

Development and Validation of the Boehm Test of Basic Concepts

South Pacific Educators
in Vision Impairment

Auckland, NZ

16 January 2013



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Bringing
education
to life.

PLEASE NOTE:
**All videos have been removed from
this presentation to honor
confidentiality agreements with
families.**

**Images from the original Boehm-3
Preschool have also been removed to
preserve the integrity of the test.**

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Developed by the
**American Printing House
for the Blind**

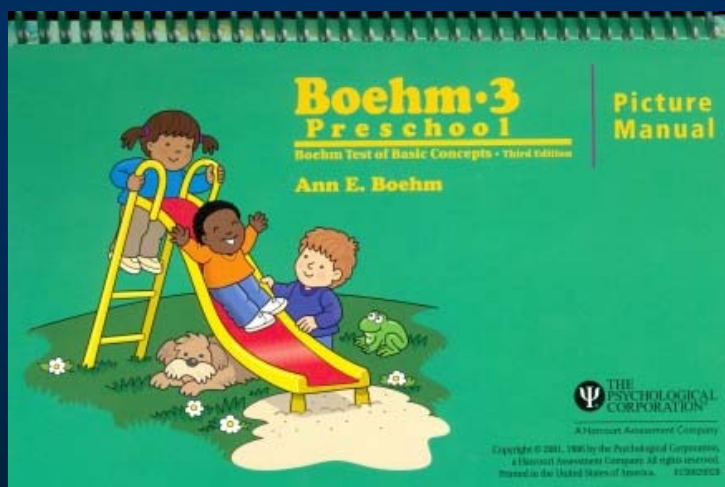
with special thanks to Ann Boehm
and Barbara Henderson

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**Tactile Adaptation of the
Boehm-3 Preschool**



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The Importance of Choosing the Boehm-3 Preschool

- History of tactile adaptation of school-age Boehm
 - Tactile Test of Basic Concepts
 - Hilda Caton, 1967
- Individually administered to children ages 3 years 0 months to 5 years 11 months

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Importance, continued

- Assesses young children's understanding of basic relational concepts:
 - Important for language and cognitive development.
 - Linked to academic success in school
 - Understanding of directions and classroom routines.
 - Critical aspect of emerging literacy.

Ferrell (1998, 2011); Dunst & Gorman (2011)

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Technical Construction Boehm-3 Preschool

- Downward extension of the Boehm Test of Basic Concepts (BTBC) (Boehm, 1971)
- 660 children, ages 3-0 to 5-11 years
- Stratified by age, gender, race/ethnicity, parent education level, geographic region to replicate the US population

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Technical Construction, continued

- Internal consistency: .85 to .92
- Test-retest reliability: .90 to .94
- Content validity:
 - Correlation with Boehm school-age = .84
 - Correlation with Bracken Basic Concepts Scale-Revised = .80 (3-year-olds) and .73 (5-year-olds)

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Concepts Measured

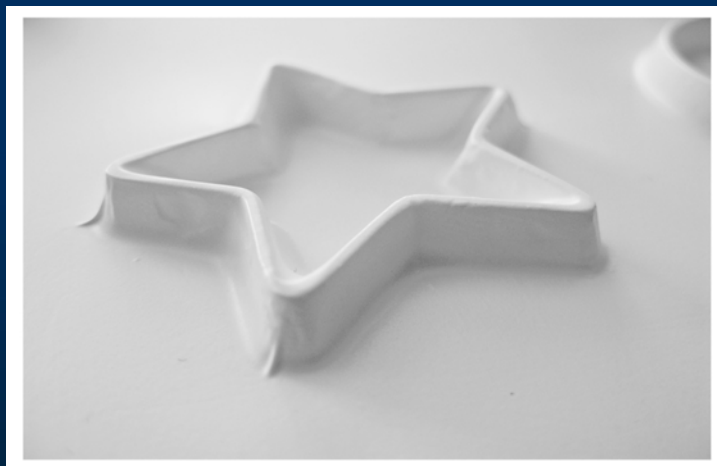
Child Age	Space (where?)	Quantity (how many?)	Time (when?)	Other
3 yrs 0 mos to 3 yrs 11 mos	Top	Empty	Finished	Missing
	Down	Another		
	Under	Full		
	Highest	All		
	Next			
	Up			
3 yrs 0 mos to 5 yrs 11 mos.	Outside			
	Nearest	Many	Smallest	Different
	Across	Most	Longest	Same
	In front	Largest	Both	
	Around		Tallest	

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Child Age	Space (where?)	Quantity (how many?)	Time (when?)	Other
4 yrs 0 mos to 5 yrs 11 mos	Before	Shortest		
	Farthest	Some, but not many		
	Lowest	Least		
	Last			
	Bottom			
	Together			
	Middle			
	First			
	Between			
	Right			
	Left			
	Corner			

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APH Tactile Treasures Items Consulted for Familiarity and Inspiration



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Tactile Items

- Functional and Familiar Items
 - Buttons, zippers, spoons, etc
- Shapes and Representations
 - Circles, squares, stars
- Engagement
 - Gingerbread cookie

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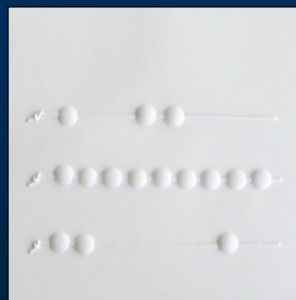
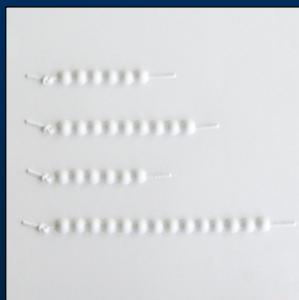
Prototype Development: What does Recent Haptic Research Suggest?

- Limit number of symbols to three or less to address cognitive load concerns

(Spence & Gallace, 2007)

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- Original Boehm-3 Preschool included four stimuli for each item to reduce possibility of guessing.
- An equal number of test items with three or four stimuli were randomly assigned for field test.



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Pilot Study Results: Three vs. Four Stimuli

3 vs. 4 stimuli	% Passing 3- items	% Passing 4- items
$n = 12$	85.6	79.4

- Although more participants passed the 3-item stimuli, there was no significant difference.
- Majority of teachers preferred 4-stimuli.
- Revisions revert to 4-stimuli.

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Prototype Development: What does Recent Haptic Research Suggest?

- Preliminary studies with young children with visual impairment show that:
 - Both hands move together in synchrony
 - The hands show a preference for textures that are increasingly dense
 - Once a complex texture is found, movement patterns are slowed for further exploration

Schellingerhout, Smitsman, & Cox (2005)

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Pilot Study Results: Both Hands Move in Synchrony

- Qualitative video evidence indicates that two-handed tactile scanning is **not required** to discriminate concepts or test items.
- Most subjects favored one hand or the other to explore items.
 - High-level tactile skills do not appear to be related to concept understanding for this age range.

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Child Using Tactile Prototype

Child video clip removed.

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Pilot Study Results: Preference for Dense Textures

Children demonstrated a marked preference for stimuli with texture, or beads:



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Child video clip removed.

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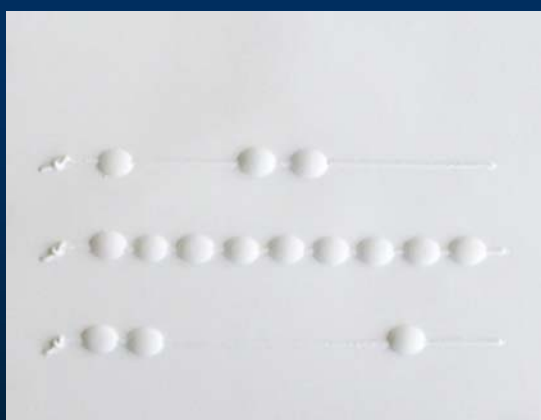
Pilot Study Results: Complex Textures Slow Movement

- Further research with a larger sample necessary
- “Familiarity” rather than “complexity” seems related to speed of understanding
- Concerted effort to replicate everyday stimuli (such as zippers, spoons, buttons, bead strings, etc.), to encourage child to attend to concept being measured.
- Engagement also a factor (gingerbread cookie).

Decker, 2010; Spence & Gallace, 2007.

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Bead Strings Create Good Discrimination Even When Fatigue Sets In



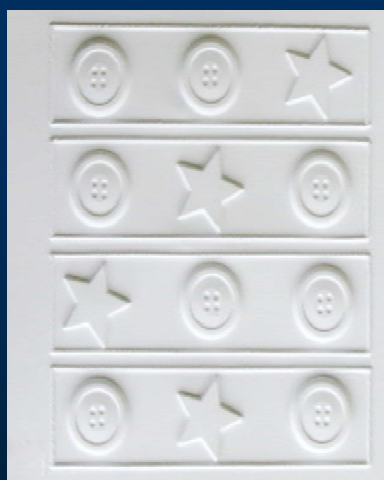
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Stars and Buttons are Good “Distractor” Combinations



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(Stars and Buttons are Good “Distractor” Combinations)



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Additional Issues

- If distractors are significantly different from each other, focus remains on the concept (Pathak & Pring, 1989)
- Size of stimuli affects task time (Berla, 1972; Millar, 1978)
- Concepts of motion (across, pointing up)

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Additional Issues, continued

- Appropriateness of age-bands for tactile assessment
 - 4-6 age range was the only group that displayed significant difficulty in mastery of the tactile perceptual functioning skills on the Tactual Profile (Withagen, Mathijs, Janssen, Knoors, & Verhoeven, 2010)
- Volume vs. number
 - Some vs. many
 - Least vs. most

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Additional Issues, continued

- Eliminate 3-dimensional representations
- Create performance items
 - In front of / behind
 - First (in line)

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Teacher Feedback

- Stimuli appropriate for children with low vision, blindness, multiple disabilities, learning disabilities
- Favorite items: Gingerbread cookies, stars, zippers, spoons
- Not-so-favorite: Boxes around groups of objects, arrows

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[Original test item in this position removed]



Child video clip removed.

Manipulatives

Child video clip removed.

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Pilot Study Results: Age-Appropriate Items

Age	Percent Passing	
	3 year olds	4 & 5 year olds
<i>n</i> = 12	0.875%	0.948%

Preliminary data indicated that the tactile version of the Boehm-3 Preschool shows developmental progress across age ranges.

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Next Steps

- Revised tactile and large print adaptations of Boehm-3 Preschool now in production
- Test of Basic Concepts, Third Edition (Boehm-3) (2000) for Kindergarten – Third Grade now in development
- Phenomenological study of how teachers of students with visual impairment teach basic concepts to preschool children

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Grant Proposal

- Institute for Education Sciences, US Department of Education
- 3-year project, US \$1.6M
- 600 participants from collaborating agencies and itinerant teachers
 - 300 tactile, 300 large print
- Additional 240 participants with additional disabilities
 - 120 tactile, 120 large print

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Grant Proposal, continued

- Randomly-select participants for
 - Test-retest (300 + 90) (reliability)
 - Brigance (120) (concurrent validity)
 - Oregon (120) (concurrent validity)
 - Tactual Profile (60) (concurrent validity)

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Grant Proposal, continued

- Randomly select participants for video strategy analysis (135):
 - Positioning
 - Hand use
 - Exploratory procedures
 - Cognitive strategies

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Other Test Items

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Biggest (since revised)

[Original test item in
this position removed]

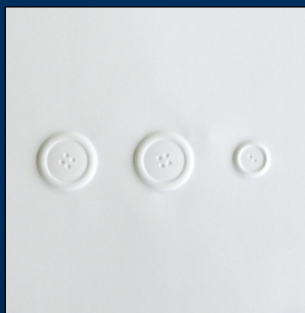


Look at all the candy.
Point to the *biggest*
one.

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Different (since revised)

[Original test item in this position removed]



Point to the shoe that is *different*.

Farthest (since revised)

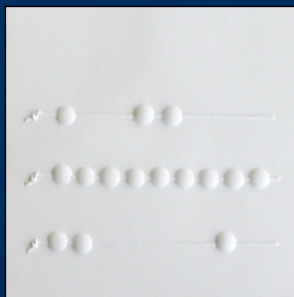
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Here is a boy. Point to the duck that is *farthest* from the boy.

Full (since revised)

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this position removed]

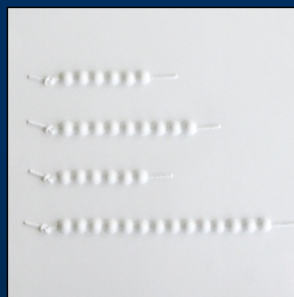


Point to the jar that
is *full* of jellybeans.

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Longest

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this position removed]



Point to the *longest*
train.

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Lowest (since revised)

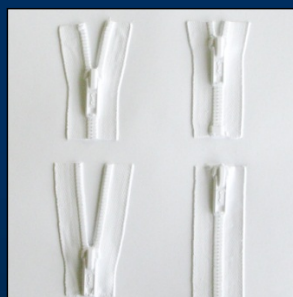
[Original test item in this position removed]



Point to the bear that is *lowest* on the shelf.

Up

[Original test item in this position removed]



Point to the dog that is going *up* the stairs.

Big Picture Book -- UP

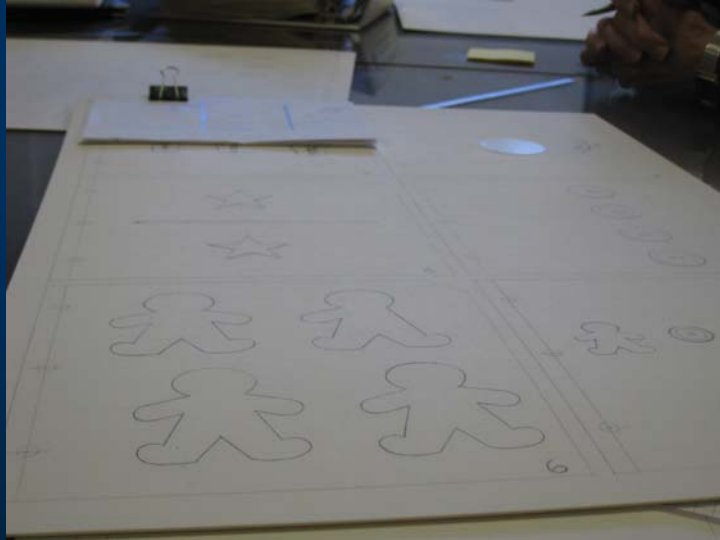
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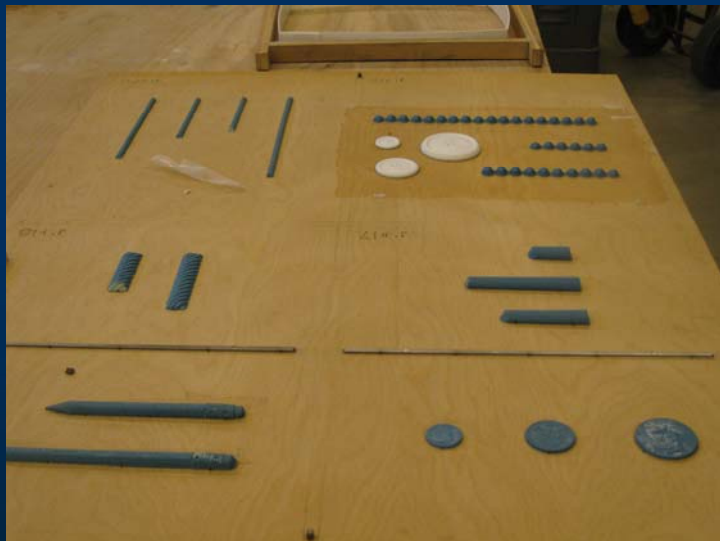
Our Model Makers



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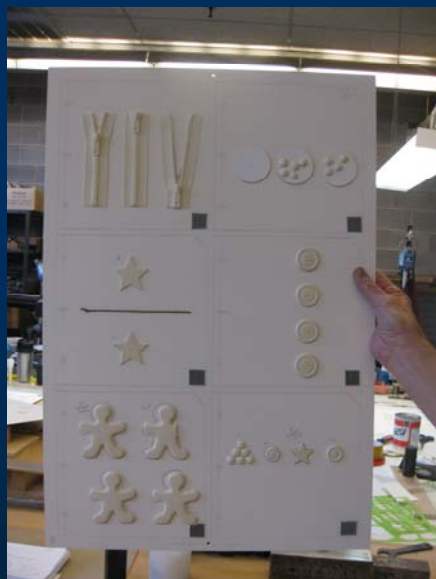
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Changes in Large Print Version

- Simplify drawings
 - Color contrast
 - Shadows
 - Size
 - Binding
- Number of items not an issue

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Big Picture Book -- TOP

[Original test item in
this position removed]

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Big Picture Book – IN FRONT

[Original test item in
this position removed]

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Big Picture Book -- INSIDE

[Original test item in
this position removed]

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Big Picture Book -- LOWEST

[Original test item in
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Big Picture Book -- BOTTOM

[Original test item in
this position removed]

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Preschool (Boehm-3 Preschool). Copyright
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