

# Specificity of Computerized Assessment of Motor Imitation (CAMI) for Distinguishing Autism from ADHD and Neurotypical Development



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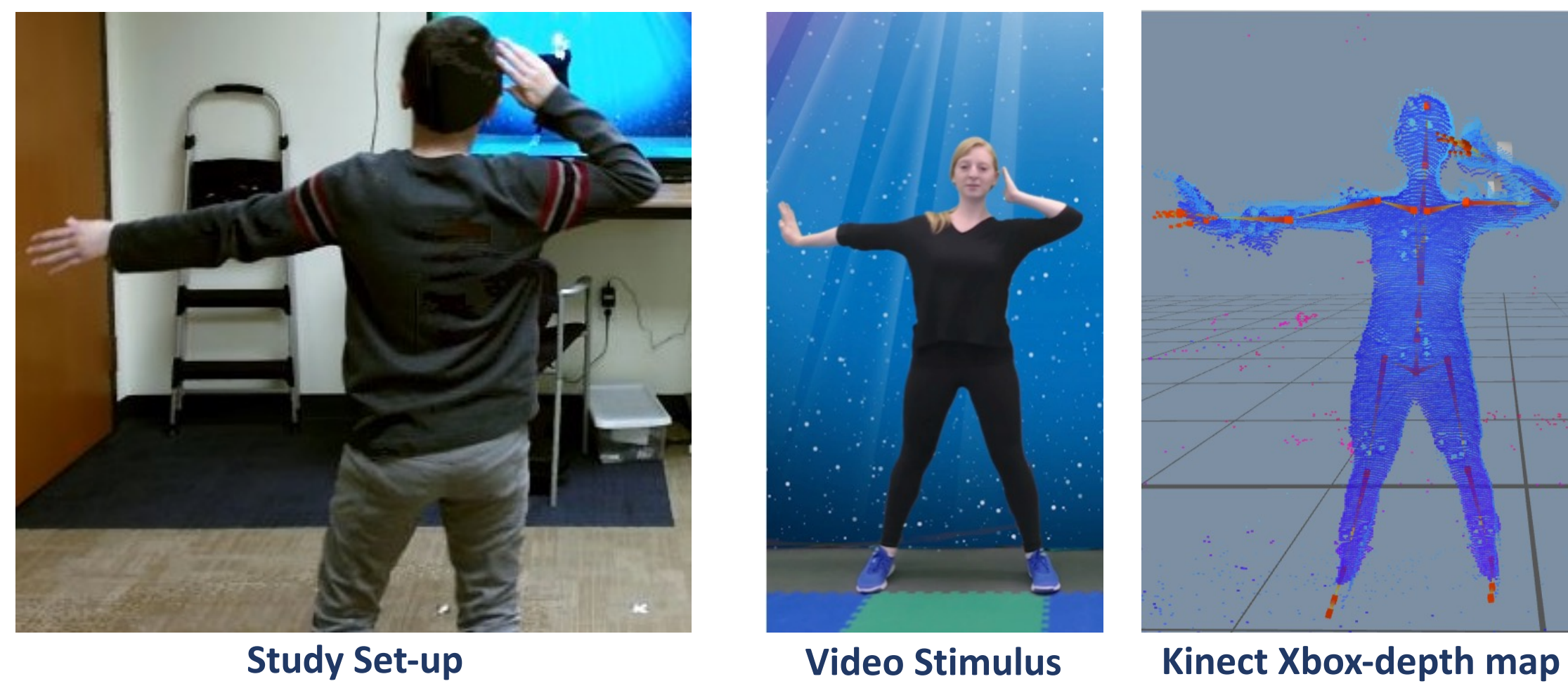
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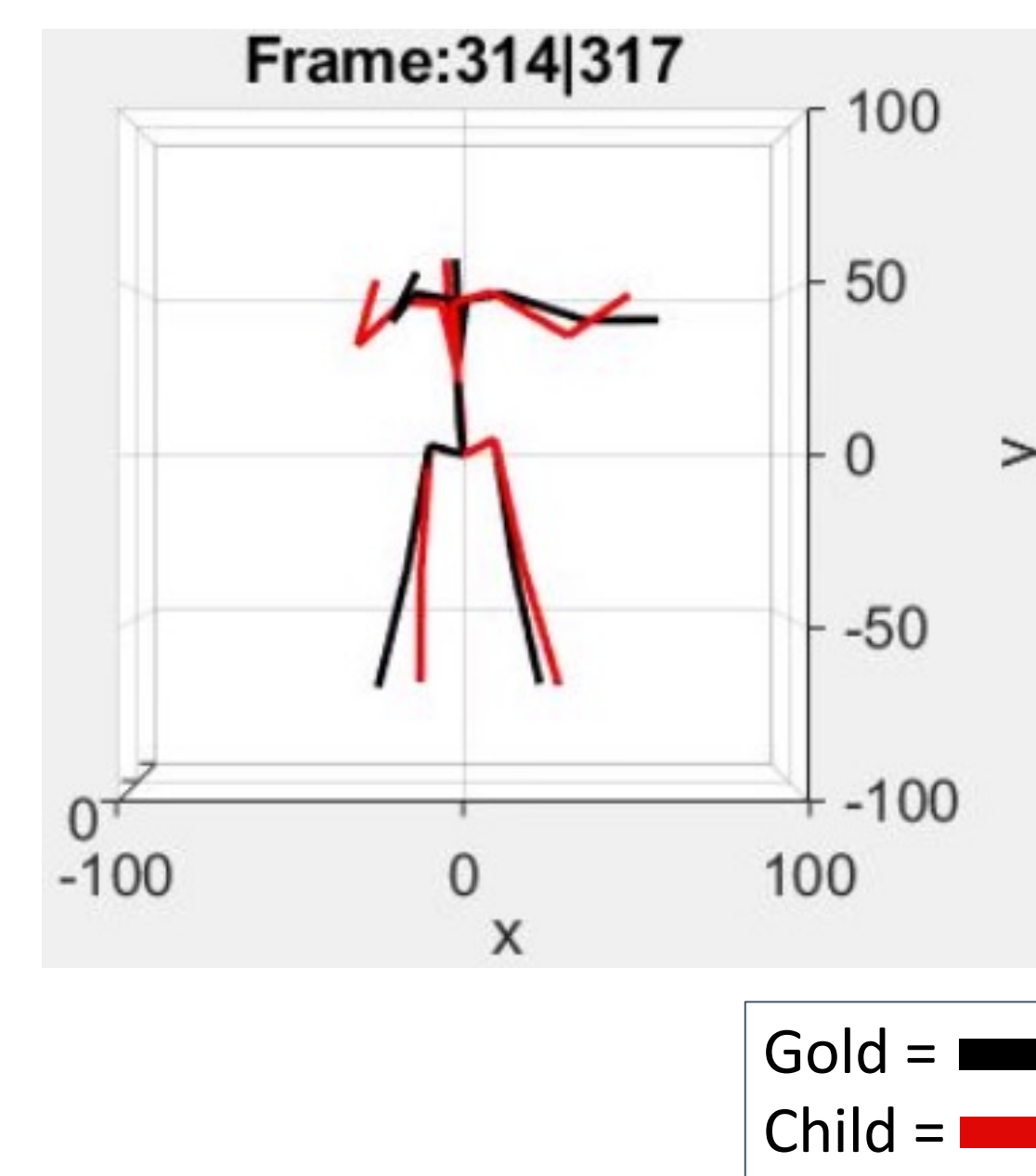
## BACKGROUND & AIMS

- Although not a core feature of autism spectrum disorder (ASD), impaired motor imitation is commonly observed in autistic individuals.
- Given the prevalence of motor difficulties, some have suggested including motor signs in ASD diagnostic criteria [1]. However, there is first a crucial need to establish greater specificity of motor impairments for ASD.
- Motor imitation, which is crucial to social development, has strong potential to provide such specificity [2] and in doing so, address autism heterogeneity.
- We developed a brief (one-minute) computer-vision method, CAMI, and found it to be highly effective at distinguishing ASD children from neurotypical (NT) children [3].
- Objective #1: Examine whether CAMI and its spatiotemporal sub-scores can distinguish ASD from other, commonly co-occurring/differential developmental conditions, such as attention deficit hyperactivity disorder (ADHD).**
- Objective #2: Examine whether dimensional measures of ASD and ADHD symptom presentation predict CAMI performance.**

## METHOD: CAMI



- Children were instructed to imitate dance-like movements of a video avatar for one minute. Front and back Kinect Xbox recorded children's movements. The x-y-z coordinates of 20 joints were extracted using iPi motion capture software.
- The CAMI algorithm applies dynamic time warping (DTW) to assess overall imitation, outputting an overall score from 0 (no imitation) to 1 (perfect imitation).
- CAMI is comprised of a spatial accuracy score and temporal scores reflecting percent time in advance, delay, and in synchrony with a gold standard.



## METHODS: CONTINUED

	Participants			
	ASD n=24	ASD + ADHD n=44	ADHD n=20	TD n=62
Age	10.3 (1.3)	10.4 (1.4)	10.5 (1.5)	10.3 (1.4)
Sex (M/F)	20/4	38/6	13/7	44/18
Full Scale IQ (FSIQ)	100.6 (16.3)	97.7 (17.2)	109.3 (14.1)	113.3 (13.2)
ADOS Total Score	14.4 (5.6)	14.1 (4.3)	-----	-----
SRS Total Score	70.7 (8.5)	74.4 (7.8)	-----	45.9 (7.5)
Conners Inattentiveness Score	63.3 (12.7)	73.0 (11.8)	72.6 (14.6)	46.2 (8.2)
Conners Hyperactive/Impulsive Score	65.5 (11.4)	71.3 (14.7)	73.8 (15.5)	47.6 (9.8)
CAMI Total Score	.26 (.21)	.27 (.17)	.49 (.25)	.48 (.20)
Spatial Accuracy Score	.24 (.12)	.22 (.09)	.33 (.11)	.33 (.10)
Time Advance	.07 (.02)	.06 (.02)	.07 (.02)	.07 (.02)
Time Delay	.07 (.02)	.07 (.03)	.10 (.12)	.07 (.02)
Time In-Sync	.94 (.02)	.94 (.02)	.93 (.01)	.93 (.02)

SRS-2 = Social Responsiveness Scale-2, ADOS= Autism Diagnostic Observation Scale-2

### Statistical Analyses

- Group differences in CAMI scores were assessed using ANOVA with Bonferroni correction
- Multilinear regressions with symptom measures as predictors and CAMI scores as the outcome variable were used to assess contributions of ASD and ADHD to imitation performance.

## RESULTS: CONTINUED

Figure 2. Among ASD Children: Imitation (CAMI) performance was predicted by ADOS-2 but not ADHD Conners 3 Scores

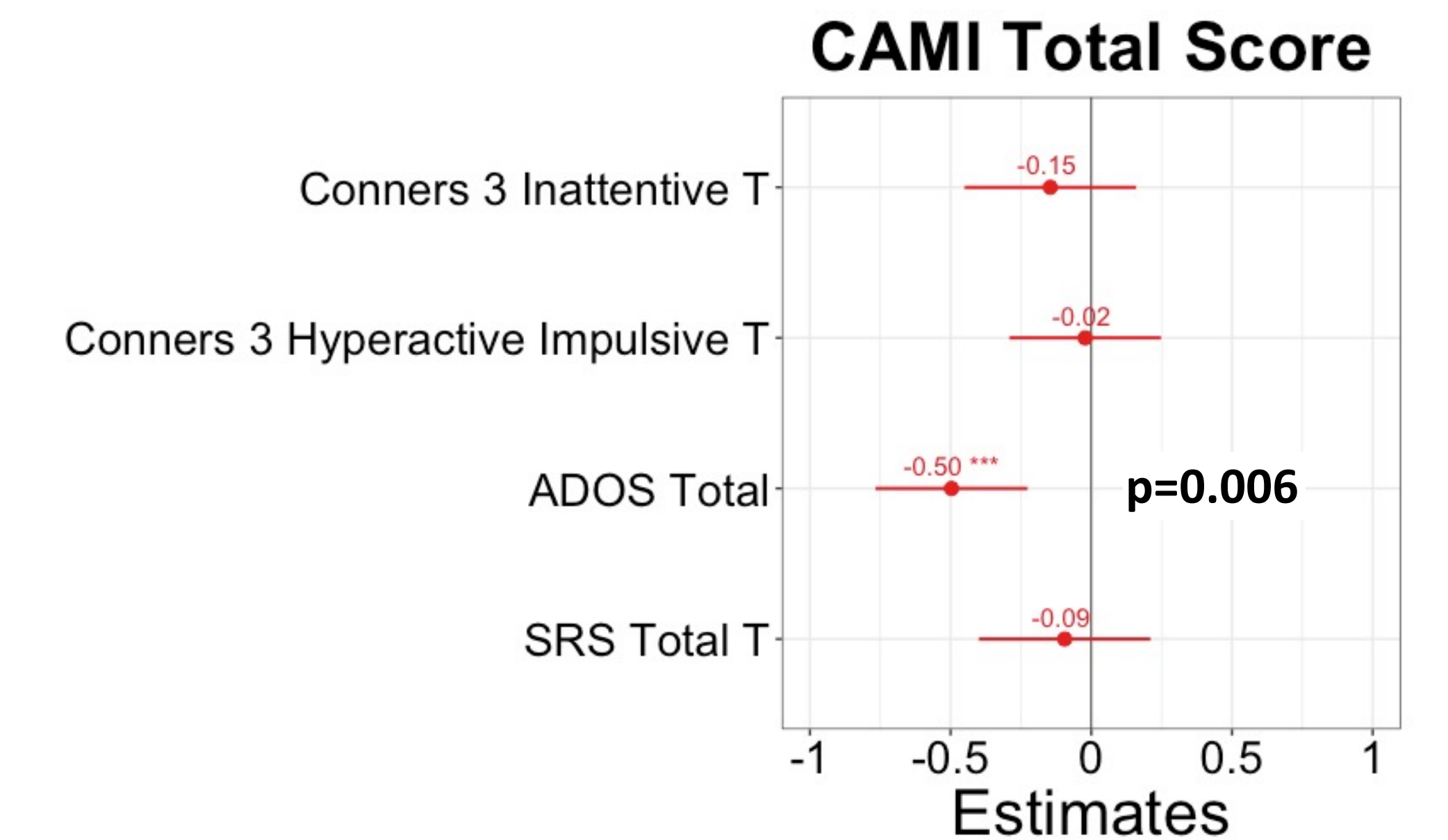
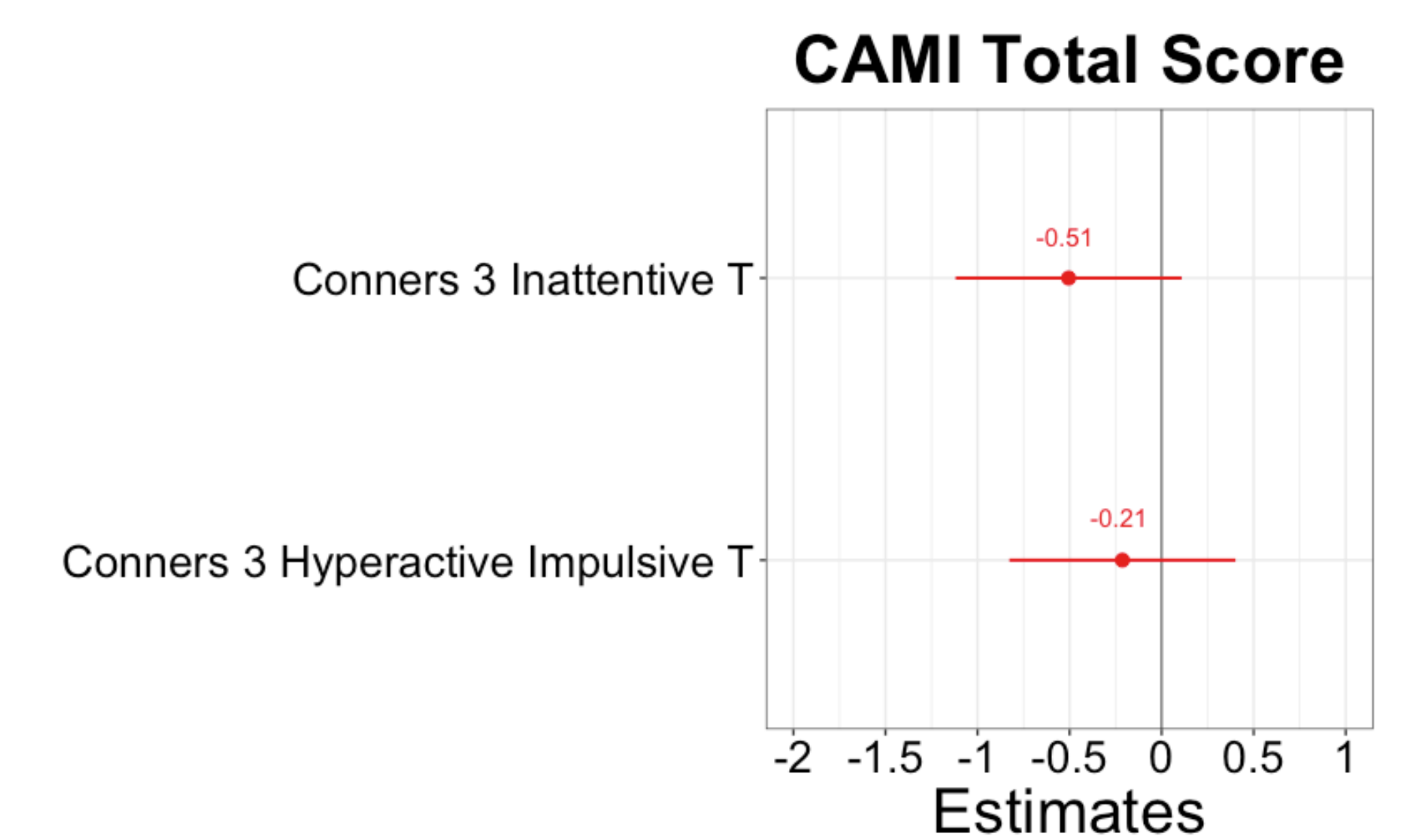
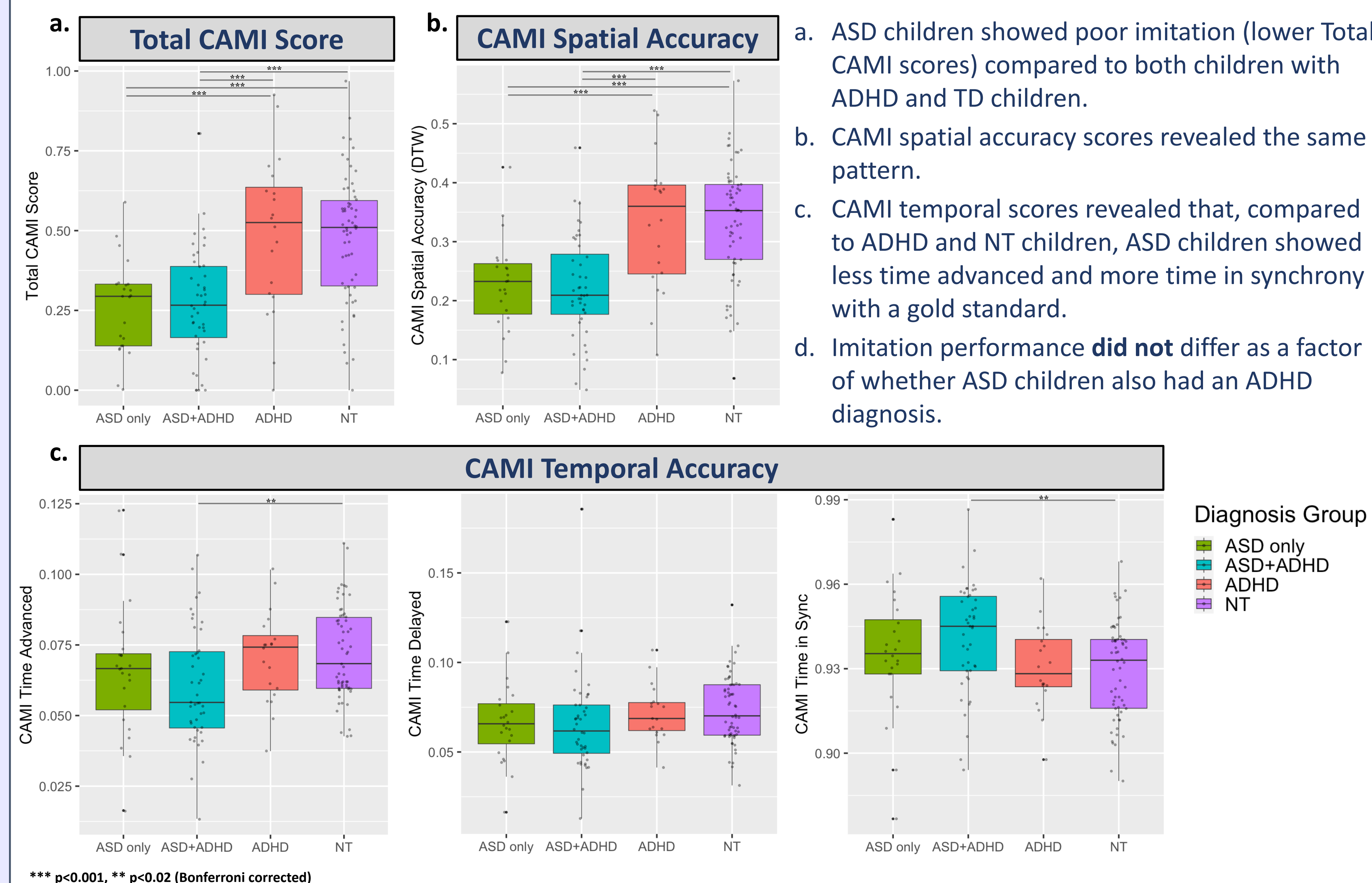


Figure 3. Among ADHD Children: Imitation (CAMI) performance was not predicted by ADHD Conners 3 Scores



## RESULTS

Figure 1. ASD children show impaired imitation (CAMI) compared to ADHD and NT children



## CONCLUSIONS

- Imitation performance (CAMI) reflects autism-specific traits that are not shared by children with ADHD.
- For ASD children, the severity of their autistic traits (as measured by ADOS-2) contribute to poorer imitation.
- Autism-associated difficulties with imitation can be attributed to difficulties with both spatial and temporal mapping.
- Spatial findings suggest that ASD children are less spatially accurate compared to their peers.
- Temporal findings suggest that while TD and ADHD children often anticipate movements, ASD children often do not.

## REFERENCES

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