

RoSIP: A Scale for Measuring Appearance-Based Social Interaction Potential in Robots



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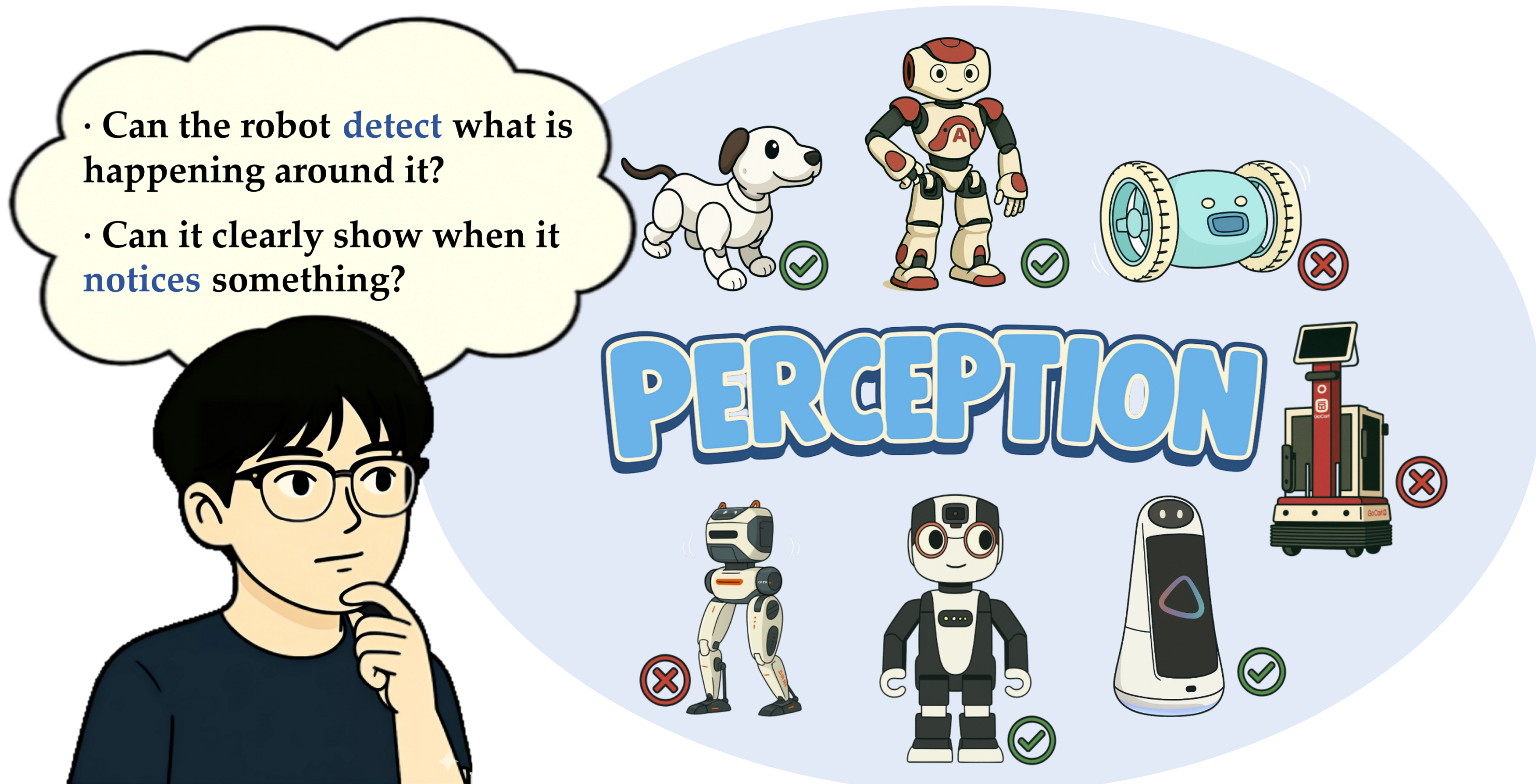
View Paper



Project Website

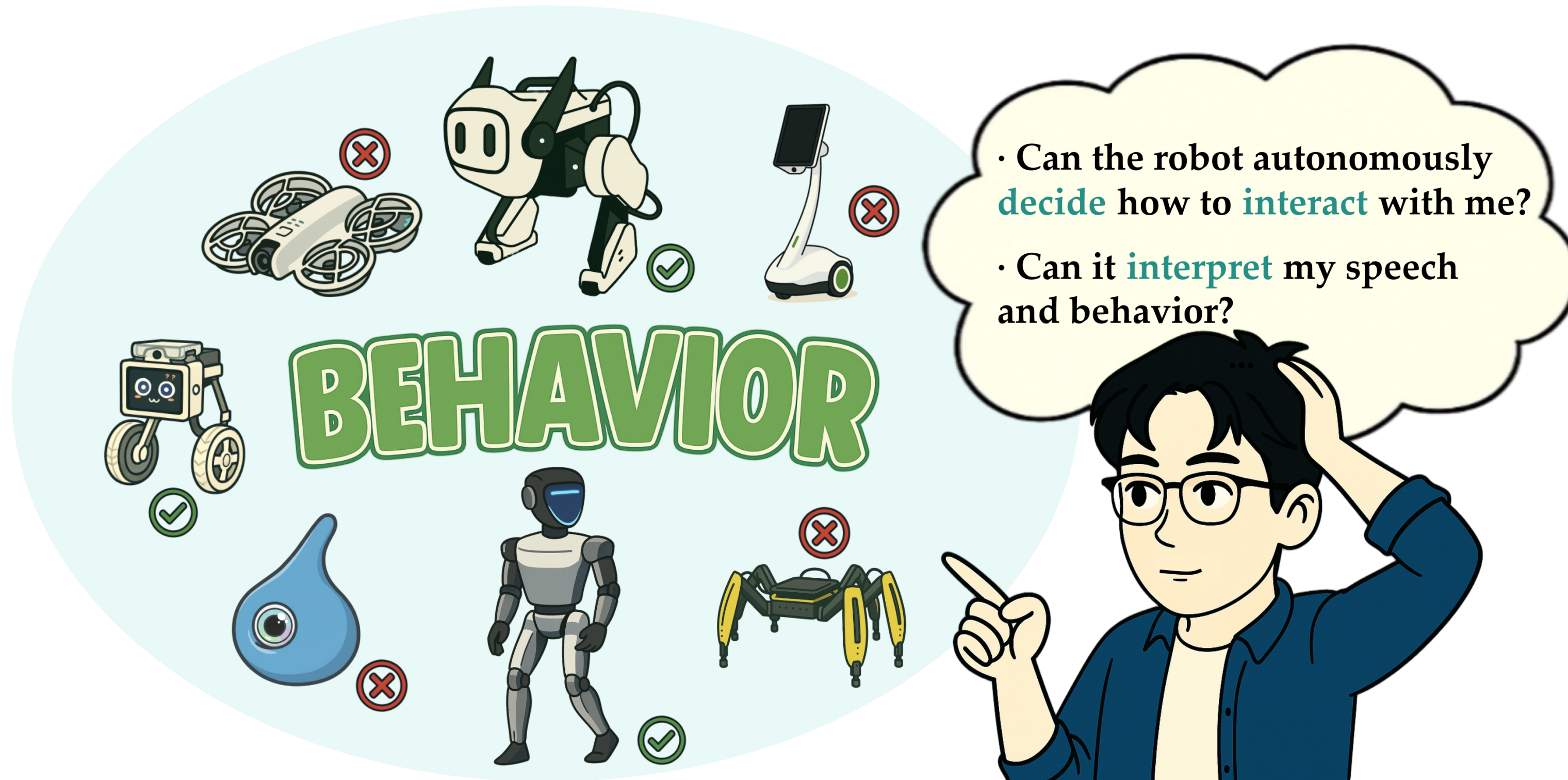
Background

- In brief encounters with public-facing robots, people rapidly infer whether a robot can interact with them based on its appearance alone (e.g., whether it appears able to see them).
- Existing scales focus on global impressions such as anthropomorphism or mind perception, but do not directly capture appearance-based interaction potential.
- We address this gap by introducing a dedicated scale **targeting first-impression inferences from robot morphology**.



What is RoSIP?

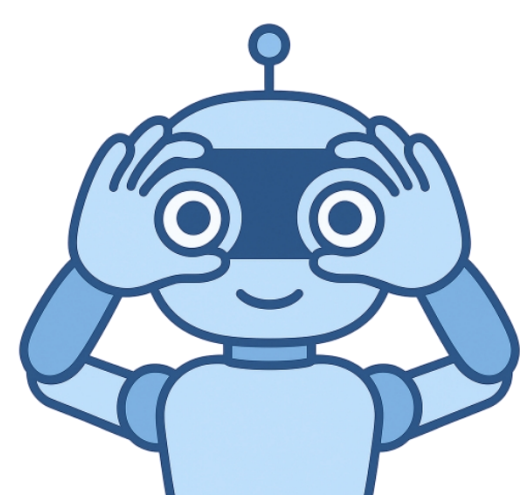
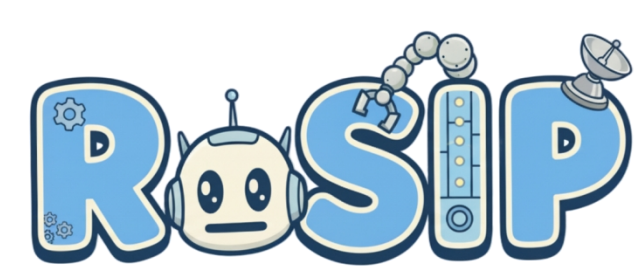
- **RoSIP (Robot Social Interaction Potential) scale** is a concise appearance-based scale that measures how people infer a robot's potential for social interaction from its appearance.
- It captures two dimensions: **Perceptual Potential** (whether a robot appears able to perceive users or the environment) and **Behavioral Potential** (whether it appears able to respond in socially meaningful ways).



Why two dimensions?

- A review of prior HRI studies shows that social perception effects consistently emerge when robots display structures indicating **two kinds of inferred capacities**.
- **Perceptual Potential** reflects whether a robot appears able to perceive or attend to others (e.g., *eye- or camera-like features*).
- **Behavioral Potential** reflects whether a robot appears able to generate socially meaningful responses (e.g., *arms or limbs*).

Scale Development



Perceptual Potential

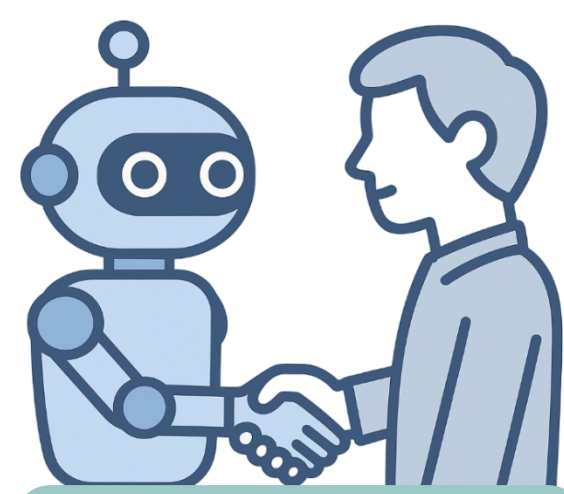
User believe agent can Receive information

Perceptual Reception

- It can detect what is happening around it.
- It can detect changes in its environment.
- It can notice when something new appears nearby.

Perceptual Expression

- It is easy to tell what this agent is attending to.
- It clearly shows when it notices something.
- It is easy for me to tell what it is paying attention to.
- I can tell from its reactions whether it is about to shift its attention.



Behavioral Potential

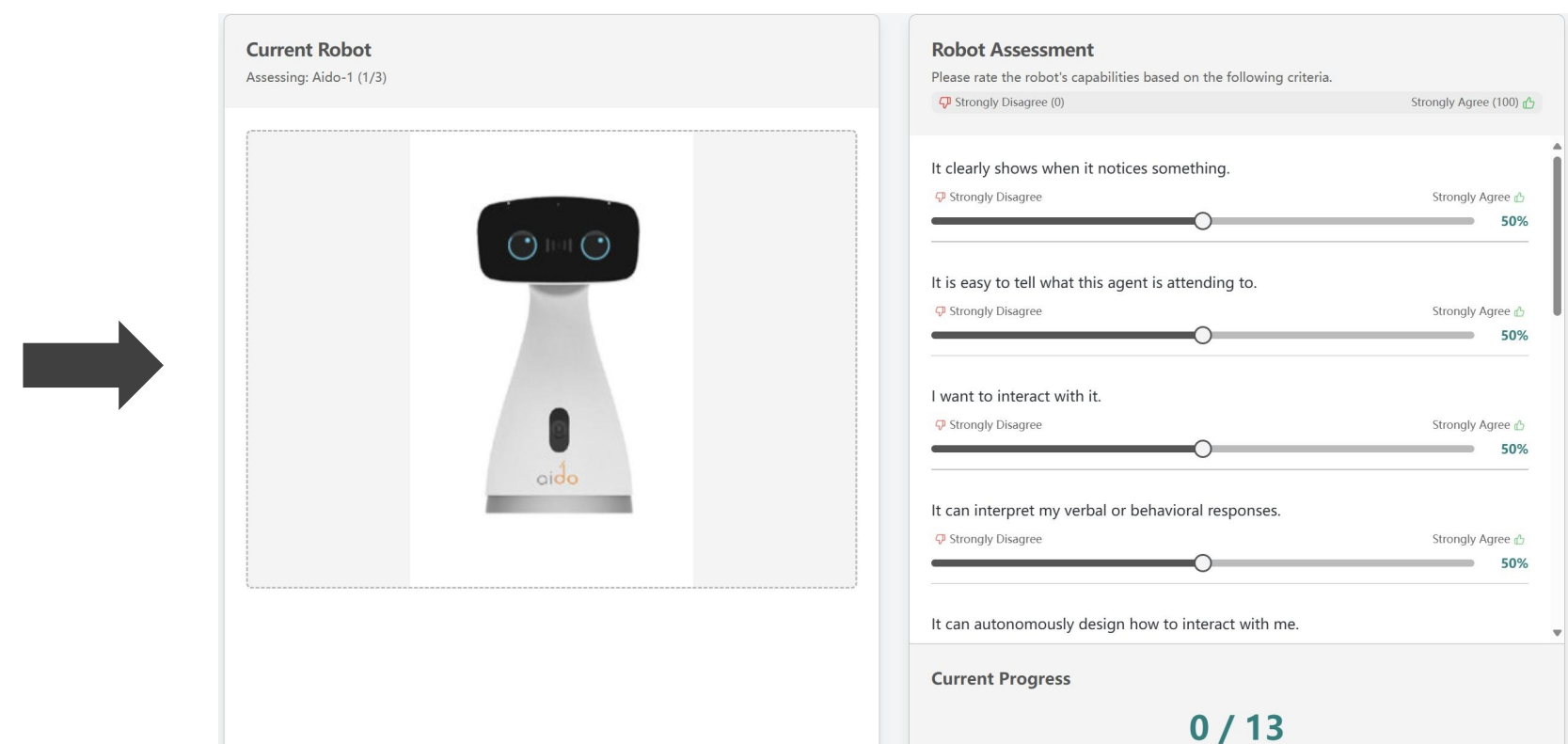
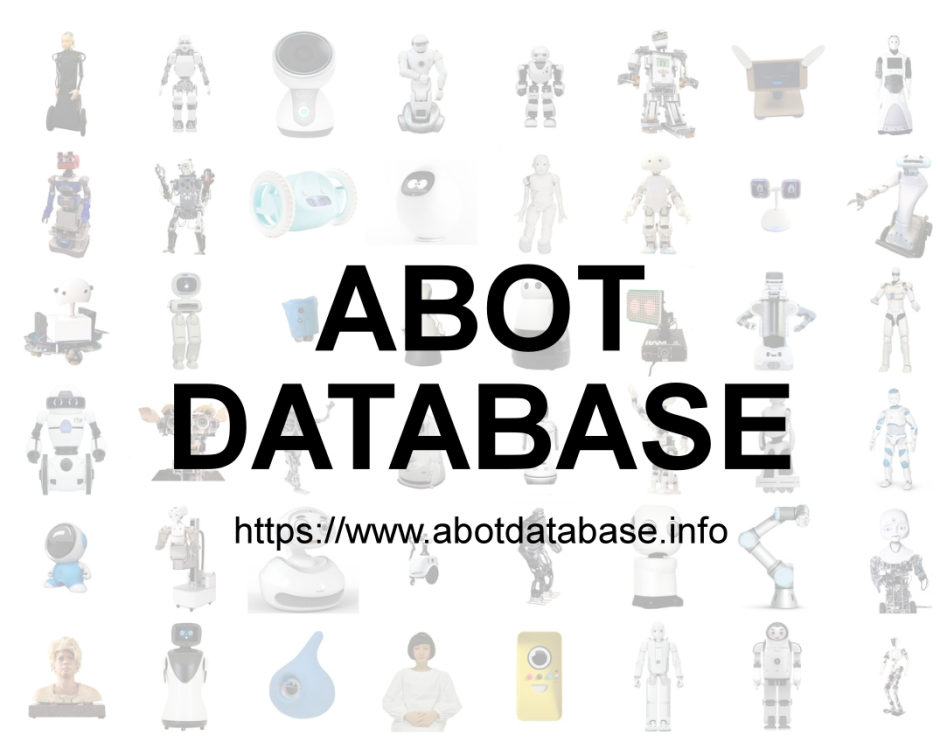
User believe agent can Respond to them

Social Interactivity

- It wants to interact with me.
- It can autonomously design how to interact with me.
- It can predict how I will respond to its actions.
- It can interpret my verbal or behavioral responses.
- I want to interact with it.

¹ Grey items were deleted during CFA.

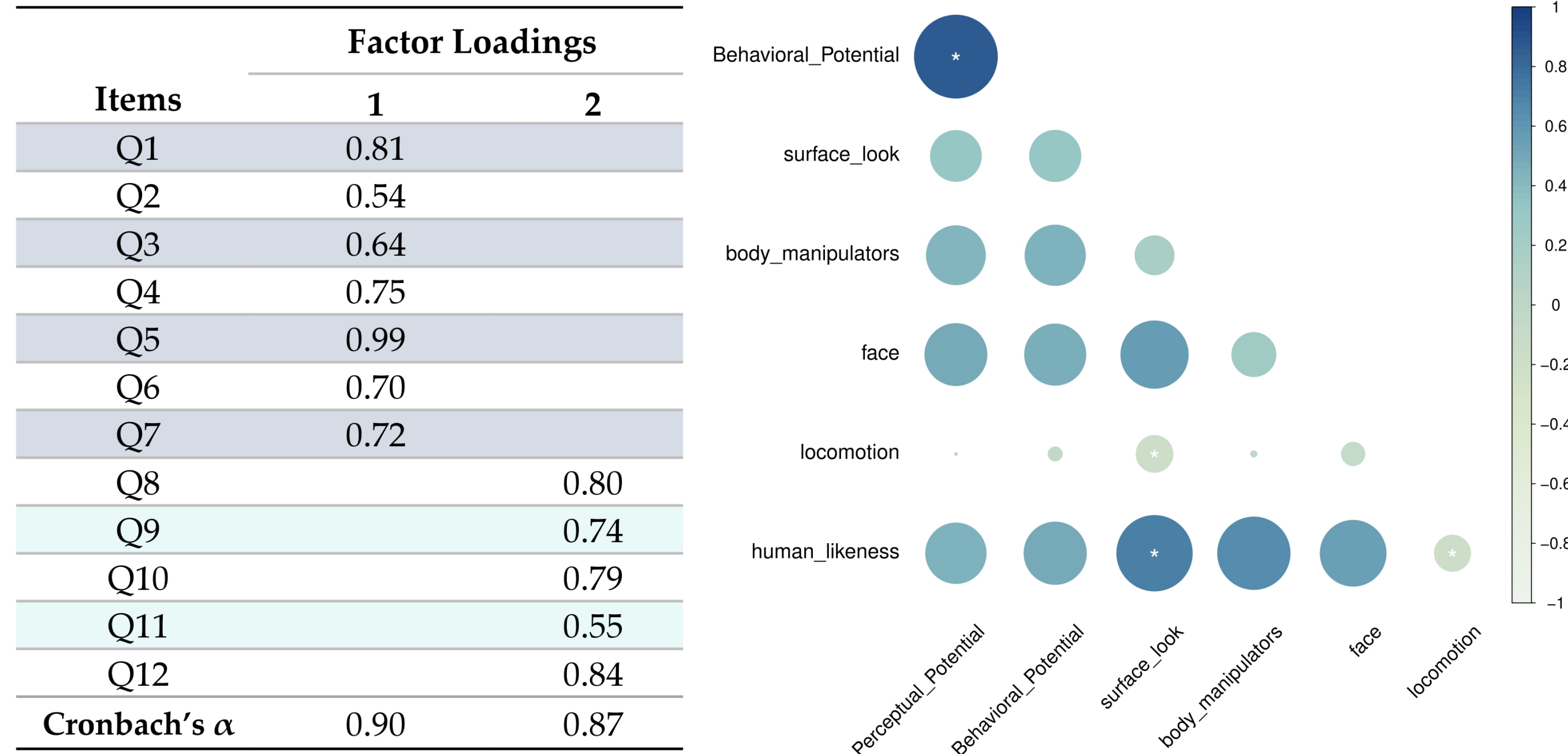
- **RoSIP** was developed from 13 items informed by prior social perception scales and theories of social affordances and communication. A pilot study (**N = 48**) ensured item clarity and preliminary reliability.
- Participants rated one randomly assigned robot image from the **ABOT Database** (251 designs).



Results

· Exploratory Factor Analysis (EFA)

- **EFA** was conducted on an independent sample (**N = 204**). A clear two-factor structure emerged. One item was removed due to substantial cross-loading.
- **All retained items loaded $\geq .50$** on their intended factor, with **high internal consistency (Perceptual Potential $\alpha = .90$; Behavioral Potential $\alpha = .87$)**.



· Confirmatory Factor Analysis (CFA)

- **CFA** was conducted on a separate sample (**N = 498**).
- The final RoSIP scale consists of **10 items** across two factors: Perceptual Potential (6 items) and Behavioral Potential (4 items); two items were removed due to high cross-loadings and semantic redundancy.
- The two-factor model showed acceptable fit (CFI = .90, RMSEA = .09, SRMR = .05).
- **Subscale reliability remained high (Perceptual Potential $\alpha = .90$; Behavioral Potential $\alpha = .84$)**.
- RoSIP showed only moderate correlations with anthropomorphism and human-likeness measures ($r = .32-.49$), supporting **discriminant validity**.

Implications

- A **concise, user-centered scale** for assessing appearance-based interaction potential.
- Supports rapid evaluation and iteration of **social robot prototypes**.
- Enables **design insights** by comparing high-scoring robot appearances and their visual cues.