

# Validating the Mobile Toolbox: A Remote Assessment for Measuring Cognitive Change

Nowinski, CJ<sup>1</sup>, Pila, S<sup>1</sup>, Kaat, AJ<sup>1</sup>, Amagai, S<sup>1</sup>, Hosseinian, Z<sup>1</sup>, Slotkin, J<sup>2</sup>, Novack, M<sup>1</sup>, Gershon, R<sup>1</sup>

<sup>1</sup>Northwestern University, <sup>2</sup>University of Delaware

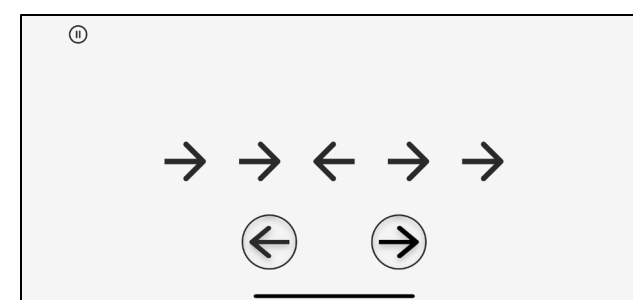
**Methodological Question:** How can we reliably and validly assess cognition in diverse research designs and populations, including in groups who are challenging to reach?

## Introduction

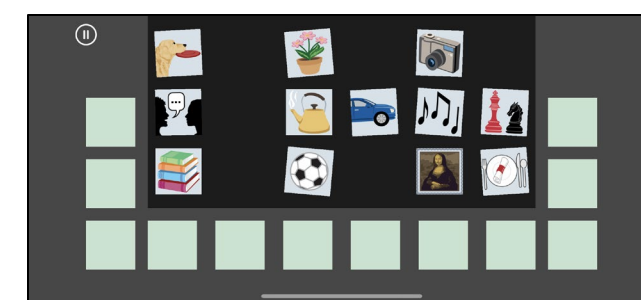
- Detecting cognitive impairment and/or risk factors for brain disease AND differentiating these from typical cognitive aging is critical for developing and evaluating prevention and treatment options for abnormal cognitive decline.
- The **Mobile Toolbox (MTB)** provides standardized assessment tools to address this need and reduces barriers to testing diverse populations.
- MTB enables remote, smartphone-based (iOS and Android) assessment of cognition, increasing the ability to conduct research with a broad range of participants.
- MTB includes an expandable library of brief cognitive tests (several adapted from the NIH Toolbox<sup>®</sup>) plus a complete HIPAA-compliant, research platform for app creation, study management, data collection, and data management.
- We present initial validity and reliability evidence for the first eight cognitive measures available through MTB.

### Examples of MTB Measures:

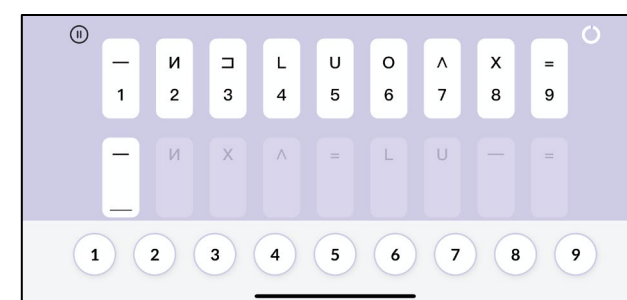
Flanker



Picture Sequence Memory

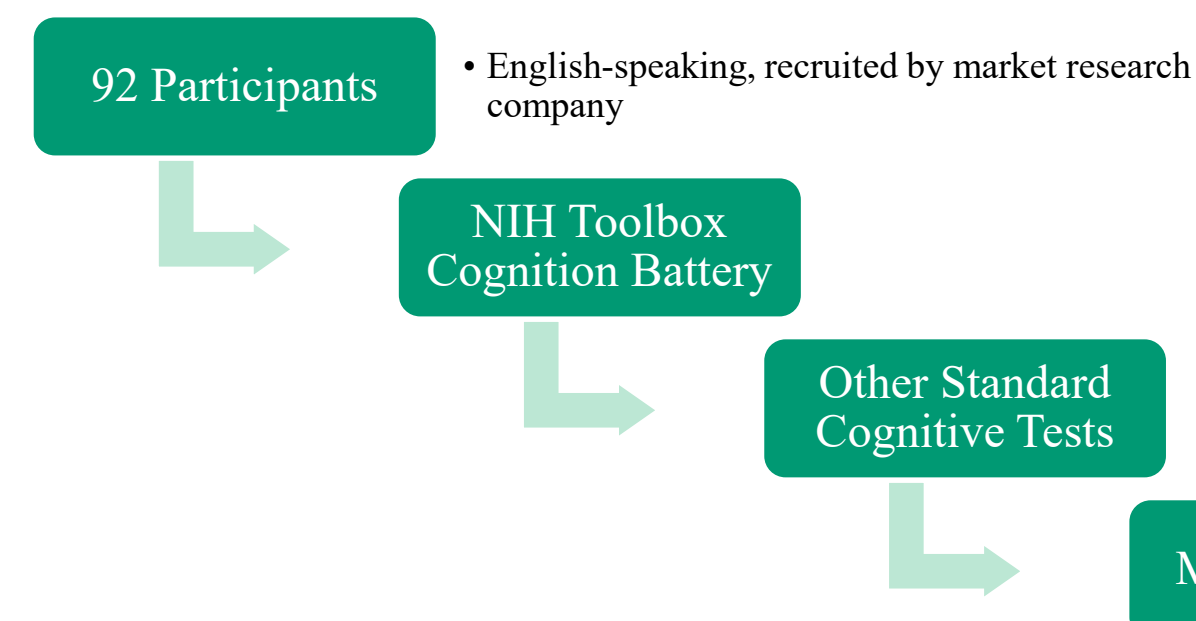


Number Match



## Methods

### Procedures:



### Analyses:

- Reliability -> split-half reliability, Cronbach's alpha or IRT-based indices
- Convergent validity -> correlations with measures of same or similar constructs

## Results

### Participant (N=92) Demographics:

- Age: Range = 20-84; mean = 49
- Sex: 67% female
- Race/ethnicity: 52% White, 33% Black, 14% other; 99% non-Hispanic

MTB Test	Domain	Reliability Estimate	Comparable Measure	Validity Estimate*
Flanker Inhibitory Control	Attention/ Executive Function	iOS = 0.93 Android = 0.94	Delis Kaplan Executive Function System (D-KEFS) Color-Word Interference Test	-0.44**
Vocabulary	Language	0.81	Peabody Picture Vocabulary Test (PPVT)	0.78
Spelling	Language	0.80	Wechsler Individual Achievement Test (WIAT-4) Spelling	0.86
Face-Name Associative Memory Exam (FNAME)	Memory	0.73	Wechsler Memory Scale (WMS-IV) Verbal Paired Associates I and II	Immediate: 0.54 Delayed: 0.53
Dimensional Change Card Sort (DCCS)	Executive Function	iOS = 0.93 Android = 0.98	Wisconsin Card Sorting Test (WCST-64)	0.41
Picture Sequence Memory (PSM)	Episodic Memory	0.69	Wechsler Memory Scale (WMS-IV) Verbal Paired Associates I and II	Immediate: 0.71 Delayed: 0.73
Memory for Sequences	Working Memory	0.90	WAIS-IV Digit Span, Letter Number Sequencing	Digit Span: 0.71 LNS: 0.73
Number Match	Processing Speed	iOS = 0.98 Android = 0.99	Wechsler Adult Intelligence Scale (WAIS-IV) Symbol Search and Coding	Coding: 0.71 Symbol Search: 0.61

\*all significant at  $p < 0.01$ ; \*\*Measures are scored in opposite directions

## Conclusions and Next Steps

- Validation is an essential step in the development and dissemination of the MTB.
- Initial results show satisfactory internal consistency and convergent validity for MTB tests.
- MTB will become publicly available in June 2023 and these results provide evidence researchers need to make an informed decision about using MTB when studying cognition.
- Further development and evaluation of MTB is ongoing. Current and future work includes:
  - Creation of normative scores based on results from a large sample of adults representative of the US population (Available Summer 2022)
  - Longitudinal evaluation in clinical samples, including persons at risk for MCI or AD, cognitively impaired and those with Parkinson's disease
  - Creation of a Spanish-language version of MTB
  - Addition of other measures of cognition and measures of emotional health, motor and sensory functioning

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