Robotics: A Quest for Intelligence

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RobIn: Robot Interactive Intelligence Lab

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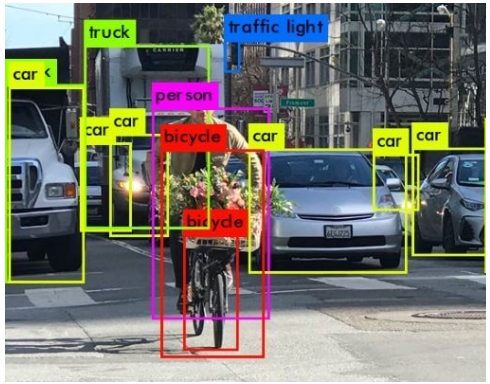
ROBOT INTERACTIVE INTELLIGENCE LAB

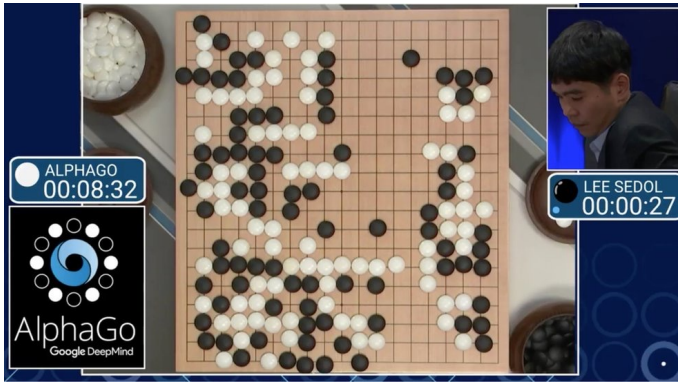
TEXAS Robotics

THE UNIVERSITY OF TEXAS AT AUSTIN

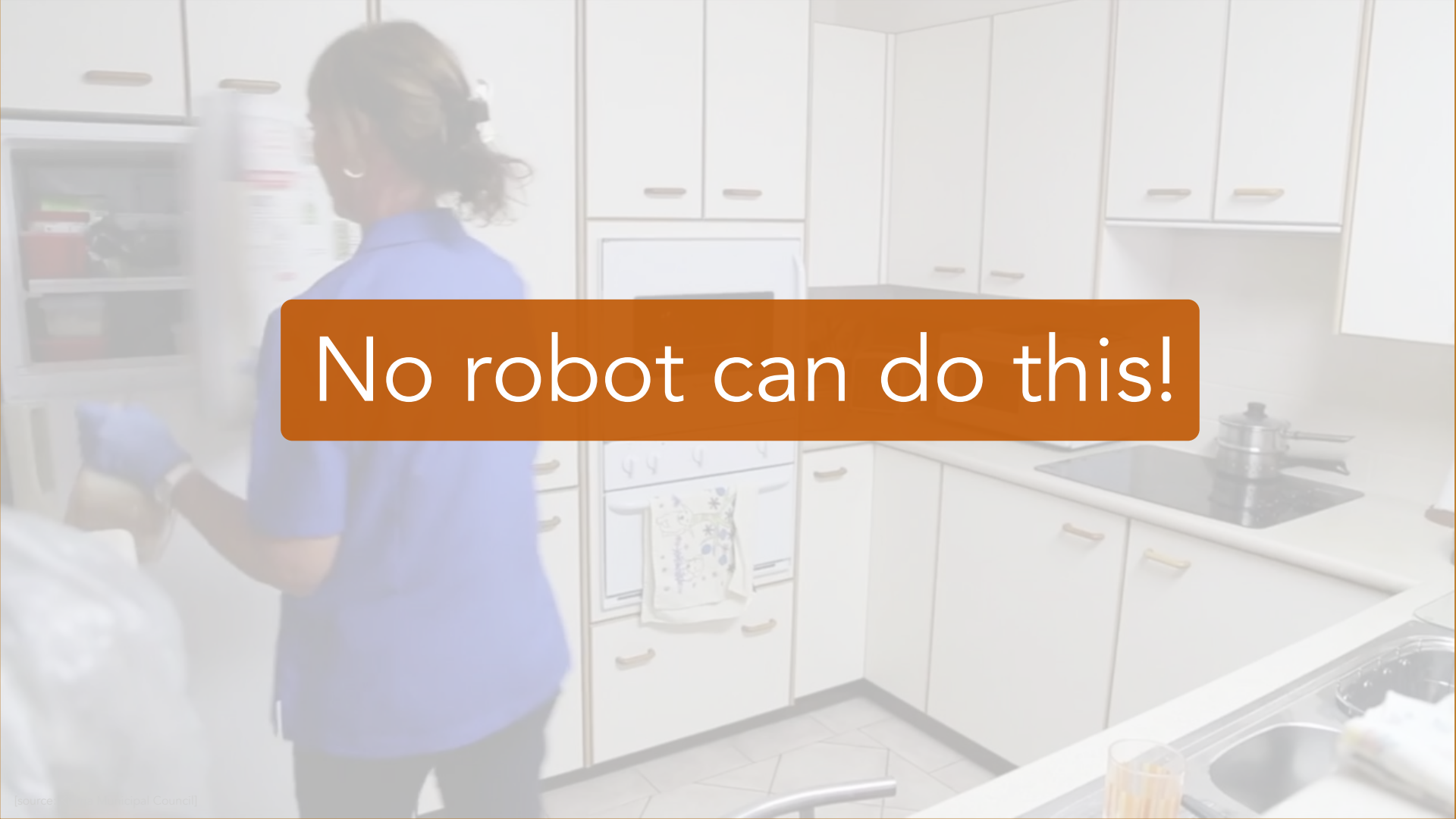
The AI Revolution

What kind of "I"?



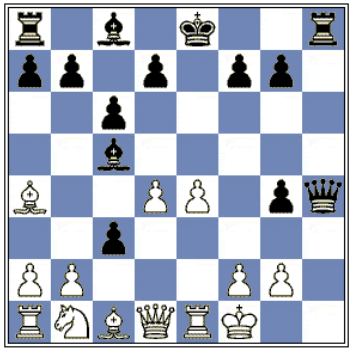


[Krizhevsky et al. '12, Deng et al. '09, Silver et al. '16, Ouyang et al. '22]

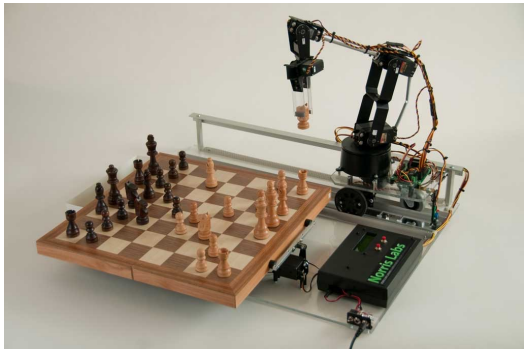

No robot can do this!

Moravec's paradox (1988):

"it is comparatively easy to make computers exhibit adult level performance on intelligence tests or playing checkers, and difficult or impossible to give them the skills of a one-year-old when it comes to perception and mobility"

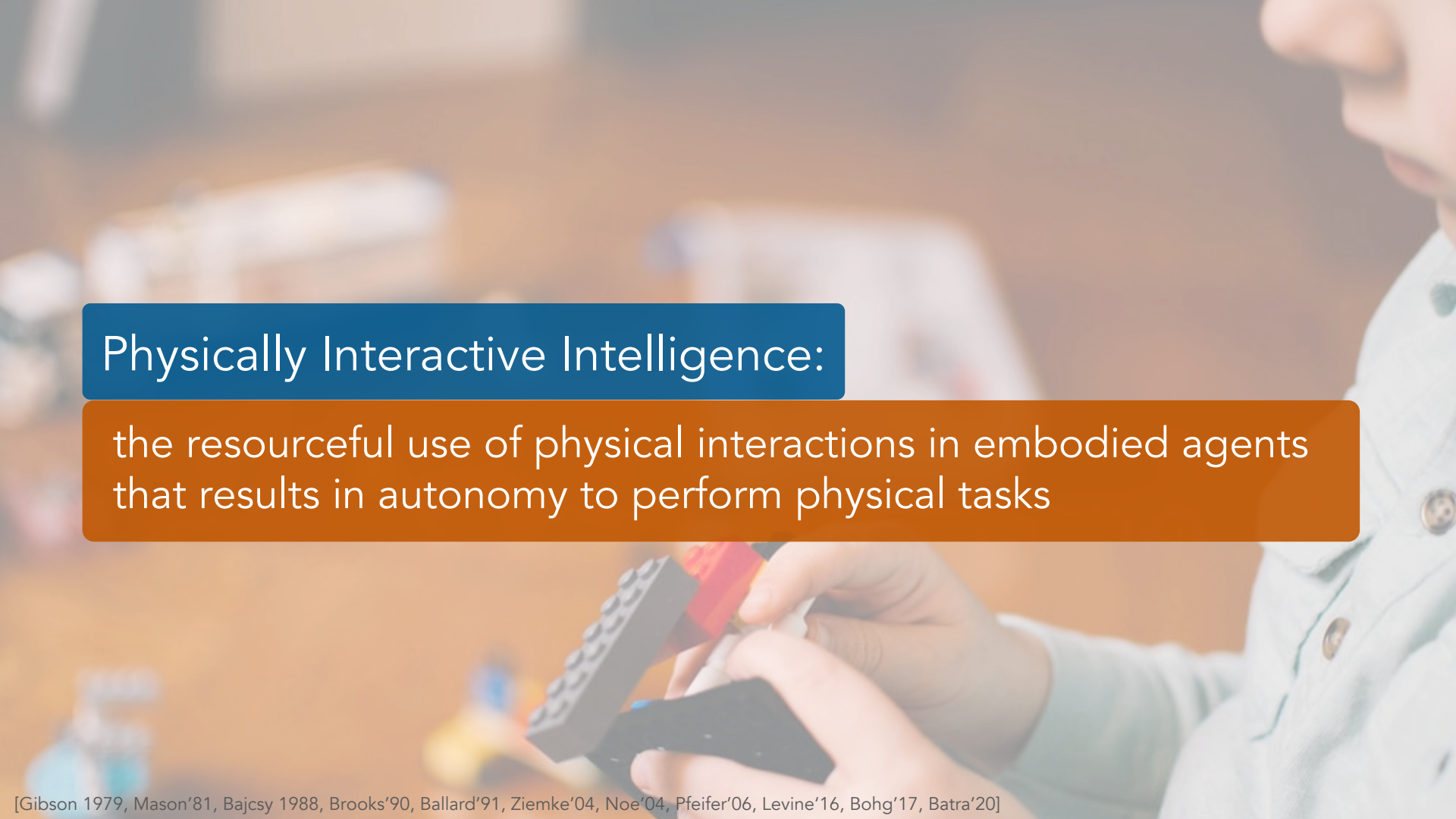


[source: getty]



[source: Norris Labs]

[Hans Moravec (1988), Mind Children, Harvard University Press]



Physically Interactive Intelligence:

the resourceful use of physical interactions in embodied agents that results in autonomy to perform physical tasks

[Gibson 1979, Mason'81, Bajcsy 1988, Brooks'90, Ballard'91, Ziemke'04, Noe'04, Pfeifer'06, Levine'16, Bohg'17, Batra'20]

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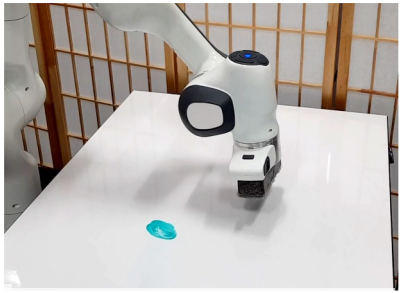
Research in my lab:
Creating learning methods that exploit physical interactions to increase autonomy in robotic systems

[Martín-Martín et al. IROS'14, ICRA'16, ICRA'18, IJRR'19]

[Martín-Martín et al. ICRA'18, Baum et al. Hum'17]

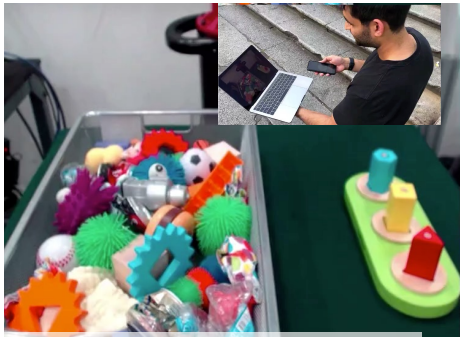
[Danielczuk et al. ICRA'19, Kurenkov et al. IROS'20, Kurenkov et al. '22 (under review)]



[Martín-Martín et al. IROS'19, Martín-Martín et al. '21 sub.]

[Martín-Martín et al. RSS'16, AuRo'18, Jonschkowski et al. IROS'16]

[Xu et al. NeurIPS'19, RSS'20, NeurIPSws'21]



[Mandlekar et al. IROS'19, '21 sub., Wong et al.'21 sub.]

[Srivastava CoRL'21, Li et al. CoRL'21, Martin-Martin* et al. CoRL'22, Wu et al. (under review)]

Some of our Future Directions

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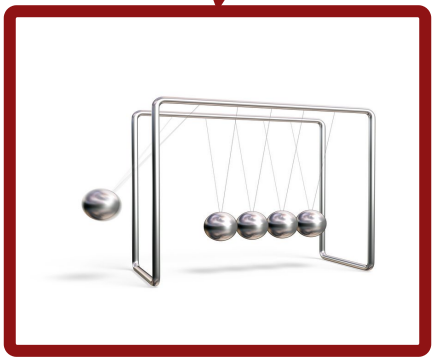
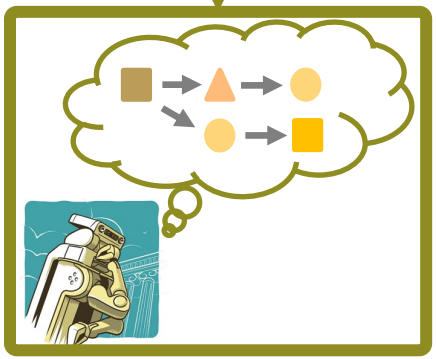
Physically Interactive Intelligence



causal and semantic understanding of the effect of interactions



from skills to long-horizon interactive activities

error awareness and recovery

Algorithmic Foundations and Methodology

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robotics foundations:
- (optimal) control
- motion planning
- task planning
- 2D and 3D perception
- prob. theory

…

Physically Interactive Intelligent Solution

robot learning:
- reinforcement learning
- imitation learning
- representation learning
- foundation models

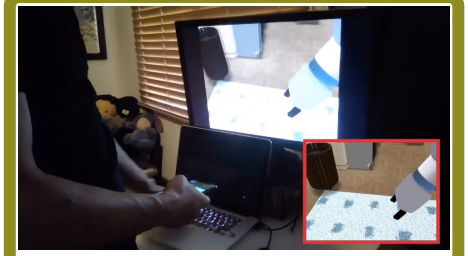
…

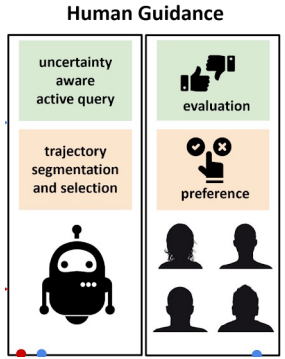
Domains and Problem Settings

stationary and mobile manipulation

robosuite

simulation, benchmarking, sim2real





human-in-the-loop

[Zhu et al. '20, Li et al. '23, Srivastava et al. '22, Zhang et al. '22]

Thank you!

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