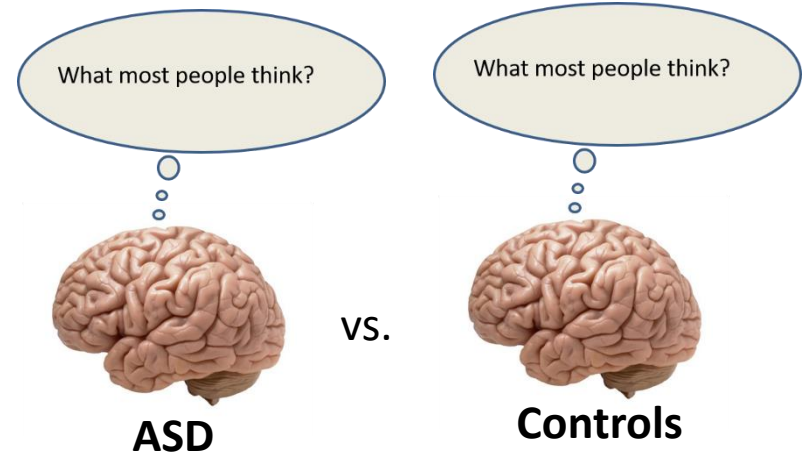
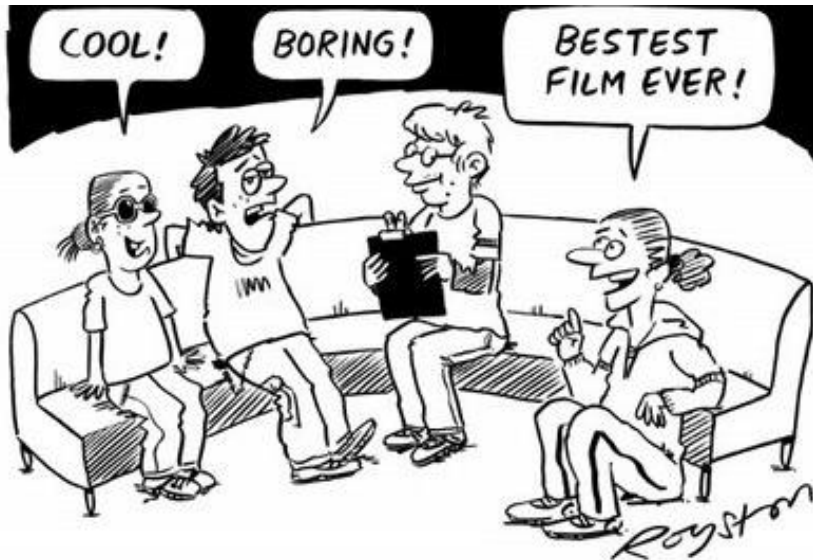


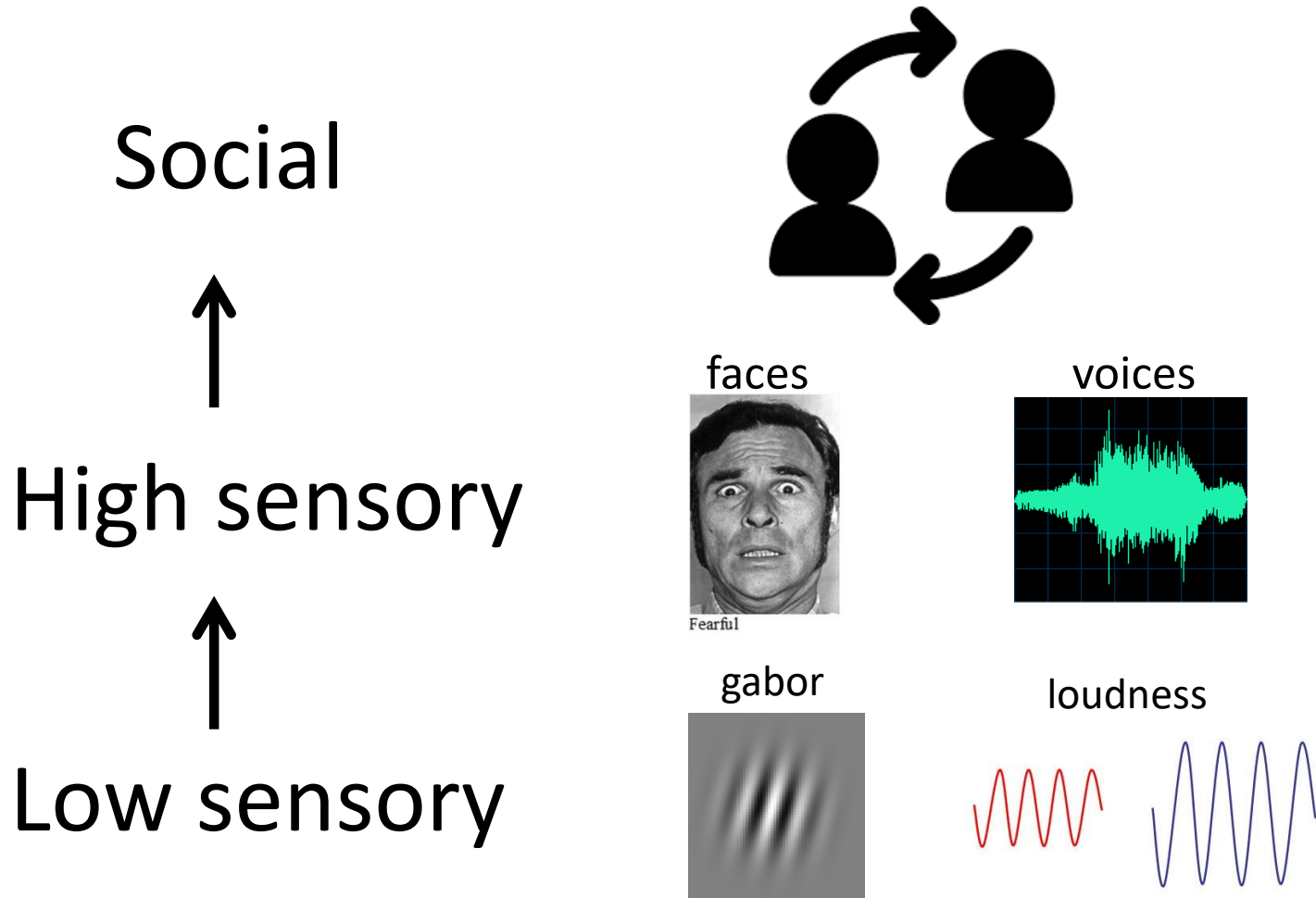
Idiosyncratic neural representations in task-relevant brain areas in autism



Felipe Pegado
MD, PhD

Laboratoire de Psychologie Cognitive
Aix-Marseille Université, France

Autism abnormalities



DSM-5: ASD- Autism Spectrum Disorders

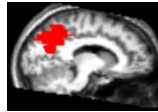
- A. Persistent **deficits in social communication** and social interaction across multiple contexts
- B. **Restricted, repetitive patterns of behavior**, interests, or activities
- C. Present in the **early developmental** period
- D. **Significant impairment** in social, occupational areas.
- E. These disturbances are **not better explained** by intellectual disability or global developmental delay.

B4. Hyper-or hypo-reactivity to sensory input or unusual interest in sensory aspects of environment; (such as apparent indifference to pain/heat/cold, adverse response to specific sounds or textures, excessive smelling or touching of objects, fascination with lights or spinning objects).

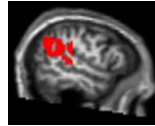
Typical studies

mentalizing network

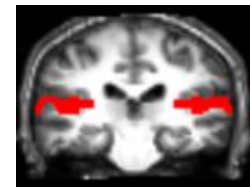
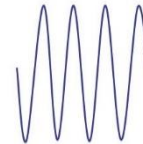
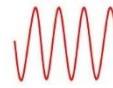
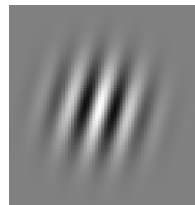
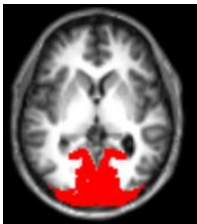
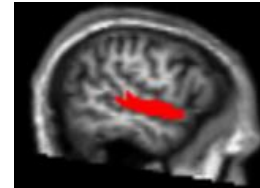
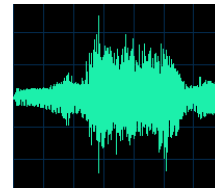
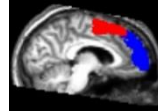
Precuneus-PC



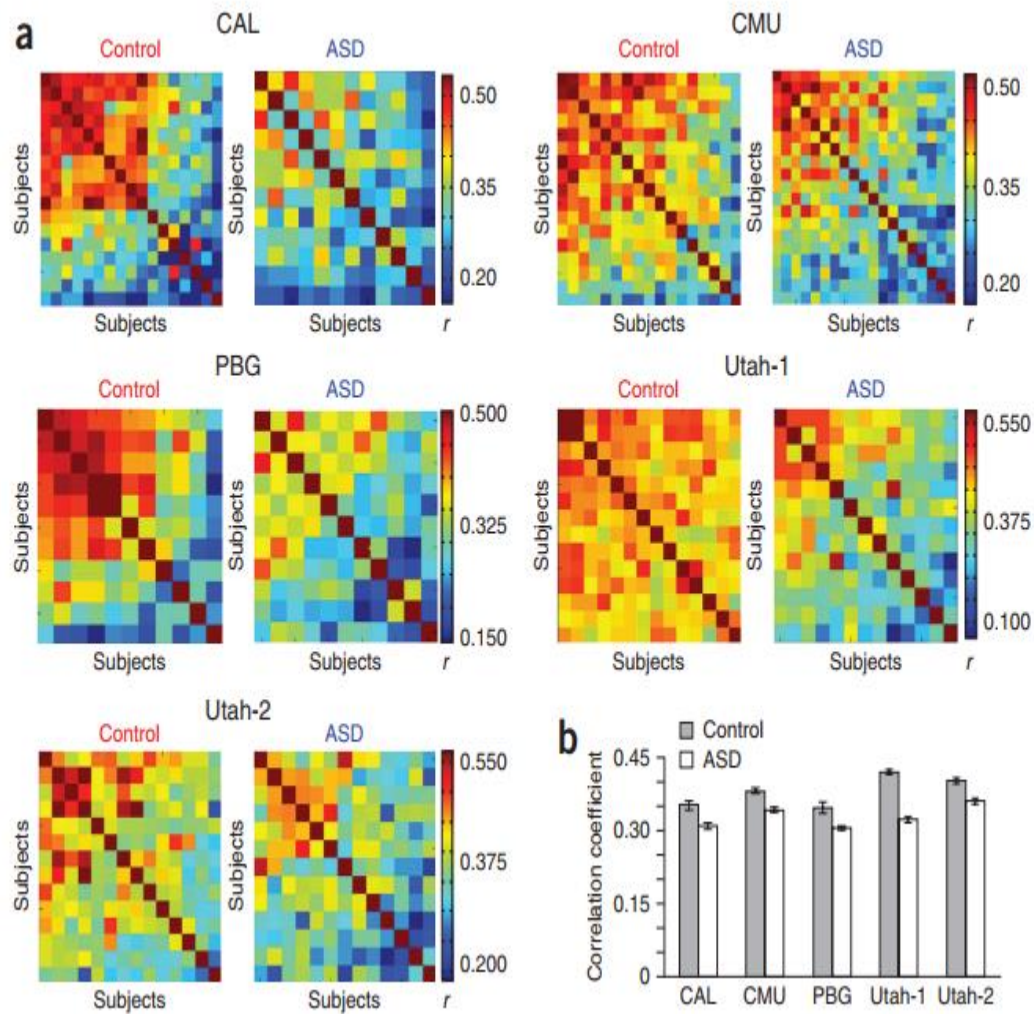
TPJ



posterior & anterior mPFC

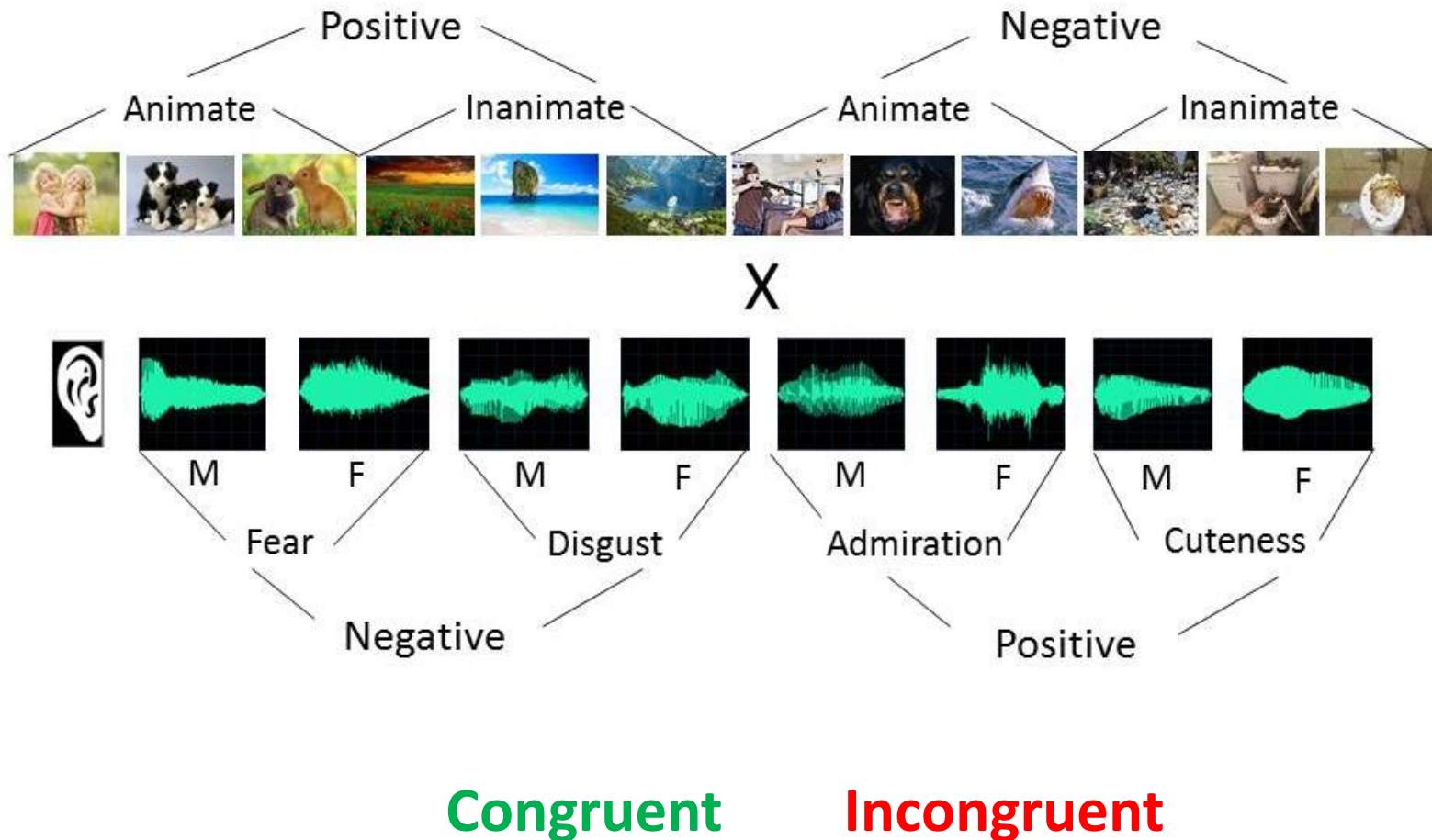


Increased Idiosyncrasy in Autism Brain Connectivity



Studying multiple brain representations at once

A) Audio-Visual stimuli combinations



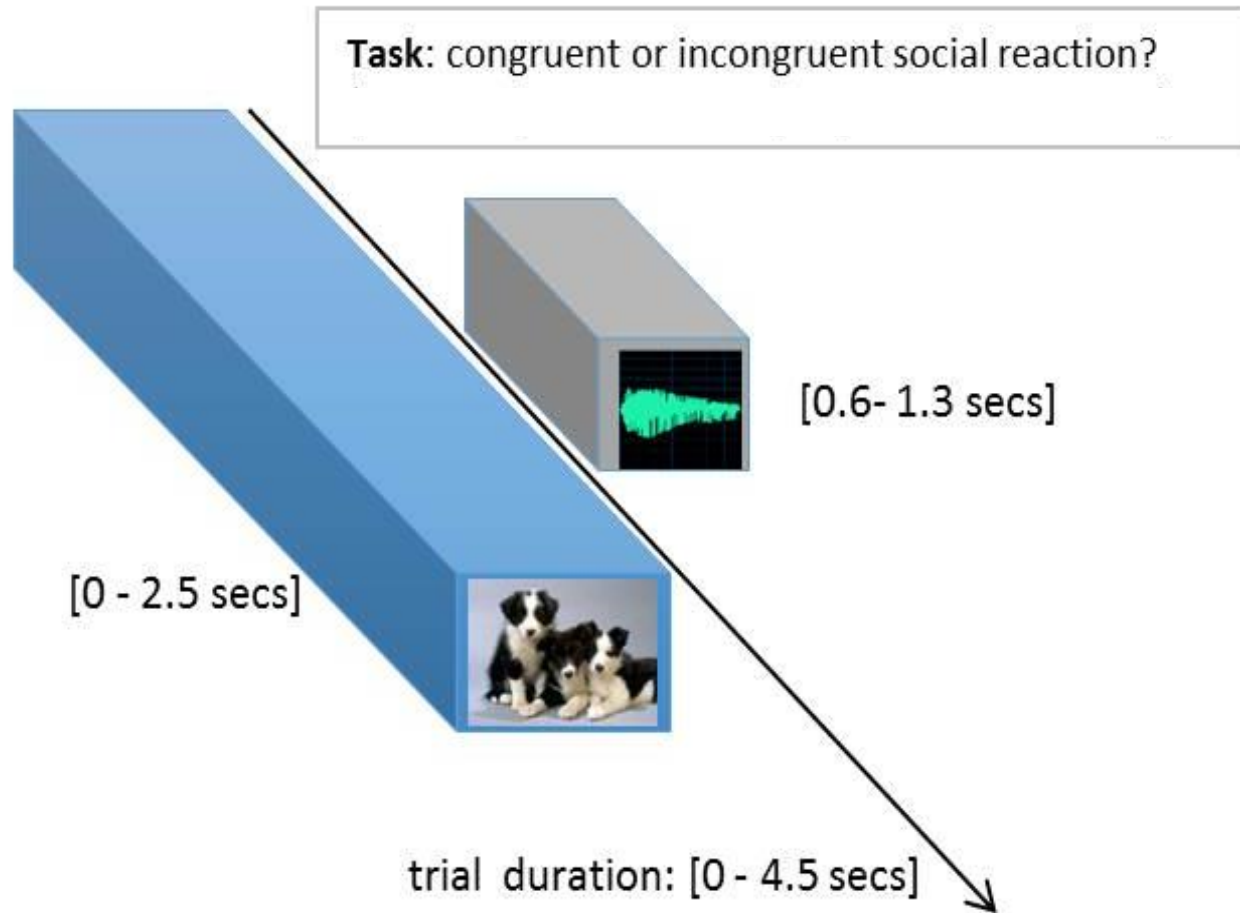
Congruent reaction



Incongruent reaction



Experimental trials



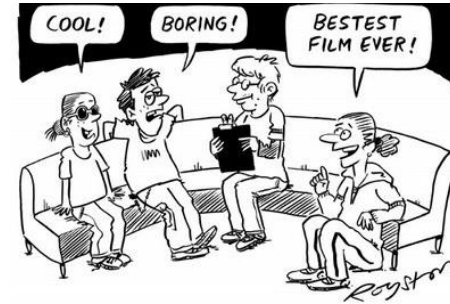
Task validation in healthy subjects

« Self-reference » task



versus

« Social norm » task

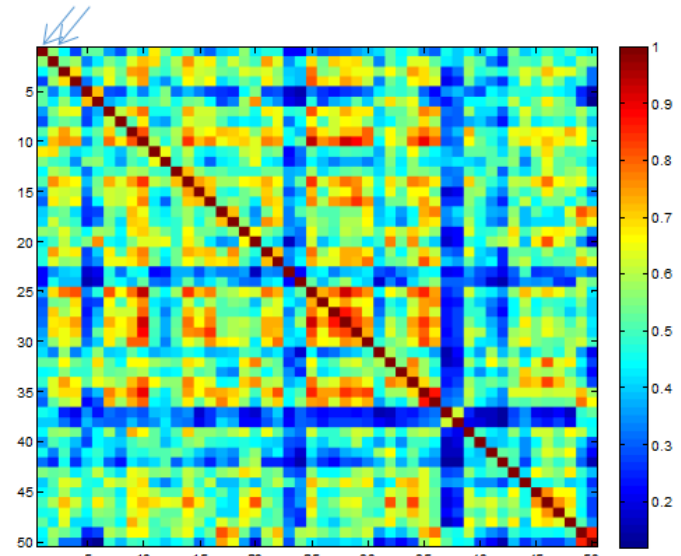
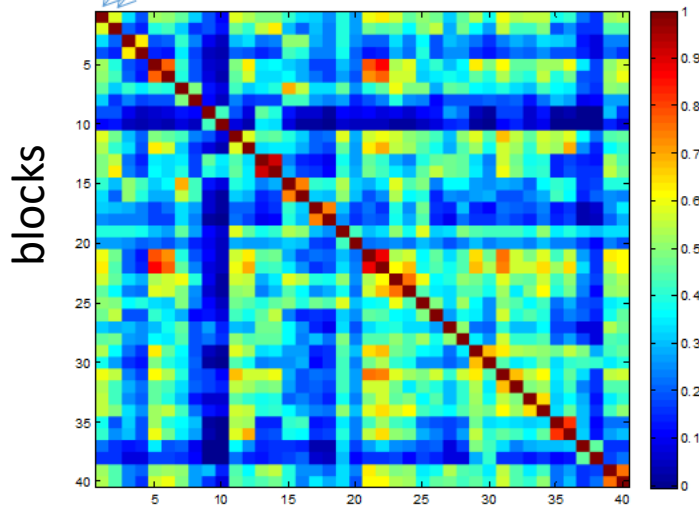


Similarity of response patterns

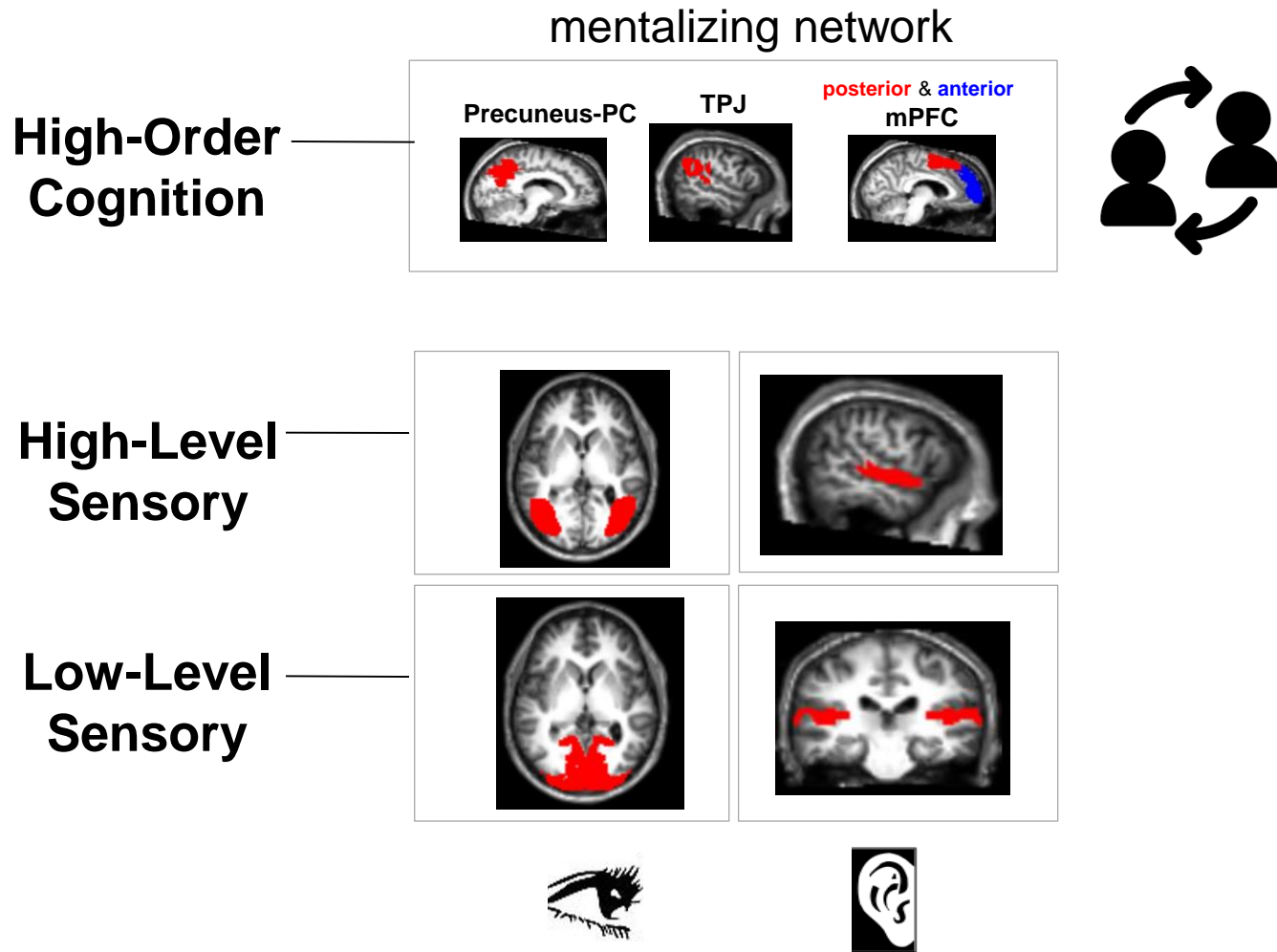


Within-subjects: $r = 0.65$ vs 0.67 ; $t(43) = -0.3$

*** Between-subjects: $r = 0.33$ vs 0.50 ; $t(43) = -7.1$; $p < 0.0001$



Hierarchical Brain Areas



Separate GLMs :

visual, audio and congruency GLMs

Visual GLM

- Duration & onset for *visual* stimuli (0-2.5 sec)
- Conditions: 12 visual stimuli

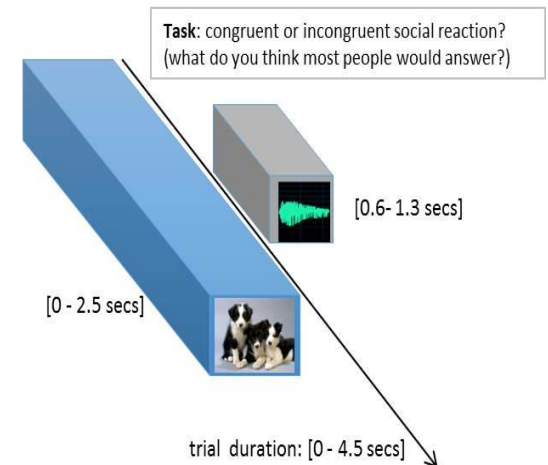
Auditory GLM

- Duration & onset for *auditory* stimuli (0.6-1.3 sec)
- Conditions: 8 auditory stimuli

Congruency GLM

- Duration & onset : 0.6 - 4.5 sec
- 2 Conditions: congruent vs incongruent

Experimental trials

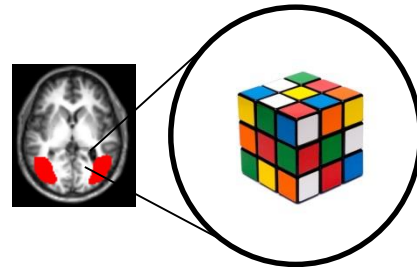


Studying **multiple brain representations** at once

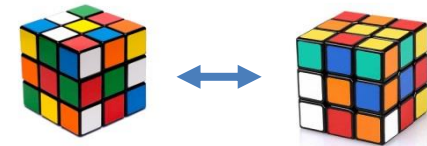
3 GLMs:

 congruency

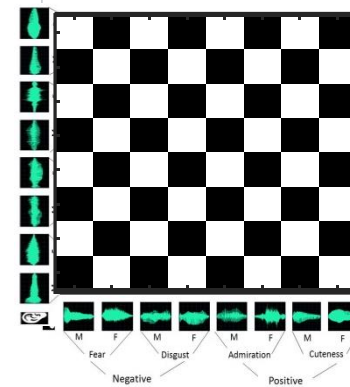
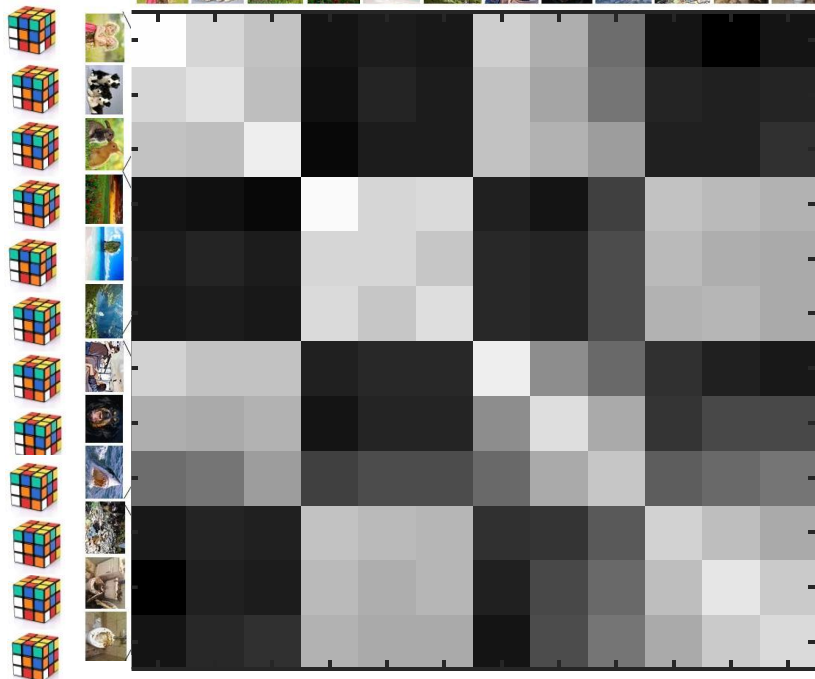
MVPA



RSA



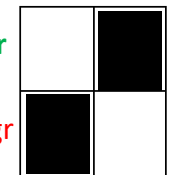
RSA



congruency

congr

incongr



congr
incongr

Pegado, Op de Beeck et al, *Frontiers* 2018

Pegado Op de Beeck et al., *Sci Rep* 2018

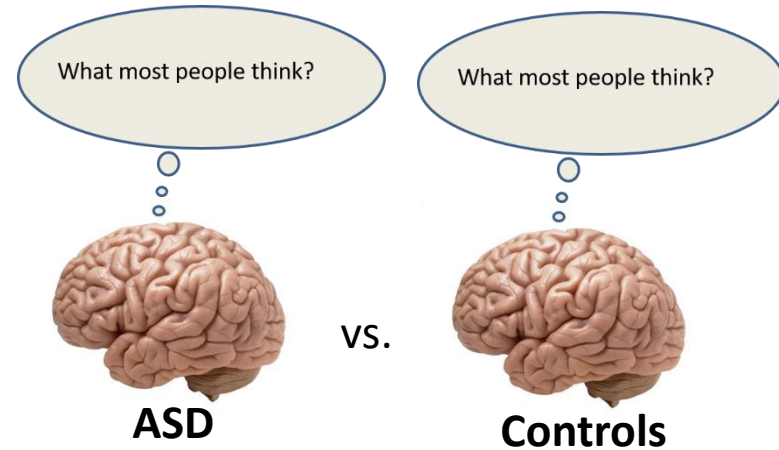
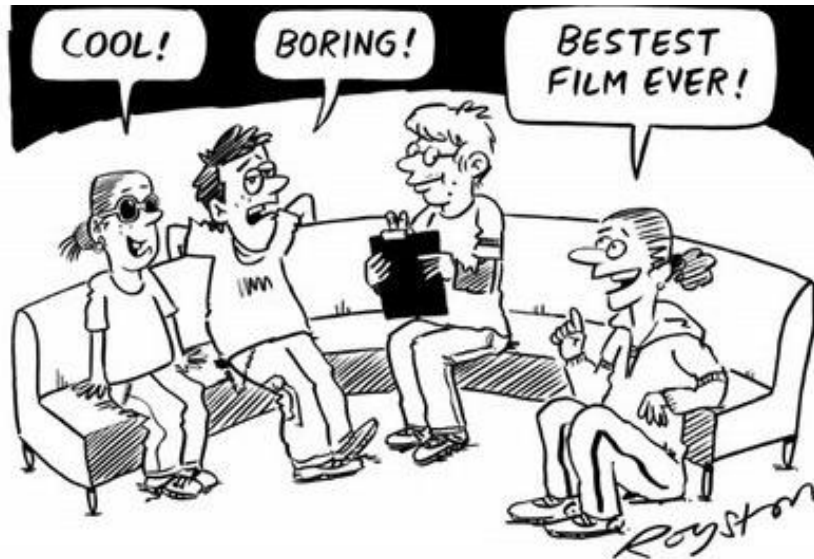


B. Boets
KU Leuven

ASD study



H. Op de Beeck
KU Leuven



Groups' matching

22 High-Functioning Autism (**HFA**)

vs

22 matched Typically Developing (**TD**)

	ASD N = 22	Matched TD N = 22	T-statistic	P-value
Age	22.5 (+/- 4.09)	22.8 (+/- 2.94)	T(42) = 0.34	P = 0.74
IQ	108.6 (+/- 14.5)	112.4 (+/- 15.4)	T(42) = 0.84	P = 0.40
SRS-A	63.0 (+/- 13.0)	49.0 (+/- 8.0)	T(42) = 4.28	P = 0.0001

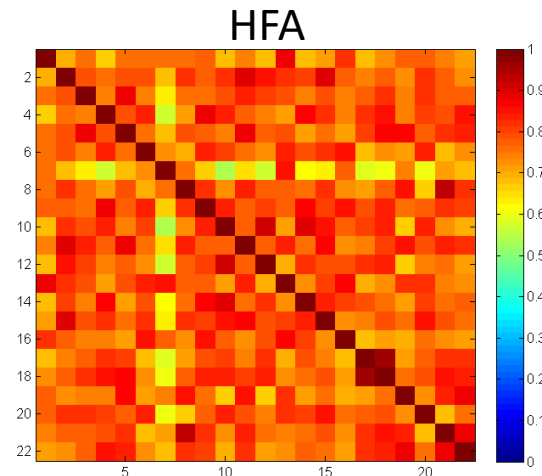
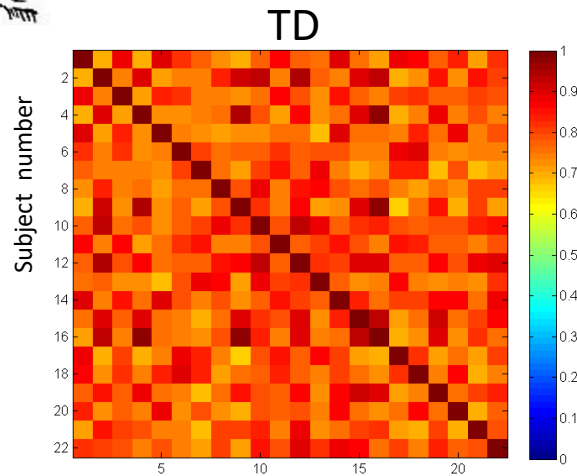


Variability across subjects

Behavioral ratings



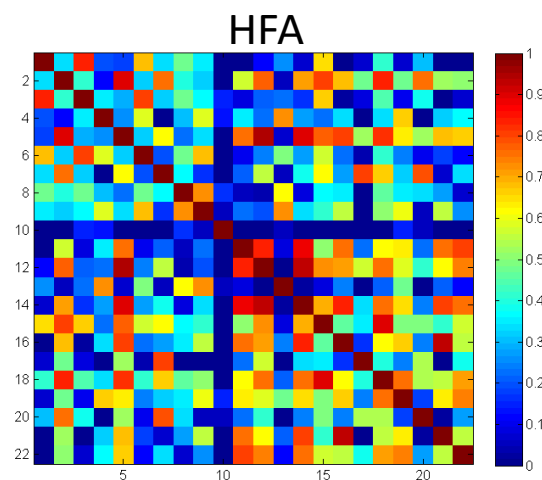
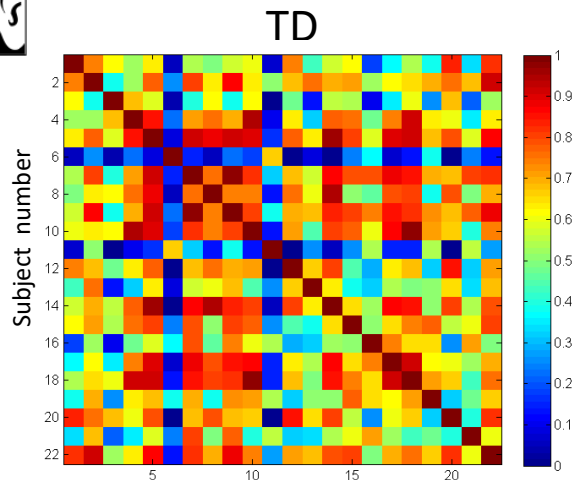
Similarity of *visual* valence ratings across participants



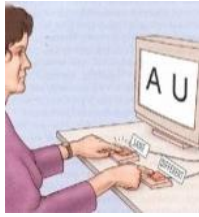
** $T(42) = -2.83$;
 $p = 0.007$



Similarity of *auditory* valence ratings across participants



*** $T(42) = -4.78$;
 $p < 0.0001$

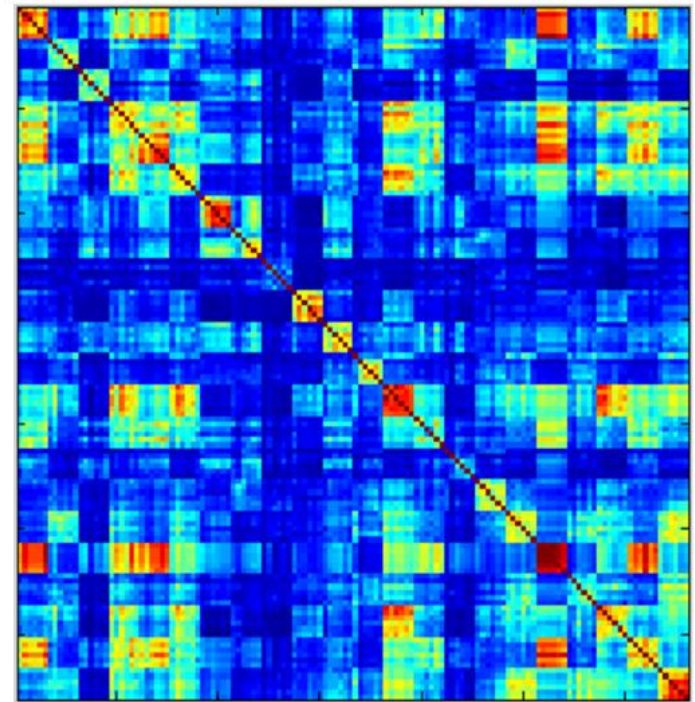
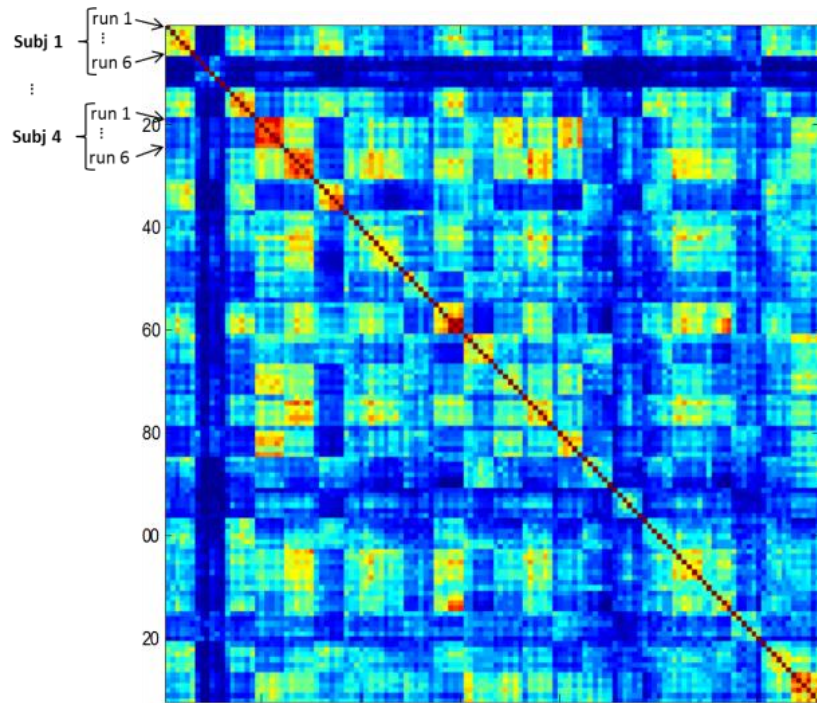


Behavioral ratings

Similarity of *congruency* judgements
within and *between* participants
(inside the scanner)

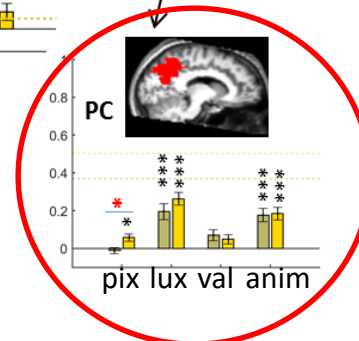
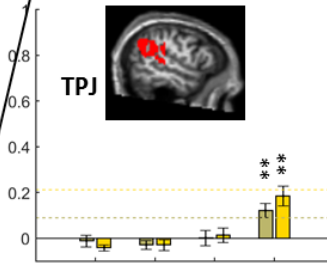
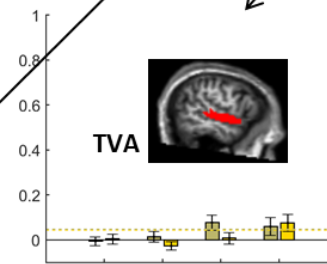
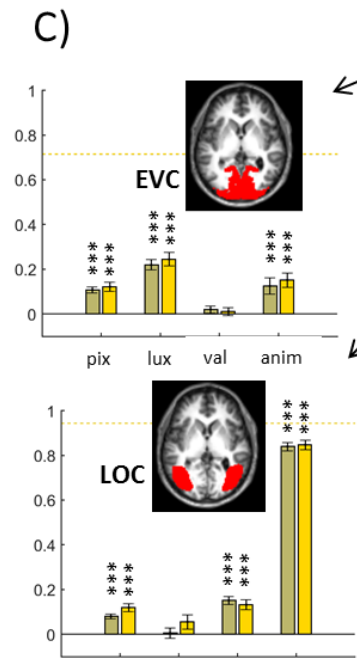
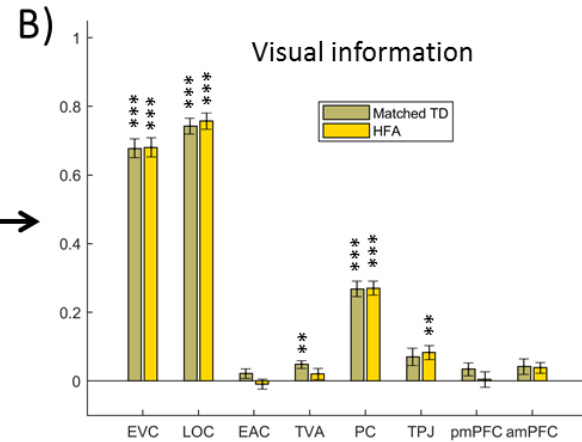
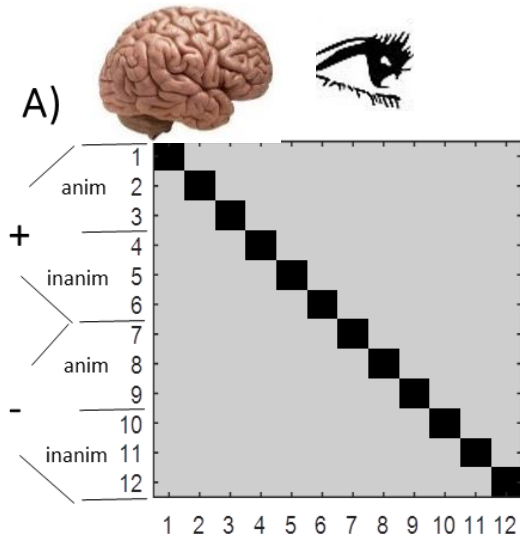
TD

HFA

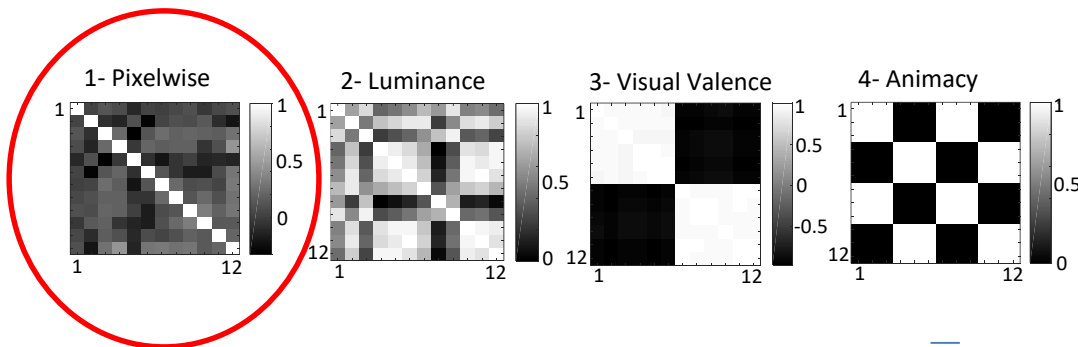
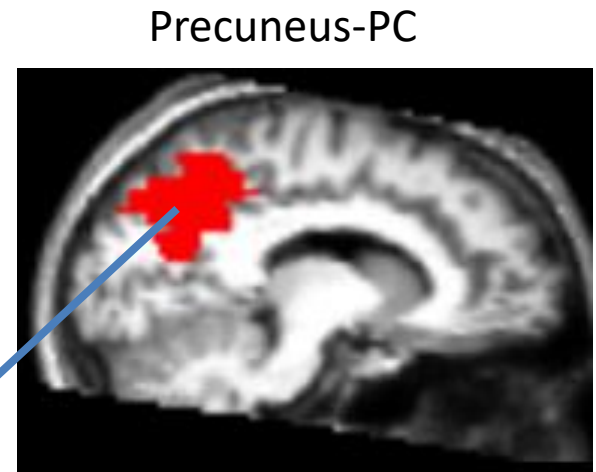
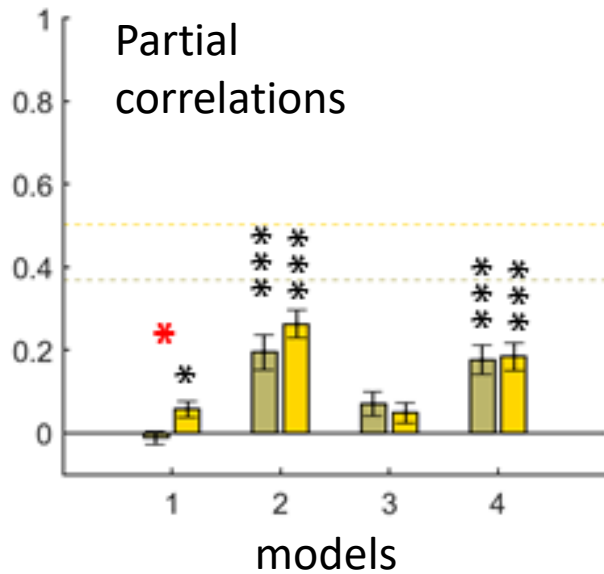


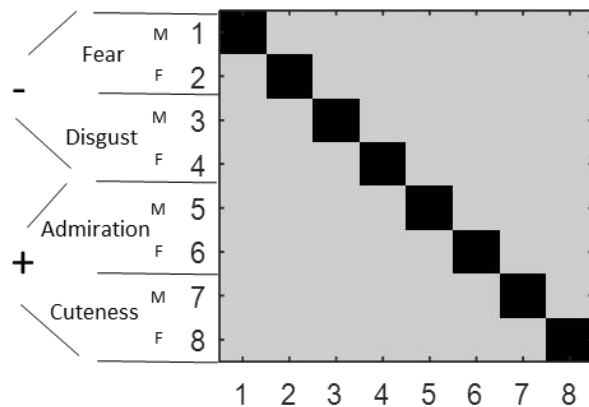
within-subject correlations (TD: $r = 0.51$ vs ASD: $r = 0.54$; $T(42) = -0.59$; $p = 0.56$).

**** between-subject** correlations (TD: $r = 0.26$; ASD: $r = 0.19$; $T(42) = 2.62$; $p = 0.01$).

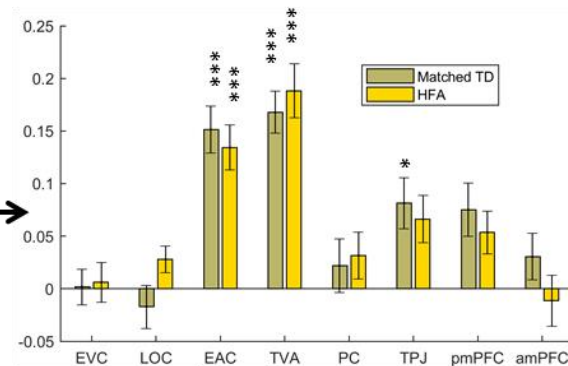


HFA show more *low-level* visual information in PC

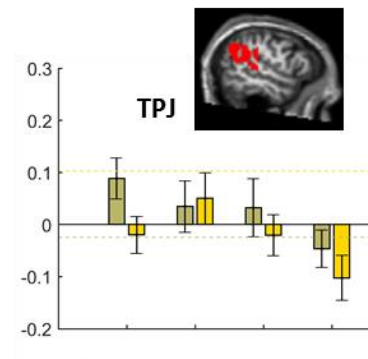
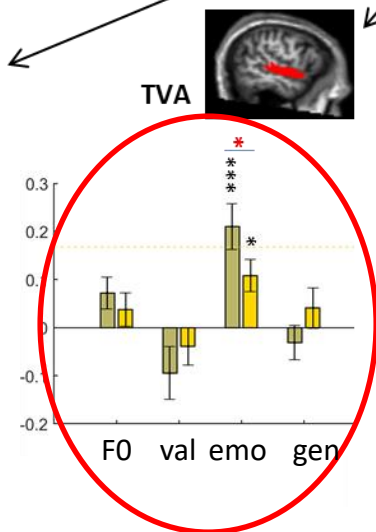
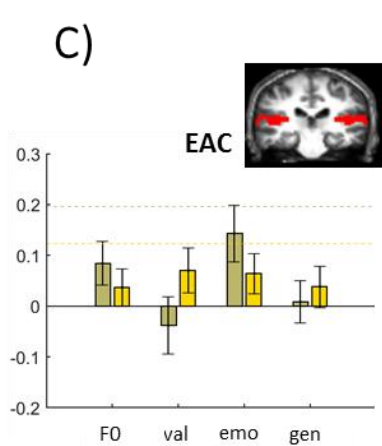


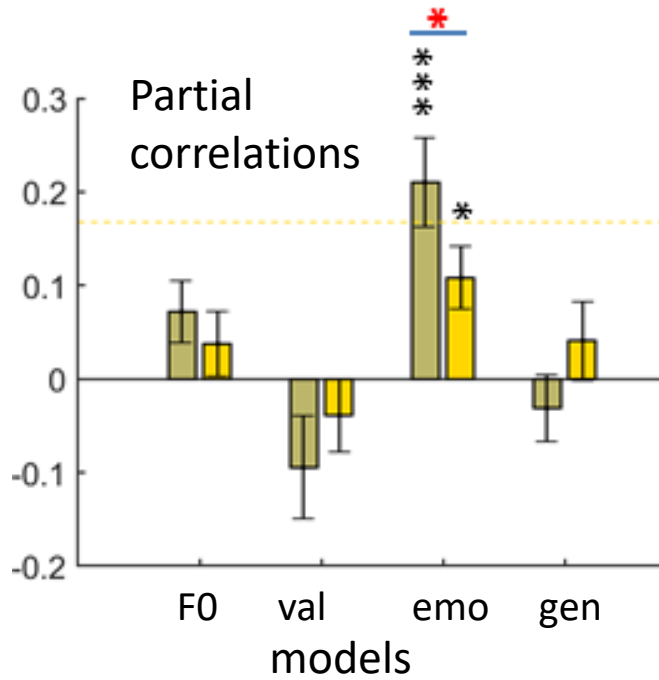


B) Auditory information

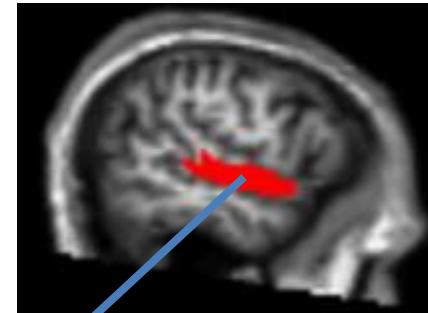


C)

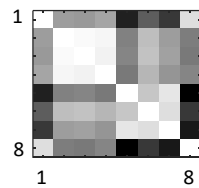




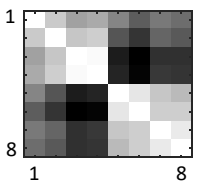
Temporal Voice Area- TVA



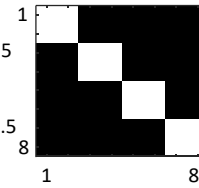
1- Fundamental Frequency (F0)



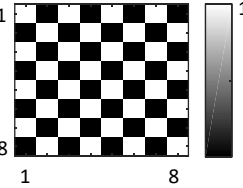
2- Auditory Valence



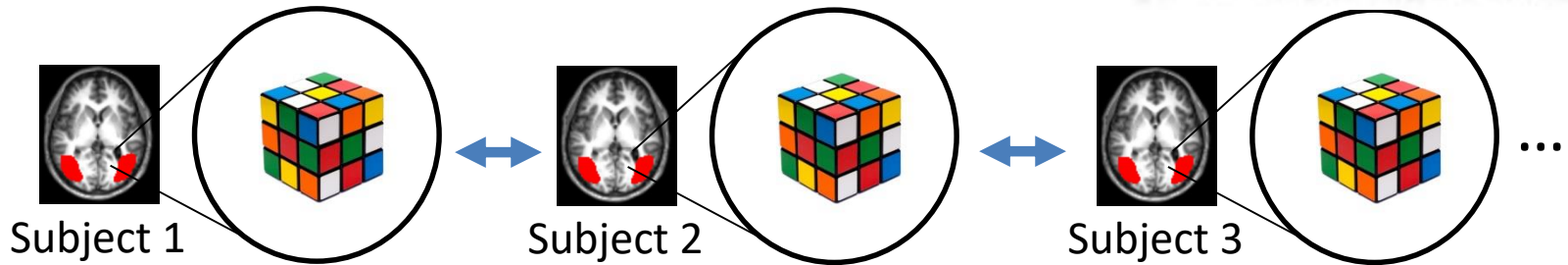
3- Emotion



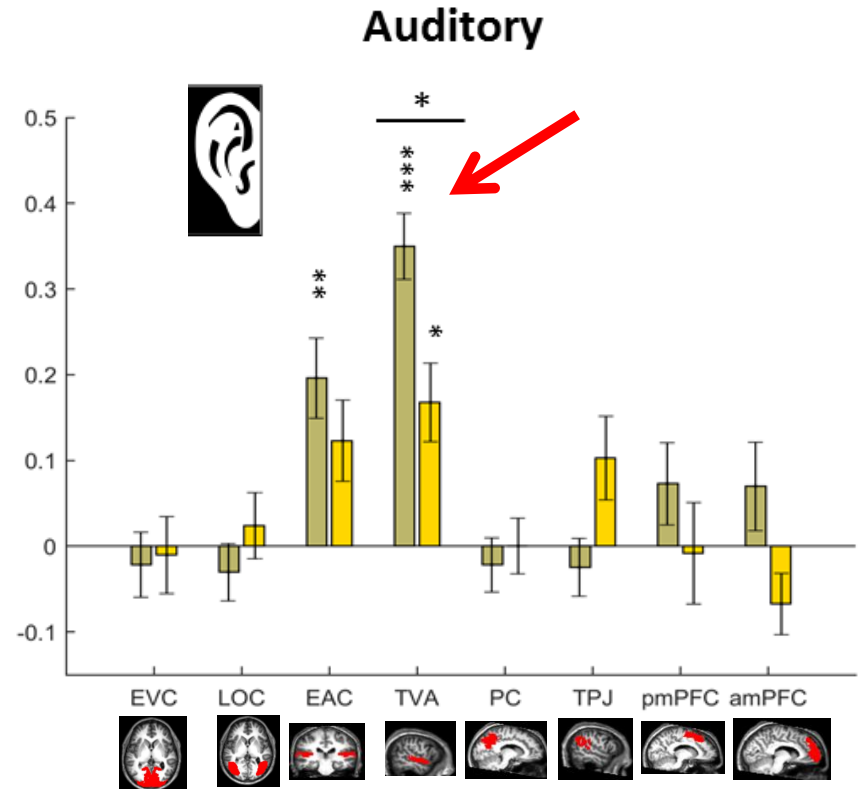
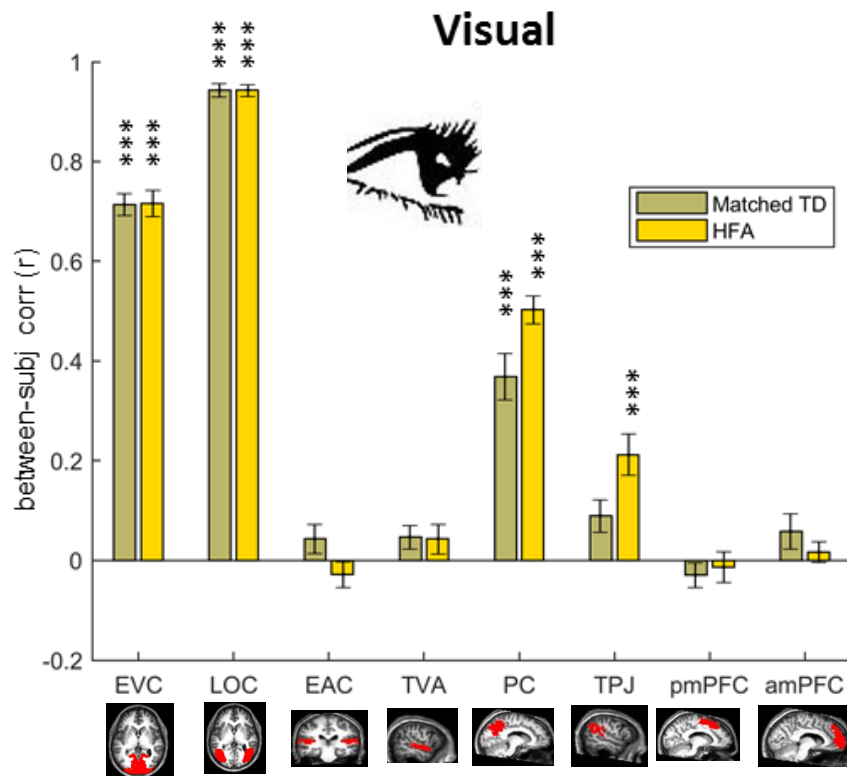
4- Voice Gender



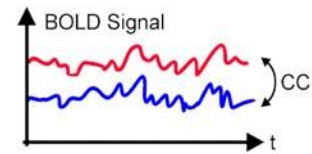
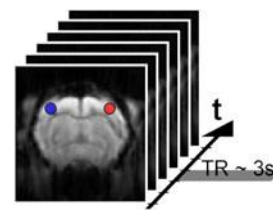
Variability across subjects



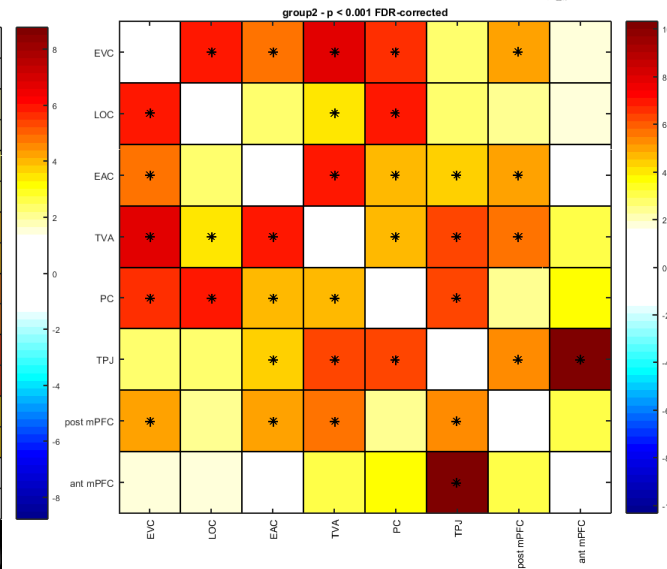
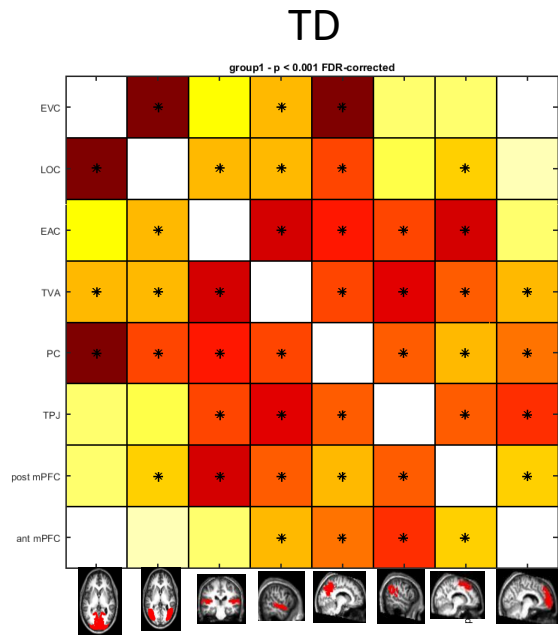
Similarity of Neural Representations across subjects



Functional Connectivity

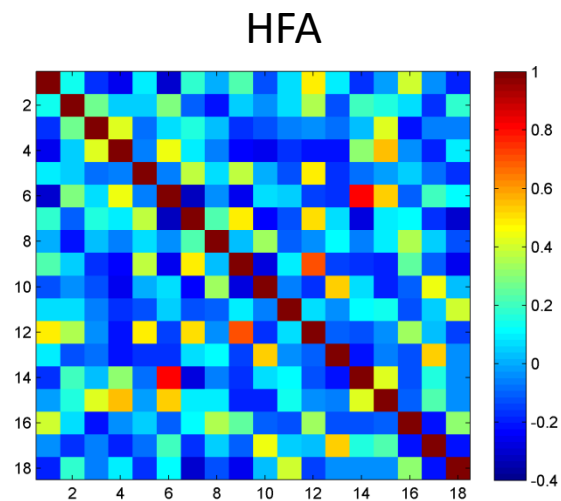
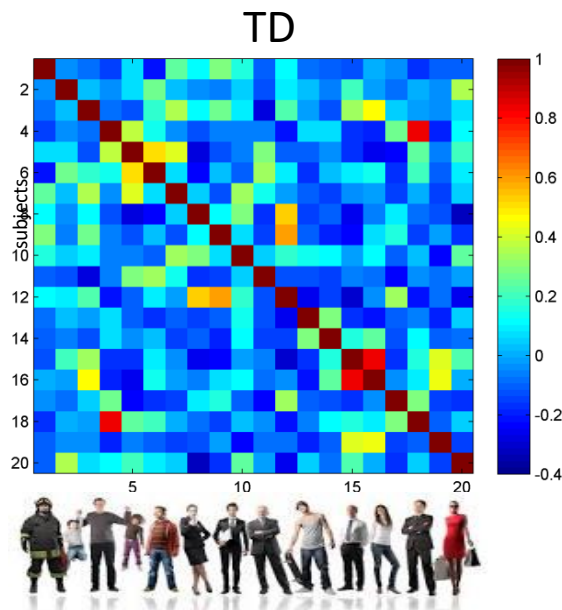


Between
brain
regions



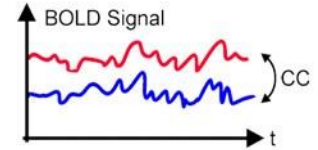
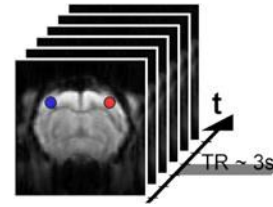
n.s.

Between
subjects
[all 8 ROI]



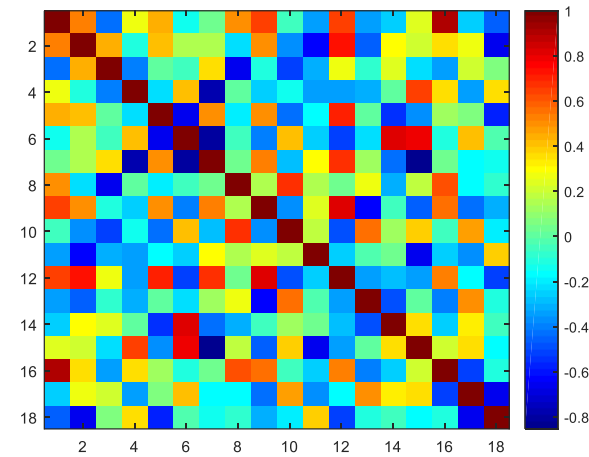
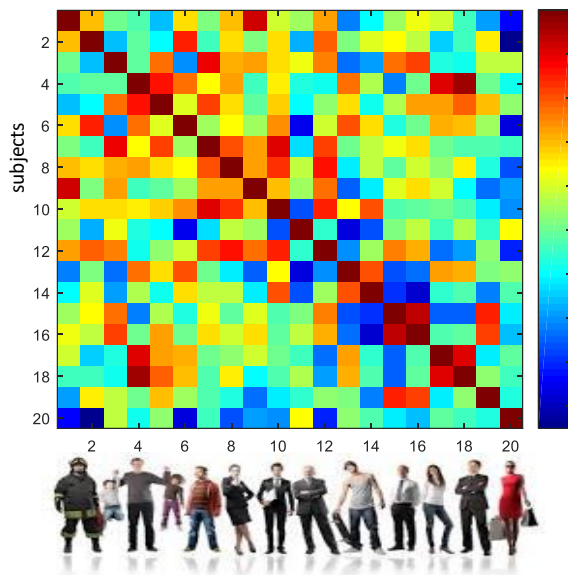
n.s.

Functional Connectivity



TD

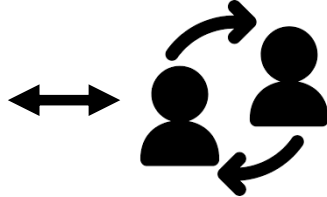
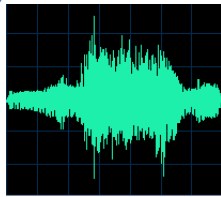
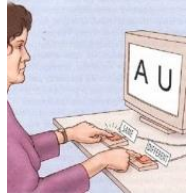
HFA



Between subjects
[Only TVA]

**** group difference**
 $T(36) = 2.76;$
 $p = 0.009$

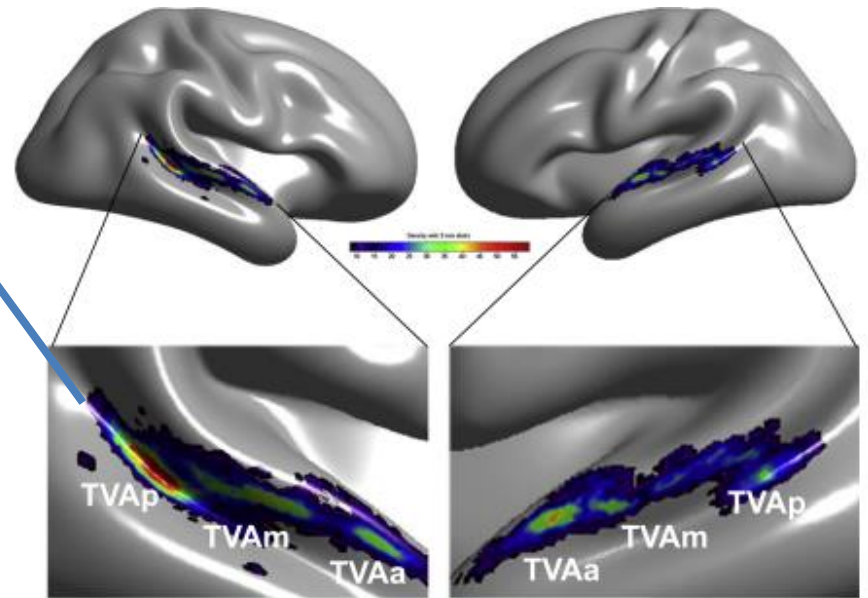
HFA show *more uniqueness* of neural patterns and functional connectivity in the **Voice Area**



behavioral judgments of **auditory valence...**

and **auditory congruency** with visual scenes was also **more idiosyncratic in HFA**

Voice Area (TVA)



High Functioning Autism

Social



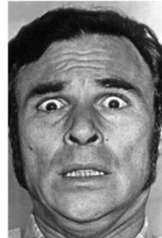
High sensory



Low sensory

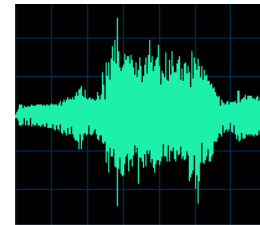


faces

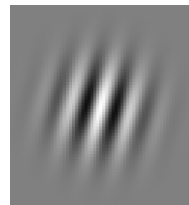


Fearful

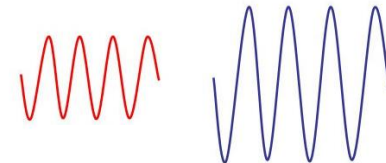
voices



gabor



loudness



Financial Support



Open science

