

# Evaluation of Robot Social Intelligence based on the ESI(Evaluation of Social Interaction) Assessment

Miyoung Cho

(mycho@etri.re.kr)

# Background

- Existing HRI evaluation methods
  - Self-assessment or Self-report methodologies
  - Behavioral measurement through observations
  - Psycho-physiological measurements
  - Task performance metrics
  
- In order to evaluate interaction between human and robot in a more natural and intuitive way, it is necessary to understand human social intelligence.
  
- In this paper, we propose a method for evaluating the social intelligence of robots by applying Evaluation of Social Interaction(ESI).

# ESI(Evaluation of Social Interaction)

- ESI is a standardized, observation-based, and criterion-referenced evaluation of a person's quality of social interaction.
- ESI is an assessment that takes place while an individual performs social interaction with a specific goal, in a real situation.
- Scoring of the ESI is criterion-referenced, and determines whether an interaction is socially appropriate, mature, polite, respectful, and timely, given the intended purpose and the context in which the social interaction occurs.

## < 27 Social Interaction Skills >

<p><b>Initiating and terminating social interaction</b></p> <p>1. Approaches/Starts 2. Concludes/Disengages</p> <p>Producing social interaction</p> <p>3. Produces Speech 4. Gesticulates 5. Speaks Fluently</p> <p><b>Physically supporting social interaction</b></p> <p>6. Turns Toward 7. Looks 8. Places Self 9. Touches 10. Regulates</p> <p><b>Shaping content of social interaction</b></p> <p>11. Questions 12. Replies 13. Discloses 14. Expresses Emotion 15. Disagrees 16. Thank</p>	<p><b>Maintaining flow of social interaction</b></p> <p>17. Transitions 18. Times Response 19. Times Duration 20. Takes Turns</p> <p><b>Verbally supporting social interaction</b></p> <p>21. Matches Language 22. Clarifies 23. Acknowledges/Encourages 24. Empathizes</p> <p><b>Adapting social interaction</b></p> <p>25. Heeds 26. Accommodates 27. Benefits</p>
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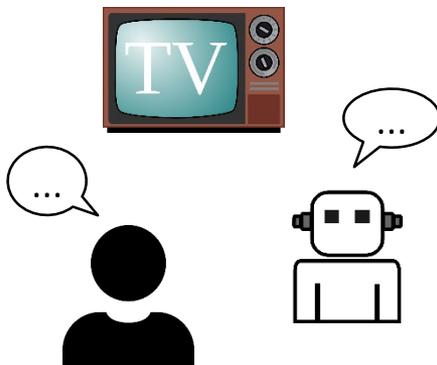
# HRI evaluation based on ESI(1/2)

- Scenario
  - the social robot and the user share conversation with family

< Conversation script >

Robot	User	ESI items: scores
(Moving to the center of the living room, located in front of the grandmother) Hello.	(Watching TV)	Approaches /Starts: 4 Places Self: 3
	Hello.	
Did you enjoy your lunch?		Approaches /Starts: 4
	I did not.	
Oh, why did not you eat? If you take a meal, ~ (long nagging).		Times Duration: 2
	I cannot see. Go away.	
Ah. I'm sorry. (Robot stands side by side with grandmother and watch TV together. Grandma, are you friends with your children?		Looks: 4 Questions: 4
...	...	...

Living room



# HRI evaluation based on ESI(2/2)

- ESI scoring for HRI

ESI items	Score				ESI items	Score			
	4	3	2	1		4	3	2	1
Approaches/Starts	○				Disagrees	-			
Concludes/Disengages	○				Thank	○			
Produces Speech	○				Transitions	-			
Gesticulates				○	Times Response		○		
Speaks Fluently	○				Times Duration		○		
Turns Toward	○				Takes Turns	○			
Looks	○				Matches Language	-			
Places Self		○			Clarifies	○			
Touches				○	Acknowledges/Encourages	○			
Regulates			○		Empathizes		○		
Questions	○				Heeds	○			
Replies	○				Accommodates	-			
Discloses	○				Benefits	-			
Expresses Emotion	○				Total	20	4	1	2

\*Scoring

4 = Competent social interaction skill

3 = Questionable

2 = Ineffective

1 = Severely limited

# Conclusions

- The social interaction level of a social robot can be quantitatively assessed through HRI evaluation based on ESI assessment.
- The proposed method analyzes the strengths and weaknesses of social robots and can be used as foundational data for implementing additional functions, and for improving interaction functions.
- The evaluation criteria of each social interaction skill proposed by the ESI can be presented as HRI technology development goals.