

Effects of Facial Emotions on Social-motor Coordination in Schizophrenia

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Impairments in schizophrenia

In processing non-verbal social cues

- Body posture [Thoma 2013]
- Hand gesture [Mathews 2013]
- Gaze direction [Rosse 1994]
- Facial emotion [Kohler 2003]

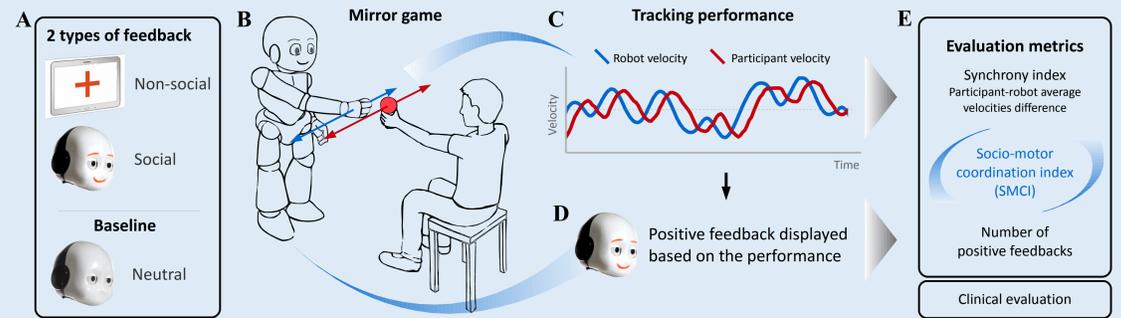
In social-motor coordination

- Motor signature [Varlet 2012]
- Social priming [Raffard 2015]

How do these impairments interact?

More precisely, how does facial emotion affect social-motor coordination in schizophrenia

Human-robot social-motor coordination



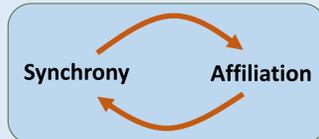
- 22 schizophrenia patients and 22 matched healthy control performed 15 trials of mirror game
- During the interaction, the robot provided the participants with positive feedback based on their synchrony performance.
- clinical aspects of the participants (symptoms and cognitive impairments) were evaluated.

Social-motor coordination

The social aspect of interpersonal interactions (e.g., automatic processing of the social information) and the dynamics of the motor coordination are highly interlinked and are referred to as *social motor coordination*.

Synchrony:

Synchrony is the reciprocal adaptation of the temporal structure of movement in two or more interactive partners and is used often as a means to quantify social interaction in simple motor tasks.



Can positive facial emotions increase synchrony in schizophrenia patients?

Task: Mirror game

A paradigm based on a theater joint-improvisation activity. This game provides a quantifiable framework, while maintaining the natural aspect of the interaction; e.g., the bi-directionality. In this game, two participants mirror each other's hand movements. In the mirror game, **synchrony** is simply investigated by measuring temporal coordination across participants' hand trajectories.

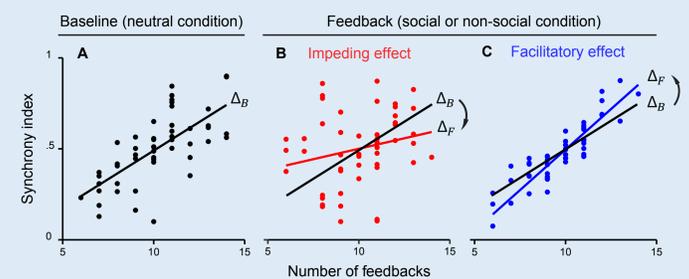
Analysis

Two covariates:

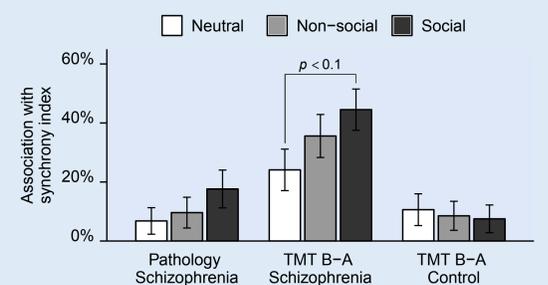
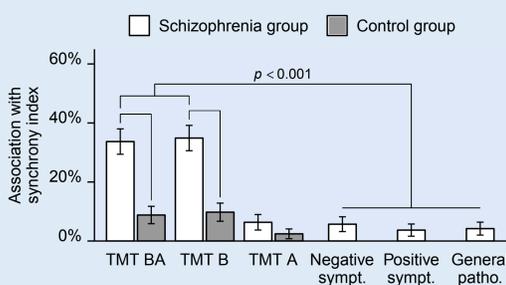
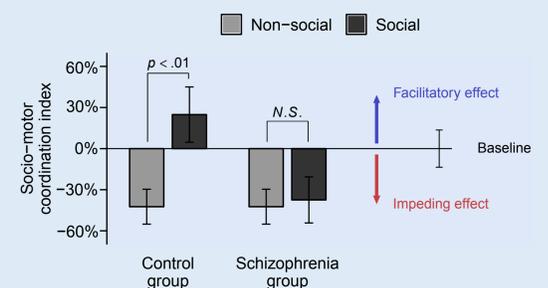
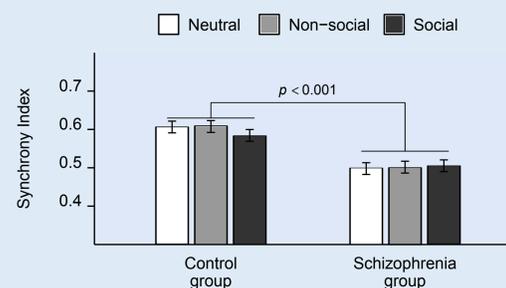
- Synchrony
- Number of given feedback

Causal direction:

- One-way in the neutral condition
- Bi-directional in the feedback conditions



Results



We contribute three main findings

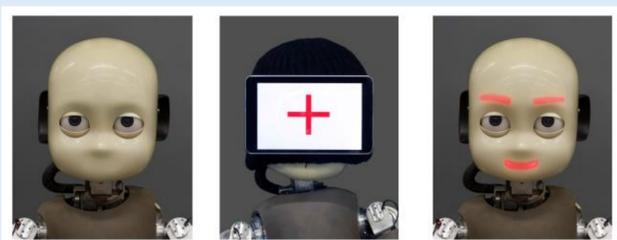
- 22 schizophrenia patients and 22 matched healthy controls performed 15 trials of mirror game
- Non-social feedback has an **impeding** effect on synchrony in both groups
- Social feedback has a **facilitatory** effect for the control participants
- Social feedback has an **impeding** effect for the schizophrenia patients
- The patients' performance is more associated with their performance in Trail-Making-Test.

Humanoid robotics

Use of humanoid robots provides us advantages such as

- Repetitive behavior across trials
- Solving the attribution problem
- Controlled facial expressions

Can artificial facial emotions increase synchrony?



Neutral

Non-social

Social

Conclusion

Our results suggest that the social-motor coordination impairment observed in schizophrenia (i.e., lack of facilitatory effect of facial emotion on synchrony) is due to a deficit in their automatic processing of social information that is compensated by higher-order cognitive mechanism (such as cognitive flexibility measured by TMT).