An Ecologically Valid Measure of Cognitive Control Needed for Daily Living in Autistic Adolescents and Young Adults

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Background/Objectives

Autistic adolescents frequently exhibit cognitive control (or executive function) deficits for which the field lacks ecologically valid measures. The Map task is a new measure that has been validated in assessing the functional capacity of children at clinical high risk for psychosis, a pre-psychotic phase that shares similar deficits in communication and executive function with autism. This suggests it could be used in autistic children to measure similar cognitive deficits. We report preliminary results with these goals:

1) Examine whether autistic participants show impairments on the Map task compared to age, gender, and IQ-matched non-autistic participants, 2) Examine associations between Map task performance and another test of similar construct, the NIH Toolbox Cognition Battery. 3) Investigate associations between Map task performance and the Adaptive Behavior Assessment System-3 (ABAS-3), a measure of adaptive functioning.

METHODS: Participants (N = 146)

	Autistic	Non-autistic	p
n	73	73	
Age (Years) (mean (SD))	17.01 (3.05)	16.47 (3.15)	0.288
Gender (Male) = M (%)	61 (83.6)	57 (78.1)	0.528
FSIQ (mean (SD))	104.18 (12.56)	107.11 (11.35)	0.141
SCQ Total (mean (SD))	21.41 (5.33)	3.21 (3.18)	<0.001
ADOS CSS (mean (SD))	7.70 (1.59)	NaN (NA)	NA

Inclusion/Exclusion: WASI-2-FSIQ>70; No psychotropics, but psychostimulants w/washout. **ASD**: DSM-V Checklist, ADOS-2, SCQ. **TYP**: No neurodevelopmental or Axis I disorders. Matched set on gender, age, and IQ. **Cohort sequential study** = T1

Measures/Analysis

MAP TASK Participants were required to efficiently plot a route on a map of a fictional town in order to complete a set of specified errands. Specific rules and sequences, when violated, captured specific deficits. **Door Errors, Extra location errors, Shortcut errors** = deficit in sustained attention. **Ordering errors** = deficit in logical planning.

Total errors combined all errors and was averaged with **Completion Time, Number of Errands Completed** to create a **Capacity Score**. *(McLaughlin, 2016)*

NIH TOOLBOX Measures cognition. **Fluid cognition** = working memory, sequence memory, inhibition, cognitive flexibility, processing speed. **Crystallized cognition** = vocabulary, reading

ABAS 3 Measures adaptive functioning. **Conceptual** = communication, functional academics, self-direction. **Practical** = social skills, leisure skills. **Social** = self-care, home living, community use, health and safety, work skills. **General Adaptive** = All

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STATISTCAL ANALYSES Group differences between non-autistic v autistic Map task variables were assessed using non-parametric Kruskal-Wallis Rank Sum Test. The Spearman's rho coefficient was used to determine the separate relationship between the Map task Capacity and NIH age adjusted indices, as well as ABAS-3 indices. In correlational analyses, Capacity scores were re-standardized using the mean and SD of non-autistic group, per the previous validation study.

RESULTS: Map Task Performance (Non-autistic, Autistic)

Fig1. Mean differences in Map Task Performance for Non-autistic, Autistic.
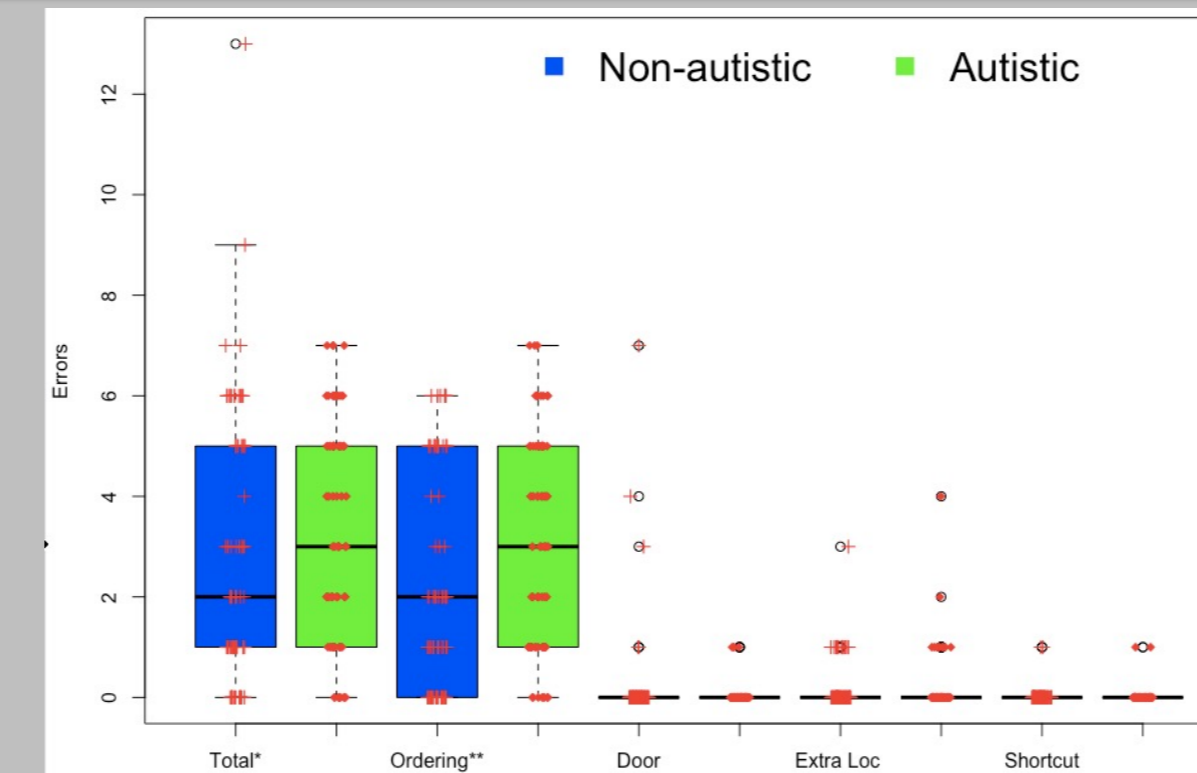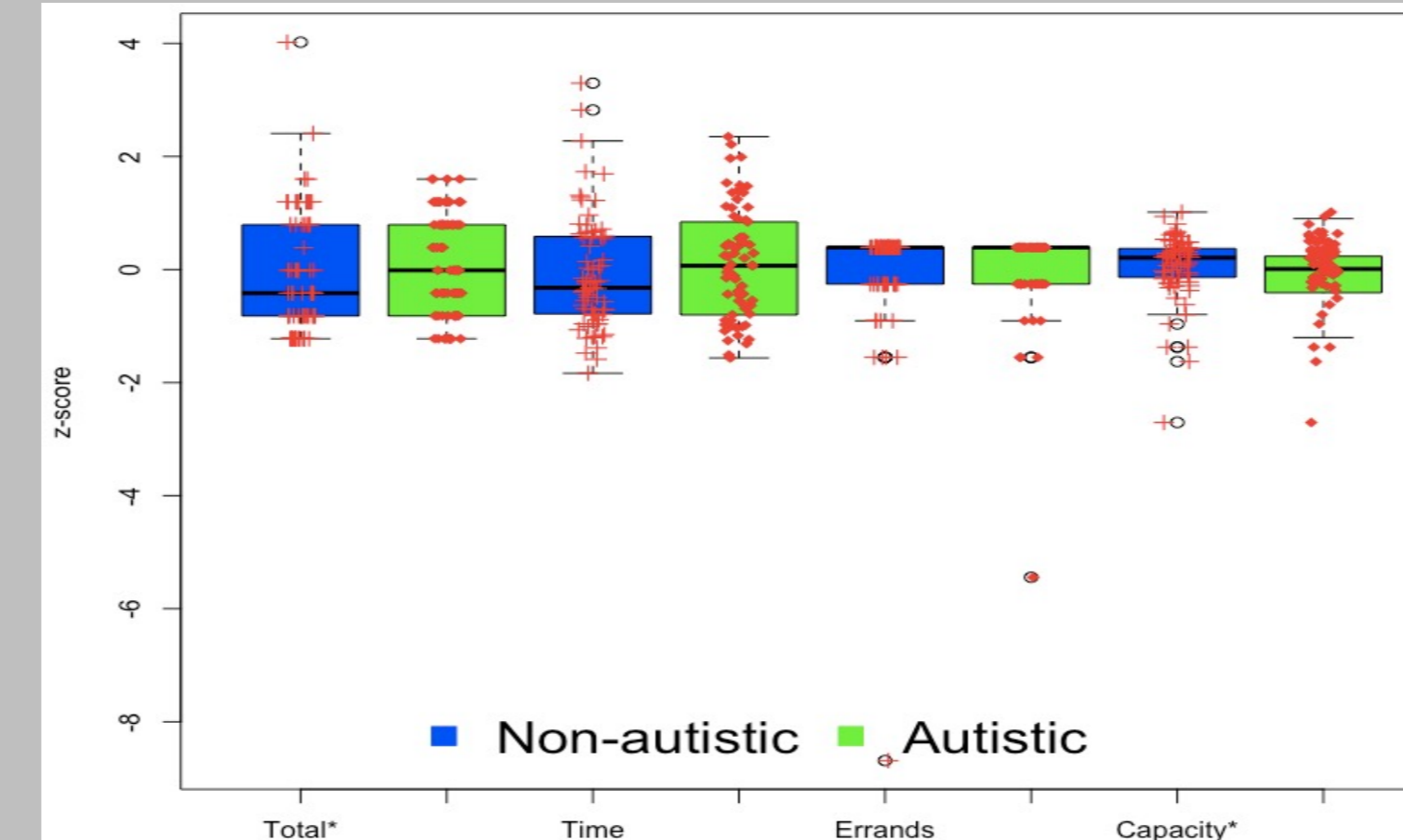*P < .05
**P < .01

Fig2. Mean differences in Map Task Performance for Non-autistic, Autistic.
*P < .05
**P < .01

Correlations: Map Task and Cognition

In autistic group, Map task Capacity significantly correlated with NIH Crystallized Cognition and Fluid Cognition (Bonferroni corrected)

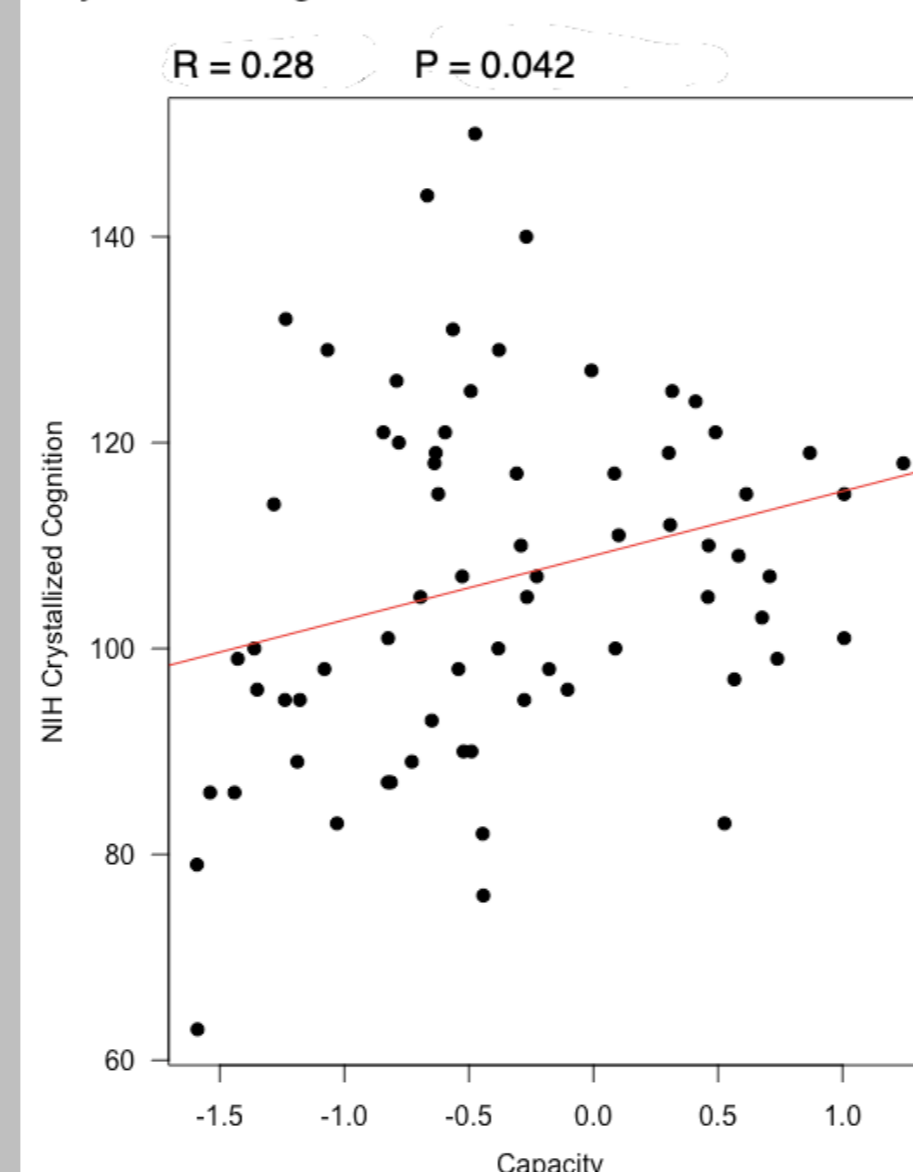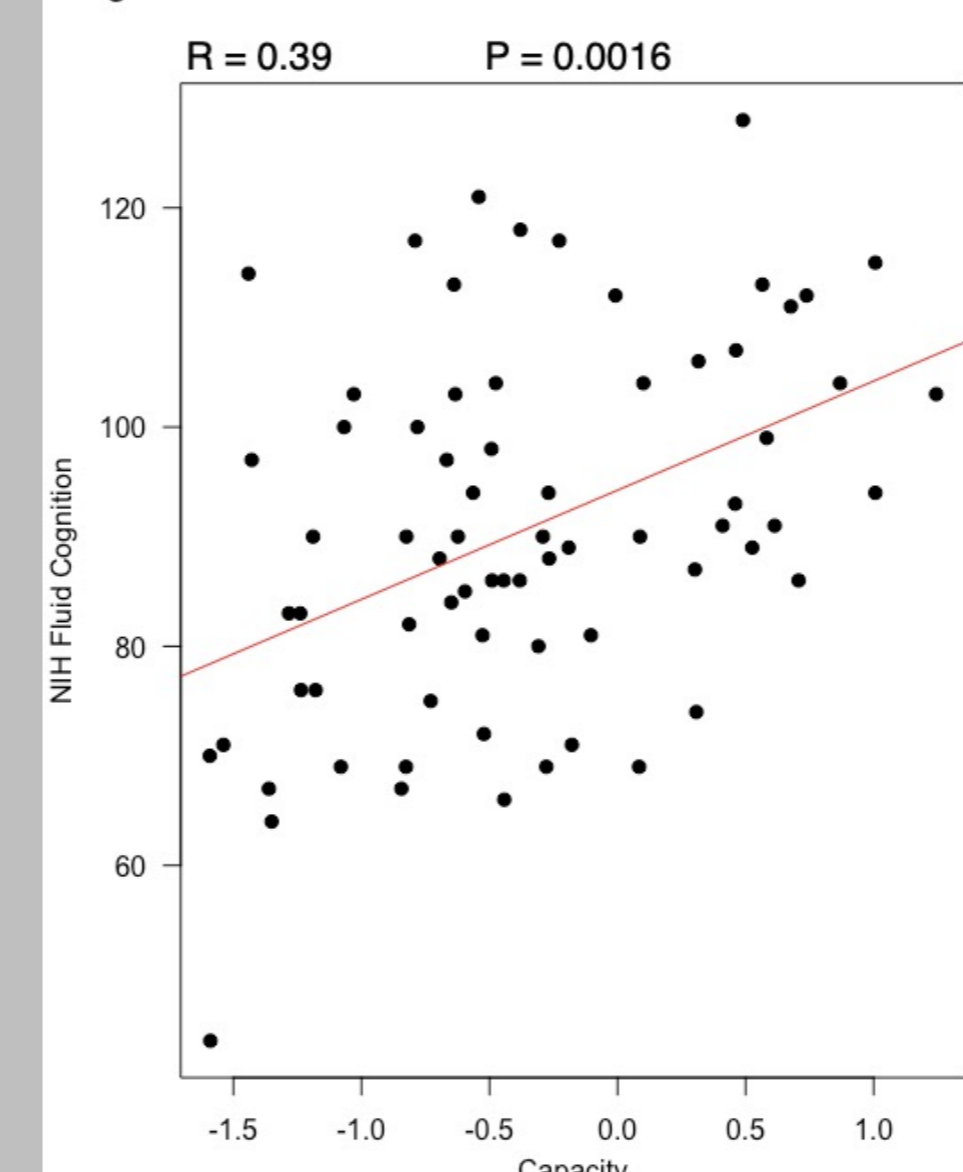Fig 3. Scatterplot of Map task Capacity and NIH Crystallized Cognition
R = 0.28   P = 0.042

Fig 4. Scatterplot of Map task Capacity and NIH Fluid Cognition
R = 0.39   P = 0.0016

Correlations: Map Task and Measures of Adaptive Functioning

In the autistic group Map task Capacity Score significantly correlated with ABAS-3 Conceptual (Bonferroni corrected).

Fig 5. Scatterplot for Map task Capacity and ABAS-3 Conceptual
R = 0.30   P = 0.05
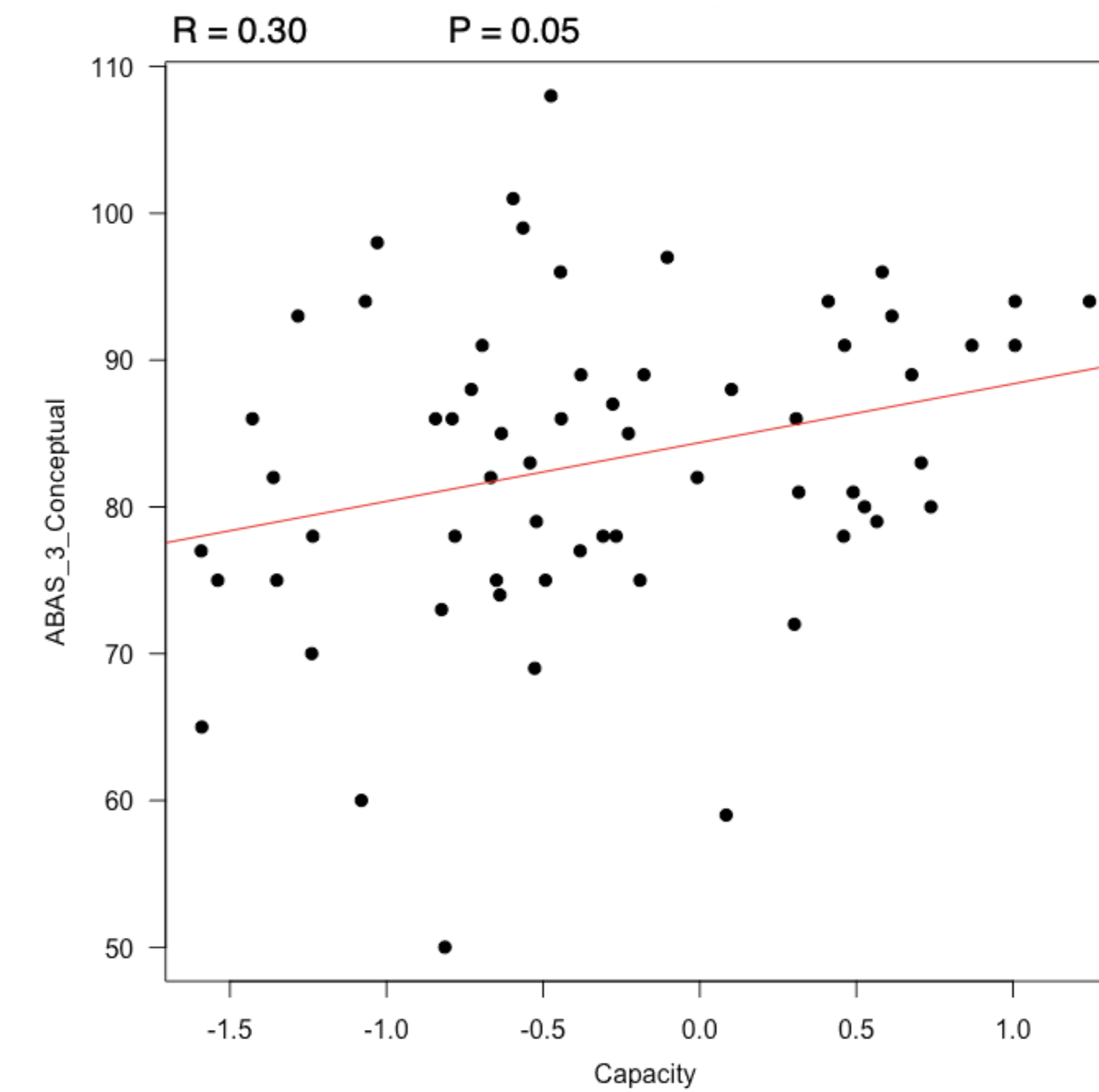
Discussion

- Autistic group showed impairments on Map task Ordering Errors, Total Errors, and Capacity score, supporting the task's ability to capture cognitive impairments in this demographic.
- Ordering errors drive Total errors which drives Capacity score, suggesting it is the most sensitive variable. This pattern of error is different than those made by children at high risk for psychosis suggesting Map task performance can be used as a biobehavioral marker differentiating autism from the pre-psychotic phase of schizophrenia.
- Significant correlations with NIH Fluid Cognition and Crystallized Cognition in autistic group support the task's ability to measure cognitive control and language skills.
- Significant correlation with ABAS-3 Conceptual in autistic group supports the task's ability to measure adaptive functioning.