

INTRO

- Robots are designed to interact and communicate with humans, so it is important they exhibit social intelligence (the ability to interact effectively with others to accomplish goals).
- Better social intelligence might lead to more effective human robot interactions (HRI) by allowing humans and robots to complete their shared goals more easily.
- This research examines the factor structure of the 20 Perceived Social Intelligence (PSI) Scales.

METHODS

- 295 Mturk workers (150 male) aged 19 to 72 (M = 37.39, SD = 11.50) watched five videos showing robots interacting with people, then rated the robots on 20 scales of social intelligence. See Table 1.
- Videos ranged from 1-3 minutes long and depicted a wide range of robot social intelligence.
- Participants rated their impressions of the robots on each item using a 5-point agreement scale.
- Five criteria (theory, Kaiser-Guttman, scree test, parallel analysis, and minimum average partial test) were used to determine the number of factors to extract. Three factors were extracted.
- The direct oblimin rotation with a delta value of -1 was used, as it had a high hyperplanar count, low number of complex variables, and moderate interfactor correlation.

RESULTS

- The three factors that were extracted are as follows (See Table 2):
 - Mental Interpretation** suggests the robot was able to interpret the cognitions and emotions of humans.
 - Approachability** suggests the robot has wanted characteristics and does not have unwanted characteristics that humans many appreciate in a social companion.
 - Behavioral Interpretation** suggests the robot could interpret the behaviors of humans.
- Gender differences were found; however, they were small. See Table 3.

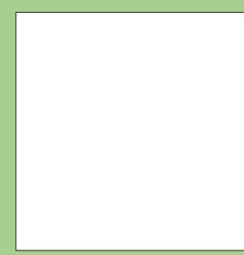
DISCUSSION

- Roboticians could use these factors to guide development of more desirable social robot companions.
- Researchers could explore robot features, functions, and behaviors that change perceptions that robots have these three different aspects of social intelligence.
- Research could explore if these aspects vary across environments, robot tasks, and people they are interacting with.



Exploratory Factor Analysis of Robot Social Intelligence
 Jennifer Frazee¹, Matthew R. Helm¹, Kimberly A. Barchard¹, Leiszle Lapping-Carr¹, R. Shane Westfall¹, & David Feil-Seifer²
¹University of Nevada, Las Vegas
²University of Nevada, Reno

The Perceived Social Intelligence (PSI) Scales measures three factors: Mental Interpretation, Approachability, and Behavioral Interpretation.



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Table 1

Perceived Social Intelligence Scales, Definitions, and Best Items

Scale Name	Definition	Single Best Item
Social Competence	The robot appears... to have strong social skills.	This robot... is socially competent
Recognizes Human Emotions	to detect people's emotions.	recognizes human emotions.
Recognizes Human Behaviors	to detect people's behaviors.	notices when people do things.
Recognizes Human Cognitions	to detect people's cognitions.	can figure out what people think.
Adapts to Human Emotions	to adapt its behavior based on people's emotions.	responds appropriately to human emotion.
Adapts to Human Behaviors	to adapt its behavior based on people's behaviors.	adapts effectively to different things people do.
Adapts to Human Cognitions	to adapt its behavior based on people's cognitions.	adapts its behavior based on what people around it know.
Predicts Human Emotions	to anticipate people's emotions.	anticipates others' emotions.
Predicts Human Behaviors	to anticipate people's behavior.	anticipates people's behavior.
Predicts Human Cognitions	to anticipate people's cognitions.	anticipates others' beliefs.
Identifies Humans	to detect human presence.	notices human presence.
Identifies Individuals	to identify and recognize people as individuals.	recognizes individual people.
Identifies Social Groups	to discern which people are with each other.	knows if someone is part of a social group.
Friendly	to enjoy social interactions.	enjoys meeting people.
Helpful	to willingly assist in tasks.	tries to be helpful.
Caring	to care about the well-being of others.	cares about others.
Trustworthy	deserving of trust.	is trustworthy.
Rude	rude and disrespectful.	is impolite.
Conceited	overly proud of itself or its abilities.	thinks it is better than everyone else.
Hostile	antagonistic and violent.	tries to hurt people.

Note. This table was adapted from the Perceived Social Intelligence (PSI) Scales Test Manual (Barchard et al., 2018).

Table 2

Factor Analysis Results for Rotated Factors

Item	Factor			h ²
	1	2	3	
Recognizes Human Emotions	.94	.03	.01	.90
Adapts to Human Emotions	.93	.08	-.05	.87
Predicts Human Emotions	.91	-.05	.08	.87
Predicts Human Cognitions	.91	-.09	.01	.81
Identifies Social Groups	.88	-.19	.07	.77
Socially Competent	.83	.14	.06	.81
Identifies Individuals	.82	-.08	.09	.71
Recognizes Human Cognitions	.81	-.06	.23	.83
Adapts to Human Cognitions	.77	.13	.20	.82
Conceited	.04	-.88	-.07	.81
Rude	-.09	-.86	-.13	.88
Hostile	.14	-.86	-.16	.80
Trustworthy	.21	.76	.02	.71
Helpful	.16	.64	.35	.78
Caring	.74	.47	-.13	.83
Friendly	.60	.47	.01	.71
Recognizes Human Behaviors	.08	.02	.90	.88
Adapts to Human Behaviors	.20	.10	.76	.79
Identifies Humans	.14	.16	.68	.65
Predicts Human Behaviors	.62	-.02	.44	.76
Factor Intercorrelations	1	2	3	
	Factor 1	1.00	.22	.37
	Factor 2		1.00	.29
	Factor 3			1.00

Note. h² = communality. Salient factor pattern matrix coefficients are in boldface. All items in Factor 2 were reverse scored. Factor 1 = Mental Interpretation. Factor 2 = Approachability. Factor 3 = Behavioral Interpretation.

Table 3

Means (and Standard Deviations) for Men and Women on Each Factor

Factor	Men	Women	t-test
1	.57(.77)	.69(.70)	t(239) = -1.26, p = .208
2	.10(.71)	.28(.69)	t(239) = -1.98, p = .049
3	-.10(.87)	.06(.72)	t(239) = -1.6, p = .111

Note. Factor 1 = Mental Interpretation. Factor 2 = Approachability. Factor 3 = Behavioral Interpretation.

