

Human Robot Interaction as Theatre

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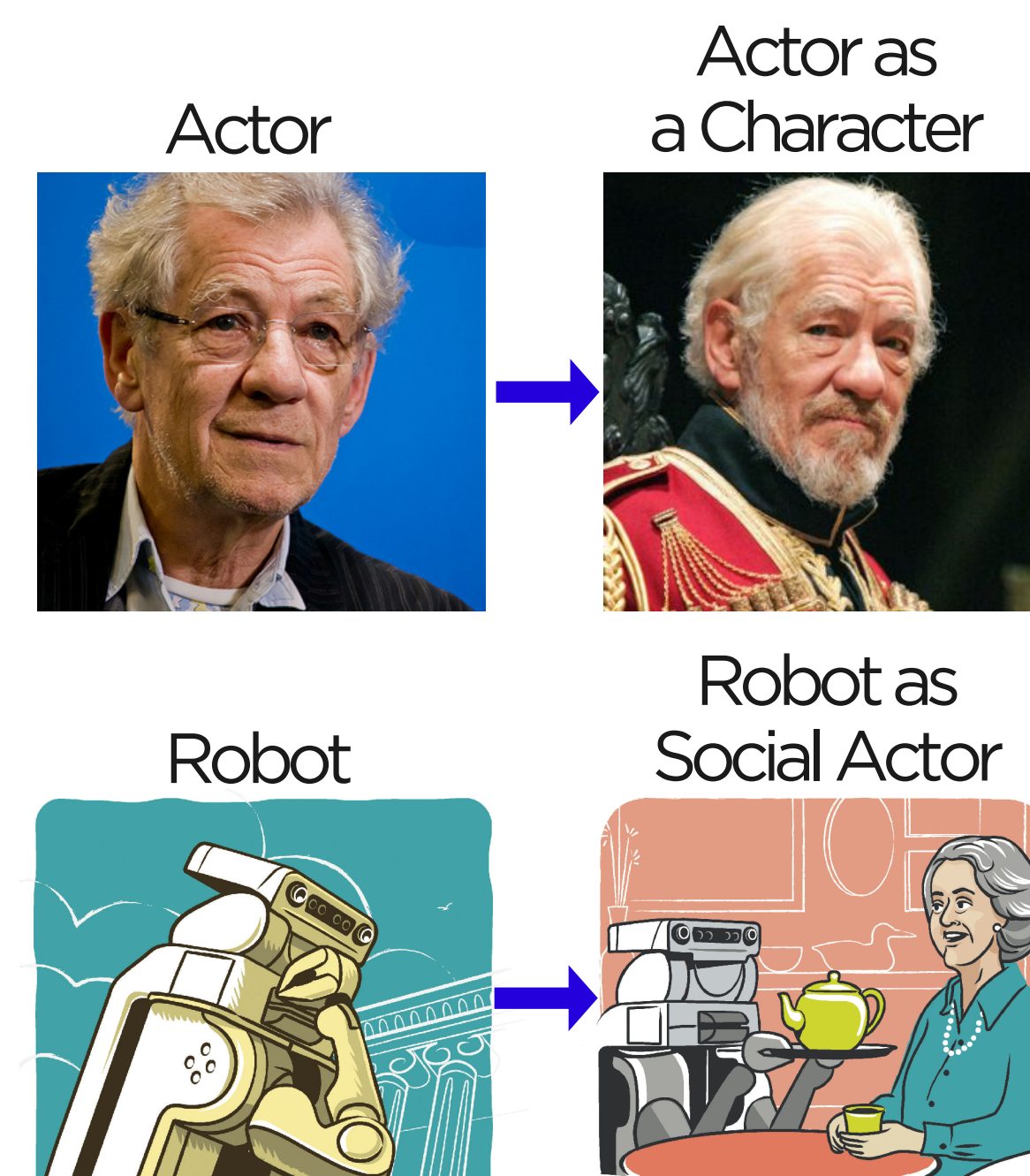
Using ideas from theatre to help improve human-robot interaction (HRI) and exploring the effects of placing robots into theatrical contexts

Improving HRI

Philosophical Foundation

When humans interact with autonomous robots, one of the primary problems is that humans have a hard time telling **what the robot is trying to do** and what its internal state is. Actors on the other hand are skilled at performing in order to **convey information to the audience** about their character's internal state and intentions. Thus, **actors are an ideal model** for helping improve the robot's interaction skills.

(Lu, Smart, 2011)

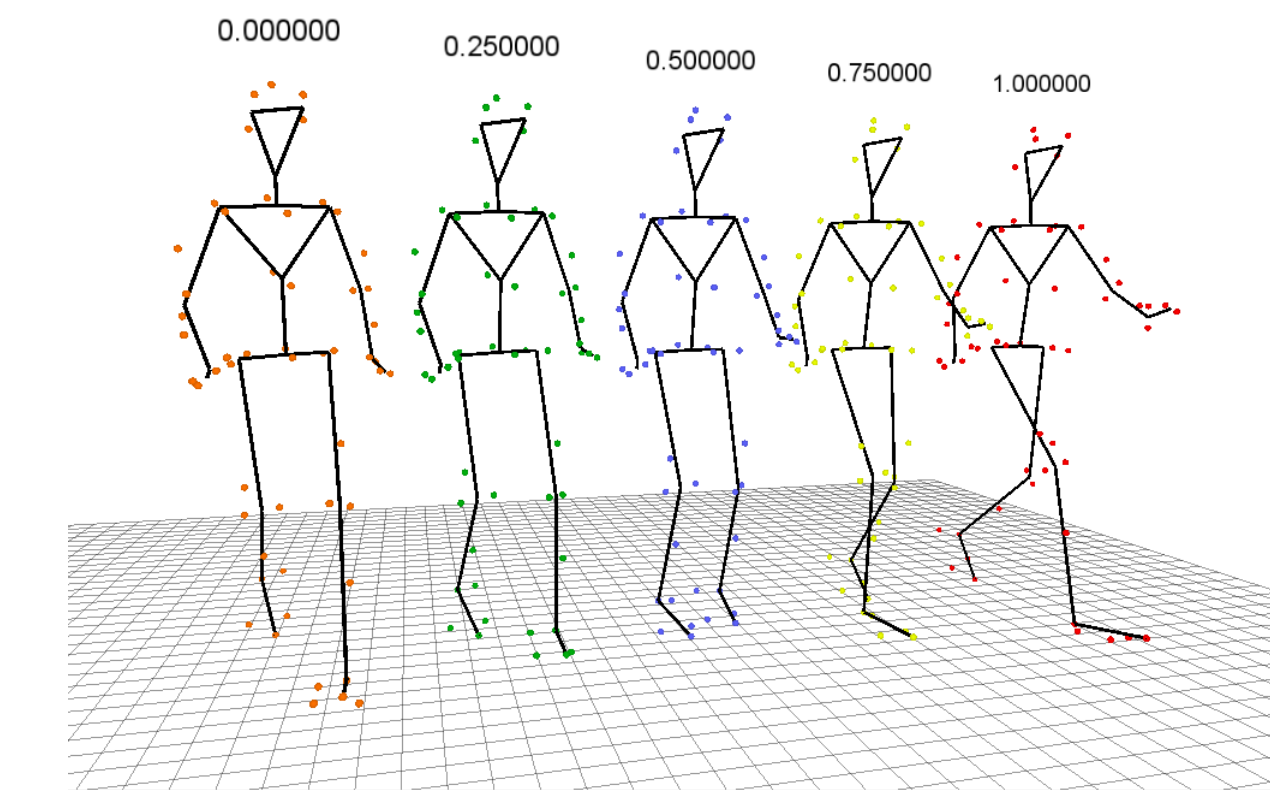


Theatre as Implicit Model

There are several specific methodologies that we have employed from the realm of theatre. It's quite useful to **structure interactions like a theatrical production**, with a clear exposition and setting of expectations. We've also used the idea of **secondary actions** to help our robot perform tasks alongside humans in a more communicative way.

Theatre as Testing Grounds

In order to make believable human-robot interactions, we employ theatre productions as **an ideal testing venue** that allows us to remove a portion of the unpredictability of the human element.



Analyzing the Actor's Movement

Actors are trained to move in very precise ways to convey subtle pieces of information to their audience. We recorded actors using a **motion capture system** and recorded them performing a set of actions using various circumstances. We then analyzed their motions to discover **not only what they did, but how they did it**. By analyzing such quantities as the actor's average velocity and acceleration, their spacing and the paths of their limb trajectories, we can **build a motion profile** which we can then implement on a robot in order to get it to convey the same information to its audience.

(Lu, Pileggi, Smart, 2011)

Robots on Stage

Robot as Acting Instructor

We used the robot in WashU's Fundamentals of Movement class to help **teach students** about context-less **intention-free movement** within the structure of the Viewpoints Movement Exercise.

(Lu, Wilson, Pileggi, Smart, 2011)



Emoting Robots on Stage

Our robot performed a short 'movement piece' with a human actress in front of a interdisciplinary audience, in order to explore how robots can **convey emotion and story** solely through physical actions.

(Lu, Pileggi, Rinker, Mohr, Smart, 2011)



Robot Film Festival

Our robot starred in a **short film** about the relationship between a graduate student and a robot to further explore the robot's ability to convey expression and **invoke empathy**. Competed at 1st Annual Robot Film Festival in NYC.

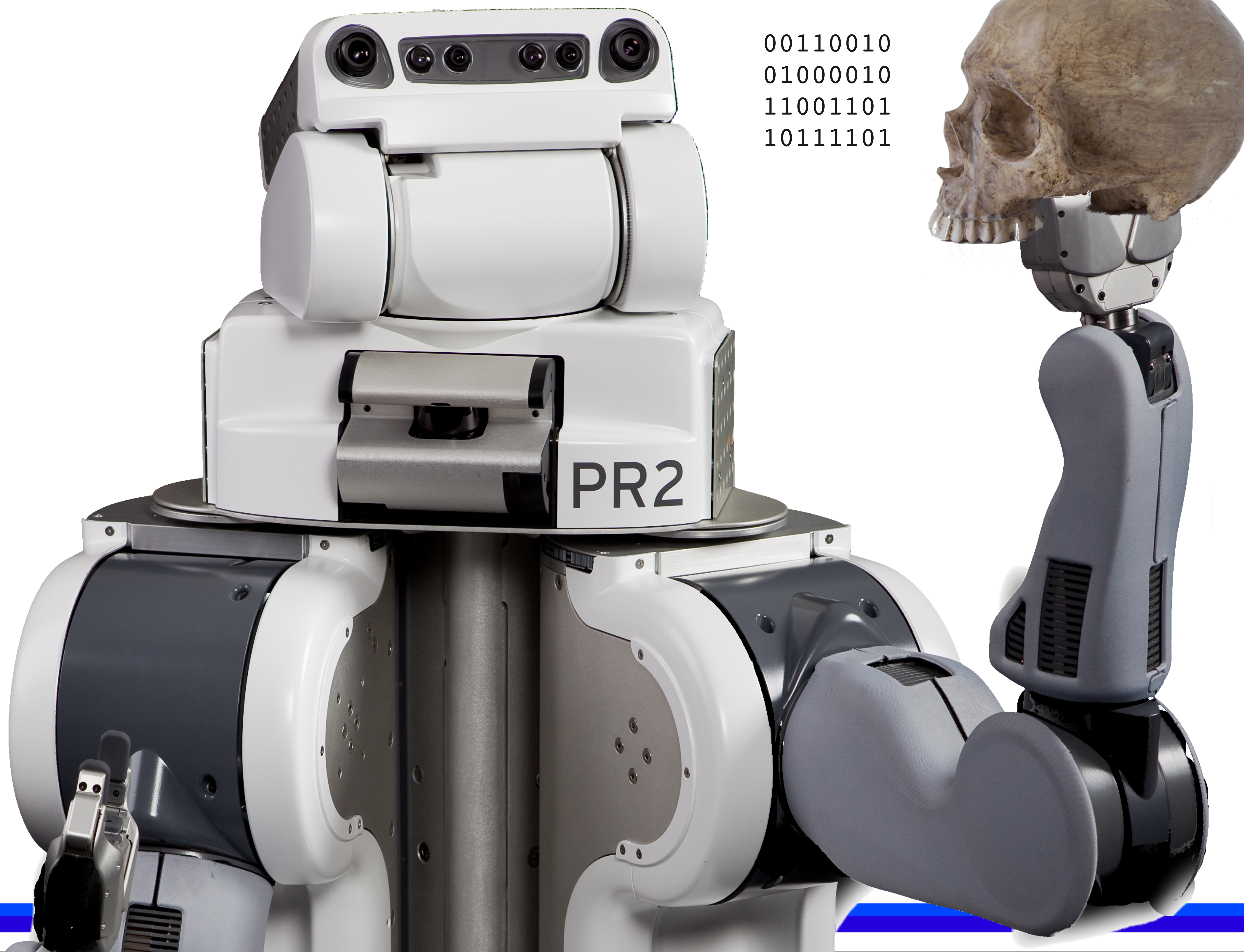
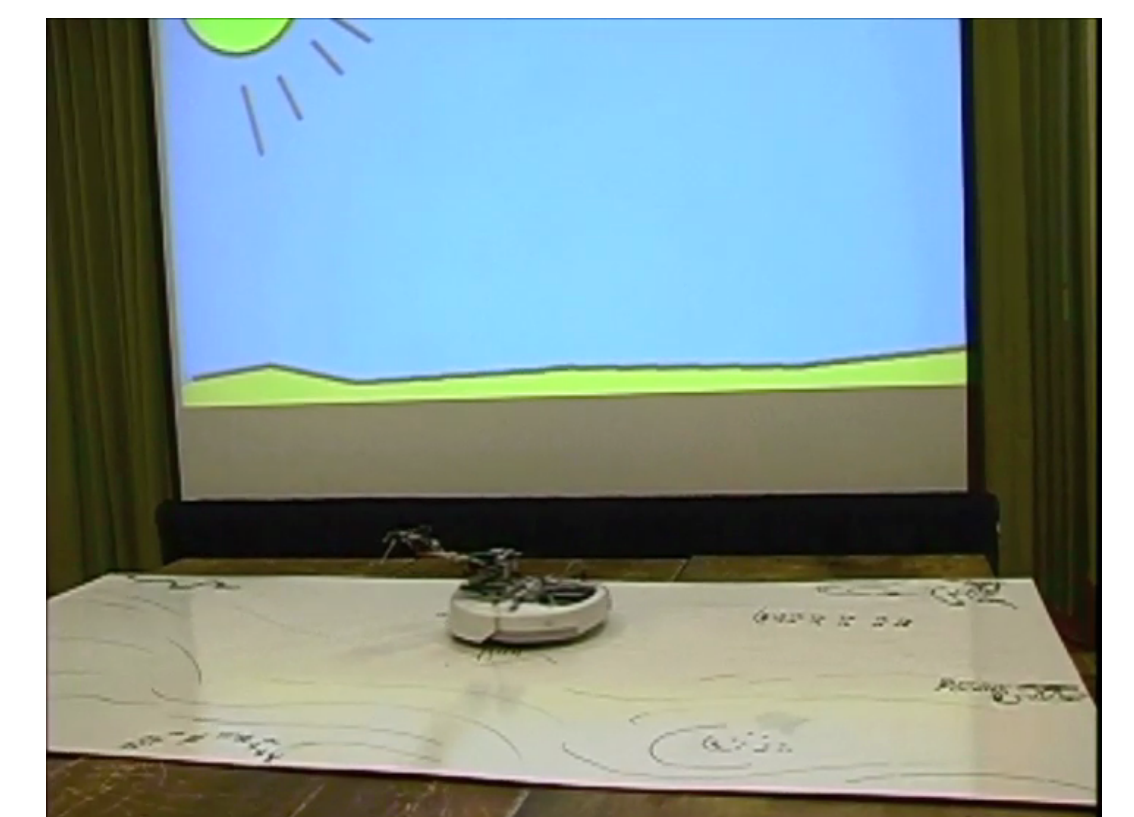
<http://vimeo.com/davidlu/researchin>



Educational Expressive Robots

We held a workshop to **teach students how to program robots to be expressive**. We plan on expanding this curriculum to get more under-represented student groups, particularly girls, interested in robotics.

(Lu, Mead, 2012)



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