

and the Conners Continuous Performance Test – 3rd Edition (CPT-3), and trait self-control on the Brief Self-Control Scale (BSCS). It was hypothesized that physiological and behavioral self-regulation variables would predict the BSCS, such that higher resting HRV and better performance on the cognitive measures would predict higher self-reported self-control.

**Participants and Methods:** Thirty-five healthy adults (Age  $M = 29.80$ ,  $SD = 8.52$ , 45.7% female) recruited from the community completed the BSCS, CPT-3, and D-KEFS as part of a larger battery. Participants also completed a 10-minute eyes-open resting condition during electrocardiogram recording. High-frequency power (0.15 – 0.4 Hz) was extracted and used to operationalize resting HRV. Linear regression was used to test the predictive relationships between the BSCS total score, resting HRV, CPT-3 scores, and a residualized executive functioning score from the D-KEFS that controls for non-executive lower-order cognitive processes.

**Results:** Regression analyses indicated that neither the D-KEFS composite, the CPT-3 indices, nor resting HRV were related to the BSCS. Resting HRV predicted the CPT-3 Hit Reaction Time (HRT;  $B = -2.97$ ,  $p < .05$ ) and HRT Standard Deviation (HRT SD;  $B = -4.55$ ,  $p < .05$ ). Resting HRV was unrelated to the D-KEFS executive composite score. CPT-3 performance variables and D-KEFS composite score were also unrelated to one another.

**Conclusions:** Results showed that the BSCS was unrelated to resting HRV, CPT-3, and D-KEFS performance. However, higher resting HRV was related to faster and more consistent responding on the CPT-3. These findings contradict previous research showing associations between the BSCS and performance on executive functioning measures. The relationship between resting HRV and reaction time on the CPT-3 is generally consistent with literature that suggests that higher resting HRV is associated with better cognitive performance. Although the association between resting HRV and executive functioning was not significant in this modest sample, it was comparable to that reported in a recent meta-analysis. Overall, despite limitations related to the small sample size, the results raise questions regarding the construct validity of common neuropsychological indices of self-regulation. Further research is needed to clarify the nature of the self-regulation construct and the relation of neuropsychological measures of

behavioral self-regulation to physiological and self-report indices.

**Categories:** Executive Functions/Frontal Lobes

**Keyword 1:** cognitive functioning

**Keyword 2:** executive functions

**Keyword 3:** self-report

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### 83 Computational Modeling of Planning and Inhibition in the Tower of London

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**Objective:** The Tower of London is commonly used to assess planning ability. Deficient outcomes may however have different causes: A participant may not have the ability to think a sufficient number of steps into the future, or may become, for example, impatient to evaluate different possible paths. Outcomes are thus not pure measures of the "planning" construct of primary interest, which may have contributed to findings of low reliability and low validity of these outcomes in the literature. The advent of computerized testing combined with computational modeling potentially allows to go beyond traditional outcomes such as "total number of moves" and "total time taken" and disentangle different processes that **are** of primary interest. The goal of the current study is to establish whether a model that consists of "planning ability" and "response inhibition" parameters can be used to describe Tower of London data.

**Participants and Methods:** We constructed an algorithm that produces Tower of London data, and a computational model that uses every single decision of a participant as input (e.g., whether a participant moves the red or the blue ball to the right peg in setting 15 when trying to get to setting 28). There are 210 unique decision situations that participants can encounter. Our algorithm and Bayesian hierarchical model uses two parameters for each participant as well as a guessing rule, that together determine the participant's decision at every step. The appropriateness of the model was evaluated in a

simulation study, where the simulated distribution of data implied by this model is compared to the empirical distribution of total number of moves observed in real datasets. Data were simulated for 10 items with a sample size of 200 participants.

**Results:** Our simulation study shows that with our model the empirical distribution of total number of moves is successfully replicated in the distribution of the simulated data.

**Conclusions:** Computational modeling provides a new window into Tower of London performance by identifying different processes. Modeling thus allows us to go beyond aspecific descriptions of planning ability. Furthermore, using the high-resolution data of computerized testing allows us to estimate these parameters reliably without requiring "big data", keeping participant burden low.

This study will be followed up in three ways. First, predictions will be preregistered and tested for these new cognitive outcomes in several large oncological patient samples. Second, the model will be extended to include reaction times, to include an additional metric of cognitive computation. Third, the new cognitive process outcomes will be analyzed in conjunction with cognitive process outcomes on other tests to establish process communalities.

**Categories:** Executive Functions/Frontal Lobes

**Keyword 1:** planning

**Keyword 2:** computerized neuropsychological testing

**Keyword 3:** psychometrics

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## 84 Preliminary Psychometric Examination of a Short Questionnaire of Executive Functions

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**Objective:** The behavioral assessment of executive functions has become increasingly common in clinical practice, with a self-report measure of executive functions becoming one of the most commonly administered assessment instruments of the construct in clinical practice. These subjective measurements serve as an

alternative to objective tests of executive functions, which have been criticized for poor ecological validity. Many behavioral measures of executive functions are now available, but there are some issues with those currently in use, in that many are lengthy, proprietary, and/or do not measure executive functions that align with a theoretical framework of the multidimensional construct. This study aimed to examine the psychometric properties of a new short questionnaire of executive functions designed to be concise, theoretically based, and ultimately freely available for use in research and clinical practice.

**Participants and Methods:** Participants included 575 college undergraduate students who completed an online questionnaire to earn credit in psychology courses. They were, on average, 18.9 years-old (SD=1.0, range: 18-22), 82.4% female, and 78.8% White. All participants completed 20 self-report items on a four-point ordinal scale measuring five theorized executive function constructs of Planning, Inhibition, Working Memory, Shifting, and Emotional Control. The 20 items were analyzed using confirmatory factor analysis and factor reliabilities were estimated using omega. As a validity analysis, correlations between the total score with measures of subjective cognition and ADHD symptoms were compared to correlations between the total score with measures of anxiety and depression, hypothesizing stronger correlations of executive functions with cognition and ADHD than negative affect.

**Results:** The initial 20-item model did not fit well,  $\chi^2=1560.10$ ,  $df=160$ ,  $p<.0001$ , CFI=0.822, TLI=0.788, RMSEA=0.130 (90% CI: 0.124-0.136). The polychoric inter-item correlations were examined for high cross-factor correlations and low intra-factor correlations. This process resulted in the removal of one item from each factor. The modified model, inclusive of 15 items, presented with adequate fit to the data,  $\chi^2=470.56$ ,  $df=80$ ,  $p<.0001$ , CFI=0.936, TLI=0.916, RMSEA=0.097 (90% CI: 0.089-0.106). The total score has good reliability ( $\Omega=.82$ ), whereas estimates for each factor ranged from .56 to .79. The total score showed a stronger correlation with ADHD symptoms ( $r=-.59$ ) and subjective cognition ( $r=.59$ ) than depression ( $r=.46$ ,  $z=4.05$ ,  $p<.001$ ) and anxiety symptoms ( $r=.38$ ,  $z=6.29$ ,  $p<.001$ ).

**Conclusions:** These preliminary findings provided modest psychometric support for this short 15-item self-report questionnaire of executive functions. The questionnaire had