Neural Correlates of Repetitive Threat-Neutralization: An Analogue for Compulsions in Obsessive-Compulsive Disorder

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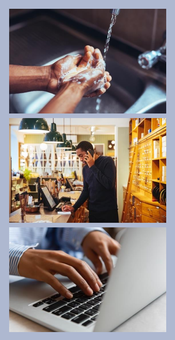
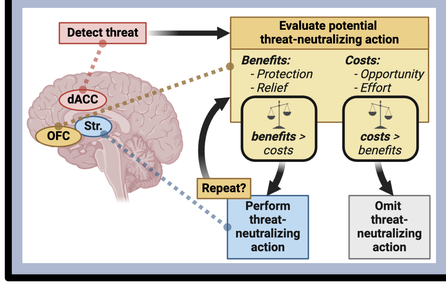
BACKGROUND

Compulsions in obsessive-compulsive disorder (OCD) are behaviors performed repeatedly to reduce anxiety or prevent a feared outcome.[1]

Cortico-striato-thalamo-cortical (CSTC) circuitry has been implicated in OCD, but the specific role of this circuit in compulsive behavior remains unclear.[2,3]





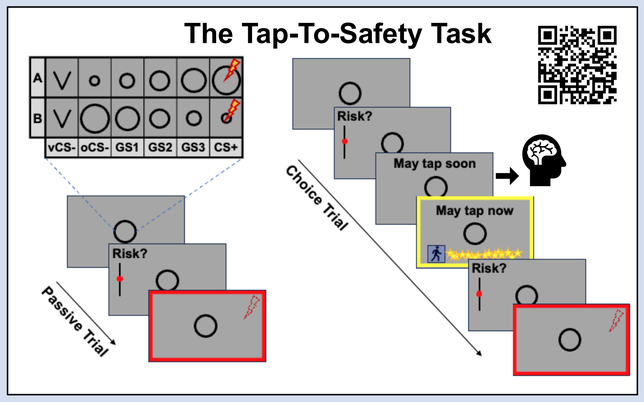
We applied a novel task to elicit compulsion-like behavior; i.e., **repetitive threat-neutralization (RTN).**

METHOD

Participants: Adults (n=49) recruited from the community completed the Dimensional Obsessive-Compulsive Scale (DOCS)[4] and the Tap-To-Safety Task[5] during fMRI.

In the task, **repeated button-tapping leads to more protection from shock and fewer points.**

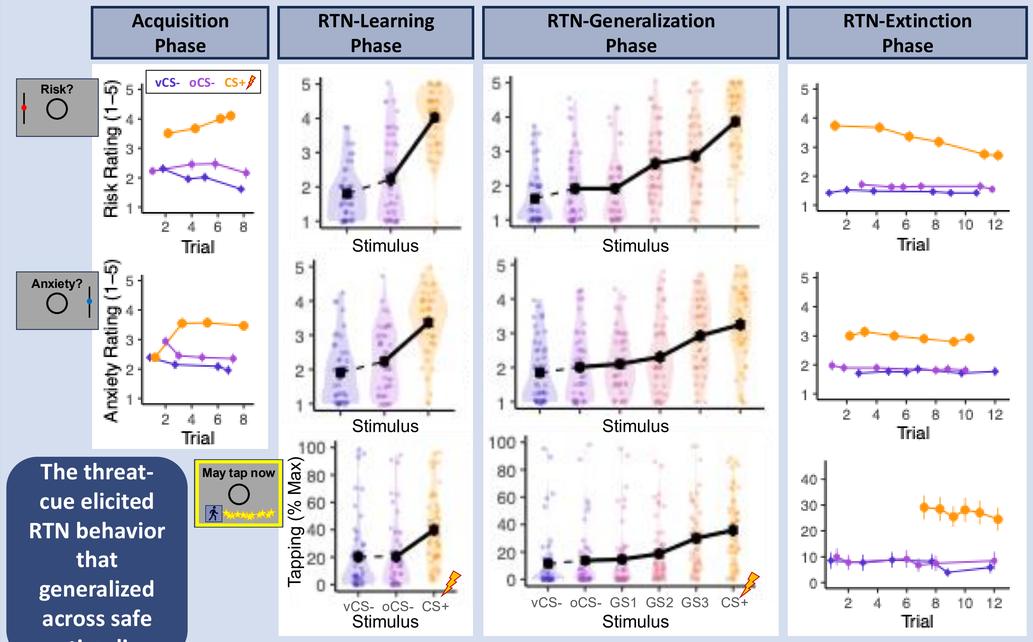
Sample Characteristics	
% Female	67%
% American Indian	6%
% Asian	16%
% Black	4%
% Multiracial / Other	18%
% White	55%
Mean (SD) Age	36.2 (13.6)
Mean (SD) DOCS (clinical cutoff=18)	10.9 (11.6)



Analysis:

1. Linear mixed-effects models (LMEs) to assess task behavior across trials and by stimulus-type.
2. LMEs with neural activity during RTN preparation ("May tap soon") to assess neural activity by stimulus-type; correlations of neural activity with RTN behavior.
3. Assessed effects of individual differences in obsessive-compulsivity on behavioral and neural task indices.

1. BEHAVIORAL TASK EFFECTS

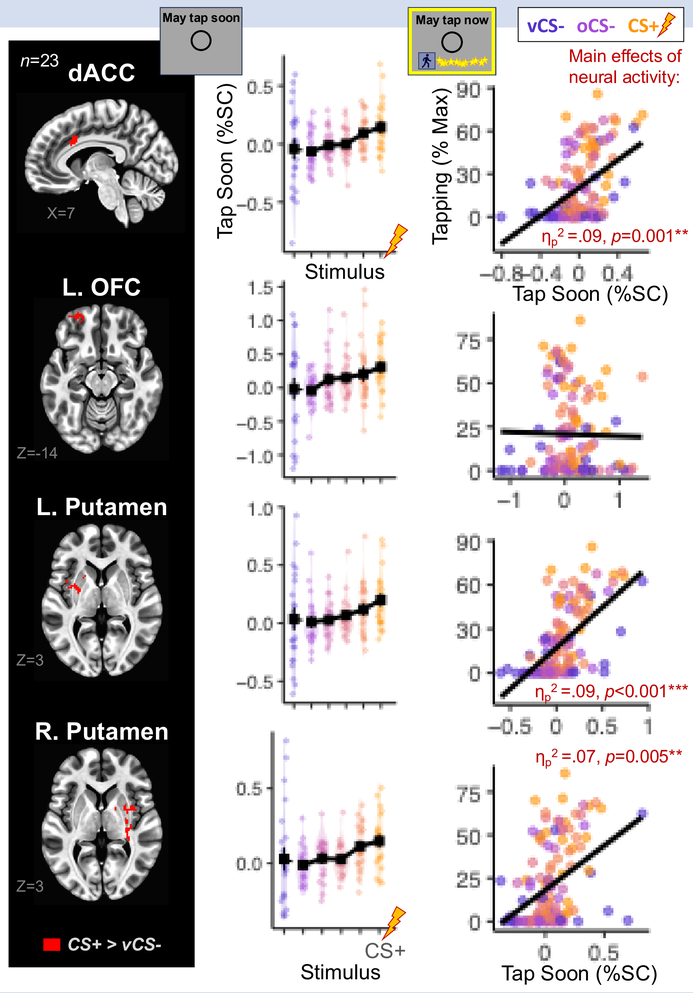


The threat-cue elicited RTN behavior that generalized across safe stimuli.

Main effects of stimulus: η_p^2>.42, *ps*<.001***

2. NEURAL CORRELATES OF RTN

RTN-preparation elicited activation in CSTC circuitry, which correlated with RTN behavior.



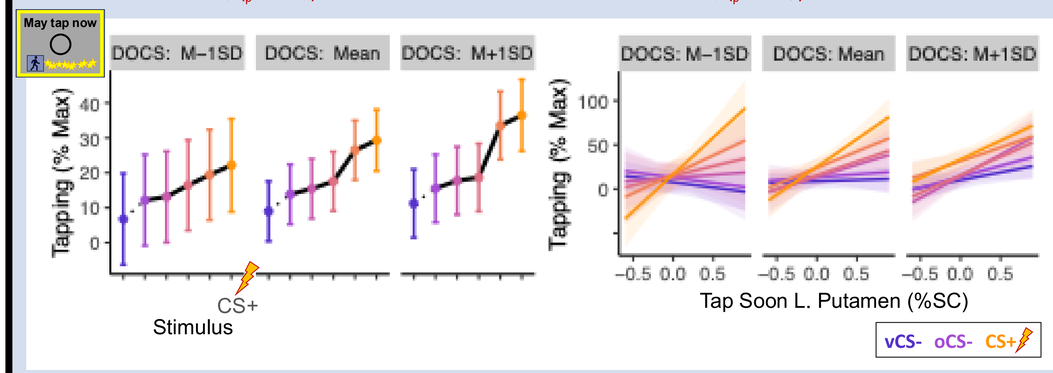
3. INDIVIDUAL DIFFERENCES IN OBSESSIVE-COMPULSIVITY

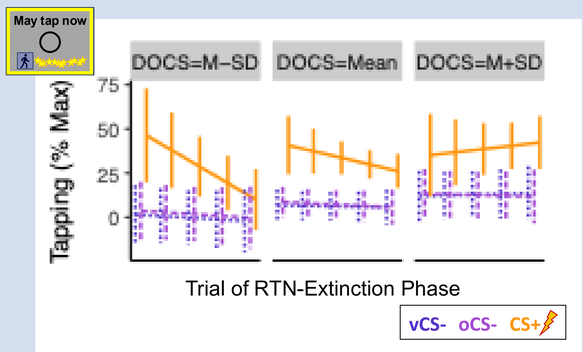
Obsessive-compulsivity was associated with more RTN behavior…

DOCS x Stimulus:
F= 2.85, η_p^2=0.09, *p*=.020*

…less differentiation between threat and safety cues in striatum-behavior relationship…

DOCS x Stimulus x Tap Soon L. Putamen:
F= 3.79, η_p^2=0.19, *p*=.004**





…and slowed reduction of RTN behavior following extinction.

DOCS x Trial:
F=5.46, η_p^2=0.04, *p*=.021*

CONCLUSIONS

The Tap-To-Safety Task elicits compulsion-like behavior and activity in CSTC circuitry.

Results support **altered striatal involvement in threat-related behavior** among those with elevated obsessive-compulsivity, suggesting a potential mechanism by which compulsions persist in safe situations.

Future research with clinical populations may shed light on the neural correlates of compulsions in OCD and guide development of targeted interventions.

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3. van den Heuvel OA, van Wingen G, Soriano-Mas C, Alonso P, Chamberlain SR, Nakamae T, et al. *Eur Neuropsychopharmacol.* 26:810–27 (2016).
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