model** of the robot's visual capability.
    - Measured by **accuracy**

2. Indicators towards the environment will **improve task efficiency** more during human-robot collaborations.
    - Measured by **task completion time**

Hypotheses - Subjective

1. Participants will be **more confident** in the robot handing task objects.
    - Measured by **confidence**

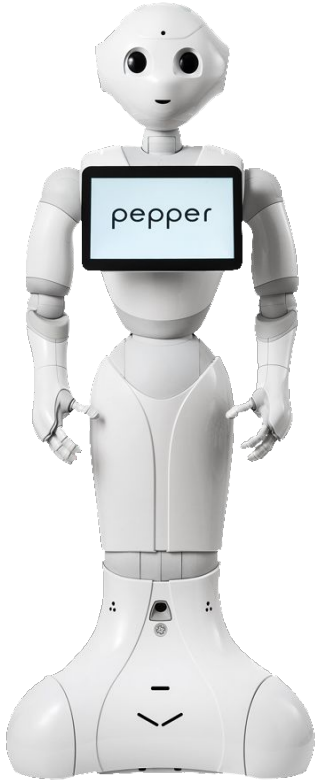
2. Designs closer to the environment will require **less cognitive effort**.
    - Measured by **cognitive effort**

Experiment Design

To test the hypotheses, we designed a within-subjects study

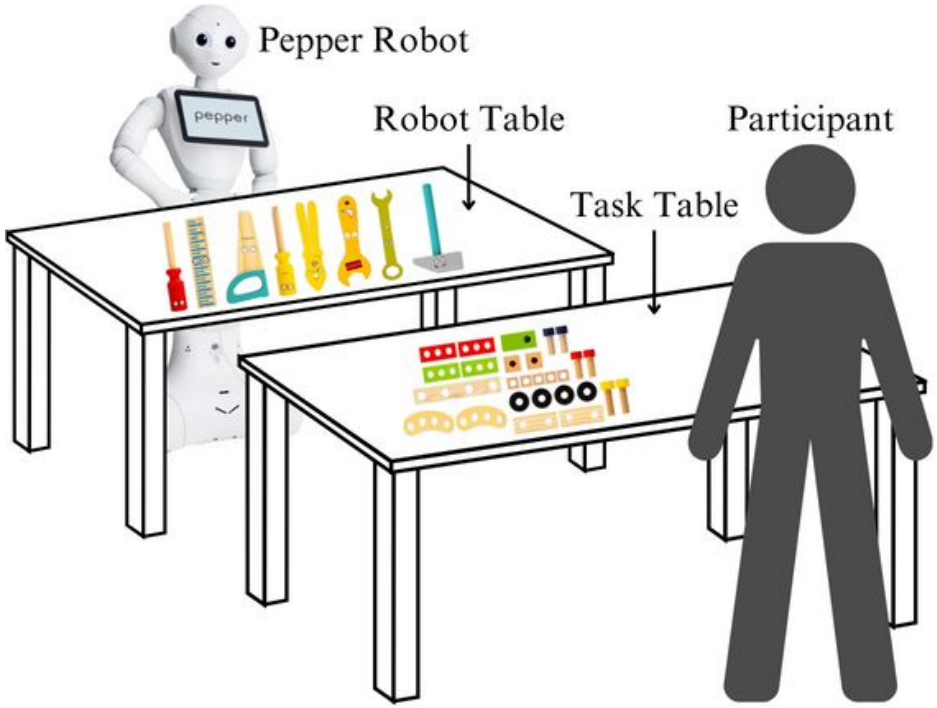
Apparatus and Materials

Pepper robot



AR Display: Microsoft Hololens 2

Task



(c) Assembled Airplane Model

The toy airplane model to be assembled

Data Collection and Measures

- **Accuracy** will be calculated by error rate.
- **Task completion time** will be coded from the videos.
- **Cognitive effort** will be measured by the NASA Task Load Index.
- **Confidence** will be measured by seven-point Likert scale.

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hongw@usf.edu
hongwang3.com

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RARE LAB
therarelab.com

Key Takeaways

1. Robots have **much narrower FoV**. People will ask for out-of-view objects.

2. We designed **9 indicators to show a robot's vision capability.**

3. We plan to **conduct user studies** to **narrow down** as well as **evaluate** our designs.