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How do people judge the capabilities of a robot?

Trevor McIntyre

Dr. Keith Jones' Lab

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How do people judge the capabilities of a robot?

How can we tell what a robot can do?

What can robots do?

There is a need for humans to understand what robots can and cannot do

- Urban search-and-rescue personnel need to understand whether a robot can fit through an opening in rubble
- Members of a military unit will need to understand the load-bearing capabilities of an assistive robot
- A user will need to understand whether their personal service robot can perform a given task

What can robots do?

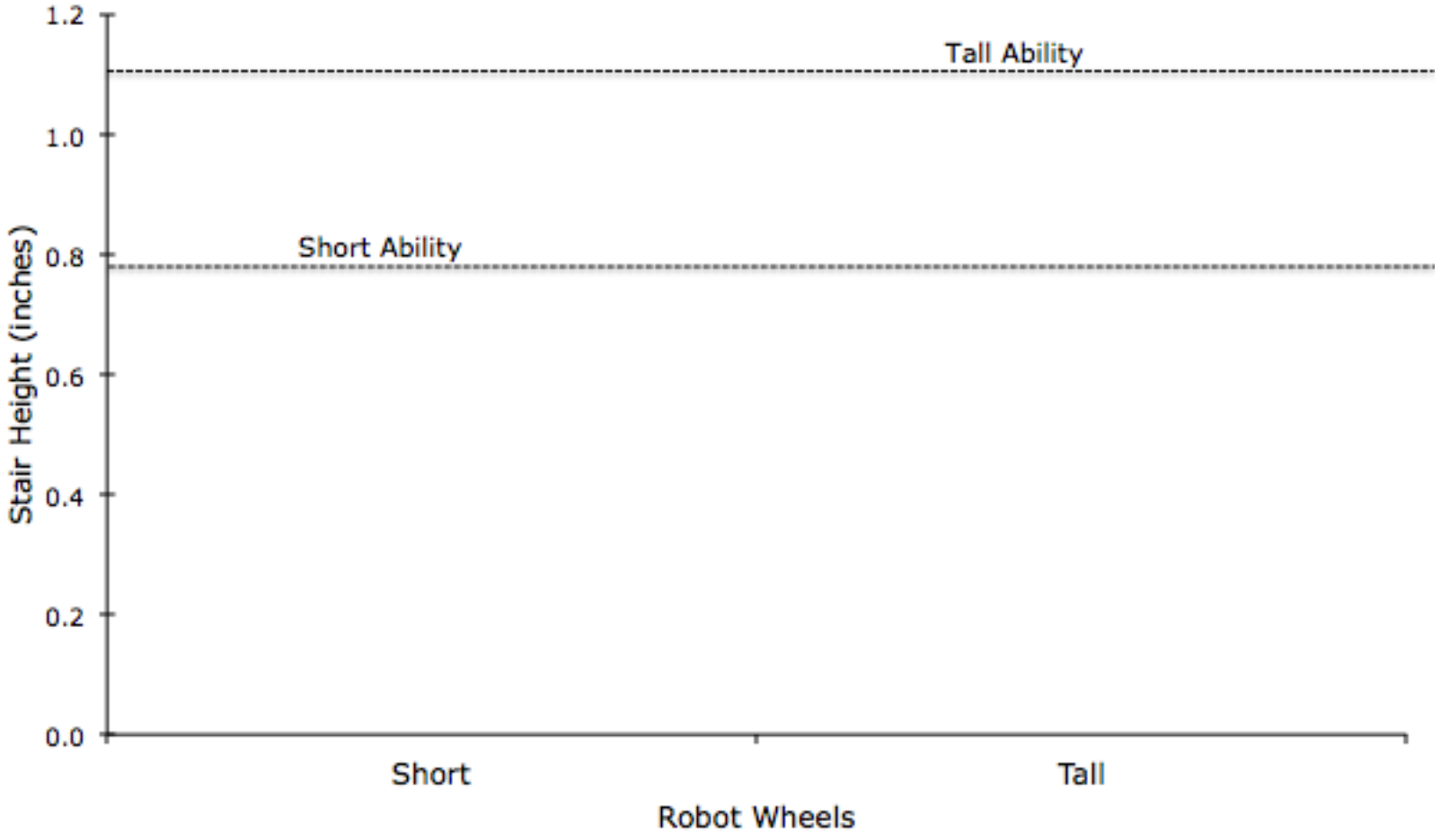
Humans can accurately judge the capabilities of other humans in performing certain actions

- Mark, 2007; Ramenzoni et al., 2005, 2008, 2010; Stoffregen et al., 1999

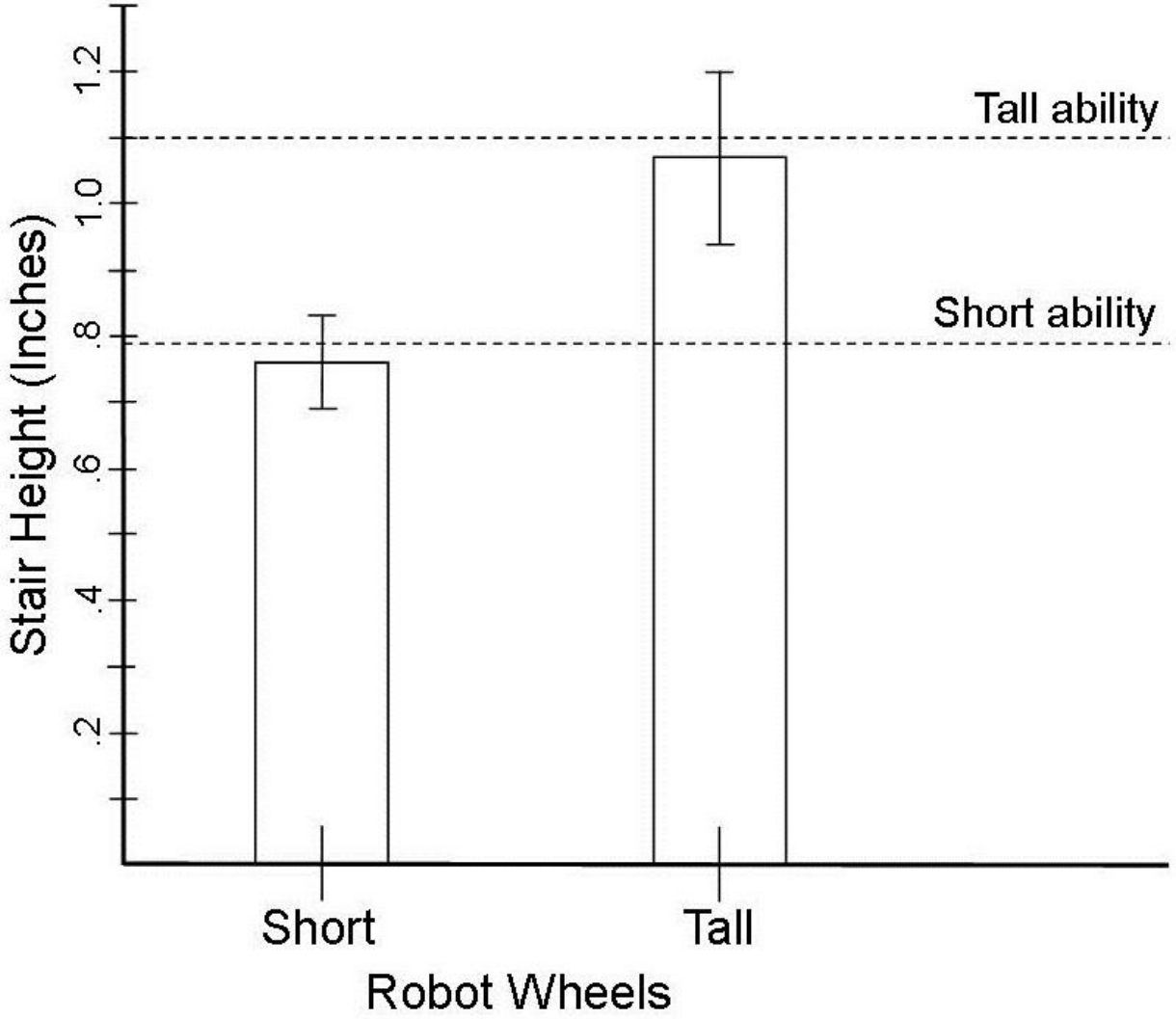
Jones, Schmidlin, & Wheeler (2012)

- Demonstrated that people are similarly accurate about robots
- Indicated participants used wheel height in their judgments of a wheeled-robot's capabilities, but there are some issues with this conclusion

What can robots do?



What can robots do?



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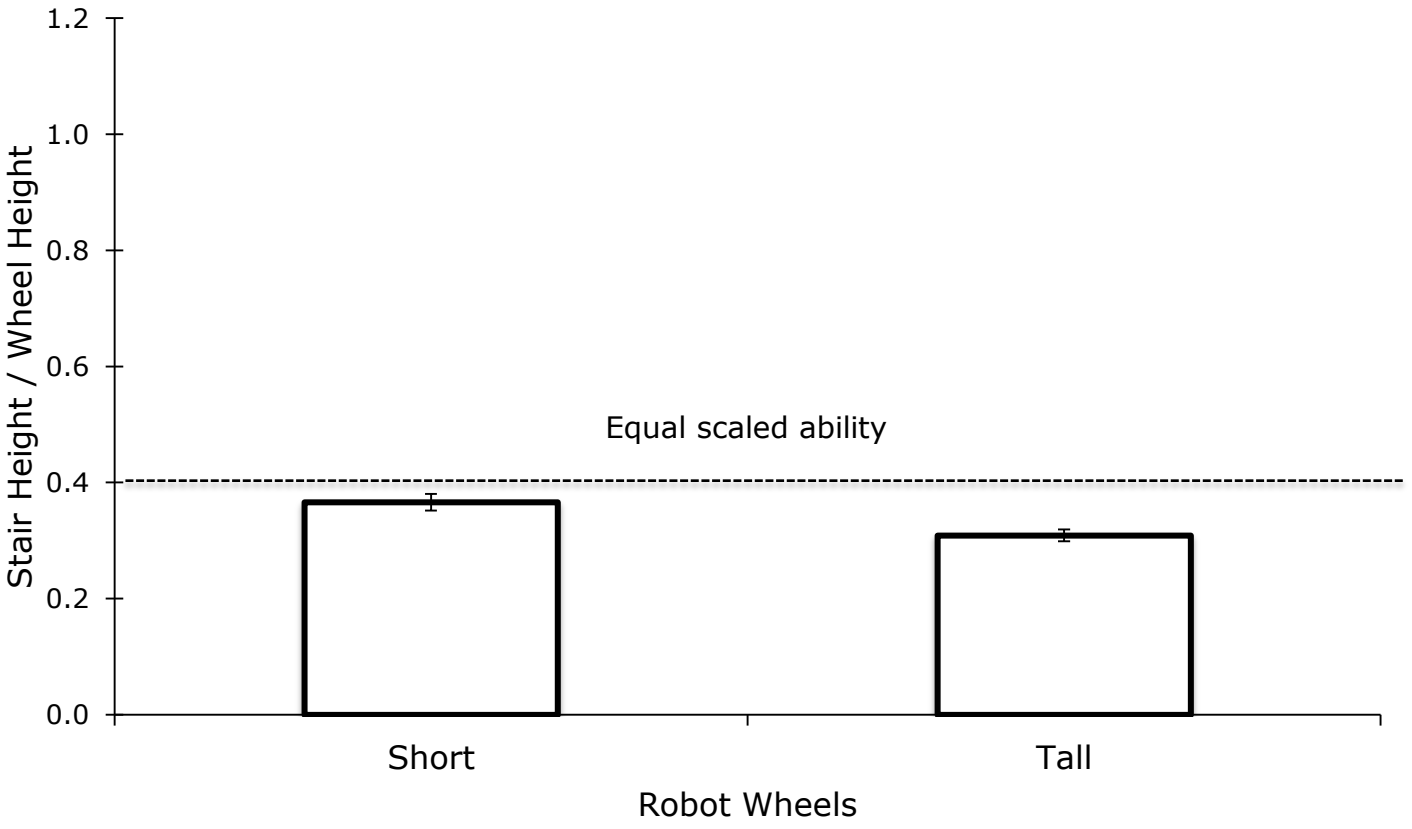
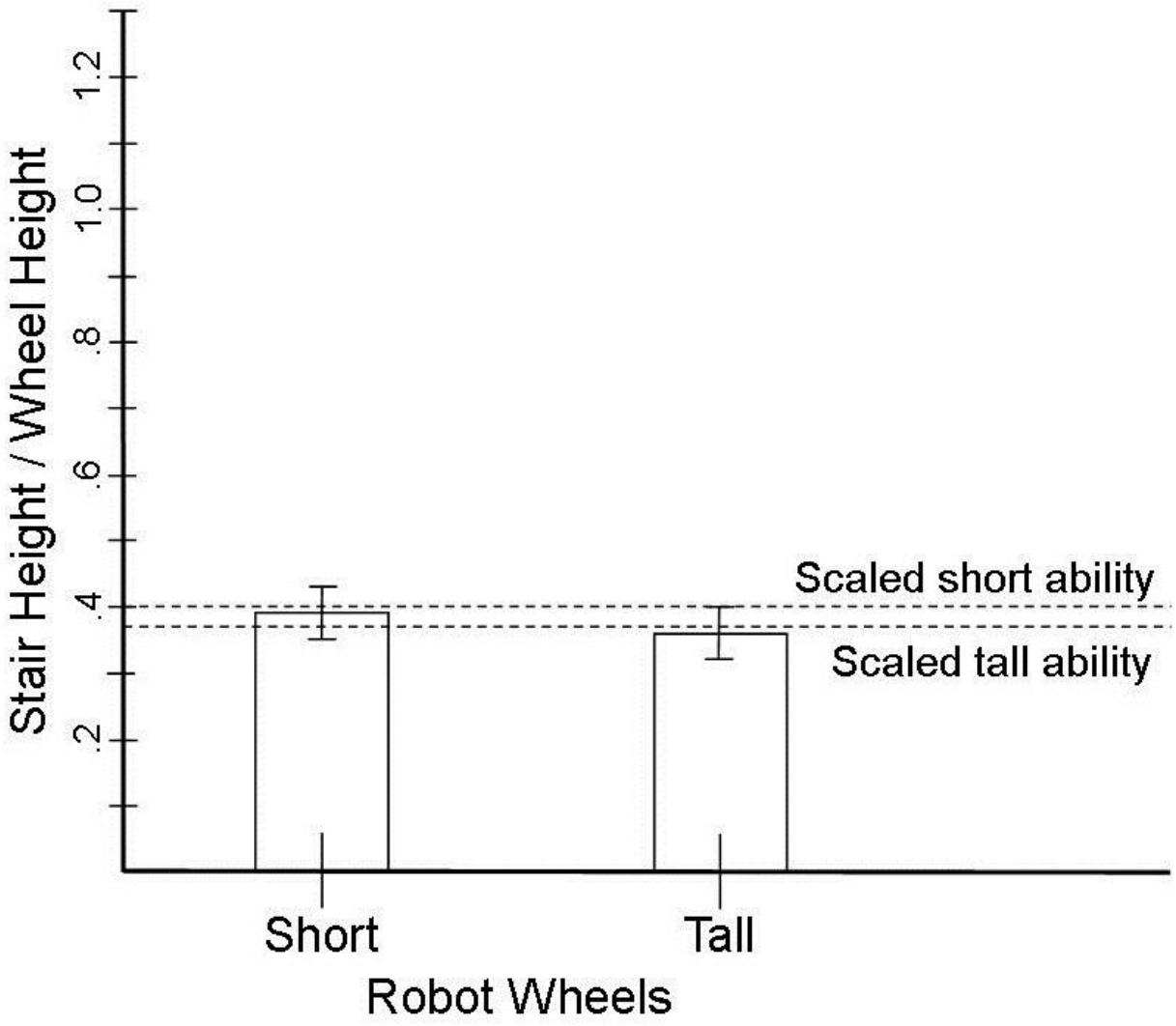


What can robots do?



How do people judge the capabilities of a robot?

Purpose

Purpose

We want to replicate the finding that people can accurately judge the capabilities of a robot

We seek to understand whether their judgments are influenced by properties that determine a robot's capabilities

- Extending Jones, Schmidlin, and Wheeler (2012), we want to see whether people use task-relevant properties in their judgments

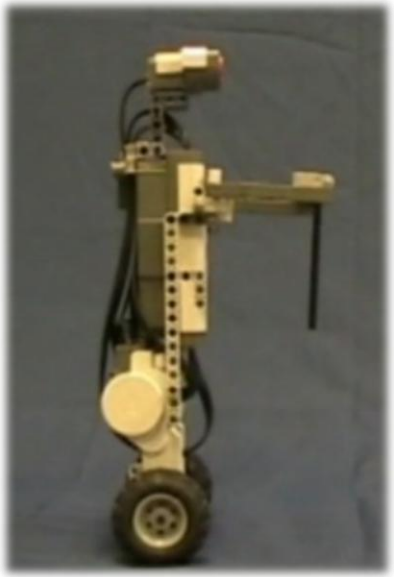
How do people judge the capabilities of a robot?

Method

Method

Participants

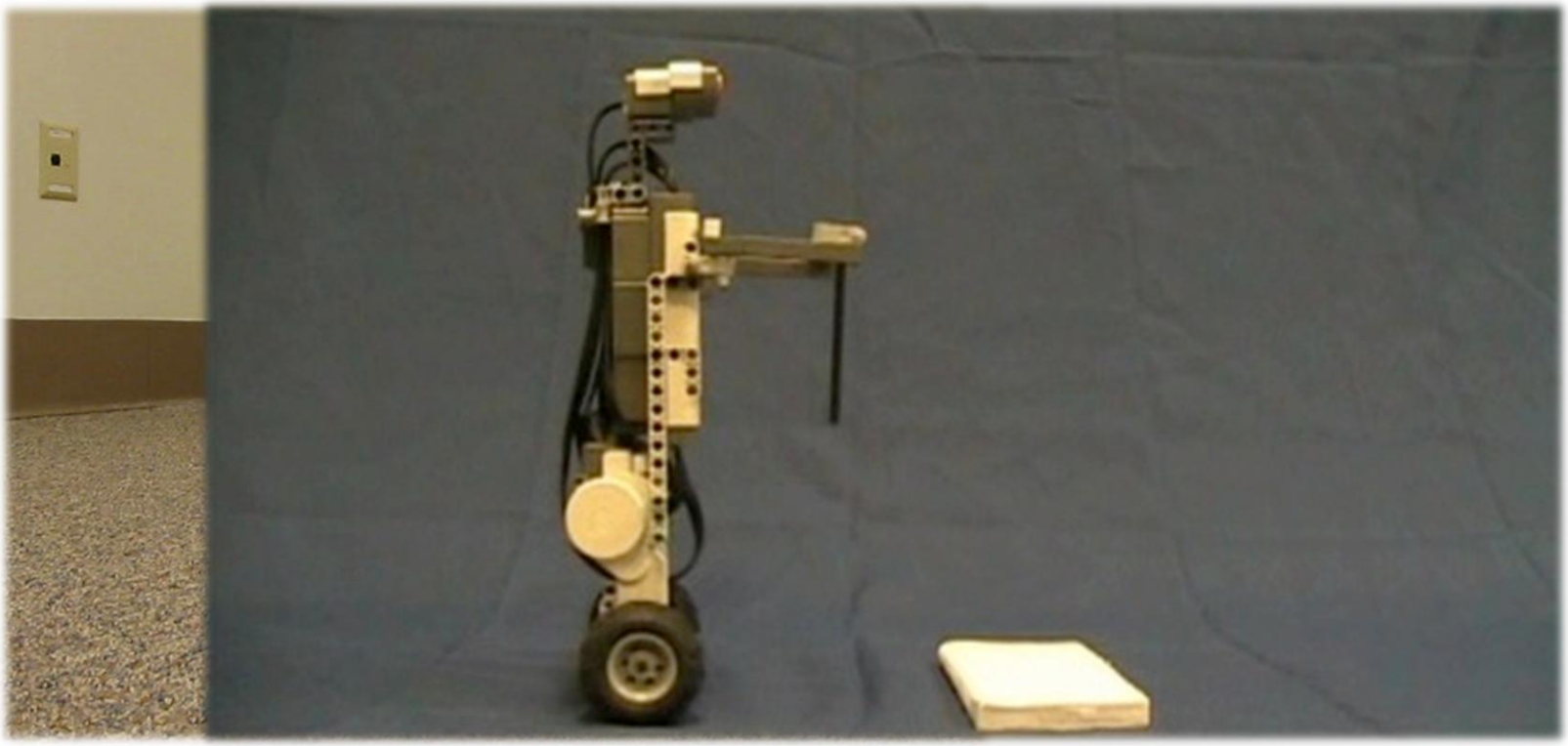
- 80 undergraduate students
  - *Recruited from General Psychology subject pool*



Robot

- Self-balancing
- Two sets of wheels
  - Short: 1.96 inches
  - Tall: 2.99 inches

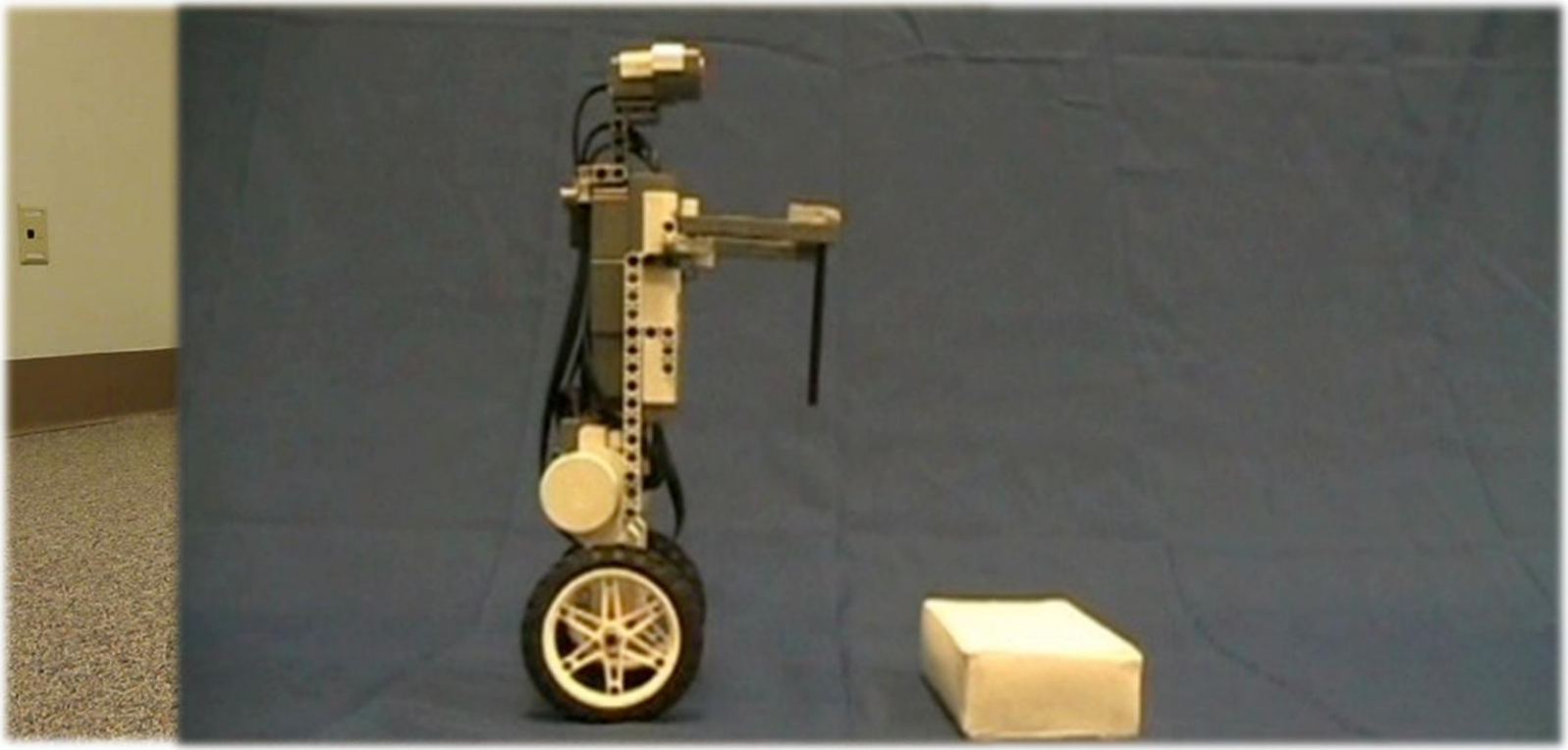
Method (Short robot)



.16, .31, .47, .63, .79, .94, 1.10, 1.26, 1.42, 1.57, 1.69 & 1.85 inches

Range of Step Heights

Method (Tall robot)



.16, .31, .47, .63, .79, .94, 1.10, 1.26, 1.42, 1.57, 1.69 & 1.85 inches

Range of Step Heights

Method

Dependent Variable

- Participants' judgments about whether the robot could climb the step
  - Given by clicking "Yes" or "No" buttons on the screen

How do people judge the capabilities of a robot?

Hypotheses & Predictions

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1. People will be sensitive to the relative action capabilities of robots
   - Participants' perceived stair-climbing boundaries for the short robot will be lower than for the tall robot

2. People will utilize a task-relevant property of the robot when making judgments about robots
   - Participants' boundaries scaled in terms of the robots' wheel sizes for the short robot will be higher than those for the tall robot

Hypotheses & Predictions

3. People will make accurate judgments about the capabilities of robots
   - Participants' perceived stair-climbing boundaries for each robot will not differ when compared to that robot's actual capability

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Results

Results

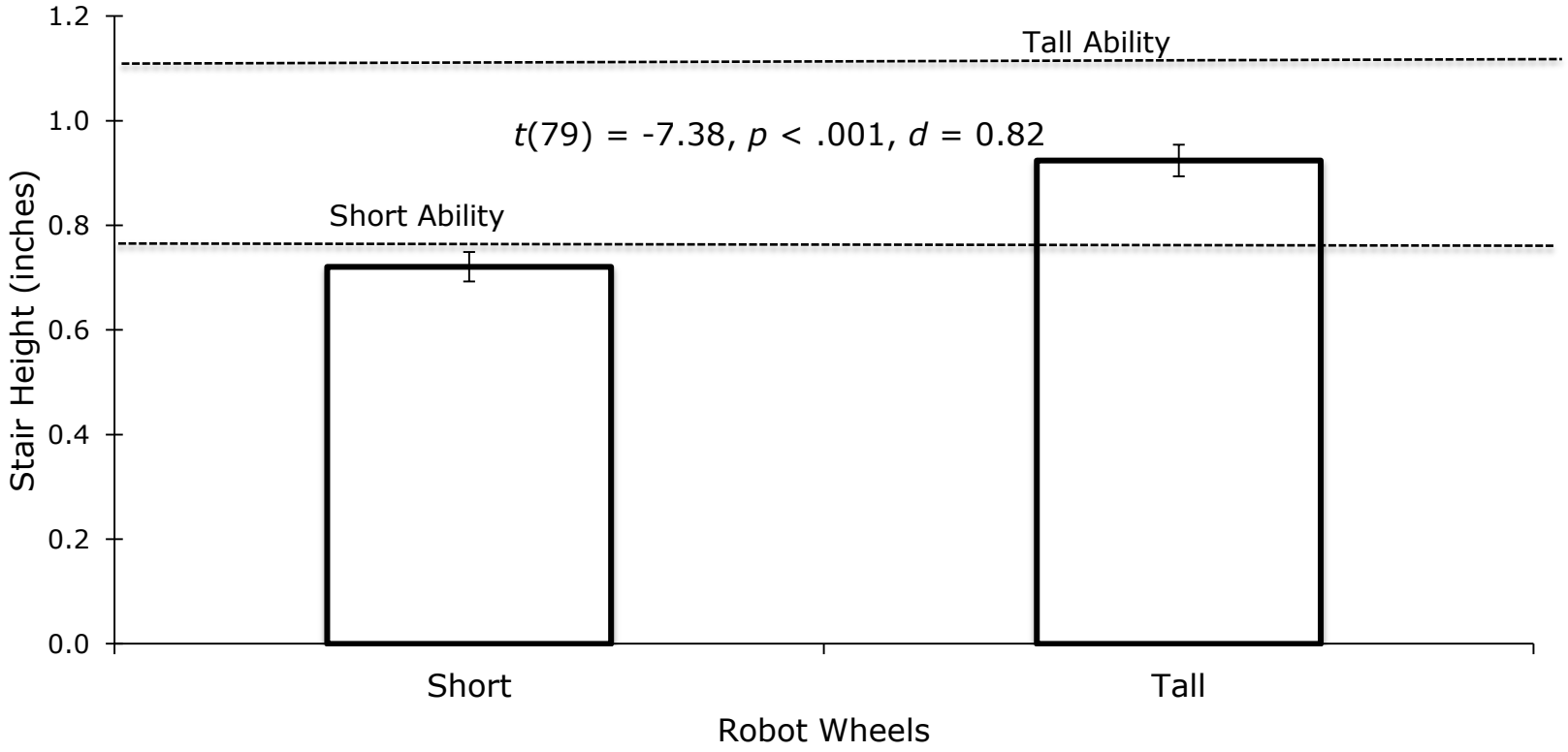
For each step height, responses were tallied across the eight trial blocks

The tallies were converted into:

- Perceived stair-climbing boundaries
- Scaled perceived stair-climbing boundaries

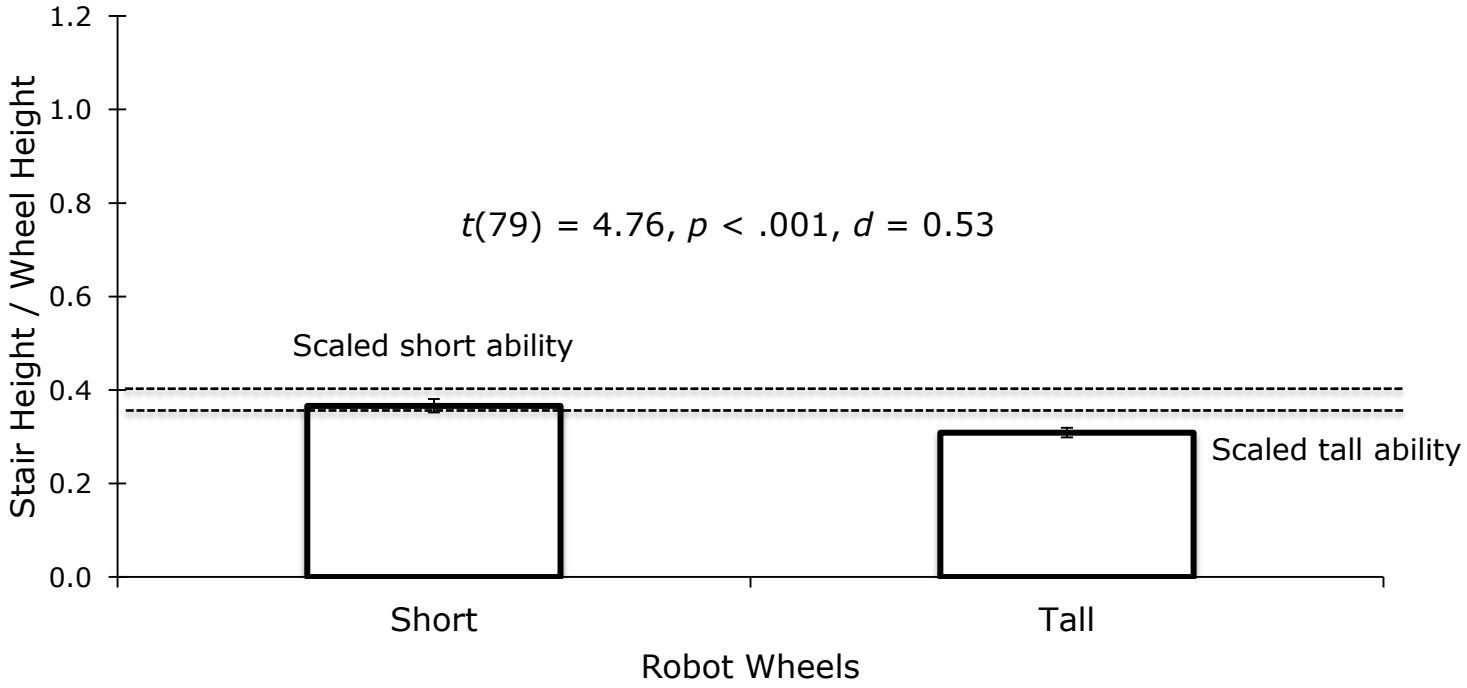
Results – Prediction 1

Participants' perceived stair-climbing boundaries for the short robot will be lower than for the tall robot



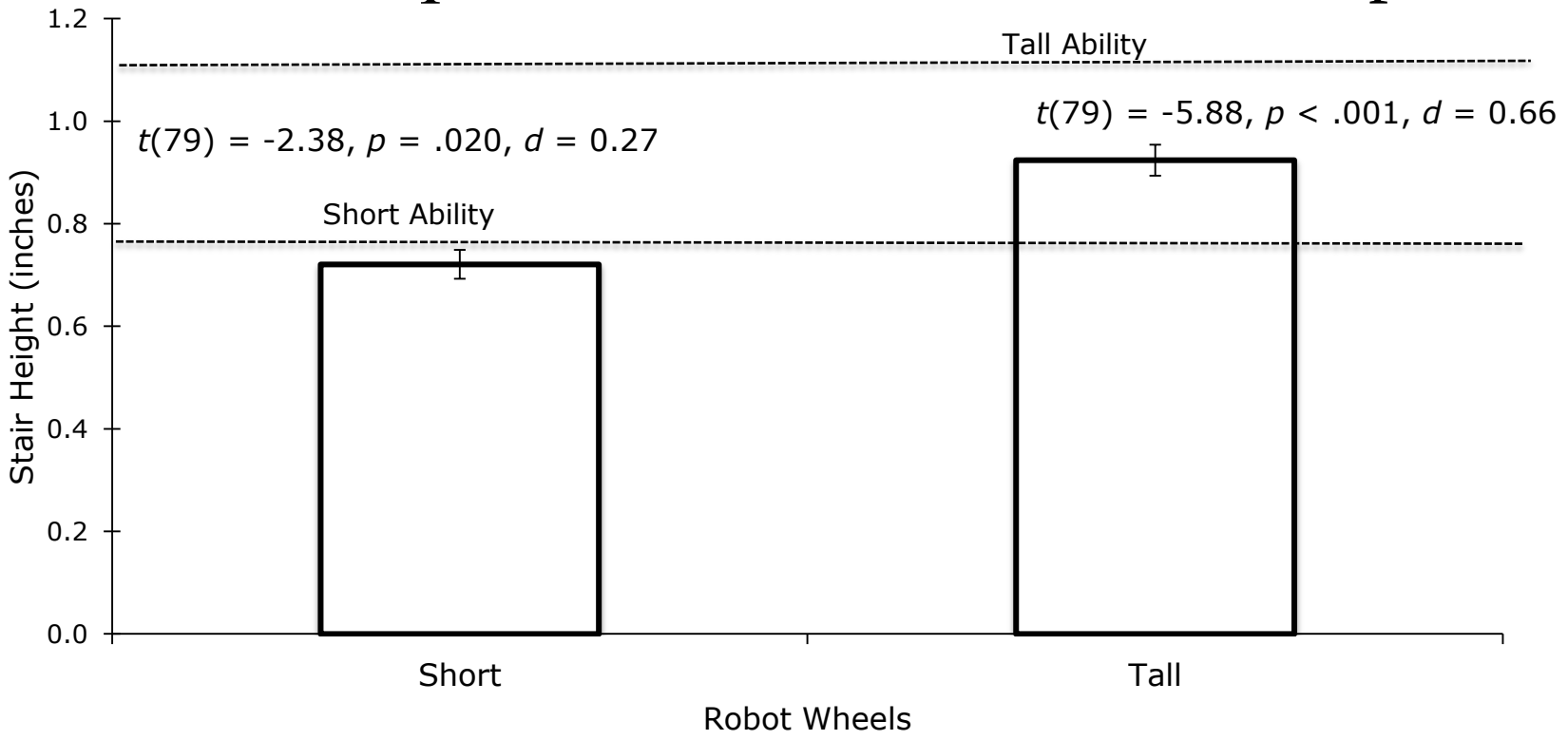
Results – Prediction 2

Participants' boundaries scaled in terms of the robots' wheel heights for the short robot will be higher than those for the tall robot



Results – Prediction 3

Participants' perceived stair-climbing boundaries for each robot will be accurate when compared to that robot's actual capability



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Conclusions

Conclusions

Participants . . .

- Were sensitive to the relative capabilities of the short and tall robots
- Showed a sensitivity to wheel height, but this effect may have been found due to some inaccuracy
- Were not able to accurately judge the absolute capabilities of the short and tall robots

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Practical Implications

Practical Implications

- People have the ability to judge robots' capabilities in relative terms, but not as accurately as we had previously thought
- People may have difficulty working with a robot partner
  - e.g. a military unit may misperceive whether their assistive robot can traverse certain terrain or overcome certain obstacles
  - This effect may be negated with training paradigms

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Future Directions

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- Further research should attempt to explore what mechanisms are involved in the accurate perception of capabilities
  - Is learning a factor?
  - Is viewing the robot beforehand necessary?
  - Do changes in anthropomorphism change the pattern of results?

Questions?

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