Body perception in Tourette syndrome – Interoception, tics & premonitory urges

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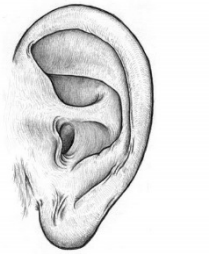
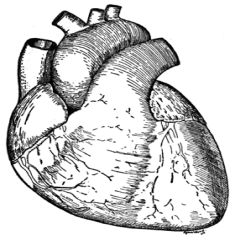
What is interoception?

"the sensing of internal bodily signals, producing emotions and feelings"





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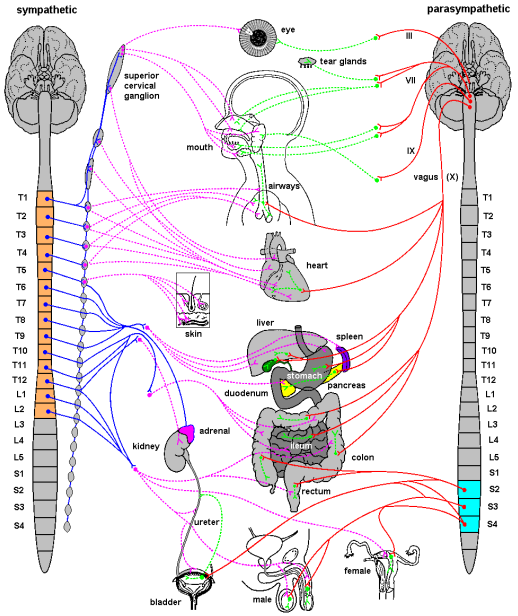
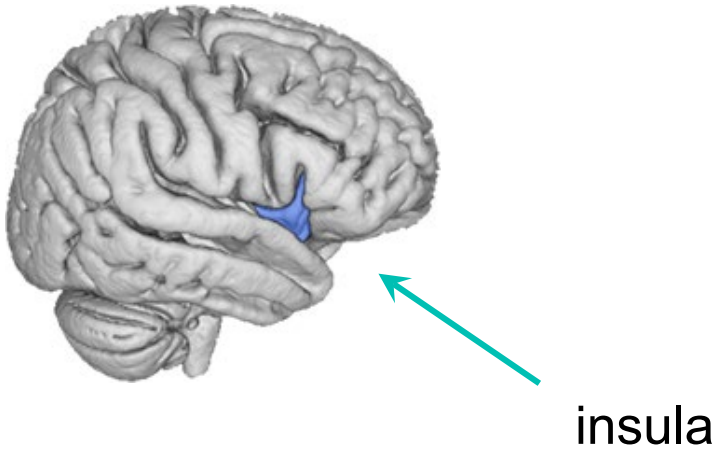
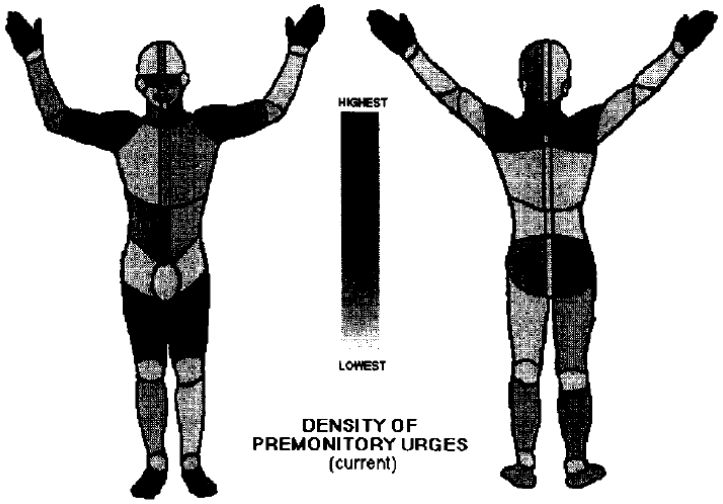




Why interoception?

PREMONITORY SENSATIONS / URGES

"A feeling of pressure – like something itches deep inside you, and the only way you can relieve it is by tics. It's like your brain itches, or your insides are being tickled…"



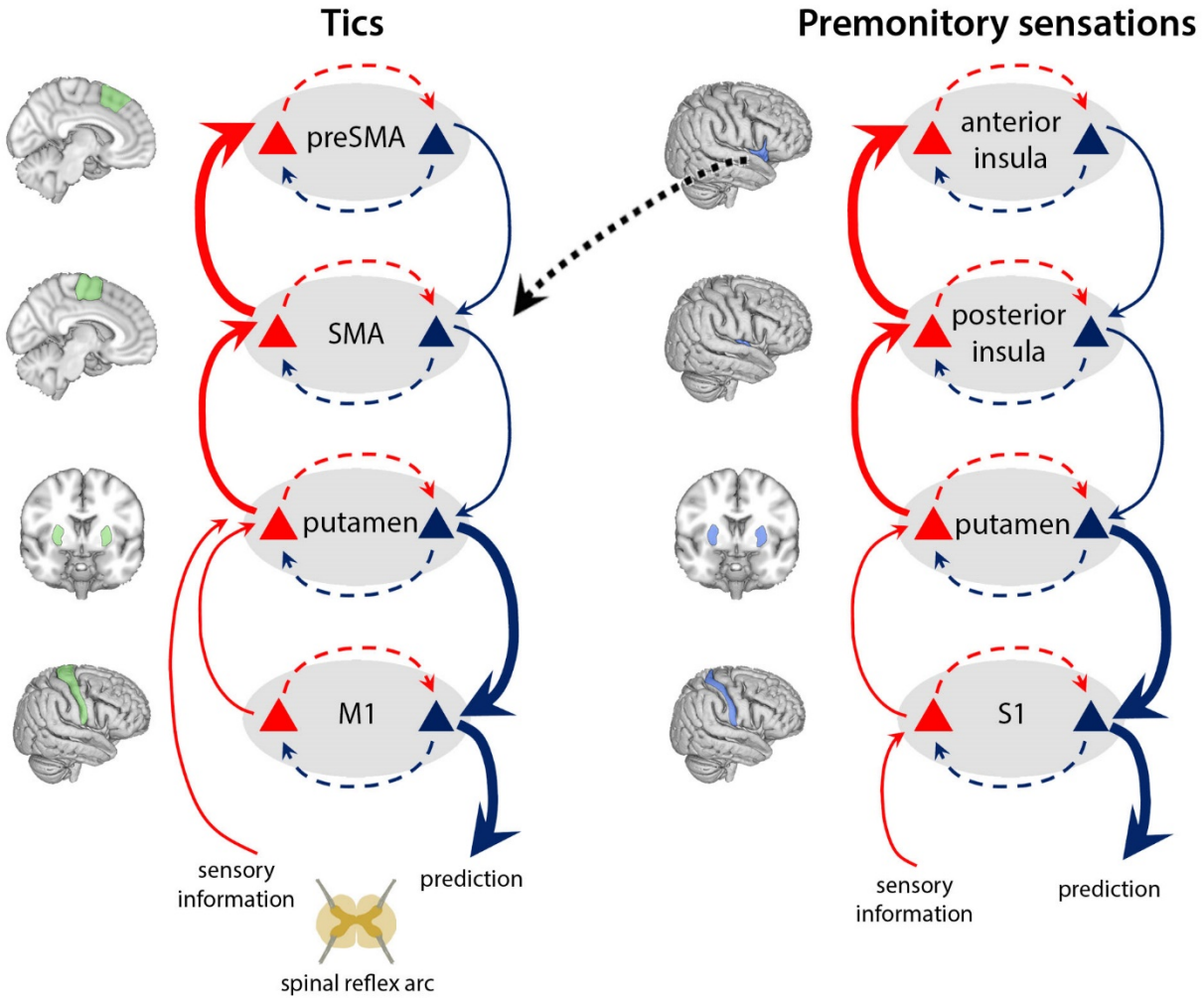
Physical sensations
that generate urges to move

Reported by 95% of adults with TS

92% say tics are fully or partially a voluntary response to premonitory urges

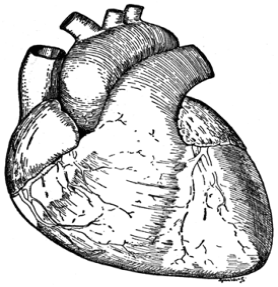
(Leckman et al, 1993, *American Journal of Psychiatry*)

Why interoception?

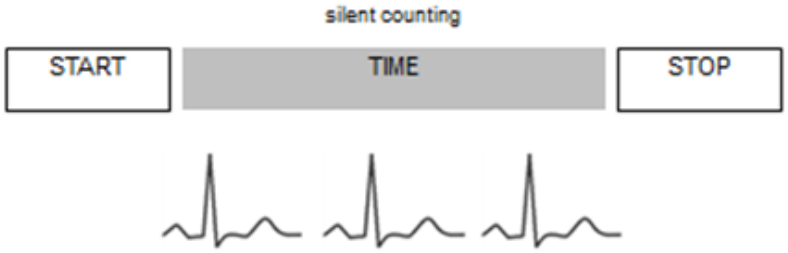


Rae, Critchley & Seth (2019) *Frontiers in Psychiatry*

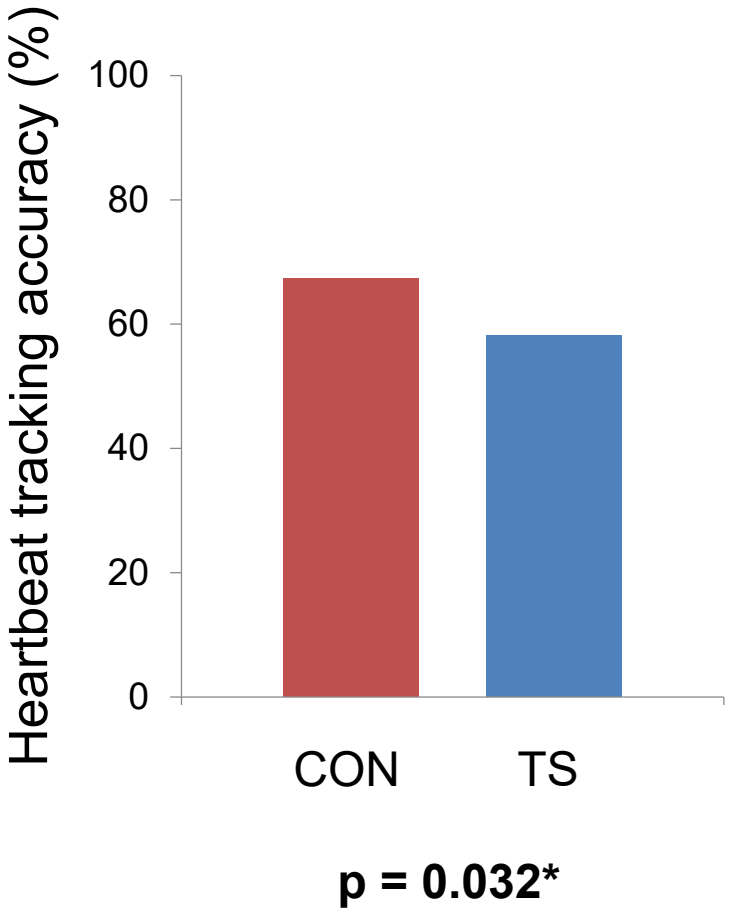
How do we investigate it?



HEARTBEAT COUNTING



First evidence...



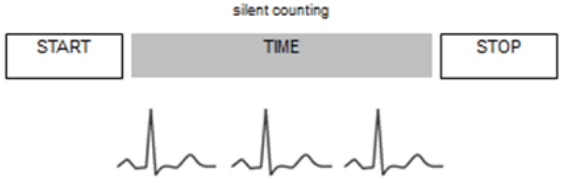
Ganos et al (2015) *Movement Disorders*

Multiple dimensions of interoception

Interoceptive accuracy

objective performance

HEARTBEAT COUNTING



Interoceptive sensibility

subjective sensitivity

During most situations, I am aware of…

- …how hard my heart is beating
- my nose itching
- muscle tension…

NEVER	SOMETIMES	ALWAYS
☐	☑	☐

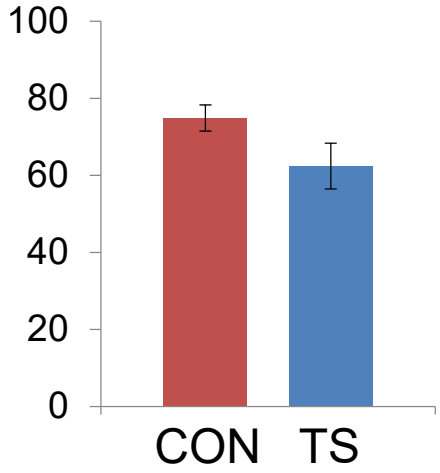
Garfinkel et al (2015) *Biological Psychology*

Multiple dimensions of interoception

Interoceptive accuracy

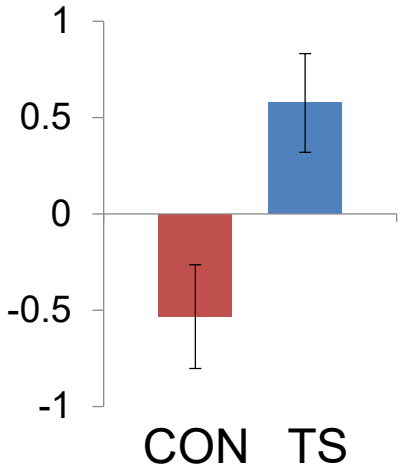
objective performance

ACCURACY



p = 0.123

DISCREPANCY

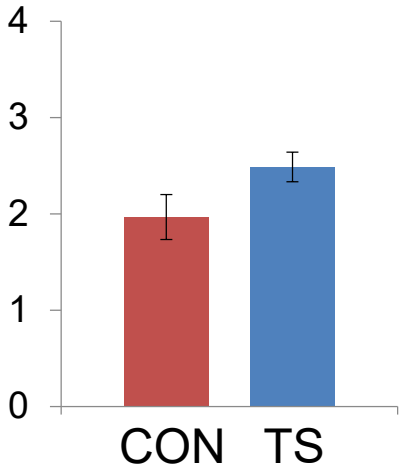


p = 0.005*

Interoceptive sensibility

subjective sensitivity

SENSIBILITY



p = 0.072

Rae et al (2019) *Psychiatry Research*

Interoception and symptom severity

Premonitory Urge for Tics Scale (**PUTS**)

Right before I do a tic, I feel like my insides are itchy

NOT AT ALL	A LITTLE	PRETTY MUCH	VERY MUCH
☐	☑	☐	☐

Yale Global Tic Severity Scale (**YGTSS**)

Number of tics, frequency, force, complexity, interruption

Interoception and symptom severity

TABLE 2. Prediction of premonitory urges (PUTS scores) in the GTS group

A. Correlation matrix for clinical variables used in the multiple regression model

Variable	PUTS	IA	Y-BOCS	YGTSS
PUTS	1.0000			
IA	0.5427	1.0000		
Y-BOCS	0.4881	0.3463	1.0000	
YGTSS	0.4076	−0.1242	0.7147	1.0000

B. Partial regression coefficients and significance tests from the multiple regression model

Predictor	Beta	R^2	Standard Error	$t(15)$	P
IA	0.6999	0.4024	8.1472	3.0831	0.0076
Y-BOCS	−0.2202	0.7031	0.1811	0.6838	0.5046
YGTSS	0.6519	0.6678	0.1094	2.1410	0.049

IA, interoceptive awareness; Y-BOCS, Yale-Brown Obsessive-Compulsive Scale; YGTSS, Yale Global Tic Severity Scale; PUTS, Premonitory Urge for Tics Scale.

Ganos et al (2015) *Movement Disorders*

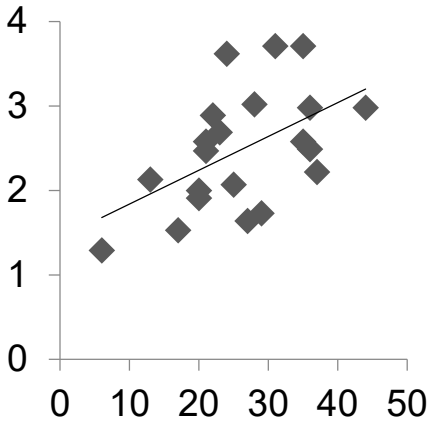
Interoception and symptom severity

	Accuracy tracking	Sensibility	$tIPE_T$
YGTSS tic severity	$r = 0.258$	$r = 0.518$	$r = 0.058$
	$p = 0.129$	$\mathbf{p = 0.008}$	$p = 0.401$
	$p_{FDR} = 0.217$	$p_{FDR} = 0.056$	$p_{FDR} = 0.433$
YGTSS impairment	$r = 0.125$	$r = 0.431$	$r = 0.142$
	$p = 0.295$	$\mathbf{p = 0.026}$	$p = 0.270$
	$p_{FDR} = 0.413$	$p_{FDR} = 0.182$	$p_{FDR} = 0.473$
Premonitory sensations (PUTS)	$r = 0.274$	$r = 0.571$	$r = 0.075$
	$p = 0.114$	$\mathbf{p = 0.003}$	$p = 0.373$
	$p_{FDR} = 0.399$	$\boldsymbol{p_{FDR} = 0.021}$	$p_{FDR} = 0.435$

Rae et al (2019) *Psychiatry Research*

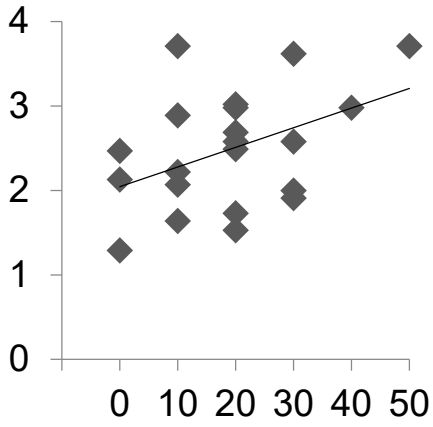
Interoception and symptom severity

YGTTS
(tic severity)



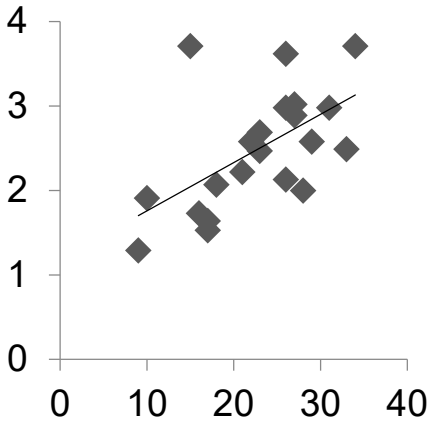
p = 0.008*

YGTSS
(impairment)



p = 0.026*

PUTS



p = 0.003*

Rae et al (2019) *Psychiatry Research*

Summary so far

Interoceptive accuracy is moderately reduced in TS

But adults with TS self-report as more sensitive to bodily sensations

This means more sensitivity to less accurate body signals

Higher body sensitivity is associated with worse tics, worse impairment, and worse premonitory sensations

Summary so far

…but which came first?

Does altered interoception cause PS?

Or do PS result in altered interoception?

➡ implications for tic management strategies:

do we treat the PS, or do we treat interoception?

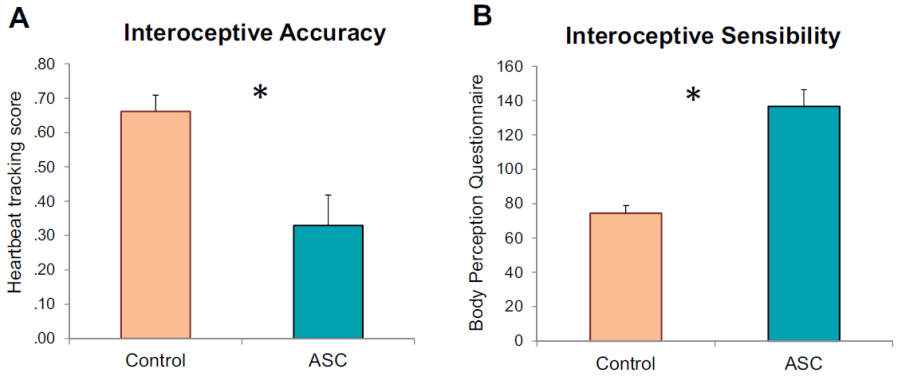
HRT / CBIT

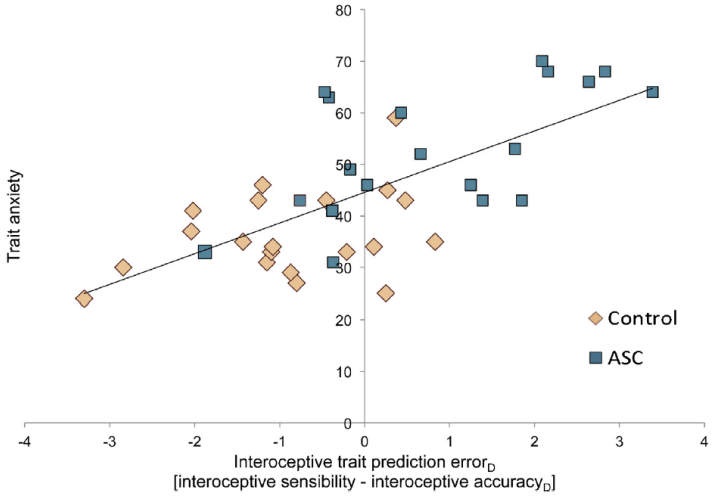
INTEROCEPTION TRAINING

Training interoception

Aligning Dimensions of Interoceptive Experience (**ADIE**)

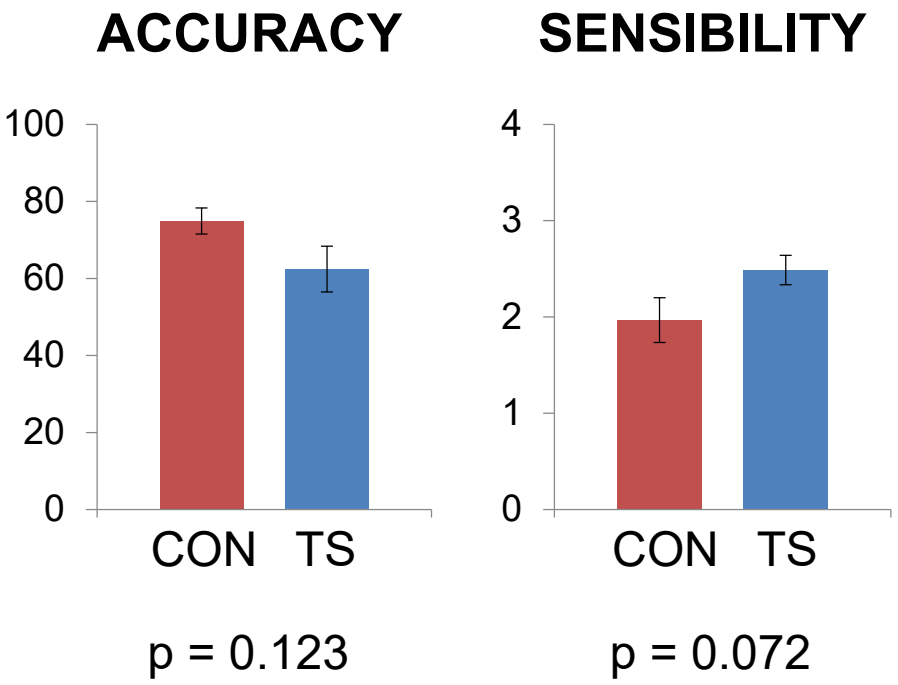
(Autistic Spectrum Conditions)

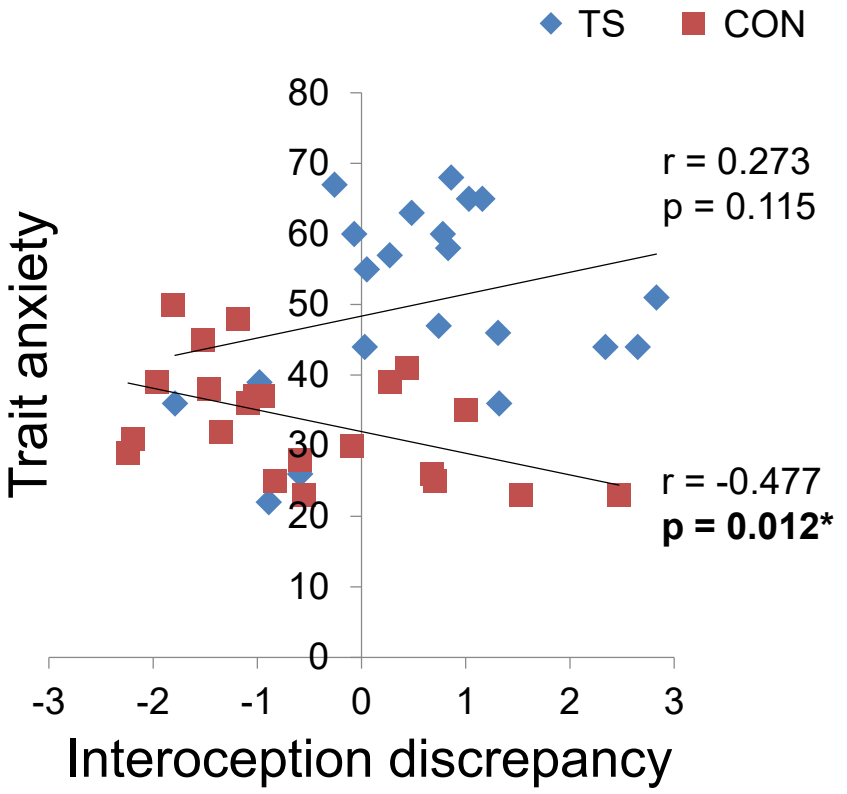




Garfinkel et al (2016) *Biological Psychology*

Training interoception in TS?





Rae et al (2019) *Psychiatry Research*

Training interoception in TS?

May be useful for those experiencing comorbid anxiety (cf ASC)?

May be useful adjunct for HRT / CBIT: increasing interoceptive accuracy of PS could assist in 'habituating to urge'?

Possible risk of increasing PS and tic expression?

Interaction with tic attacks – currently completely unknown. Could be useful to know when tic attack is coming?

TS spectrum heterogeneity

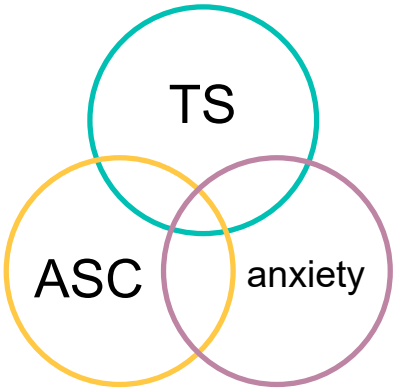
Need more studies with larger samples to tease apart possible effects of comorbidities on all dimensions of interoception

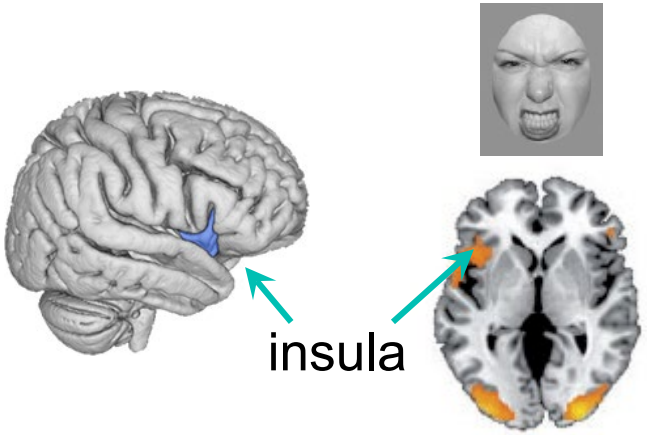
(ADHD, OCD, ASC, anxiety)

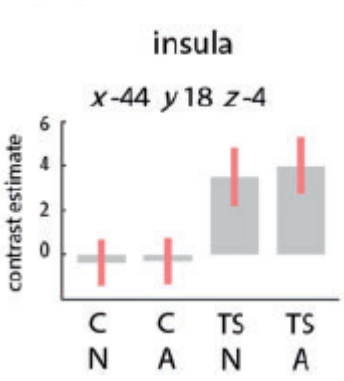
As above for medications: Would SSRIs have a beneficial effect in TS, or increase PS?

Different age groups: 95% of adults with TS report PS, but few children – likely that awareness develops with age

Neural basis of TS interoception







functional connectivity

Rae et al (2018) *Brain*

MQ Transforming mental health

ADIE

Conclusions

Interoception appears to be altered in TS, across dimensions, and relates to symptom severity

We do not fully understand the (causal) interaction between interoception and symptoms, or differences along the TS spectrum

We think insula function might play an important role

…we would love to hear your thoughts on priorities going forward!

Thanks

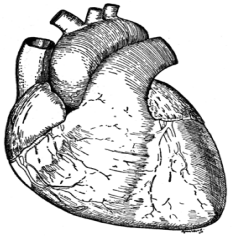
Sussex team

Prof Hugo Critchley

Prof Sarah Garfinkel

Tourettes action

21 participants with TS!



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