Compassionate, Safety-aware, Creative Physical AI for Human-Robot Collaboration

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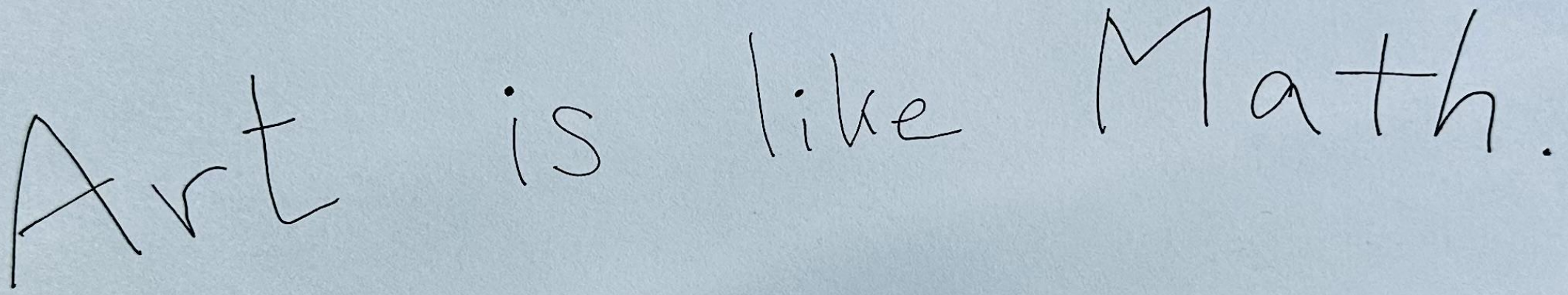
Carnegie Mellon University

Robots with Physical AI to solve real-world problems

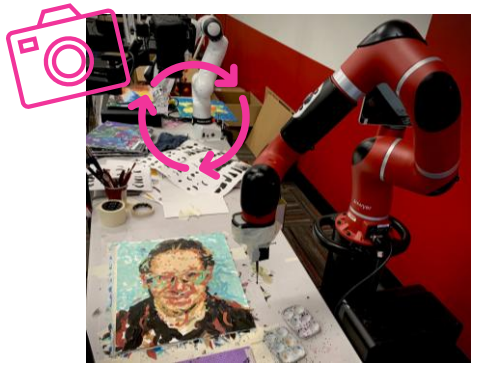
Why arts?

1. To study research questions on the purest, least applied problems

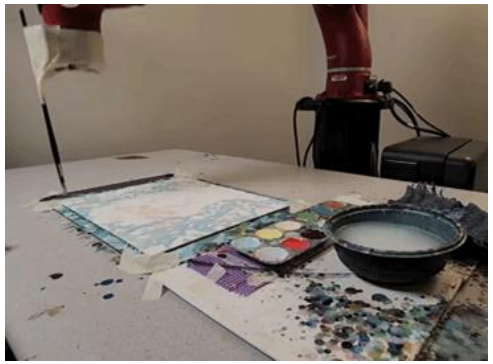


Promoting collaborative robotics research

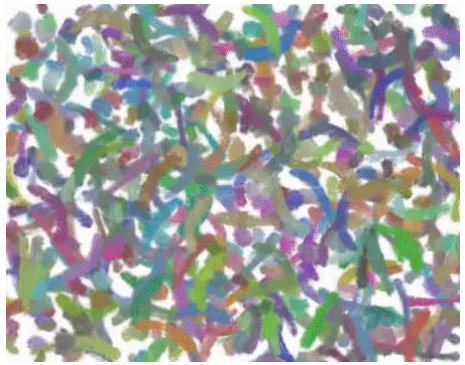
Semantic Perception



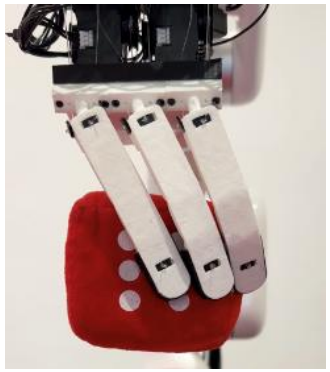
Learning & Control

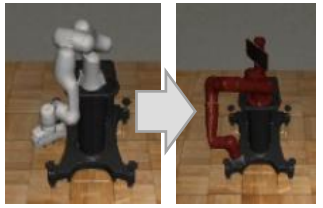


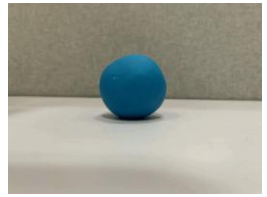
Planning



Dexterous manipulation







Generative AI

"Frida Kahlo & a red robot"

Simulation to Real gap

Multimodal HRI

Responsible AI
Data bias
Social awareness

BIG

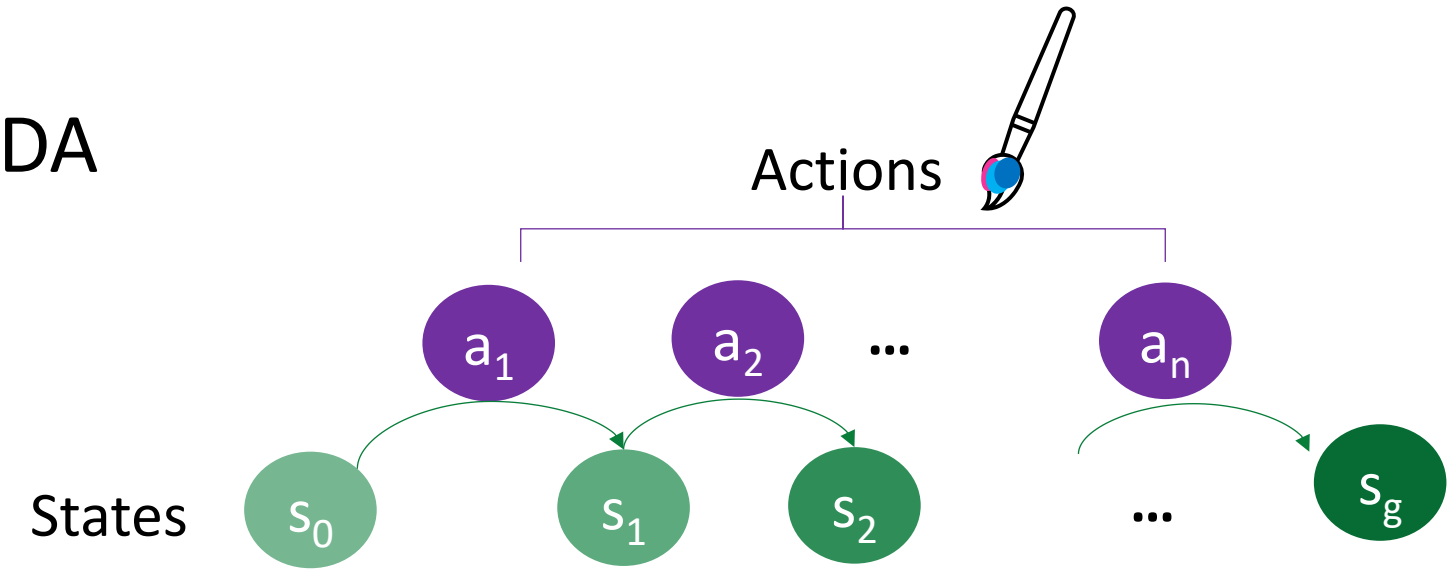
GenAI vs. Robotics: a portrait of van Gogh

- ChatGPT

GenAI vs. Robotics: a portrait of van Gogh

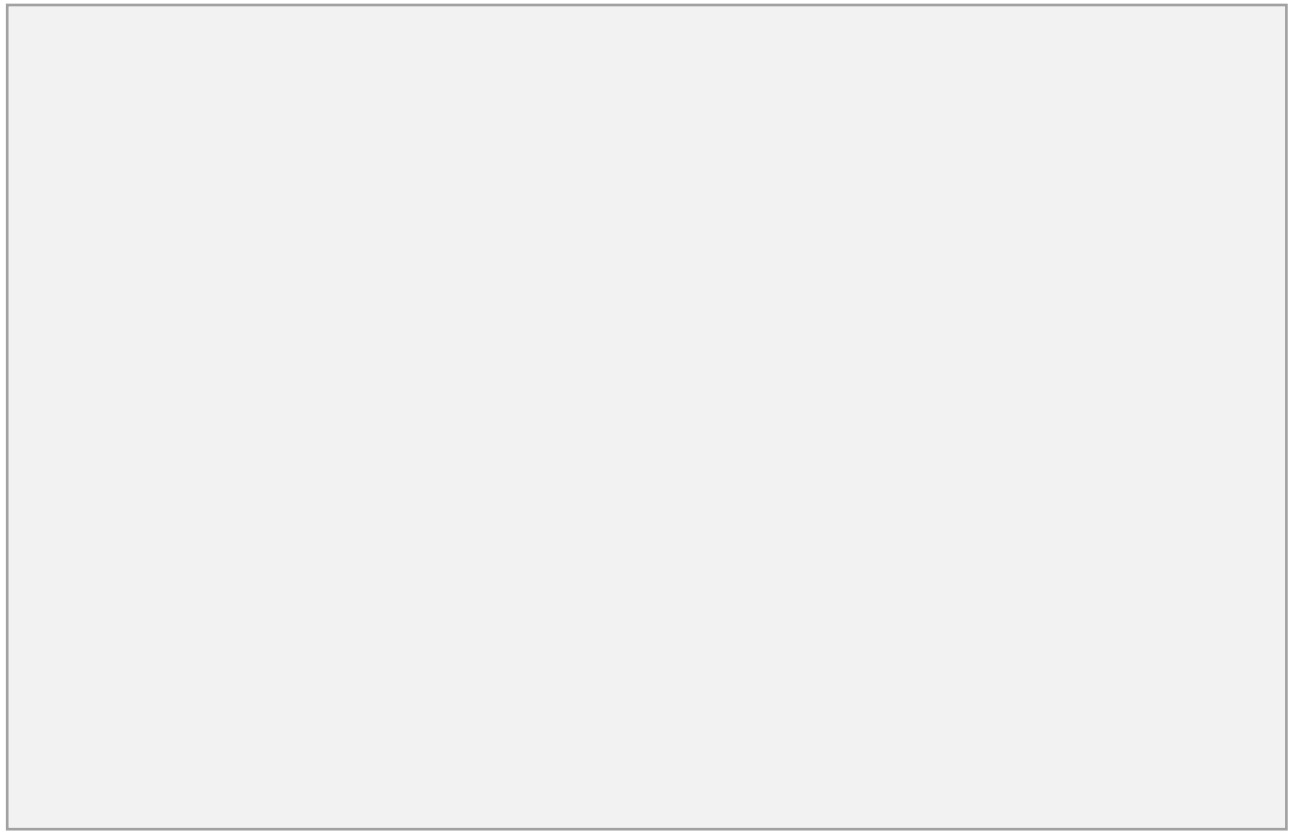
- ChatGPT

- FRIDA



BIG

What do you want to paint with FRIDA?



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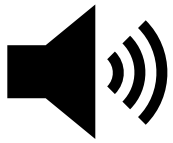
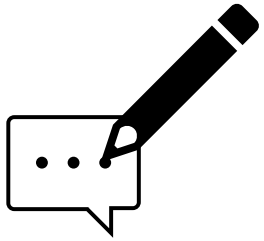
How do we [humans] describe what we want?

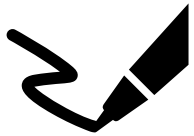
Planning with abstract goals



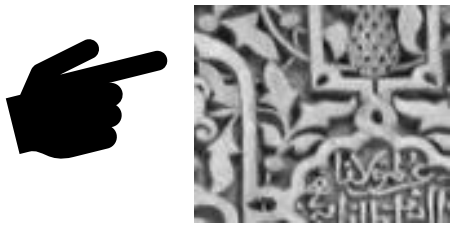
Tone/Sound



Language



Drawing



Examples

BIG

Planning with abstract goals requires Creativity Compassion

Multimodal Interaction

- Language
- Sound
- Image
- Gesture
- …

BIG

Reducing Simulation-to-Real Gap

Peter Schaldenbrand

Target Image

Sim.

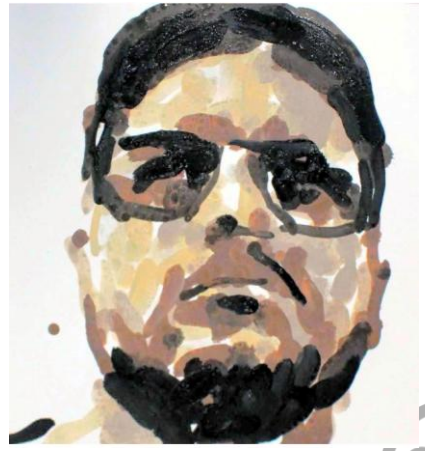
Paint Colors

Real

Reducing Simulation-to-Real Gap

Target Image

Paint Colors

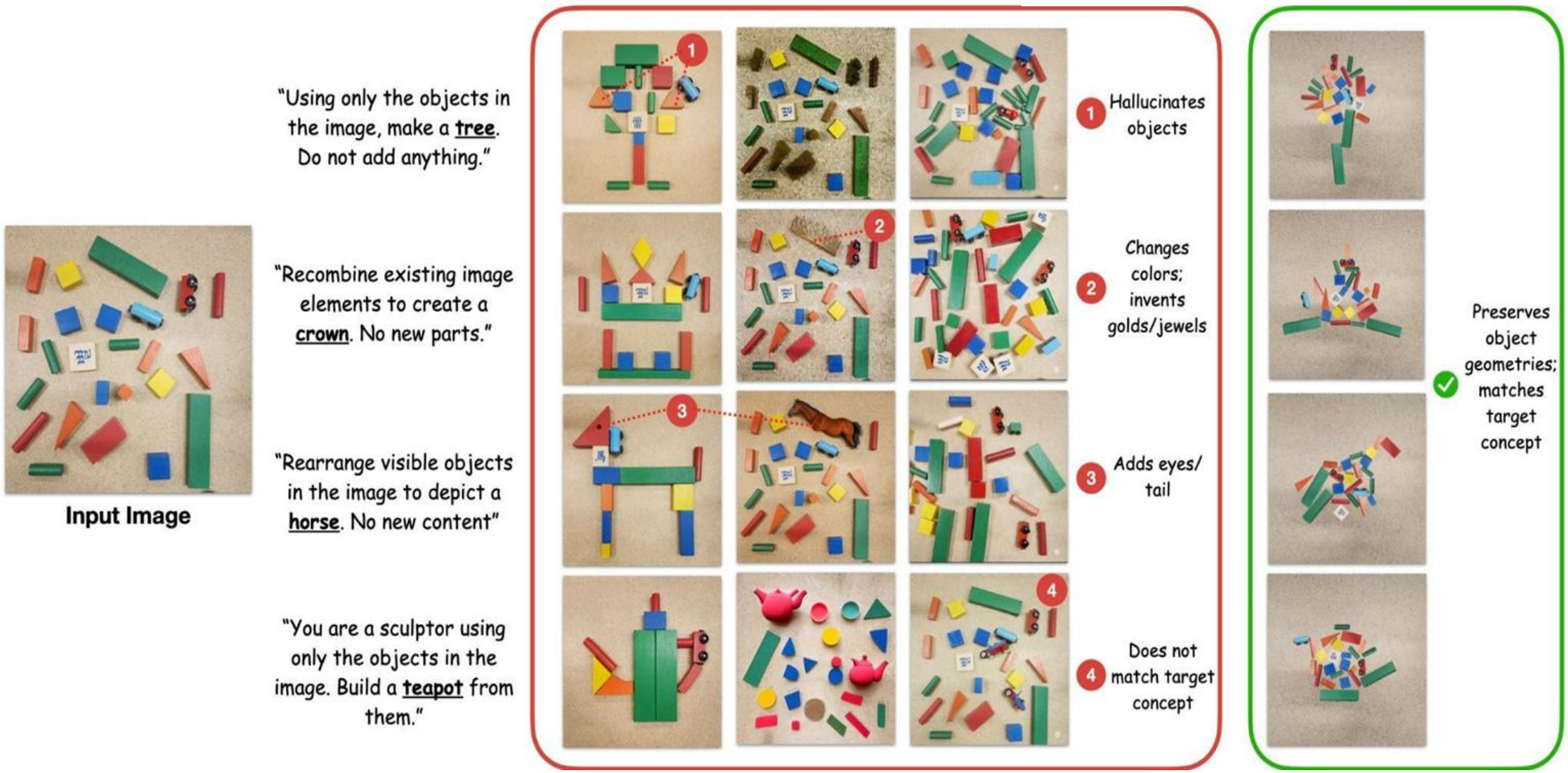
	Huang et al. 2019 [16]	Schaldenbrand & Oh 2021 [21]	[ICRA'23] (proposed)	Spline-FRIDA [RAL'25]
Sim.				
Real				
	$\Delta = 0.156$	$\Delta = 0.066$	$\Delta = 0.029$	

BIG

Physical Constraints

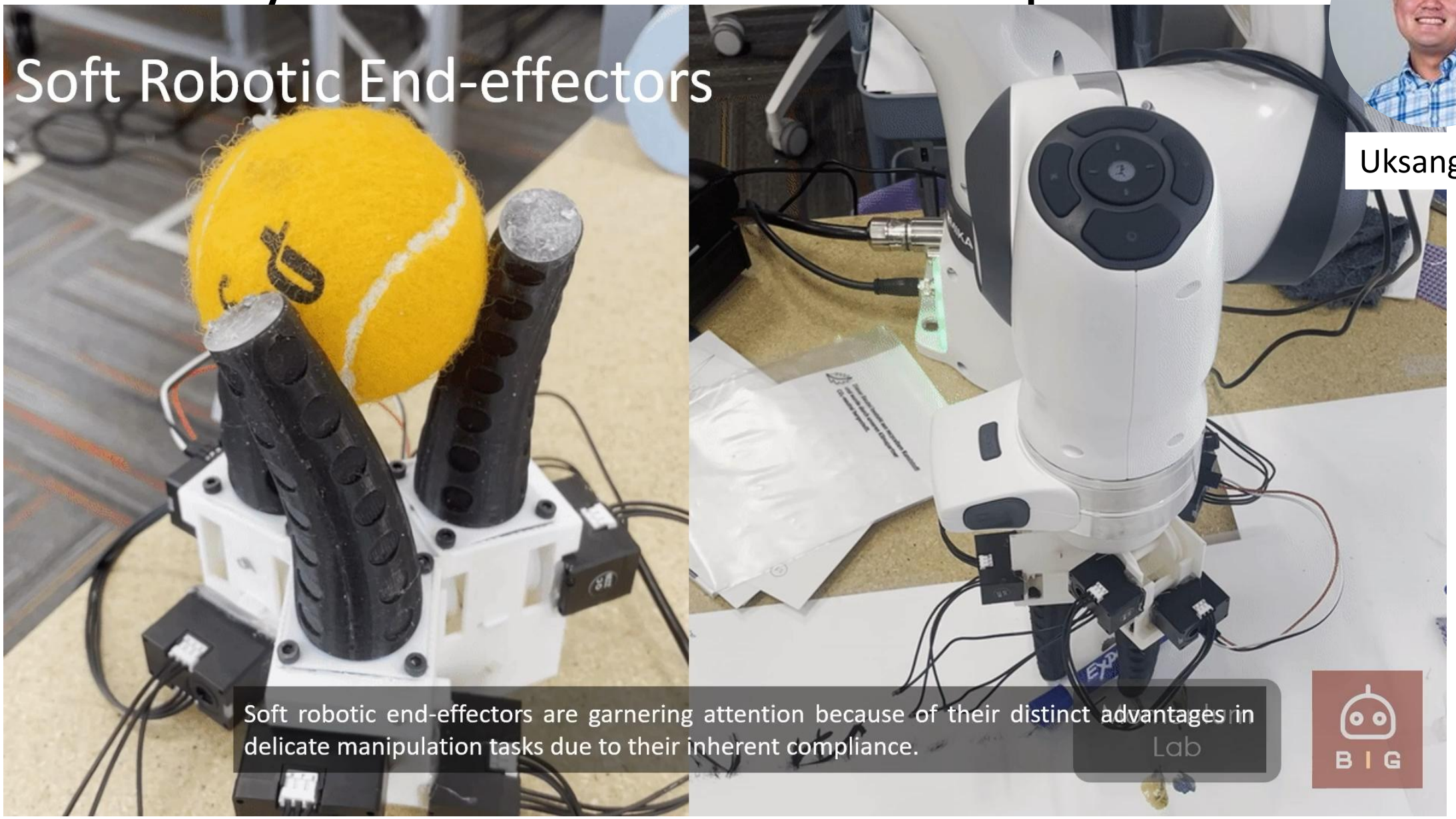
Vihaan Misra

Physical Constraints



Safety-aware Contact-rich Manipulation

Uksang Yoo



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Manipulation Research to Art

[Best Oral Presentation Award Finalist, Humanoids'24]

Soft Black Box: Explainability

Hyun Parke

Uksang Yoo

[ICRA'25 Arts in Robotics Exhibition]

Why arts?

2. To promote real-world human values

Virtual vs Real-World Interactions

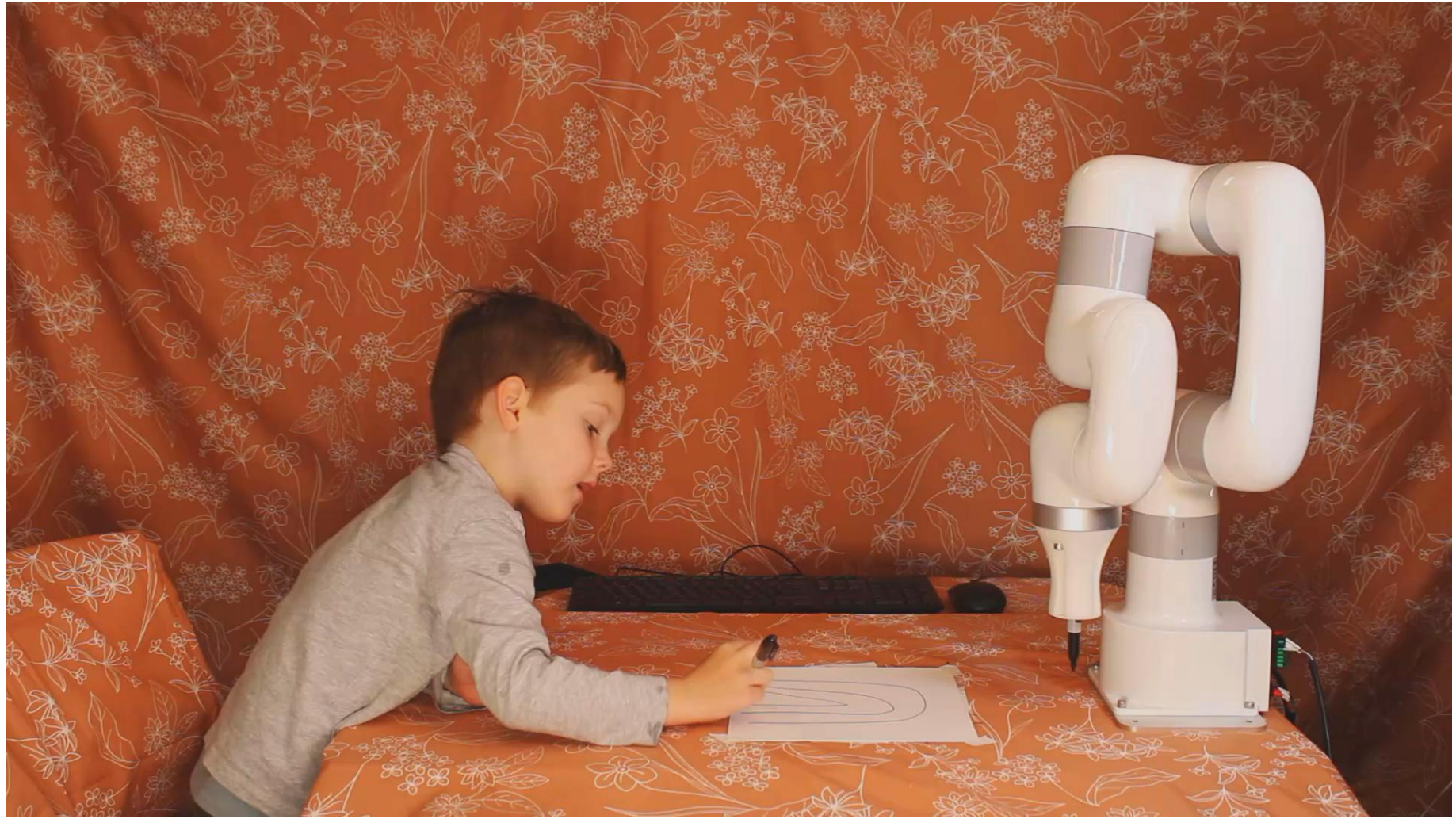
People spend more and more time using their phones and computers

Virtual vs Real-World Interactions

The FRIDA project is an effort to encourage people to interact with real world more.

Painting robot is my favorite!

CoFRIDA: Collaborative FRIDA



Schaldenbrand, Parmar, McCann, Zhu, & Oh (ICRA'24 Best Paper Award, Human-Robot Interaction)

Catalyst to invite people to create arts

Tanmay Shankar

Peter Schaldenbrand

CoFRIDA x Burke Rehabilitation Hospital. Collaboration with Dr. M. Oh-Park and S.Hsieh. 2024

We build compassionate, safety-aware, and creative Physical AI to work alongside humans, collaboratively creating flourishing experiences in the physical world.

Thank you for your attention!


Jean Oh


Jon Francis


Tanmay Shankar


Peter Schaldenbrand


Vihaan Misra


Lawrence Chen


Haokun Zhu


Chengyang Zhao


Ingrid Navarro


Uksang Yoo


Zhixuan Liu


Beverley-Claire Okogwu


Hyun Parke


Alonso Cano Villarreal


Chan Seo


Ben Stoler


Pablo Ortega-Kral


Arthur F C Bucker


Gavin Zhu


Sunyu Wang


Eliot Xing

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