



The NIH Toolbox Project: Learning and Memory (introducing the IBAM)

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Choosing measures

- Applicable across the age span (3-85 years)
 - Intellectual property
 - Psychometrically sound
 - Brief & easy to use
 - Applicable to a variety of settings and different subgroups
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The process

- Review of the literature
 - Conversations with experts
 - Initial development and pilot testing
 - Formal pilot testing ($N = 120$)
 - Pre-testing with validation measures ($N = 150$)
 - Validation ($N = 600$)
 - Norming
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The domain: Learning and memory

- Acquisition, retention, and retrieval of new information
 - One of 6 cognitive sub-domains targeted for inclusion in Toolbox
 - Survey of 147 NIH-funded researchers, 80% identified *memory* as one of the “...four areas of cognitive functioning most relevant for the Toolbox measures to assess...”
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Challenges in measuring learning and memory from 3-85 years

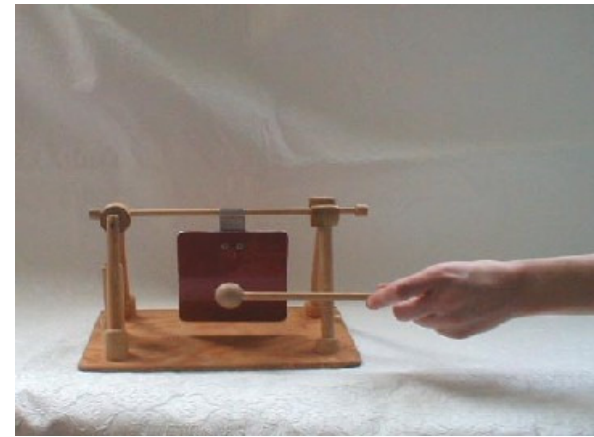
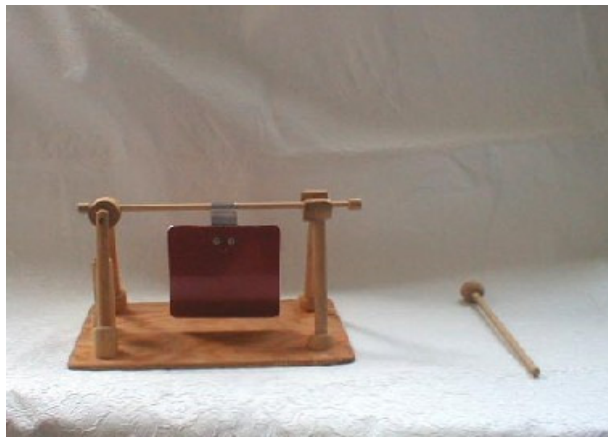
- Typical tests are either
 - verbally based (e.g., lists of words to learn and remember), or
 - impose performance demands that younger and/or older participants may not be able to meet (e.g., reproducing a figure from memory)
 - No existing measure that spans the entire age range or could be adapted for the entire range
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Developing the Imitation Based Assessment of Memory (IBAM)

- IBAM based on a measure used with preverbal infants and young children (< 3 yrs)
 - elicited/deferred imitation



In elicited/deferred imitation...



Elicited/deferred imitation: A nonverbal analogue to verbal report

- Populations with impaired performance on traditional recognition/recall tasks show impaired performance
 - adult-onset amnesia (McDonough et al., 1995)
 - developmental amnesia (Adlam et al., 2005)
 - Once requisite language acquired, memories are verbally accessible (Bauer et al., 1998, 2002, 2004; Cheatham & Bauer, 2005)
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Adaptations for the NIH Toolbox

- 2D pictures rather than 3D objects
 - Adjust demand by increasing sequence length (6 to 15 steps)
 - Improve psychometric properties by administering multiple trials of each sequence
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Procedure

- Practice 3 sequences
 - criterion = correct ordered reproduction
 - maximum = 4 trials
 - Administer 1 test sequence
 - Trial 1: demonstrate/response
 - Trial 2: demonstrate/response
 - Trial 3: demonstrate/response
 - Dependent measure = Total # correctly ordered adjacent pairs
 - 1-2-3 = 2 correctly ordered adjacent pairs
 - 1-3-2 = 0 correctly ordered adjacent pairs
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“I am going to make a birthday cake. Watch how I do it.”

After 3 practice trials

- One test sequence
 - Different lengths for different ages (empirically derived)
 - 3-4 years 6 step
 - 5-6 years 9 step
 - 7-8 years 12 step
 - 9 years-Adult 15 step
 - 65-85 years 12 step
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6 steps
(3- to 4-year-olds)

15 steps
(9- to 64-year-olds)

“Evolution” of the IBAM: From experimental to Toolbox-bound measure

- Several phases of pre-testing; several procedural changes over time
 - Not all data available on all age groups
 - To date, all data based on manual version; computer version to be tested in next phase
 - Although yet to enter validation phase, some validation information, with Rey Auditory-Verbal Learning Test (RAVLT) as the “Gold Standard”
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Establishing seq length: Pre-pretesting

Age group	N	# steps	% AP IBAM (\sum 3 trials)	RAVLT (\sum 3 trials)
3-4 years	5	6	59%	NA
5-6 years	5	9	56%	NA
7-8 years	6	12	60%	57%
9-11 years	5	15	59%	57%
Young adults	11	15	55%	67%
Older adults	13	12	47%	61%

IBAM/RAVLT – Pretesting Test/Retest performance

Measure	3-4 years 6 steps (N = 35)	5-6 years 9 step (N = 7)	18-50 years 15 step (N = 40)	65-85 years 12 step (N = 13)
Test				
IBAM	29% (0%-100%)	70% (33%-100%)	63% (26-93%)	47% (24-79%)
RAVLT	NA	NA	71% (49-100%)	61% (47-80%)
Retest				
IBAM	43% (7-100%)	79% (38-100%)	83% (48-100%)	NA
RAVLT	NA	NA	77% (58-96%)	NA

IBAM/RAVLT – Pretesting Test/Retest correlation

Measure	3-4 years 6 steps (<i>N</i> = 16)	5-6 years 9 step (<i>N</i> = 3)	18-50 years 15 step (<i>N</i> = 18)	65-85 years 12 step
Test				
IBAM	.79*	.98*	.67*	NA
RAVLT	NA	NA	.75*	NA

IBAM/RAVLT – Pretesting IBAM w/ RAVLT

Measure	3-4 years 6 steps	5-6 years 9 step	18-50 years 15 step (<i>N</i> = 11/40)	65-85 years 12 step (<i>N</i> = 13)
IBAM w/ RAVLT	NA	NA	.59*/.24 ns	.64*

Thus far...

- Transitioned from experimental measure to possible Toolbox measure
 - 3D to 2D
 - developed computer version
 - Determined optimal sequence length
 - Established acceptable test-retest reliability
 - Promising correlations with validation measure (RAVLT)
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Next steps...

- Pre-testing with computer version ($N = 150$)
 - Validation ($N = 600$)
 - 3-4 years No validation measure
 - 5-7 years Children's Memory Scale (CMS)
 - 10-17 years CMS, RAVLT, BVMT-R
(Brief Visuospatial Memory Test-R)
 - 18-85 years RAVLT, BVMT-R
 - Norming
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