

Confirmatory Factor Analysis on the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT®) at Baseline



Aliyah R. Snyder, M.S.^{1,2}, Breton M. Asken, M.S., ATC.^{1,2}, James R. Clugston, M.D., M.S, CAQSM^{2,3}, & Russell M. Bauer, Ph.D., ABPP^{1,2}



¹Department of Clinical and Health Psychology, ²Sports Concussion Center, ³Community Health and Family Medicine University of Florida, Gainesville, FL

INTRODUCTION

- Computerized neurocognitive assessments for concussion such as the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT®) can be useful adjunctive measures for clinical diagnostics.
- ImPACT® proposes that outcomes from its 6 modules create four separate clinical composite scores (see figure 2), but the appropriateness of the composites is debated.
- Exploratory and confirmatory factor analyses (CFA) (Schatz and Maerlander, 2013; Iverson et al., 2005) have shown that two clinical composite scores instead of four may better account for the relationships between the data.
- For this study, we used CFA with different analytical parameters than previous studies to further examine the underlying ImPACT® factor structure.

OBJECTIVE

to assess the dimensionality of factors that compose the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT®)

METHODS

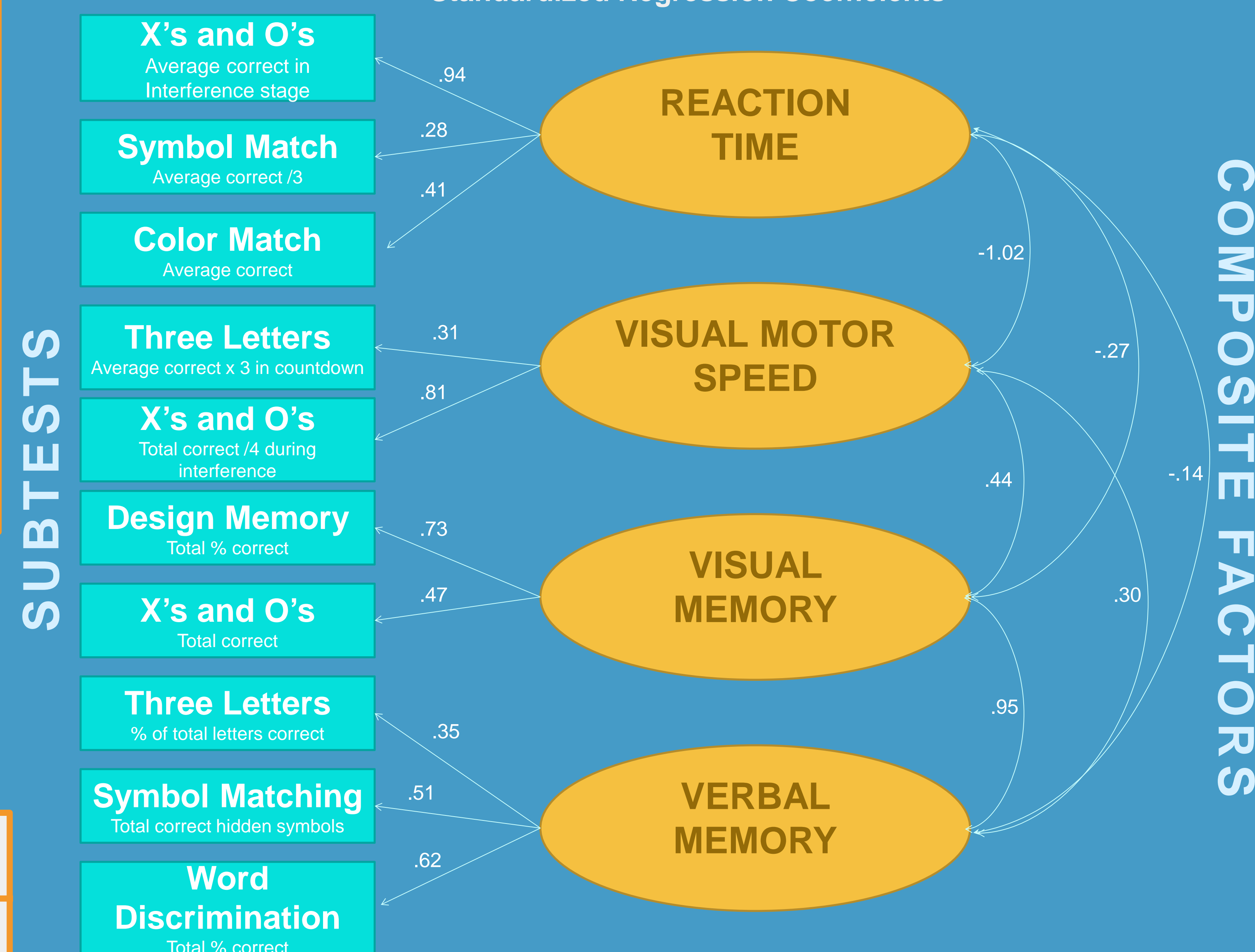
- This study used retrospective, cross-sectional data from the University of Florida Concussion Databank.
- 495 UF collegiate athletes between the ages of 17 to 28 who underwent pre-season baseline concussion assessment were included.
- Only the first assessment was included in the analysis, since many athletes were tested serially.
- All assessments occurred between 2007 and 2015

Participant Characteristics

- Athletes from the following sports were represented in the sample:
 - Baseball, basketball, cross country, track and field, golf, swimming & diving, football, softball, gymnastics, soccer, lacrosse, and volleyball

Demographics	Mean (SD)
Age	19.1 (1.2)
Sex	Frequency (%)
Male	298 (60.2)
Female	197 (39.8)
Previous Concussion History	Frequency (%)
Yes	138 (29.9)
No	323 (70.1)

Figure 1. CFA Four Factor Model Configuration Based on Existing ImPACT® Structure with Standardized Regression Coefficients



RESULTS

A confirmatory factor analysis (CFA) was conducted on retrospective baseline ImPACT® data. The CFA was analyzed using SPSS AMOS on a four factor, oblique model with maximum likelihood estimates.

- Fit indices suggested poor model fit for the proposed four factor solution in our sample (see Table 1).
- Significant overlap was found between:
 - Reaction Time and Visual Motor Speed factors and
 - Visual Memory and Verbal Memory factors
- Individual subtests varied significantly in the amount of variance explained by each of the four factors to which they were assigned (see Table 2).

Figure 2. Graphical overview of measured ImPACT® domains



COMPOSITE SCORES

- Reaction Time
- Visual Motor Speed
- Visual Memory
- Verbal Memory

Table 1. Goodness-of-Fit Indices for the ImPACT® 4-Factor Model

Index	Value	p-value
χ^2	168.1	<.001**
RMSEA	.099	<.001**
TLI ^a	.791	-
CFI ^b	.890	-

^aTucker Lewis Index, ^bComparative Fit Index

Table 2. Variance Explained by Associated Factors

Subtest	Squared Multiple Correlation	Associated Factor
X's & O's Average Interference	.26	Reaction Time
Symbol Match	.38	
Color Match	.53	
Three Letters Countdown	.12	Visual Motor
X's & O's Total Interference	.22	
Design Memory	.10	Visual Memory
X's & O's Total	.78	
Three Letters % of total	.17	Verbal Memory
Symbol Matching	.08	
Word Discrimination	.87	

DISCUSSION

Results from this study demonstrate that the existing four-factor/composite structure of ImPACT® results in poor model fit according to CFA, and these findings are consistent with previous literature. Given evidence of strong multicollinearity between the reaction time and visual motor speed factors and high correlation between visual and verbal memory factors, the two-factor solution proposed by Schatz & Maerlander (2013) describing a speed composite and a memory composite likely better represents the latent factor structure of ImPACT®. Clinical use and interpretation of ImPACT® may need to be re-assessed given the consensus of findings at this point. Our study did not directly test the two-factor solution in AMOS.

REFERENCES

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