



Abstract

The Stroop Color and Word Test (“Stroop”) is a classic, efficient test of executive functions, including inhibition and processing speed. The Stroop Normative Update is a newly released version of the Stroop, developed to:

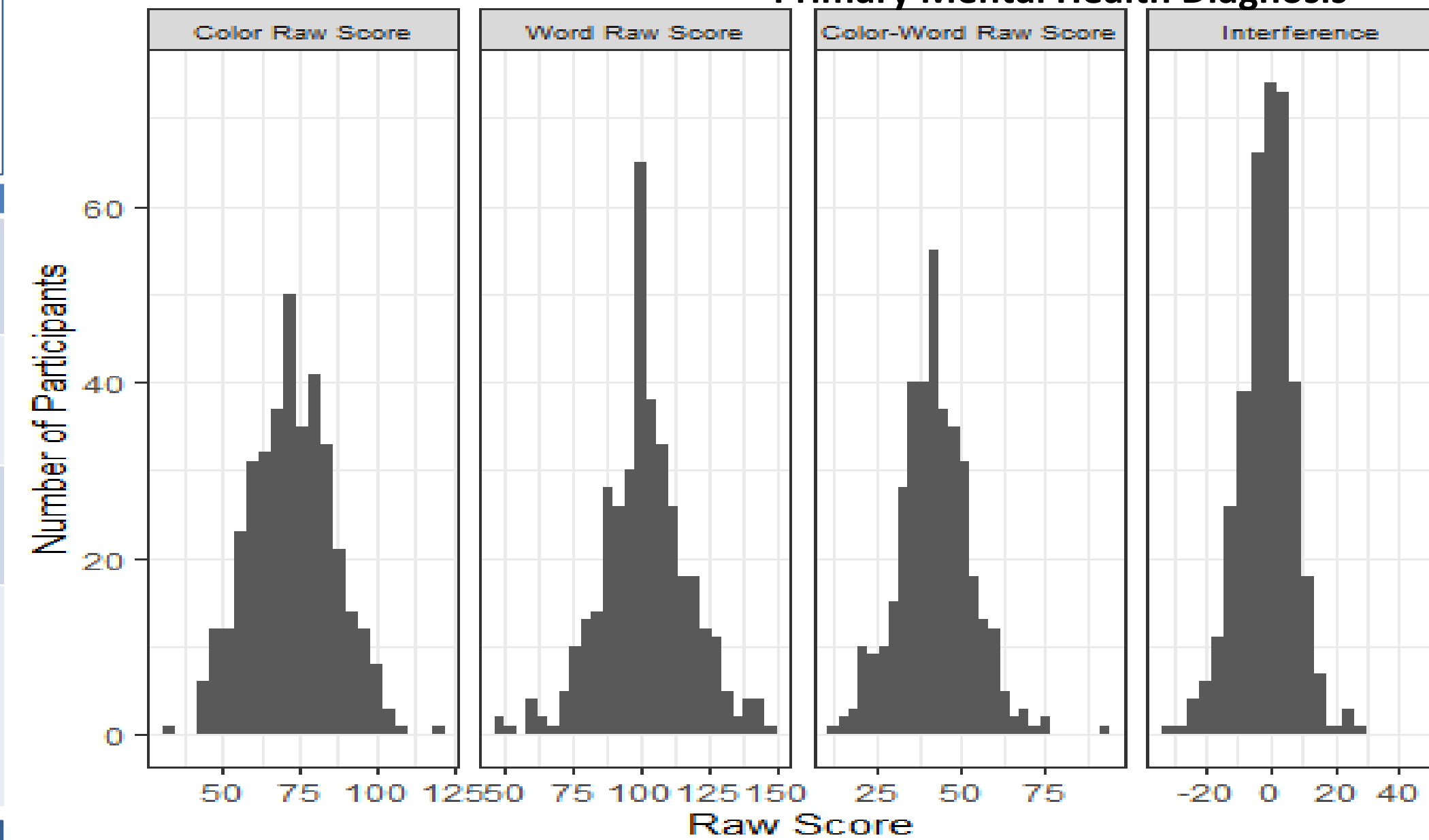
- Retain the essential features of the current version, particularly administration procedures and scoring methods, to easily facilitate longitudinal research across versions
- Update the normative tables to reflect current adult U.S. demographics
- Use updated analytic techniques to examine psychometric properties
- Clarify administration, scoring, and interpretation procedures
- Update literature review with current research
- Develop scoring application with dynamic interpretation and reporting

SCALE	DESCRIPTION	CALCULATION				
<table border="1"> <tr><td>RED</td><td>BLUE</td></tr> <tr><td>GREEN</td><td>GREEN</td></tr> </table>	RED	BLUE	GREEN	GREEN	Rote word processing	# Words stated in 45 sec.
RED	BLUE					
GREEN	GREEN					
<table border="1"> <tr><td>XXXX</td><td>XXXX</td></tr> <tr><td>XXXX</td><td>XXXX</td></tr> </table>	XXXX	XXXX	XXXX	XXXX	Rote color processing	# Colors stated in 45 sec.
XXXX	XXXX					
XXXX	XXXX					
<table border="1"> <tr><td>RED</td><td>BLUE</td></tr> <tr><td>GREEN</td><td>GREEN</td></tr> </table>	RED	BLUE	GREEN	GREEN	Inhibition of competing stimuli	# Colors stated in 45 sec.
RED	BLUE					
GREEN	GREEN					
INTERFERENCE (INT)	Comparison of Color-Word performance v. expected (based on Color and Word performance)	CW – Predicted CW				

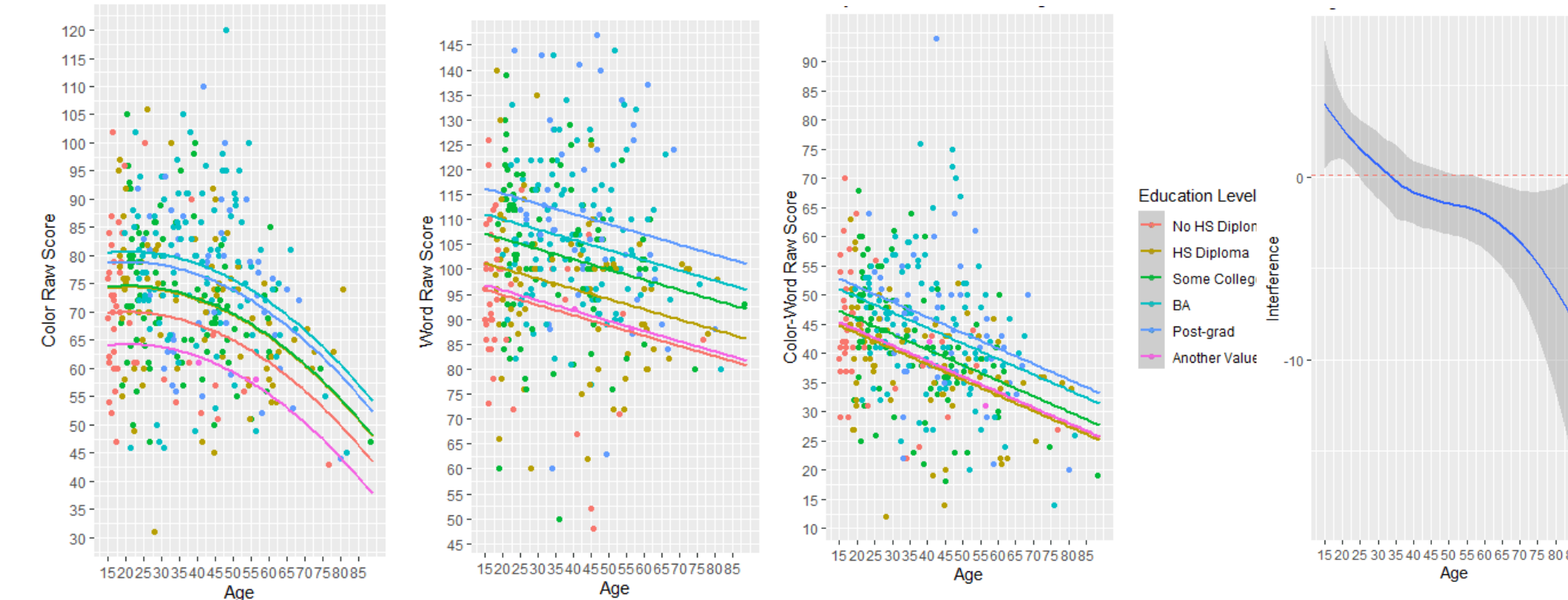
Standardization and Development

Participants were roughly stratified by typical testing demographic criteria. Effects of these factors were examined. Age and Education accounted for differences in Stroop scores.

- Age
- Sex/Gender
- Race/Ethnicity
- Highest Completed Education Group
- Region of the U.S. Currently Residing
- Community Size
- Primary Mental Health Diagnosis



N	Color			Word			Color-Word			Interference		
	Mean (SD)	SEM	Min-Max	Mean (SD)	SEM	Min-Max	Mean (SD)	SEM	Min-Max	Mean (SD)	SEM	Min-Max
373	73.31(13.62)	0.71	31-120	102.3(16.31)	0.84	48-147	42.38(11.02)	0.57	12-94	0.12(9.38)	0.49	-32-54



Results

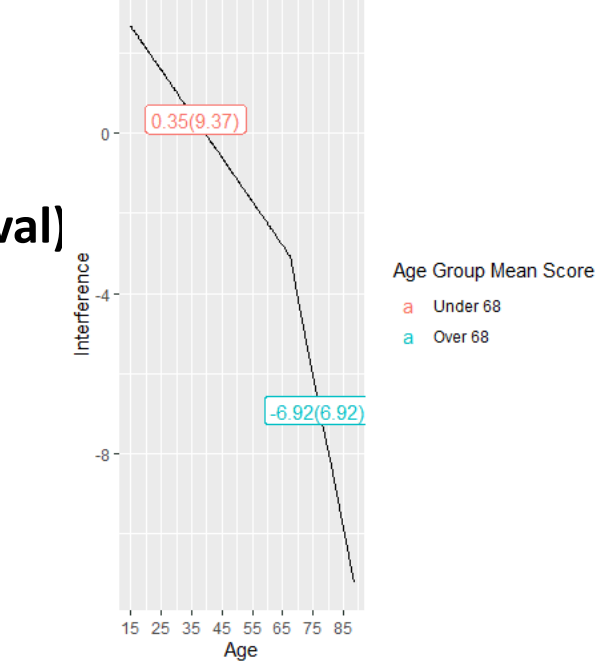
Scoring

Predicted Score

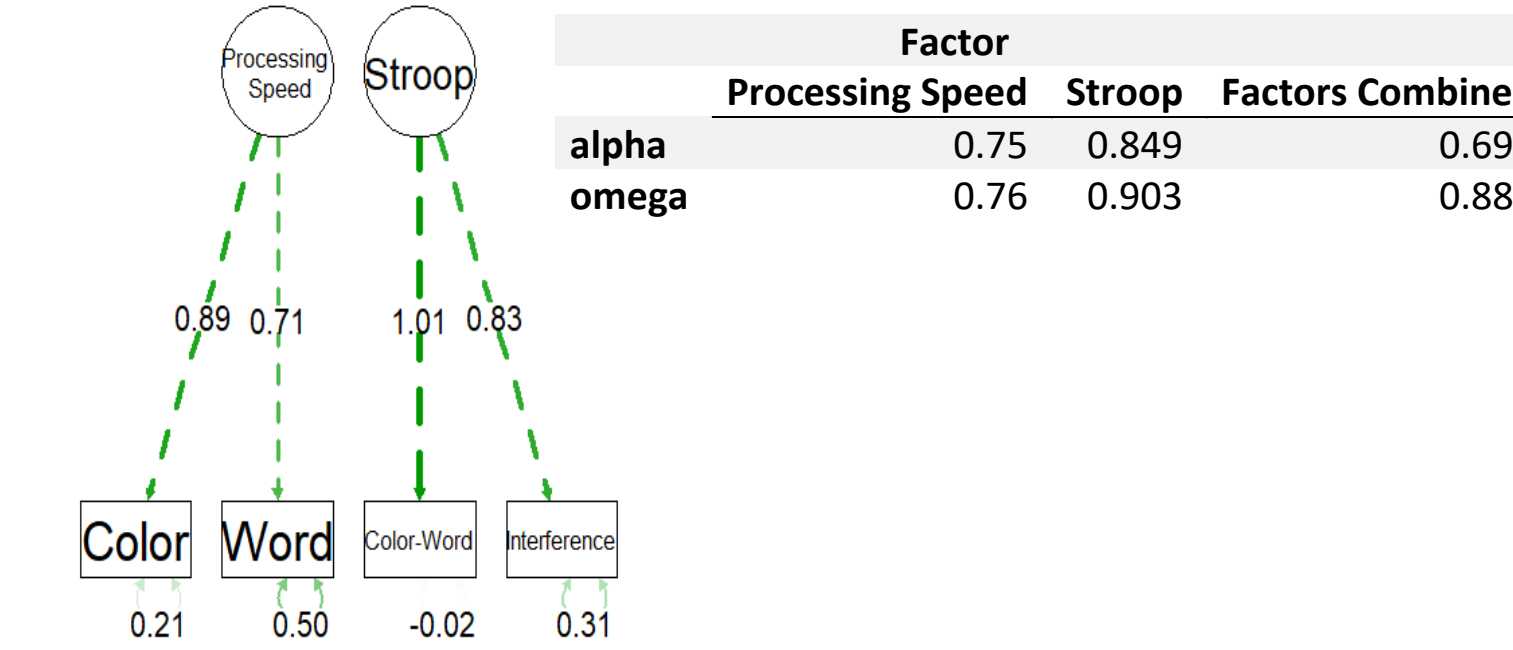
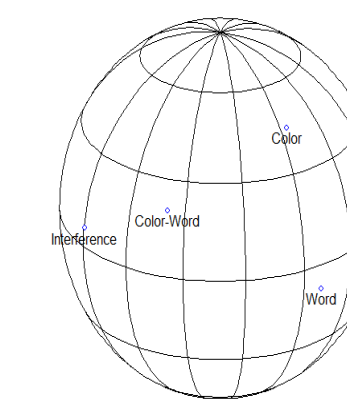
- Color, Word, Color-Word by:
 - Scale – Education level –Group (not regular interval)
- Interference- segmented model at age 68
 - Color and Word

T-score

- Residual by scale



Structure



Test-Retest

Scale	ICC Value (95% CI)	CC Value (95% CI)
Color Raw Score	0.82 (0.7 - 0.9)	0.81(0.64-0.91)
Word Raw Score	0.9 (0.83 - 0.94)	0.89 (0.70-0.96)
Color-Word Raw Score	0.68 (0.49 - 0.81)	0.67 (0.46-0.81)
Interference	0.5 (0.26 - 0.69)	0.50 (0.24-0.69)

Concurrent Validity

	Color	Word	Color-Word	Interference
Color				
Word	0.57***			
Color-Word	0.62***	0.47***		
Interference	-0.05	-0.11	0.71***	
Letter-Word	0.22*	0.36**	0.33**	0.15
Word Attack	0.17	0.30**	0.22*	0.07
CC Ratio	0.17	0.18	0.23*	0.11
CI Ratio	0.38***	0.31**	0.43***	0.20
Nonverbal Stroop	-0.26*	-0.16	-0.26*	-0.12
Trails Total	0.42***	0.29**	0.32**	0.02

Note. NS = P > 0.05, * = P <= .05, ** = P <= .01, *** = P < 0.001

Discussion

Literature Review Update

- Increased use internationally, with consistent findings, some discrepancies by factors
- Increased use in clinical trials (e.g., Huntington’s Disease)

Administration Update

- Clarify administration- one form for examiner, one for examinee
- Brief administration protocol
- Qualification check on Record Form

Residuals of New and Old Stroop Predicted Score Models

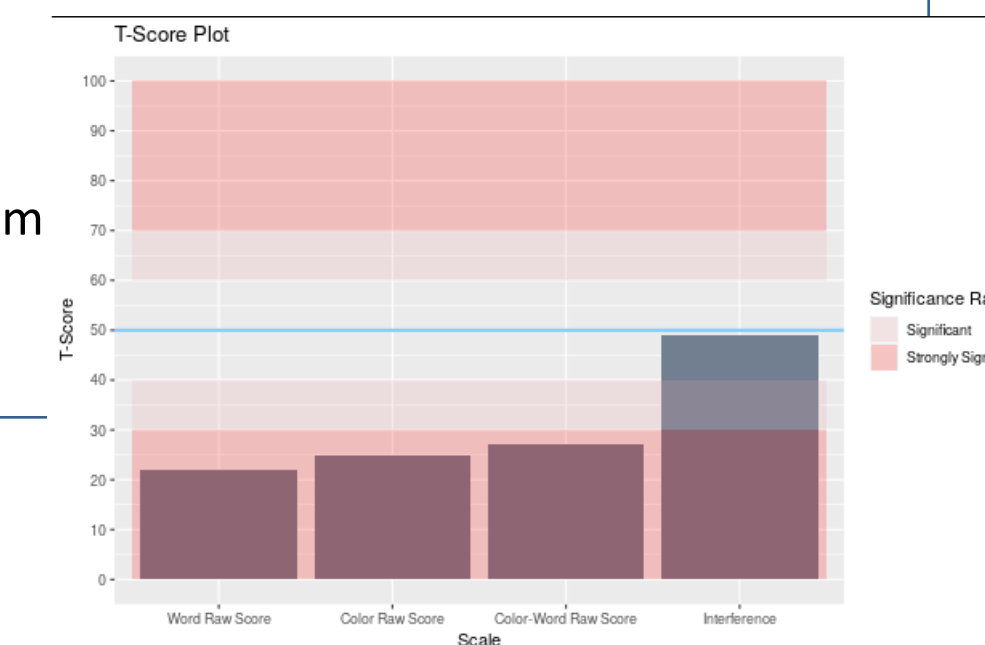
	Color	Word	Color-Word
New Stroop Models	9.75	11.63	7.57
Old Stroop Models	10.86	12.03	8.21
Difference Between Old and New Models Average Residuals	1.11	0.40	0.65

Scoring

- Clarified directions
- More accurate

Interpretation

- Clarify meaning of scales/interpretation strategies
 - Use ALL scales
 - Color-Word- normative comparison
 - Interference- ipsative
 - Example- Plot to right avg scores from UHDRS validation¹- Interference is very Average, but all scales have deficits



Methods & Materials

Administration Update

- Gather user feedback and user data
- Examine for themes and integrate with current standard administration

Literature Review Update

- Identify research with Stroop since previous publication (2003)
- Focus on factors affecting administration, application in emerging settings

Standardization

- Stroop Test with current administration procedures
- 373 participants ages 15-88, nationally representative
- Test-retest
- Concurrent measures-
 - Woodcock-Johnson Letter-Word (LW) and Word- Attack (WA)
 - Nonverbal Stroop Card Sorting Test (Nonverbal Stroop or NSCST)
 - Color-Trails Making Test (CTMT)

Conclusions

Stroop Normative Update

- Clarified administration/scoring/interpretation
- Updated literature review

Standardization

- Nationally representative sample
- Age/education only significant stratification variables
- Models to predict scores, from which residuals and T-scores obtained
- Updated tables grouped by education and age group (Interference segmented)

Structure

- 2 dimensions
- Strong composite reliability (.89),

Reliability

- .50-.90 Test-Retest

Validity

- Correlation with concurrent measures

Contact

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References

Golden, C.J., Freshwater, S.M., Syzdek, B.M., Ailes, E.L.. (2021). *Stroop Color and Word Test Normative Update*. Stoelting.
¹Unified Huntington’s Disease Rating Scale: reliability and consistency. Huntington Study Group. (1996). *Movement disorders* : official journal of the Movement Disorder Society, 11(2), 136–142. <https://doi.org/10.1002/mds.870110204>
 Stroop Information available at: <https://stoeltingco.com/stroop>