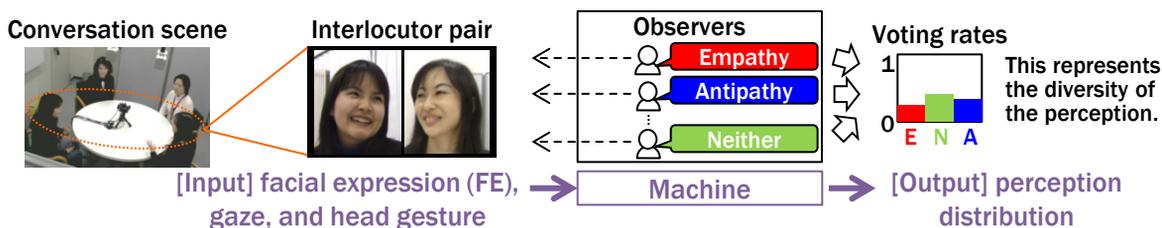# 16

Seeing into the mind in the twinkle of a smile

Analyzing expression/perception of interlocutors' empathy

Abstract—— Although conversation is vital in our social life, it is not easy for people to fully understand what others are feeling. As an initial step towards solving this problem, we proposed the world's first computational model for estimating observers' perceptions of empathy/antipathy between a pair of interlocutors based on the interlocutors' behavior; while most previous studies targeted only a single person. We further proposed inferring how differently a crowd of observers perceive interlocutors' emotions. This makes it possible to handle emotions, which are basically ambiguous, objectively and quantitatively. Our aim is to clarify the process by which emotions are expressed and perceived by others. This would be helpful for the development of remote communication systems, and for elucidating communication disorders.
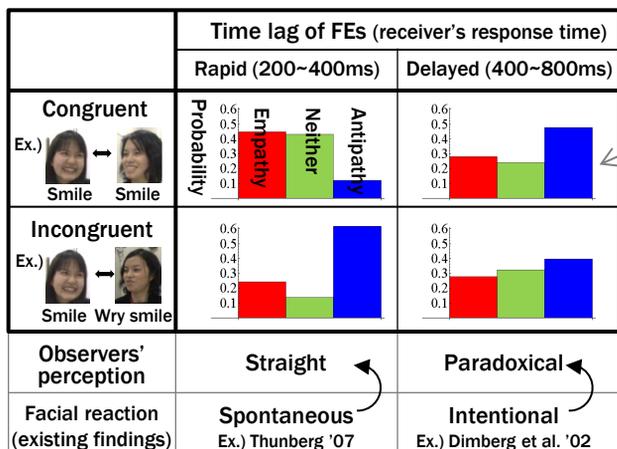
➢ **Summary** We proposed a probabilistic model for inferring observers' perceptions of empathy and antipathy between a pair of interlocutors based on the interlocutors' behavior.

Conversation scene — Interlocutor pair — Observers: Empathy / Antipathy / Neither — Voting rates: This represents the diversity of the perception.

[Input] facial expression (FE), gaze, and head gesture → Machine → [Output] perception distribution

➢ **Keys to inferring observers' perceptions**

(1) Time lag and congruence of FEs between a pair

Ex.) Delayed smile to smile is often perceived as antipathy.

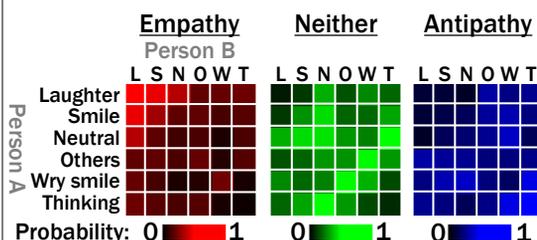|	Time lag of FEs (receiver's response time)	
	Rapid (200~400ms)	Delayed (400~800ms)
Congruent Ex.) Smile ↔ Smile		
Incongruent Ex.) Smile ↔ Wry smile		
Observers' perception	Straight	Paradoxical
Facial reaction (existing findings)	Spontaneous Ex.) Thunberg '07	Intentional Ex.) Dimberg et al. '02

(2) Co-occurrence of FEs between a pair

[Typical perception tendencies]
- Smile to smile: empathy
- Wry smile to smile: antipathy

Point: To describe these tendencies with probability matrices

Empathy — Neither — Antipathy
Person B: L S N O W T
Person A: Laughter, Smile, Neutral, Others, Wry smile, Thinking
Probability: 0—1 0—1 0—1

* Gaze and head gestures also yield different perception tendencies.

➢ **Model & inference performance**

- Probabilistic model   - Data: 5~9 observers for 70 min conversations
- The time lag of FEs increases the accuracy of empathy by 14 points (66%→80%)

Related works

[1] S. Kumano, K. Otsuka, M. Matsuda, J. Yamato, "Analyzing perceived empathy/antipathy based on reaction time in behavioral coordination," in *Proc. International Workshop on Emotion Representation, Analysis and Synthesis in Continuous Time and Space (EmoSPACE)*, 2013.

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