Joint-Olfaction: Human dyads show collective benefit in olfactory discrimination and identification

Mustafa Yavuz[1,2] , Saman Sayahpour[3] , Bahador Bahrami[4] , Ophelia Deroy[2]

1- Graduate School of Systemic Neurosciences, Ludwig Maximilian University, Munich, Germany
2- Cognition, Values and Behavior Research Group, Ludwig Maximilian University, Munich, Germany
3-Department of Philosophy, Ludwig Maximilian University, Munich, Germany
4-Department of General Psychology and Education, Ludwig Maximilian University, Munich, Germany

Yavuz.Mustafa@lmu.de

Graduate School of Systemic Neurosciences
LMU Munich

Background & Research Question

- Perception is inherently noisy and prone to errors, particularly in challenging situations.
- Humans, however, can mitigate individual limitations through communication and calibration of their perceptual judgments, resulting in well-documented "***collective benefits***" in perceptual decision-making.**[1]**
- This raises a critical question: Can such benefits extend to modalities like olfaction, where verbal communication is far less common?
- **Question 1:** Do human dyads show collective benefit in olfactory perceptual taks?
- **Question 2:** Does collective benefit in olfactory performance correlates with ability similarity?

Olfactory Testing – Sniffin' Sticks Test [2]

Discrimination

Detection Task

- Odd-one-out
- 3 options
- Sniff each option for 1 second
- Blind-folded
- Report the different odorant
- 16 trials

A B A

Identification

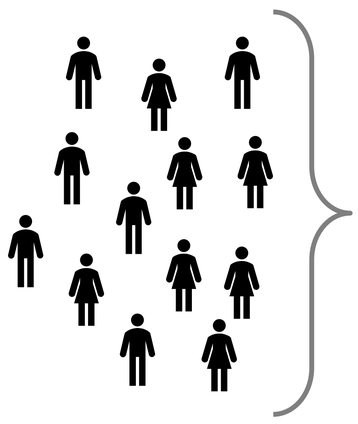
Naming / Recognition Task

- Multiple Choice (4 Options)
- Sniff the odorant for 1 second
- Report the name of the odorant
- 16 trials

Orange Rubber
Blueberry Mint

Experimental Design

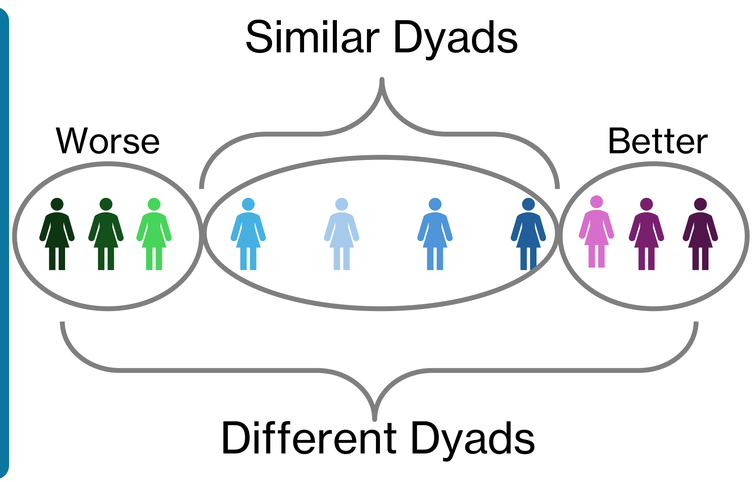
1) INDIVIDUAL TESTING



Threshold
Discrimination X16
Identification X16

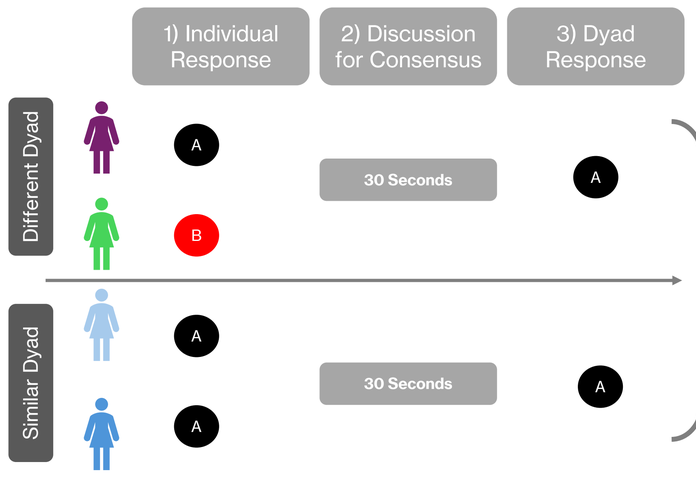
Sample
N = 53
16 Males (30%)
Mean Age: 24.42 (4.07)

2) CREATING DYADS



Sample
N = 20
10 Similar
10 Different
12 Males (30%)
Mean Age: 24.53 (4.03)

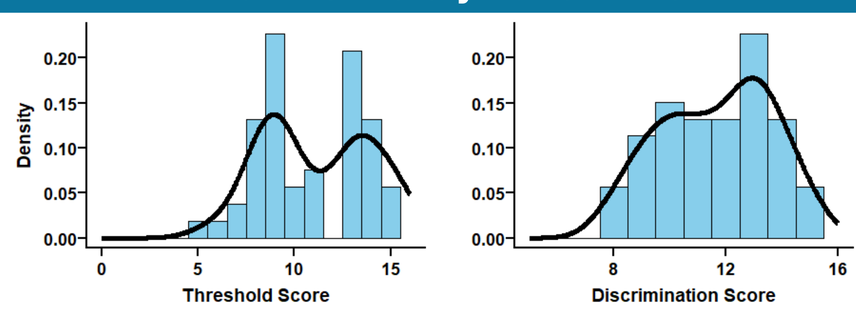
3) DYAD TESTING

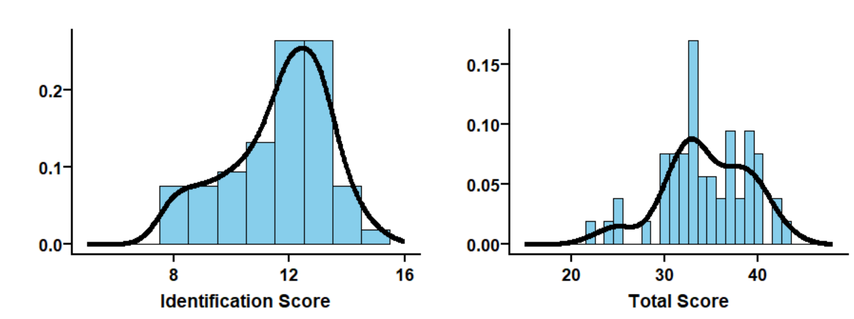


Discrimination X16
Identification X16

Results

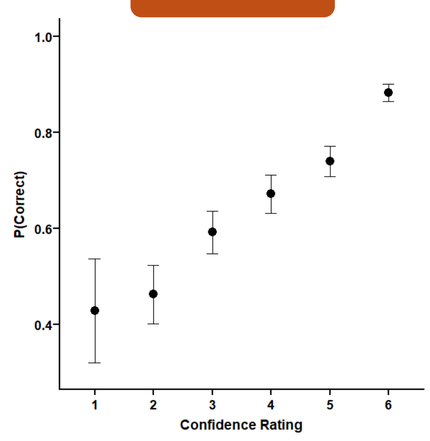
Individual Olfactory Performance



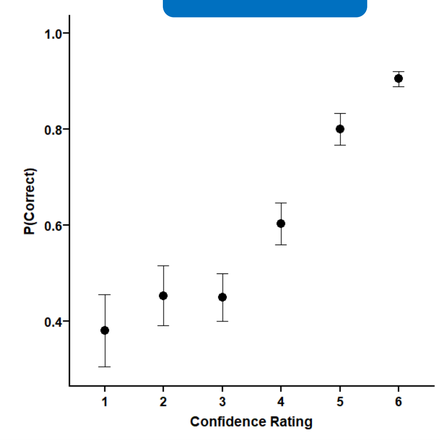


Individuals show metacognitive sensitivity

Discrimination

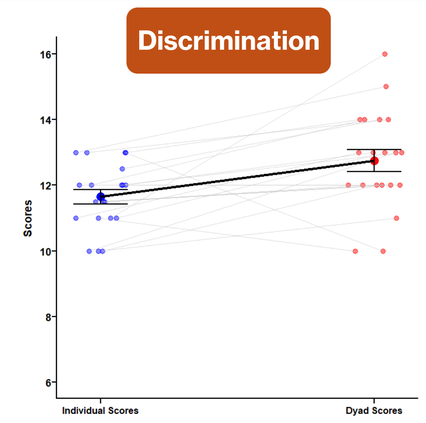


Identification

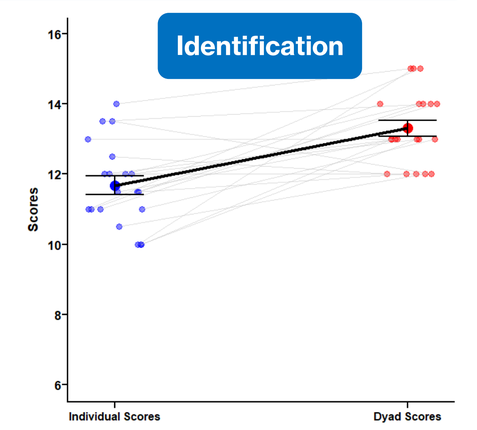


Dyads performed better than the average of individuals

Discrimination

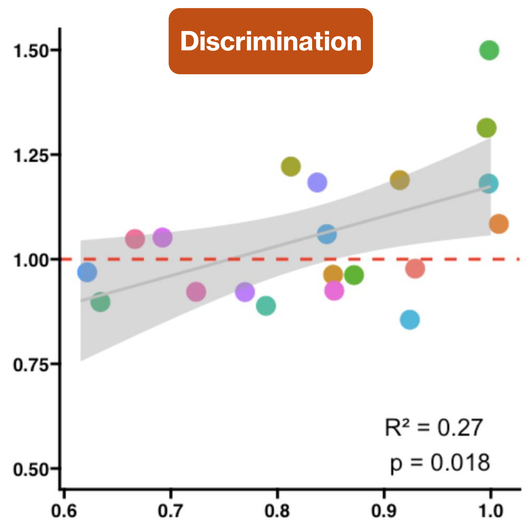


Identification

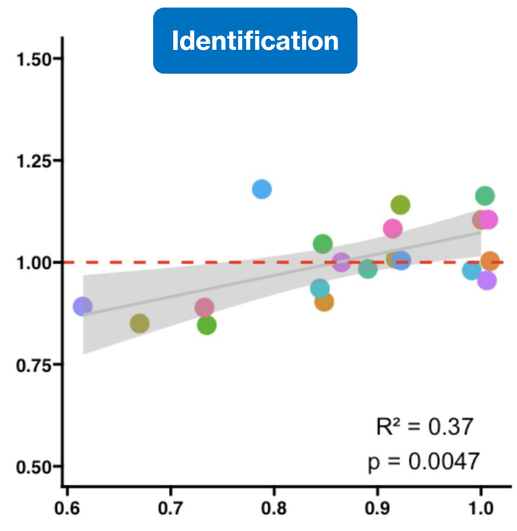


Collective benefit is associated with ability similarity

Discrimination



Identification



Conclusion

- Dyads had superior performance in olfactory discrimination and identification compared to the average of individuals in the pair.
- As predicted, collective benefit was highly correlated with the skill similarity of the individuals. Comparable olfactory ability fostered more effective sharing of perceptual evidence and corrected the individual errors.
- By extending joint decision-making research to the olfactory domain, our results broaden the scope of social cognition research across sensory modalities

European Research Council
Established by the European Commission

PREREGISTERED

Munich Interactive Intelligence Initiative

References

[1] Bahrami, B., Olsen, K., Latham, P. E., Roepstorff, A., Rees, G., & Frith, C. D. (2010). Optimally interacting minds. *Science*, *329*(5995), 1081-1085.

[2] Rumeau, C., Nguyen, D. T., & Jankowski, R. (2016). How to assess olfactory performance with the Sniffin'Sticks test®. *European annals of otorhinolaryngology, head and neck diseases*, *133*(3), 203-206.