

# COMPULSIVITY AND COGNITIVE INFLEXIBILITY AS PREDICTORS OF SUBCLINICAL OCD SYMPTOMATOLOGY

Smriti Ramakrishnan<sup>1</sup>, Trevor W Robbins<sup>2,3</sup>, & Leor Zmigrod<sup>2,3</sup>

## Introduction

- Obsessive Compulsive Disorder (OCD) may be a clinical manifestation of an over-reliance on habits.<sup>[1,2]</sup>
- To study this, we used the Habitual Tendencies Questionnaire, HTQ (divided into Compulsivity, Regularity and Novelty subscales), a validated, representative scale to measure individual variation in dependence on habits, developed in Study 1.
- Impaired cognitive flexibility has also been recognised as an important endophenotype of OCD,<sup>[3,4]</sup> and so we used the Alternative Uses Task, AUT (scored on flexibility, elaboration, fluency and originality) to measure this.
- The study of habitual tendencies and cognitive flexibility in the general population may improve our understanding of predisposing OCD traits.

## Aims and objectives

- 1) To examine the extent to which the HTQ is related to subclinical OCD symptomatology
- 2) To examine the extent to which behaviourally-assessed cognitive flexibility is related to subclinical OCD symptomatology

**Study 1** - sought to investigate associations between the HTQ, subclinical OCD symptomatology, and cognitive flexibility.

**Study 2** - aimed to validate the HTQ, and to replicate the findings of Study 1 in a larger sample.

## Methods

### Participants

- Study 1 - sample size of 130 participants
- Study 2 - sample size of 259 participants

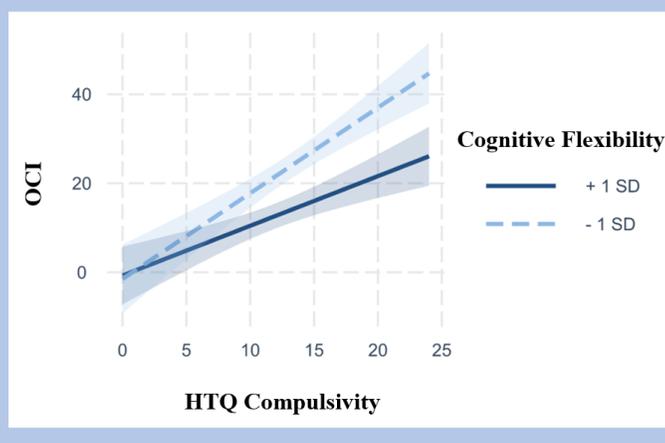
### Measures

- Electronic survey, which included:
  - the Habitual Tendencies Questionnaire, **HTQ** (developed in Study 1), which measures individual differences in habitual tendencies
  - the revised Obsessive-Compulsive Inventory, **OCI**,<sup>[5]</sup> which measures subclinical OCD symptomatology
  - the Alternative Uses Task, **AUT**,<sup>[6,7]</sup> which measures divergent thinking and cognitive flexibility.

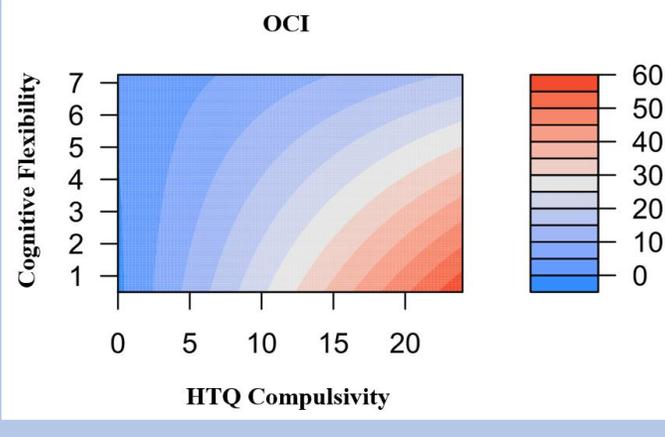
## Results

- There was a significant positive correlation between the HTQ and OCI scales, with the Compulsivity subscale contributing the most to this association, as it showed the strongest correlation with the OCI (Study 1:  $r = 0.598, p < 0.001$ ; Study 2:  $r = 0.461, p < 0.001$ ).
- There was a significant negative correlation between AUT flexibility and the OCI (Study 1:  $r = -0.390, p < 0.001$ ; Study 2:  $r = -0.362, p < 0.001$ ).
- Multiple regression showed both HTQ Compulsivity and AUT Flexibility to be significant and unique predictors of the OCI.
- Higher compulsivity and lower cognitive flexibility predicted greater levels of subclinical OCD traits.
- Hierarchical linear regression showed that HTQ Compulsivity and cognitive flexibility independently accounted for a significant proportion of the variance in subclinical OCD symptomatology (Study 1:  $r^2 = 0.476$ ; Study 2:  $r^2 = 0.352$ ).
- There was a significant interaction effect between compulsivity and cognitive flexibility, (Study 1:  $\beta = -0.547, p = 0.039$ ; Study 2:  $\beta = -0.706, p = 0.004$ ), which accounted for a further 1.8% and 2.1% of the variance in subclinical OCD symptomatology in Study 1 and 2 respectively.
- Simple slope analyses (SSA) revealed a significant negative relationship between cognitive flexibility and subclinical OCD symptomatology when HTQ Compulsivity was high (Study 1: at +1 SD,  $b = -4.52, p < 0.001$ ; Study 2: at +1 SD,  $b = -2.32, p < 0.001$ ), while no significant relationship was found when HTQ Compulsivity was low (Study 1: at -1 SD,  $b = -1.36, p = 0.27$ ; Study 2: at -1 SD,  $b = -0.68, p = 0.11$ ).
- The reciprocal SSA demonstrated significant positive relationships between HTQ Compulsivity and subclinical OCD symptomatology both when cognitive flexibility was high (Study 1: at +1 SD,  $b = 0.76, p < 0.001$ ; Study 2: at +1 SD,  $b = 1.12, p < 0.001$ ) and when it was low (Study 1: at -1 SD,  $b = 1.62, p < 0.001$ ; Study 2: at -1 SD,  $b = 1.92, p < 0.001$ ). See Figures 1 and 2.

**Both high HTQ Compulsivity and low cognitive flexibility are necessary for high levels of subclinical OCD symptomatology, while neither is sufficient independently.**



**Figure 1.** Study 1 interaction plot between HTQ Compulsivity, cognitive flexibility, and subclinical OCD symptomatology (as measured by the Obsessive-Compulsive Inventory, OCI) at 1 SD above and below the mean, controlling for age, gender and educational attainment, with HTQ Compulsivity as the predictor and cognitive flexibility as the moderator.



**Figure 2.** Representation of the regression surface predicting subclinical OCD symptomatology (as measured by the Obsessive-Compulsive Inventory, OCI) as a function of HTQ Compulsivity and cognitive flexibility, while controlling for age, gender and educational attainment.

## Discussion

### Main findings

- Individuals prone to compulsivity and low cognitive flexibility show increased subclinical OCD symptomatology.
- HTQ Compulsivity and cognitive flexibility act as significant independent predictors of subclinical OCD symptomatology.
- HTQ Compulsivity and cognitive flexibility interact to account for 49.4% of the variance in subclinical OCD symptomatology in Study 1, and 37.3% in Study 2.
- The highest levels of OCD traits were seen in participants with high HTQ Compulsivity and low AUT Flexibility, suggesting an additive or multiplicative effect, and the lowest levels of OCD traits were seen in participants with low HTQ Compulsivity scores, regardless of their AUT Flexibility scores.
- Therefore, both high HTQ Compulsivity and low cognitive flexibility are necessary for high subclinical OCD symptomatology, while neither is sufficient independently.
- Our findings are in line with the habit hypothesis of OCD, proposed by Graybiel and Rauch.<sup>[1]</sup>

### Implications and future directions

- A combination of HTQ Compulsivity and AUT cognitive flexibility may be used to screen for OCD traits in the general population.
- Replication of these findings in children may be valuable in exploring whether early compulsivity or cognitive inflexibility can help to predict the development of OCD in later life.
- Administration of the HTQ not only to those with clinically diagnosed OCD, but also to alternative populations with disorders involving compulsivity, such as addictions and binge eating disorders, may be useful.
- Future studies may employ additional measures of cognitive flexibility, as well as behavioural measures of habits.

## Conclusions

- Both HTQ Compulsivity and AUT cognitive flexibility interact, accounting for almost half of the variance in subclinical OCD symptomatology.
- This may prove useful in future research into both subclinical and clinical OCD traits, as well as other compulsivity disorders, and in the development of interventions targeting the maladaptive habits and impaired cognitive flexibility proposed to underlie OCD.

## Affiliations

- <sup>1</sup>School of Clinical Medicine, University of Cambridge
- <sup>2</sup>Department of Psychology, University of Cambridge
- <sup>3</sup>Behavioural and Clinical Neuroscience Institute, University of Cambridge

## References

- [1] Graybiel, A. M., & Rauch, S. L. (2000). Toward a neurobiology of obsessive-compulsive disorder. *Neuron*, 28(2), 343-347.
- [2] Cillani, G. M., & Robbins, T. W. (2014). Goal-directed learning and obsessive-compulsive disorder. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 369(1655), 20130475.
- [3] Chamberlain, S. R., Fineberg, N. A., Menzies, L. A., Blackwell, A. D., Bullmore, E. T., Robbins, T. W., & Sahakian, B. J. (2007). Impaired cognitive flexibility and motor inhibition in unaffected first-degree relatives of patients with obsessive-compulsive disorder. *American Journal of Psychiatry*, 164(2), 335-338.
- [4] Sternheim, L., van der Burgh, M., Berkhout, L. J., Dekker, M. R., & Rutter, C. (2014). Poor cognitive flexibility, and the experience thereof, in a subclinical sample of female students with obsessive-compulsive symptoms. *Saradivanian Journal of Psychology*, 35(6), 573-577.
- [5] Foa, E. B., Huppert, J. D., Leiberg, S., Langner, R., Kichic, R., Hajcak, G., & Salkovskis, P. M. (2002). The Obsessive-Compulsive Inventory: development and validation of a short version. *Psychological assessment*, 14(4), 485.
- [6] Guilford, J. P. (1967). The nature of human intelligence.
- [7] Zmigrod, L., Zmigrod, S., Rentfrow, P. J., & Robbins, T. W. (2019). The psychological roots of intellectual humility: The role of intelligence and cognitive flexibility. *Personality and Individual Differences*, 141, 200-208.