

## Background

- Romantic relationships are the most central relationship for most adults with an important temporal duration in human life cycle (Robles & Kiecolt-Glaser 2003). The consequences of marital conflict for society are relevant considering the impact of negative affect for the physical and mental health of each partner (SunWoo & Marks 2016), as well as for those directly involved in marital conflict such as children (El-Sheikh et al. 2009).
- We aimed to investigate the neural basis of empathy as it occurs in real interpersonal contexts, specifically in couples' relationships in an attempt to fill a gap in the literature where most studies rely on self-report measures or tasks where subjects are asked to empathize with fictional targets.
- At the peripheral level conflict interpersonal interactions lead to an higher increase over baseline in psychophysiological responses such as heart rate, blood pressure and cortisol (Robles & Kiecolt-Glaser 2003). More than the level of autonomic arousal *per se*, the physiological synchrony between dyad members may be more relevant for interpersonal processes (e.g. Levenson & Gottman, 1983).
- At the central nervous system experiencing another person's feelings recruits emotional brain circuits comprised by the anterior insula, amygdala and anterior cingulate cortex (Decety et al., 2012), whereas our ability to cognitively understand other's feelings and thoughts recruits the medial prefrontal cortex, temporal parietal junction and posterior cingulate cortex (Engen et al., 2013). These regions belong to the Default Mode Network, a resting state networks, recruited when we think about mental states both our own and others

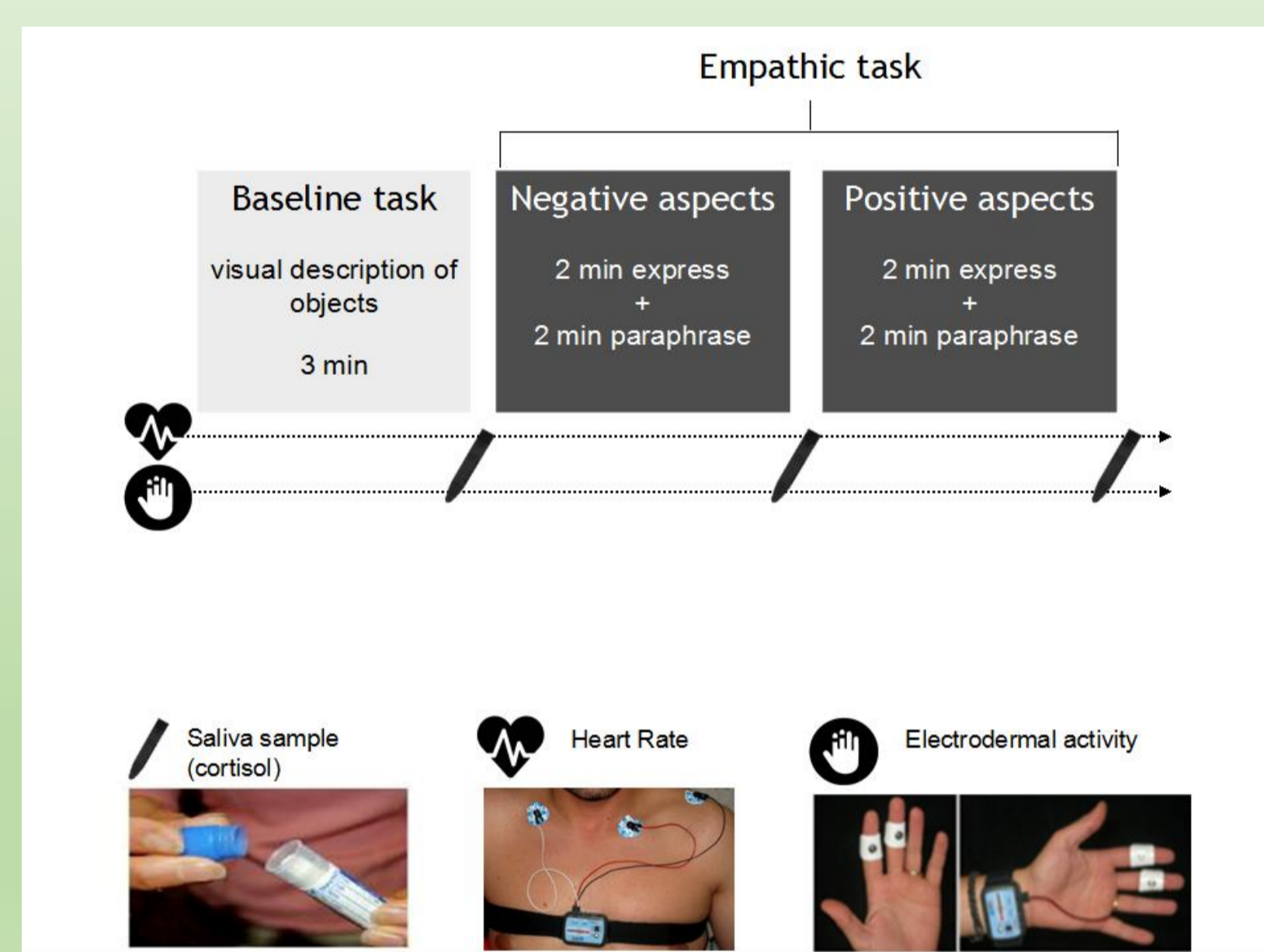
## Methods and research design

### Participants

N= 72 (36 couples) in a monogamous relationship with duration > 1 year

		Participants		Male		Female		All	
		M (SD)	Min-Max	M (SD)	Min-Max	M (SD)	Min-Max	M (SD)	Min-Max
Age	M=32.3 (SD=7.7)	32.3 (7.7)	22-62	32.3 (7.7)	22-62	32.3 (7.7)	22-62	32.3 (7.7)	22-62
Educational level	College education	68%		68%		68%		68%	
	12 <sup>th</sup> grade	22%		22%		22%		22%	
	9 <sup>th</sup> grade	7%		7%		7%		7%	
	Basic education	3%		3%		3%		3%	
Marital status	Married	35.7%		35.7%		35.7%		35.7%	
	Living together	35.7%		35.7%		35.7%		35.7%	
	Dating	28.6%		28.6%		28.6%		28.6%	
	Total	100%		100%		100%		100%	
Relationship duration	M=9.43 (SD=8.05)	9.43 (8.05)	1-38	9.43 (8.05)	1-38	9.43 (8.05)	1-38	9.43 (8.05)	1-38
	Min=1, Max=38								
With children?	Yes	12		12		12		12	
	No	20		20		20		20	
DAS	Consensus	24.29 (2.95)		24.55 (2)		24.42 (2.5)		24.42 (2.5)	
	Satisfaction	15.81 (2.04)		15.48 (1.73)		15.65 (1.88)		15.65 (1.88)	
	Cohesion	12.77 (4.23)		13.13 (3.88)		12.95 (4.03)		12.95 (4.03)	
	Total	52.87 (6.99)		53.16 (5.31)		53.02 (6.16)		53.02 (6.16)	

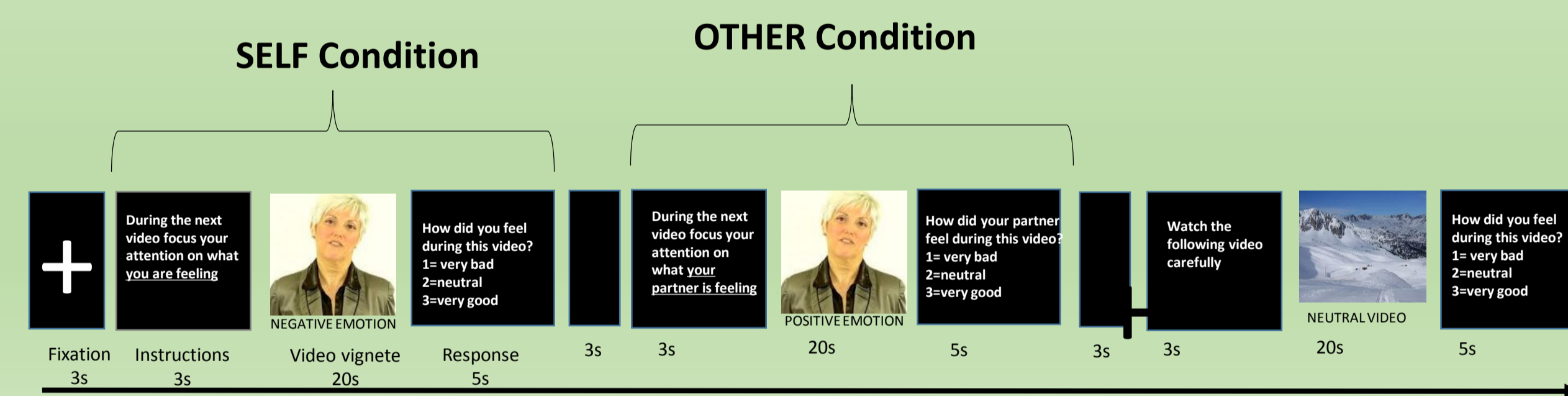
### Autonomic Nervous System and Neuroendocrin Measures



### Central Nervous System – fMRI acquisition

Functional images acquired in a clinical approved 3T MRI scanner (Siemens Magnetom Tim Trio, Erlangen, German)

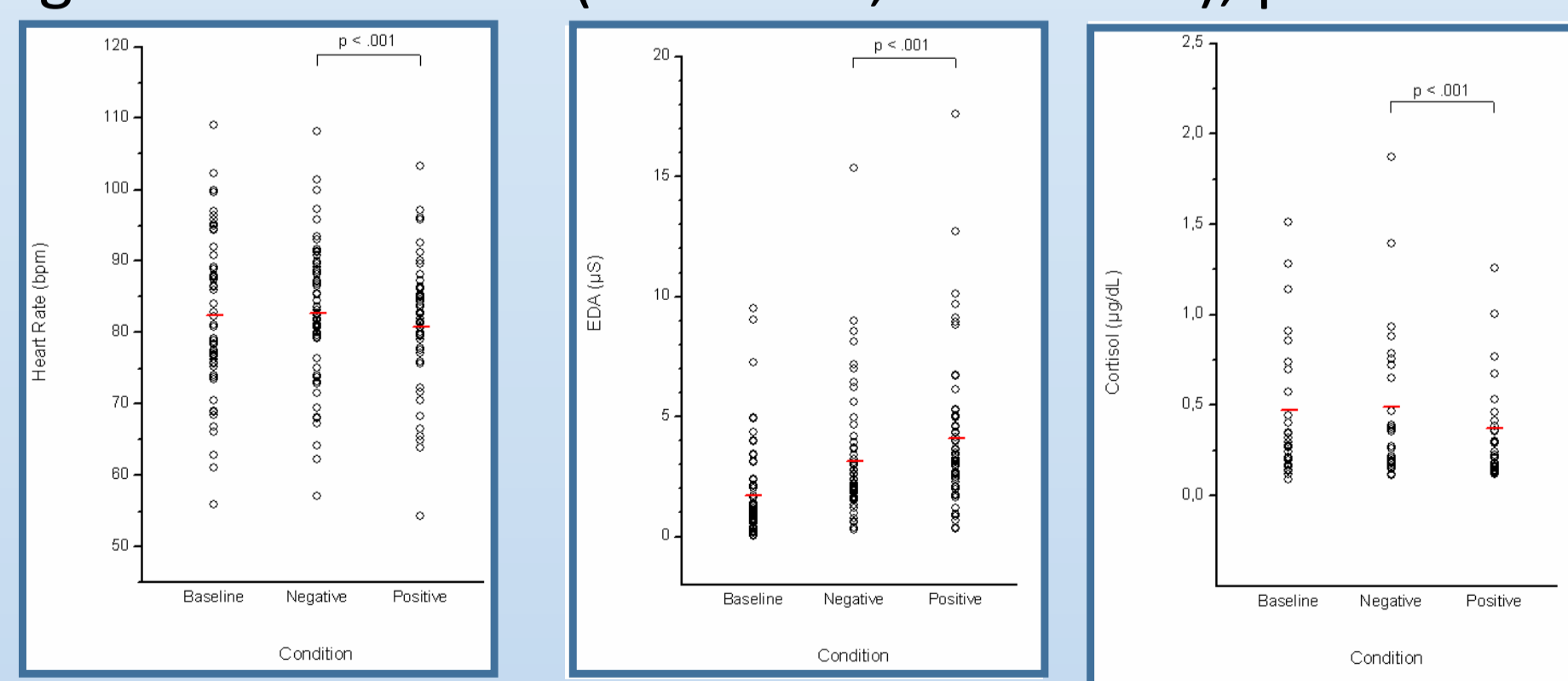
- 1) Structural MPRAGE acquisition;
- 2) 9'm Resting state acquisition;
- 3) Social fMRI Task



## Main Results and Conclusions

### ANS Markers

- Significantly higher Heart Rate in the negative interaction (M = 82.72, SD = 10.27), than in the positive interaction (M = 80.89, SD = 9.16) (p = .001).
- Higher cortisol levels immediately after the negative interaction (M = 0.39, SD = 0.35), than after the positive interaction (M = 0.31, SD = 0.24), p = .001.
- Significantly higher eletodermal activity in the positive interaction (M = 4.10, SD = 3.02), than in the negative interaction (M = 3.15, SD = 2.58), p = .001 .



Coutinho J., Patrícia Oliveira-Silva P., Mesquita A., Barbosa M., Perrone-McGovern K. & Gonçalves O. F., (2017) "Psychophysiological reactivity in couples during a marital interaction task", *Applied Psychophysiology and Biofeedback* DOI 10.1007/s10484-017-9380-2

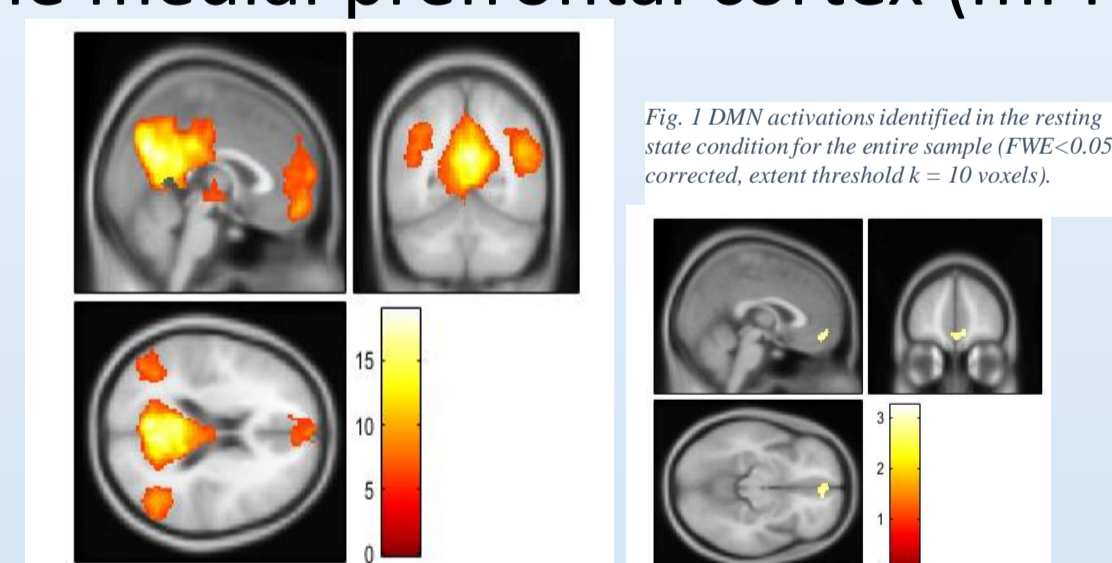
- We found evidence for EDA synchrony in the interaction task. This was significant for the negative condition ( $t(30)=4.45, p<0.001$ ), as well as for the positive condition ( $t(30)=2.03, p<0.05$ ). The effect size of the baseline condition was not significant ( $t(29)=0.40$ ).
- Synchrony was significantly higher during the negative condition ( $M=1.10, SD=0.21$ ) in comparison with the positive ( $n=227, M=0.46, SD=0.20$ ) and the baseline conditions ( $n=35, M=-0.06, SD=0.28$ ).

Joana Coutinho, Oliveira-Silva P., Fernandes E., Correia D., Gonçalves O. F. & Tschacher W. (in revision) "Psychophysiological synchrony during verbal interaction in romantic relationships", *Family Process*

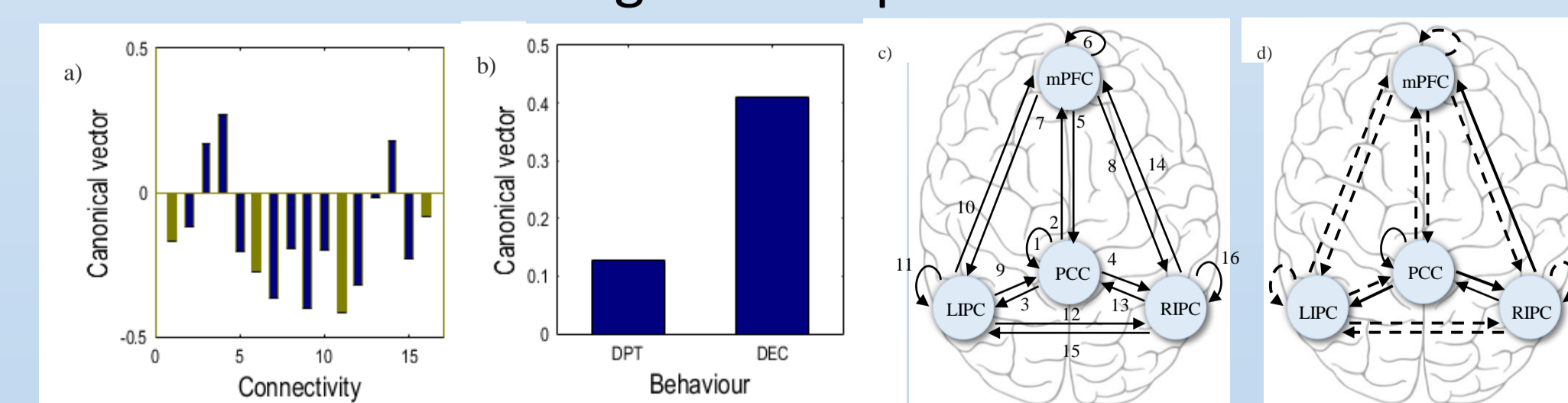
### SNC Markers

- Higher empathy scores were associated with higher functional connectivity of the DMN and an increased contribution of the medial prefrontal cortex (mPFC) to the DMN spatial mode

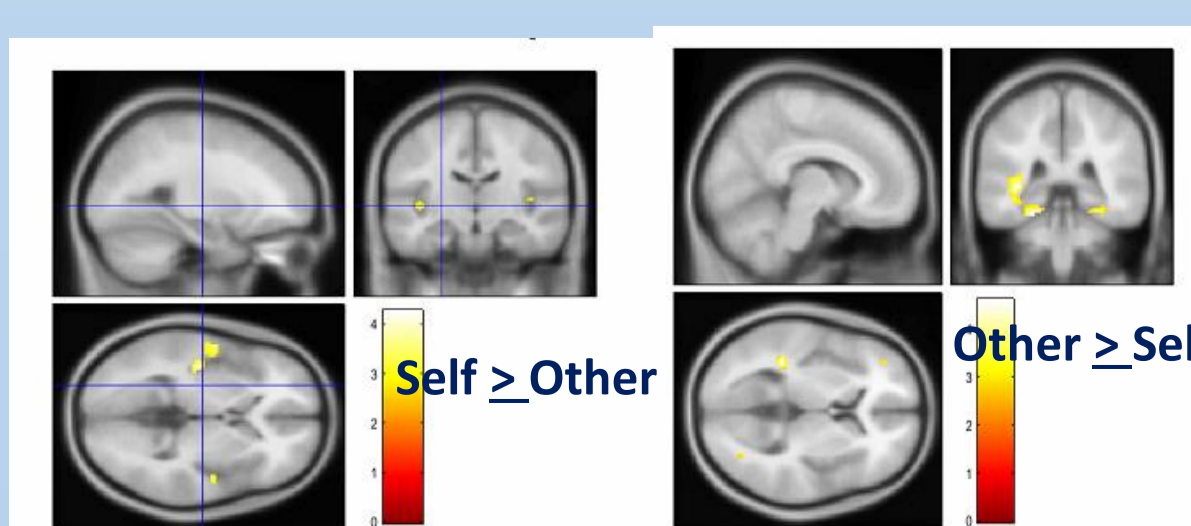
Esménio S., Soares J. M., Oliveira-Silva P., Zeidman P., Razi A., Gonçalves O. F., Friston K., Coutinho J. (in revision) Using resting-state functional and effective connectivity to characterise the functional anatomy of empathy



- DCM revealed this association was mediated indirectly by the posterior cingulate cortex via the right inferior parietal lobule: for participants with higher scores in dyadic empathy, the PCC had a greater effect on bilateral IPL and IPL had a greater influence on mPFC in the right hemisphere.



- Areas of affective processing in left insula left superior temporal gyrus, right insula whereas more active during the self condition, whereas those involved in the cognitive representation of others like the fusiform gyrus and left supra marginal gyrus were more active during the other condition.



Esménio S., Soares J. M., Oliveira-Silva P., Gonçalves O. F., Friston K., Coutinho J. (in revision) Neural basis of Self and Other perspectives during a naturalistic fMRI dyadic empathic task.