NCS Formative Project

Assessment of Executive Function for

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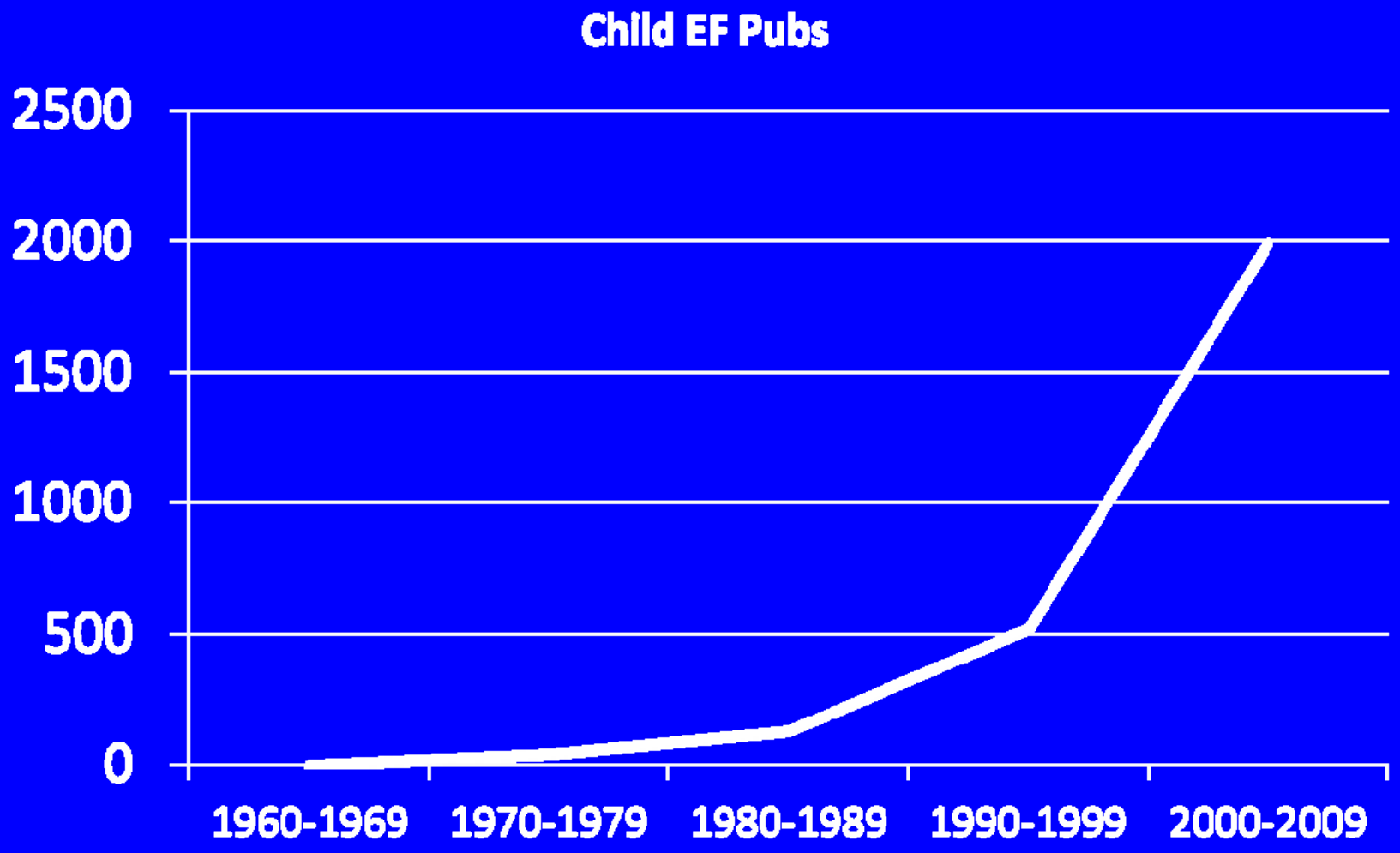
Executive Function

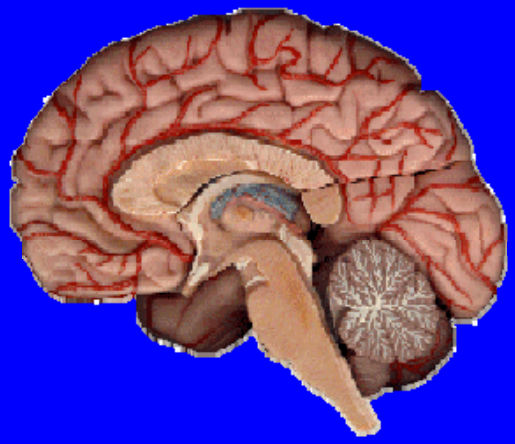
- Processes involved in top-down control of thought, action, and emotion
- Including working memory, inhibitory control, and cognitive flexibility
- Manifested in attention, rule-use, planning, and delay of gratification
- Most conspicuous in its absence
  - Neuropsychiatric patients
  - Children

Publications about EF over Time



Development of EF

- Time course linked to PFC dev: protracted (thru 20s)
- Striking improvements in the preschool years
- Common impairment in several dev disorders
- Dependent upon genetic, brain, cognitive, and social processes



Importance of EF Skills

- Predict health and other important developmental outcomes
- Develop over the life course
- Burgeoning area of research in developmental neuroscience
- Implicated as protective factor in studies of high-risk children
- Show malleability in prevention and training studies

(Blair & Razza, 2007; Carlson 2005, 2011; Diamond et al., 2007, Masten et al., 2008 CURA article; Obradović, 2010; Sapienza & Masten, 2011; Zelazo et al., 2003, 2008)

Project Aims

Adapt measures of EF for NCS to improve usability and validity with diverse preschool children and their parents for whom EF may be an important vulnerability or protective factor.

- Developing brief EF measures suitable for NCS
- Downward extension of NIH Toolbox EF tasks
- Adapting and extending the CBQ

Why Toolbox and CBQ measures?

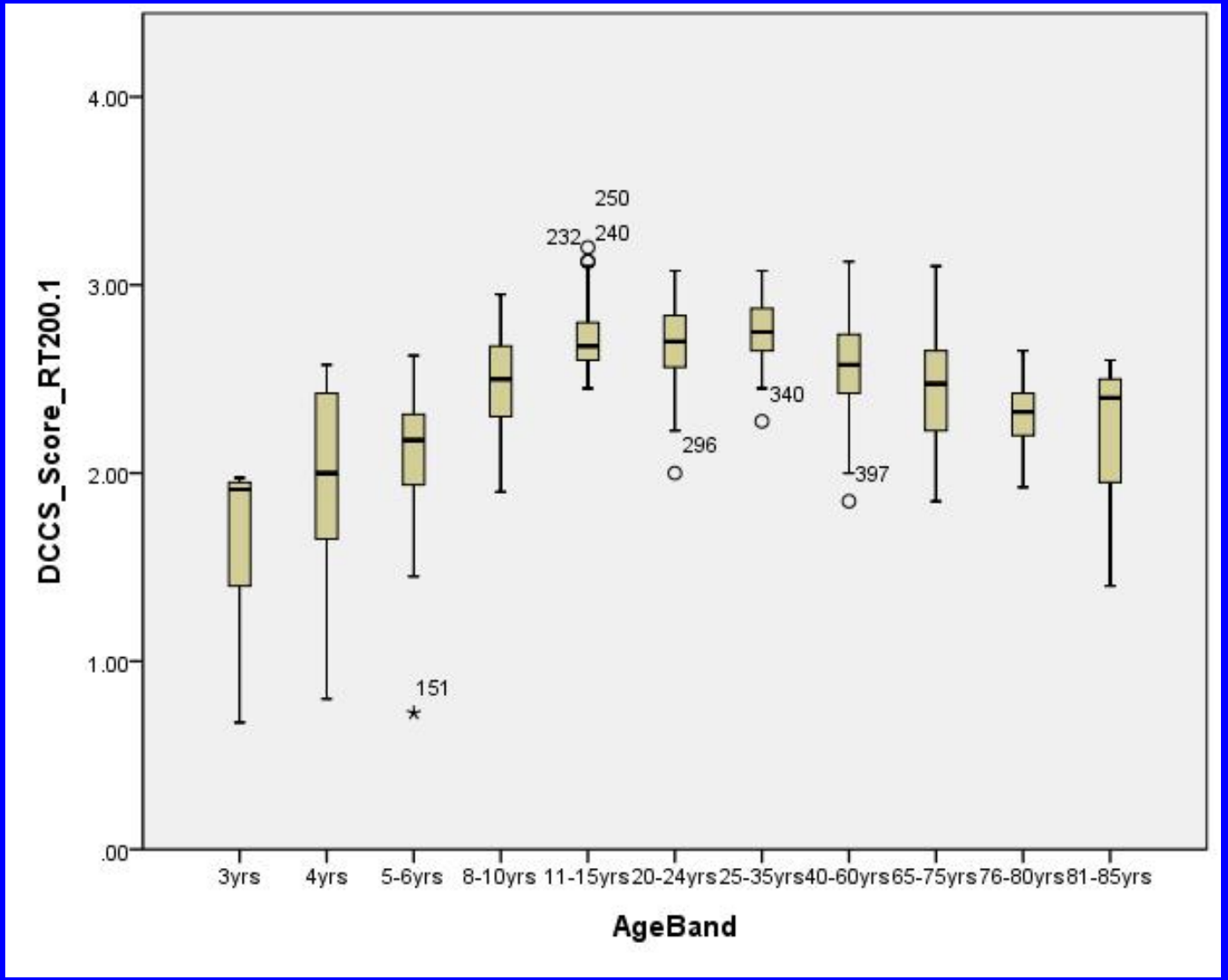
- Measures widely used or expected to be
- Free
- Good potential for brief assessments
- Already under consideration for NCS
- Expertise of Minnesota team

NIH Toolbox in a Nutshell

- Purpose
  - Create a battery of standardized measures that are brief (< 5 min each), reliable, valid, suitable for ages 3 to 85, with minimal practice effects, free, available in Eng and Spanish, normed on 4000+
  - Validation study completed (under review)
  - Philip Zelazo/Jacob Anderson developed, implemented EF tasks
- EF tasks
  - Inhibition (Flanker)
  - Cognitive flexibility or set shifting (DCCS)
  - Attention
    - accuracy and RT on Flanker congruent trials

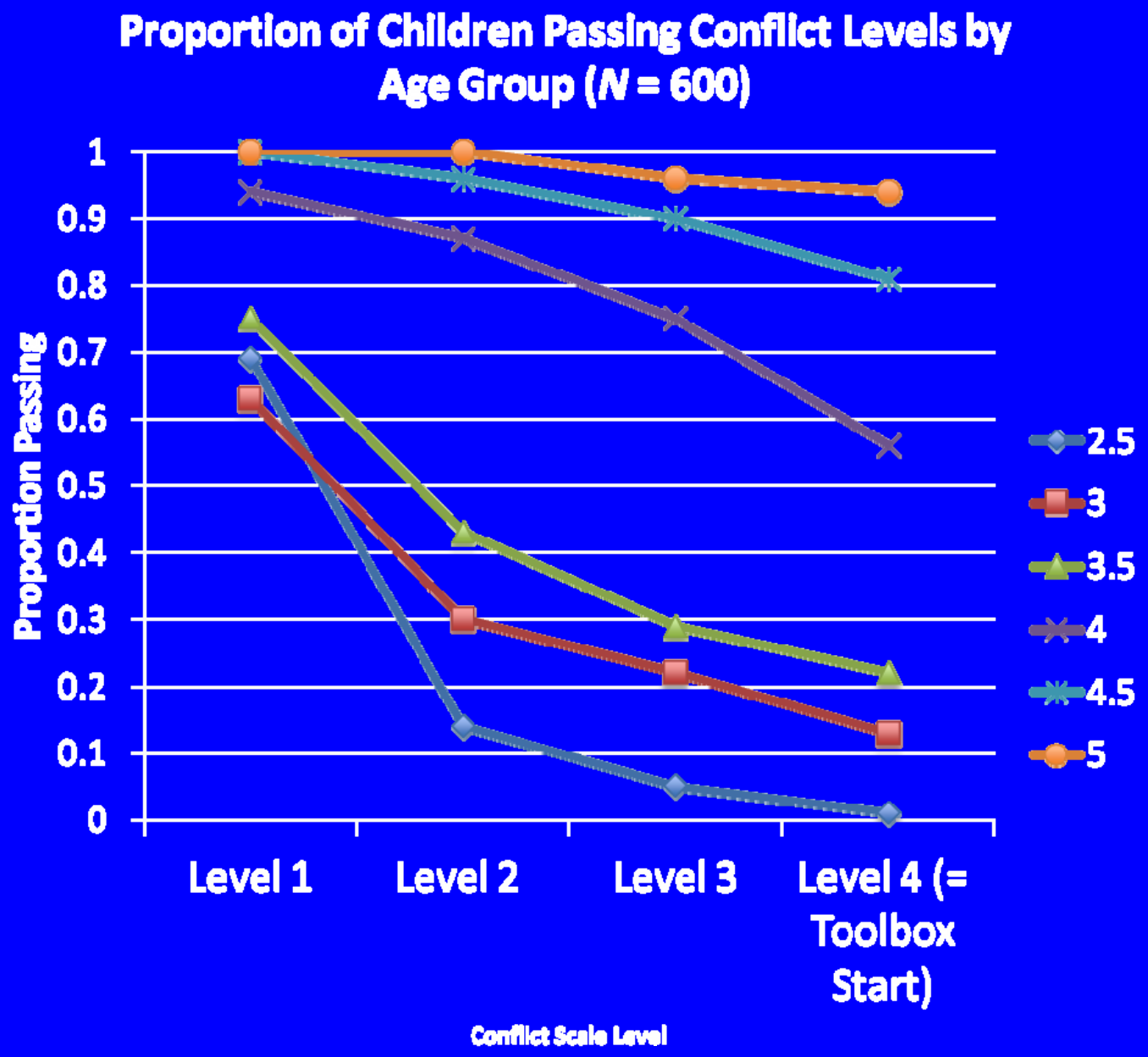
NIH Toolbox DCCS x Age

Zelazo et al., in press



Overview of Downward Extension

- Toolbox limitations for disadvantaged children
  - Floor too high for 3-5 year olds in our experience
- Carlson's Executive Function Measurement (EFM) project, NICHD Interagency Consortium on Outcome Measures
- General strategy for Dext
- DCCS adapted first (based on EFM)
- Flanker adapted to make direction of middle fish more salient with color, border, and spacing


Proportion of Children Passing Conflict Levels by Age Group (N = 600)
Proportion Passing
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Level 1
Level 2
Level 3
Level 4 (= Toolbox Start)
Conflict Scale Level
2.5
3
3.5
4
4.5
5

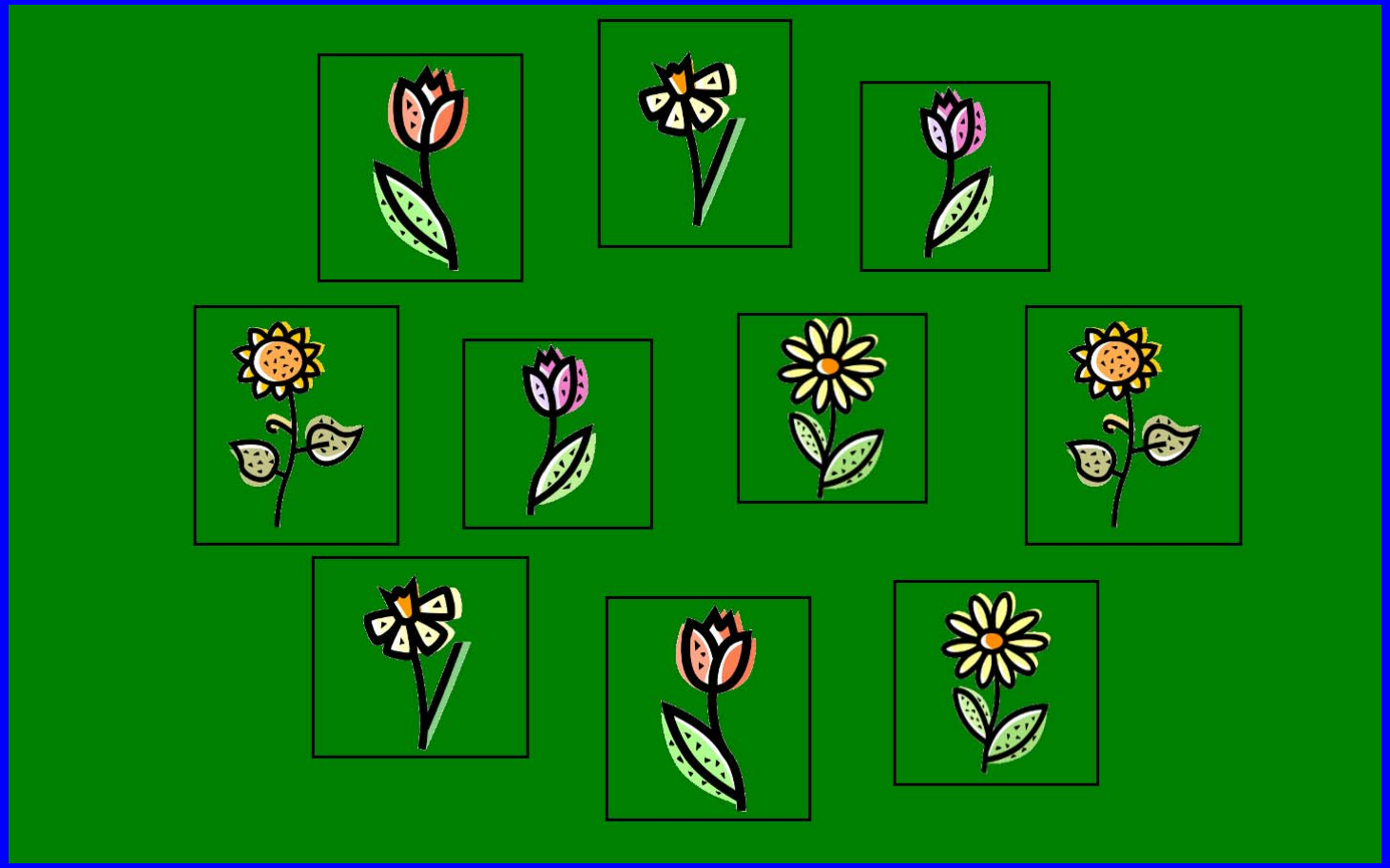
Study Design

- Participants recruited for targeted diversity: families living in emergency shelter; community-based, low-income families with a preschool child; and a university participant pool. Data collected from child, parent, and teacher.

Phase 1: Adapt measures and conduct preliminary pilot testing

- Create the Flanker-Dext and DCCS-Dext to lower the floor of the tasks
- Adapt the CBQ-VSF (36 items); Create the CBQ-VSF-EF question pool
- Evaluate appeal, time burden, usability, preliminary validity
- Modify the adapted measures based on piloting

Touchscreen Training screen example

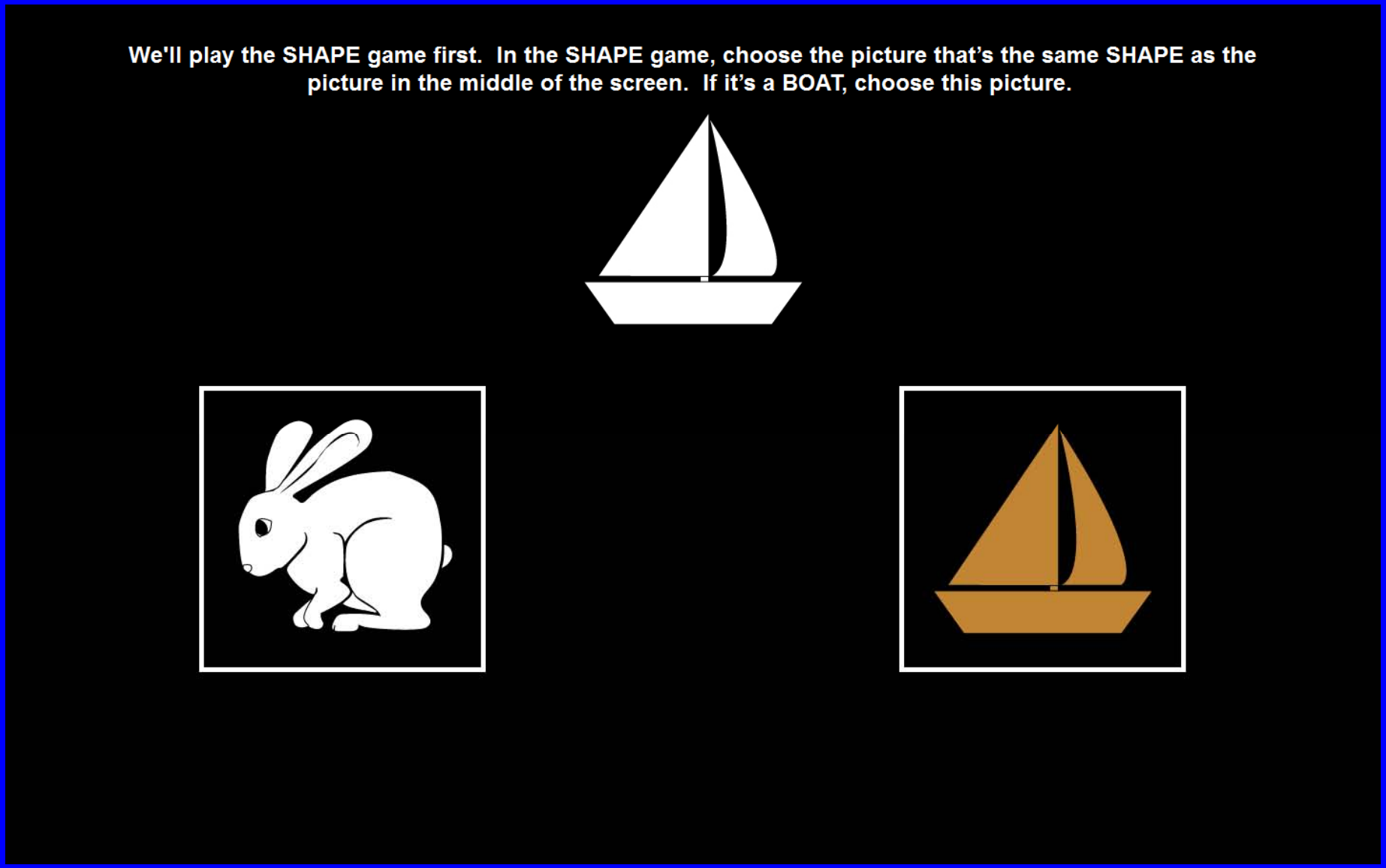


Last Touchscreen Training screen

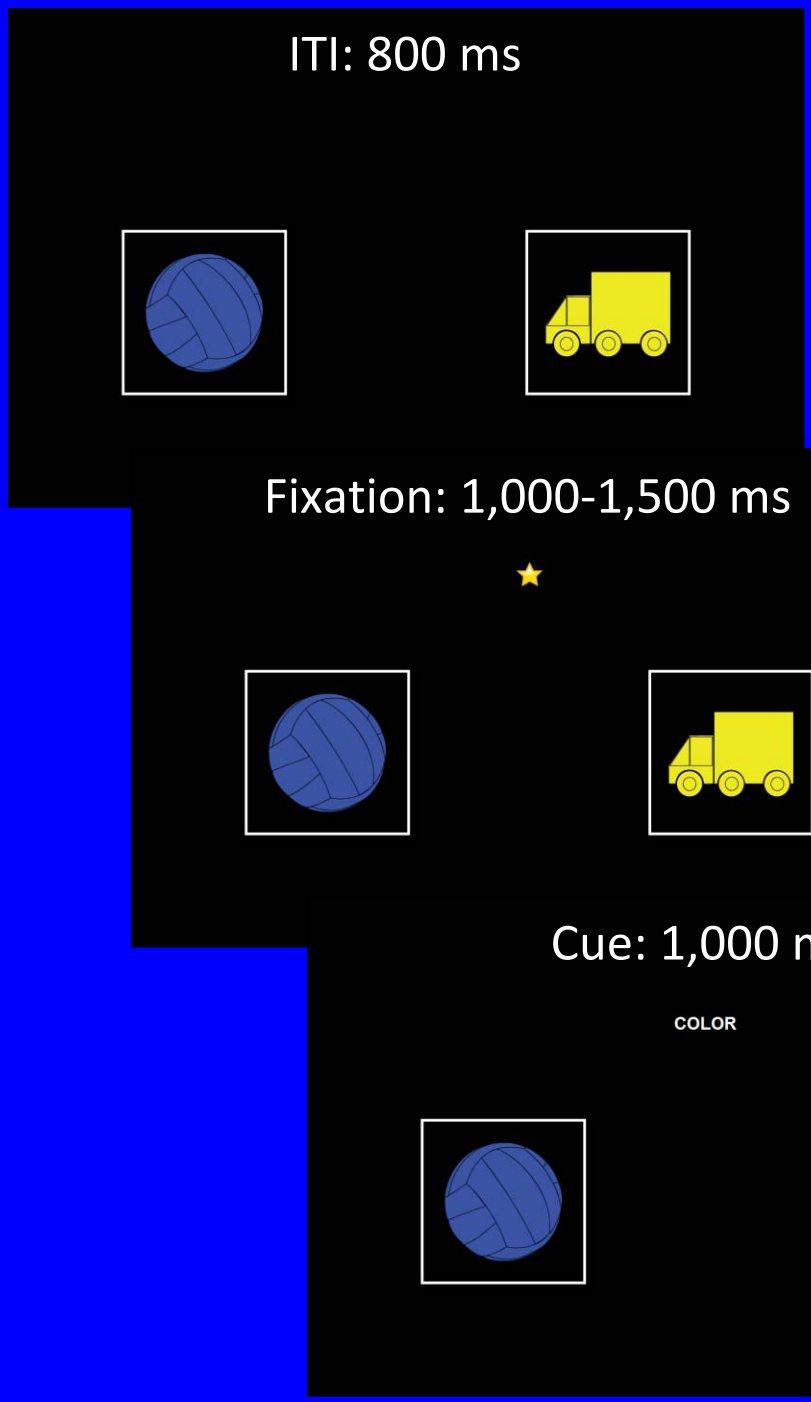
Good job!

Now you're ready to start the activities.
For the next two activities, you will have to put your finger back to "Home Base" between screens.

Toolbox DCCS instruction screen example

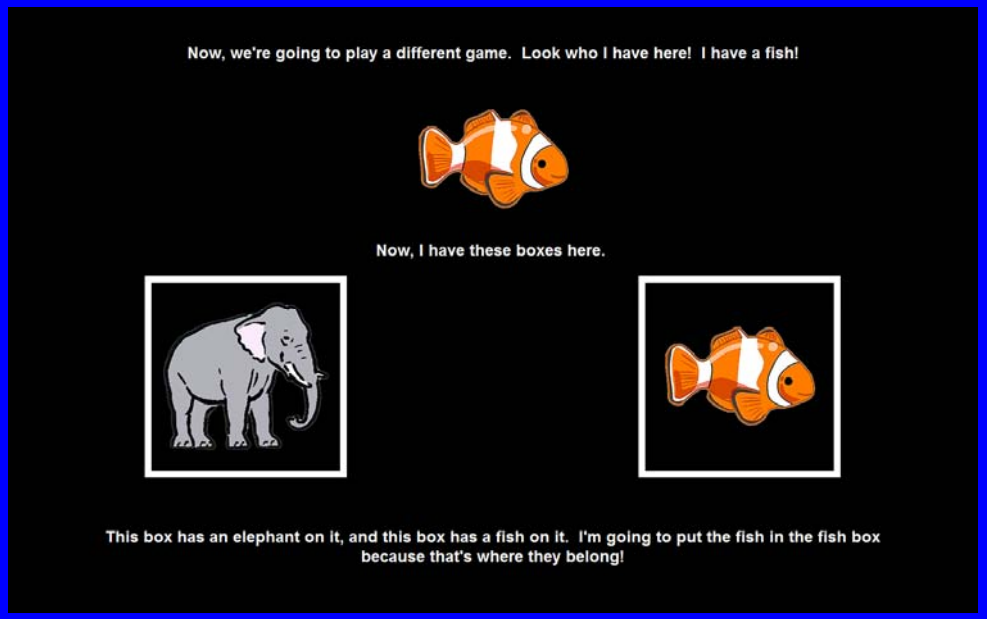


DCCS Trial Sequence: Toolbox

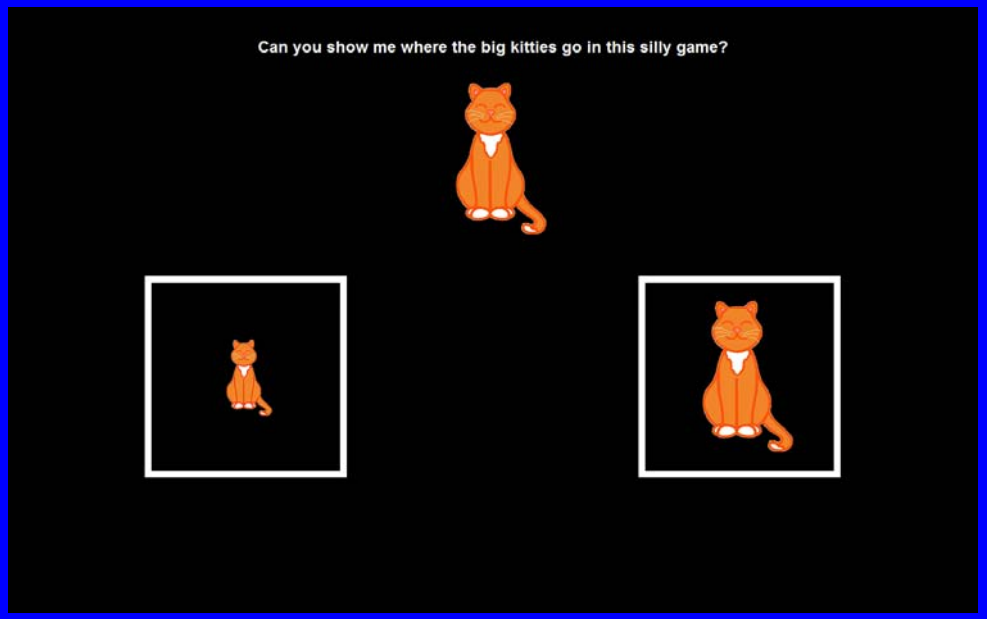


DCCS-Dext test screen examples

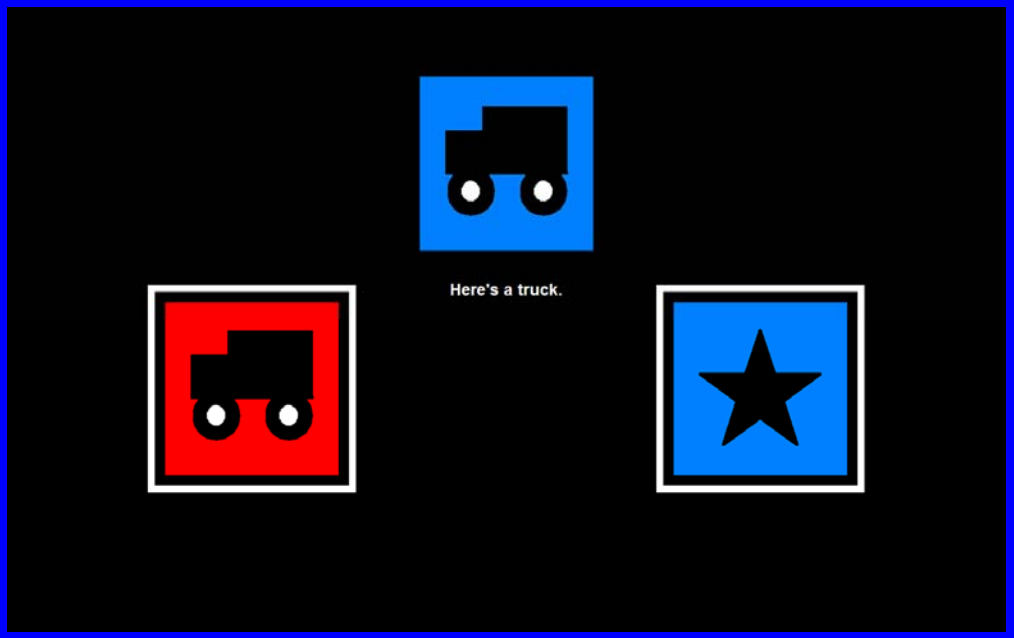
DCCS Dext Level 1



DCCS Dext Level 2

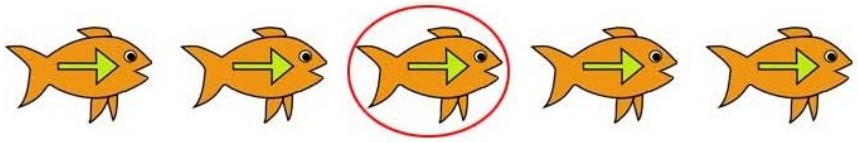


DCCS Dext Level 3

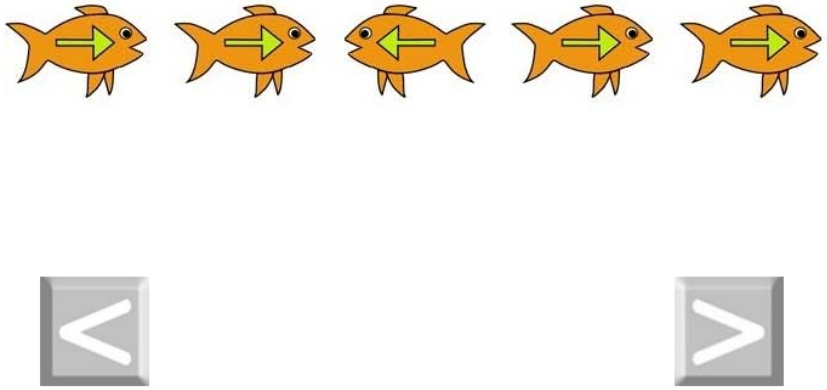


Toolbox Flanker instruction screen example

Here the MIDDLE fish is circled. Can you point to the MIDDLE fish?



Toolbox Flanker test screen example: incongruent trial



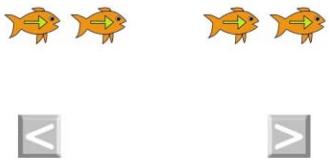
Flanker Trial Sequence: Toolbox & Dext (Following Slide)

ITI: 800 ms

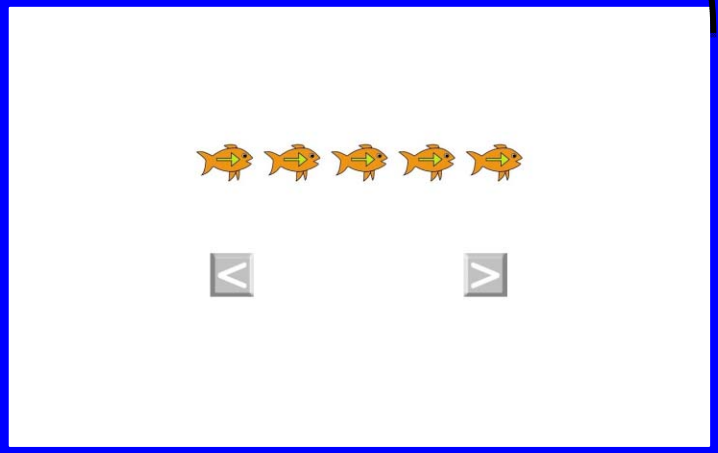
Fixation: 1,000-1,500 ms

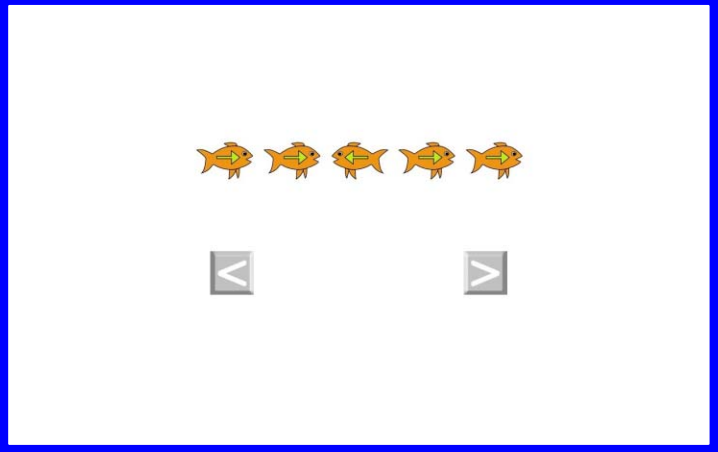
Cue: 1,000 ms

Flankers: 100 ms



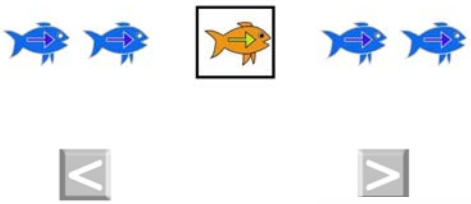
Test: 10,000 ms



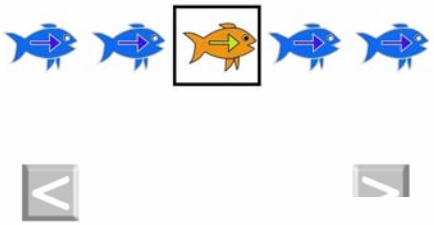


Flanker-Dext test screen examples

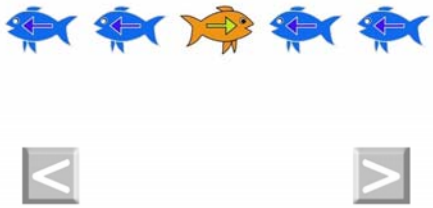
Flanker Dext Level 1



Flanker Dext Level 2



Flanker Dext Level 3

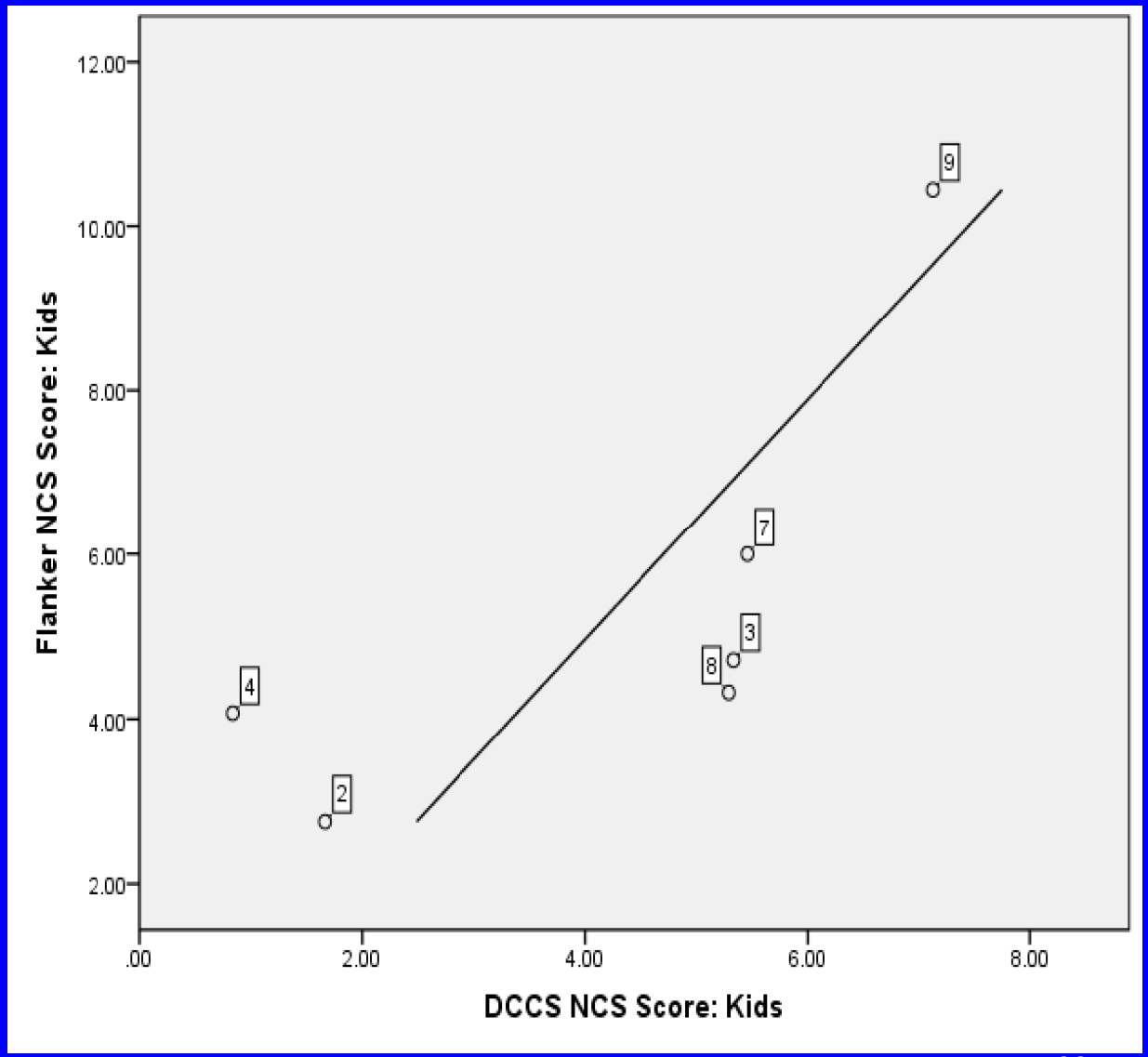


Results from Phase 1

- Pre-pilot of fewer than 10 families (age 3-5; low SES)
- Time burden
  - New measures are low burden and could be shortened further
  - Flanker-Dext and DCCS-Dext: about 6 min each
  - CBQ-VSF with EF test item pool added: about 10 min
  - NIH Toolbox Flanker and DCCS for parents: under 5 min each
- Appeal and usability
  - Parents and children enjoyed and understood EF measures

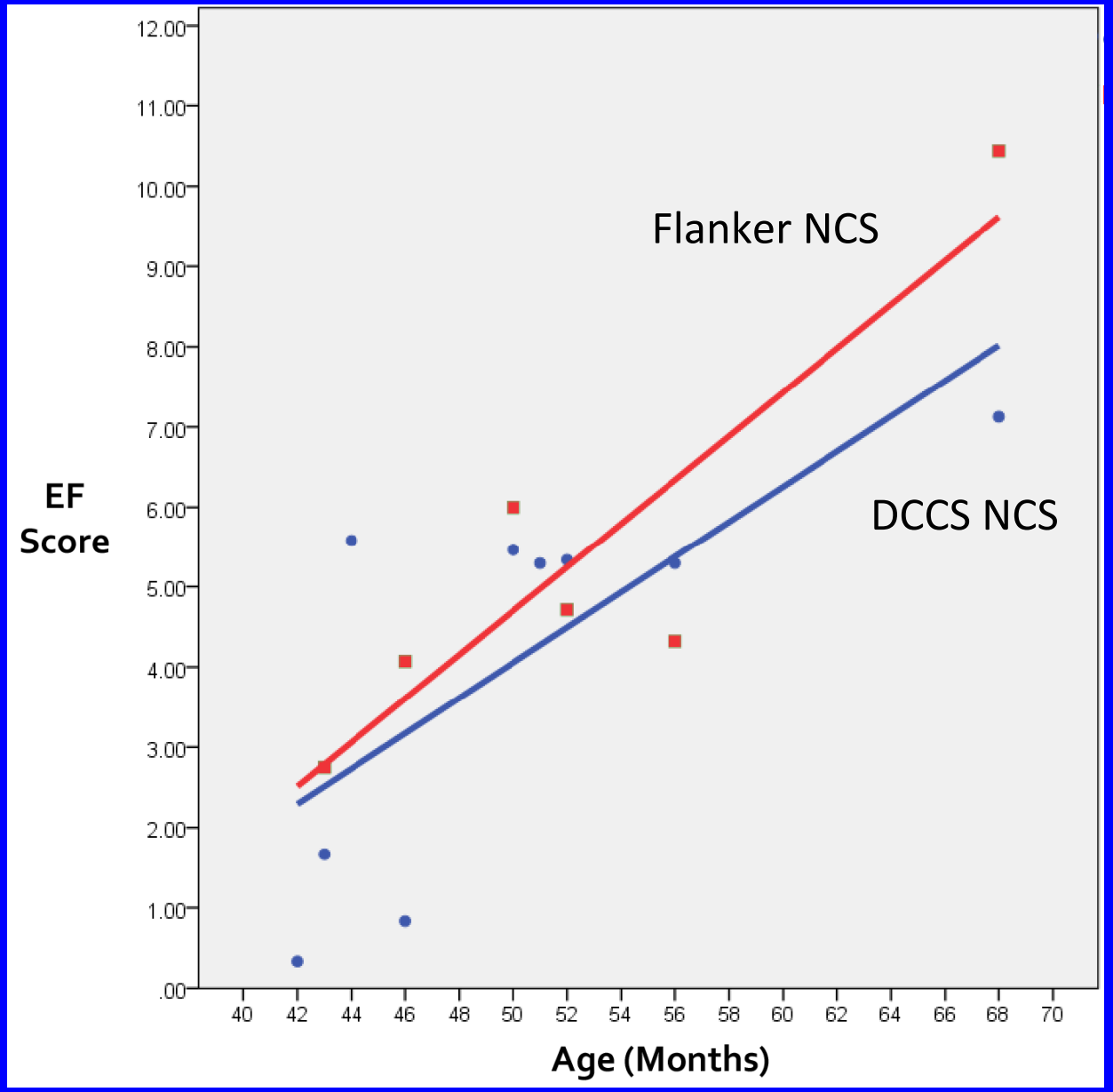
Convergent Validity

- Scores on DCCS and Flanker tasks related



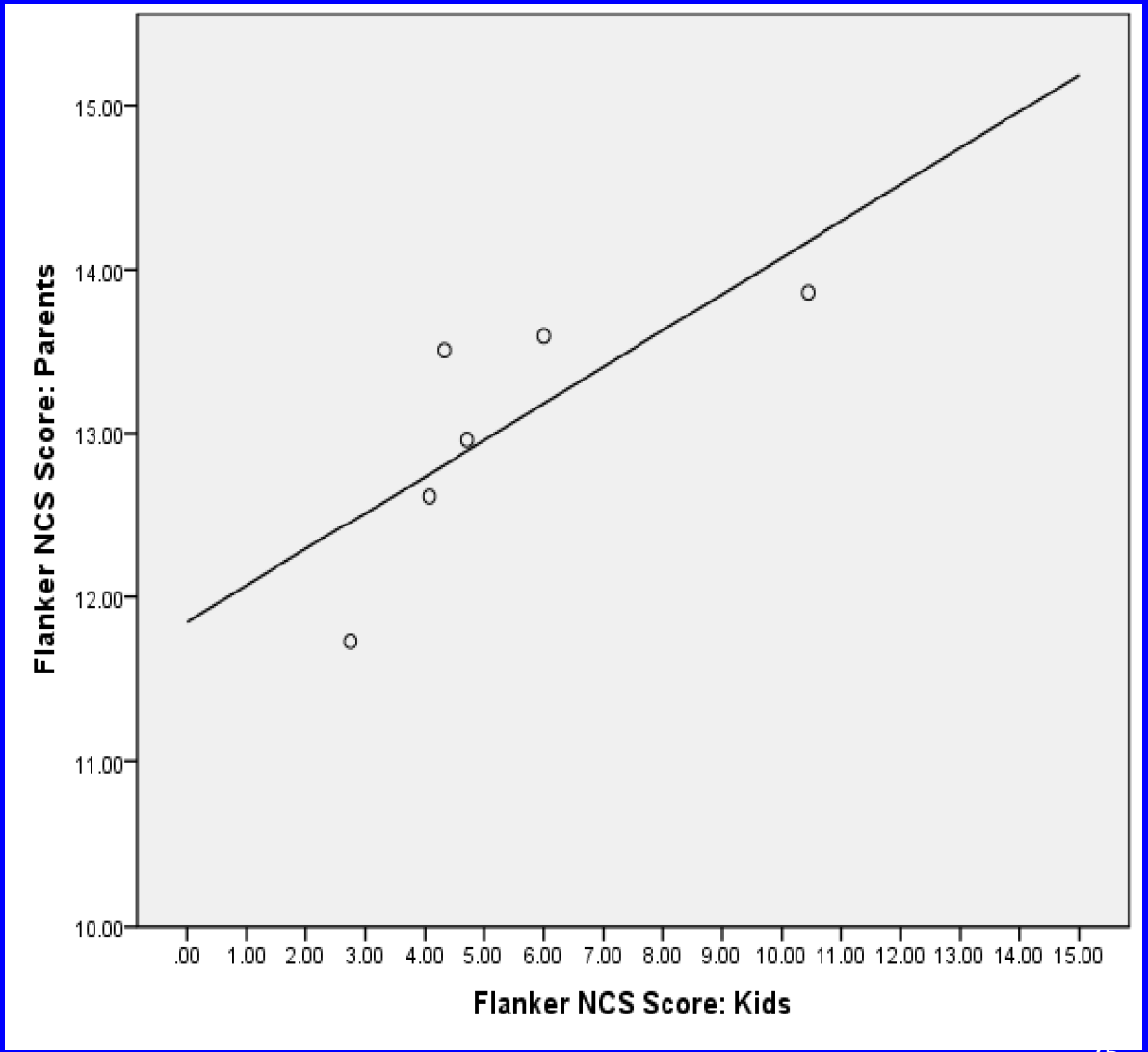
Developmental Sensitivity

- Scores on EF tasks related to age



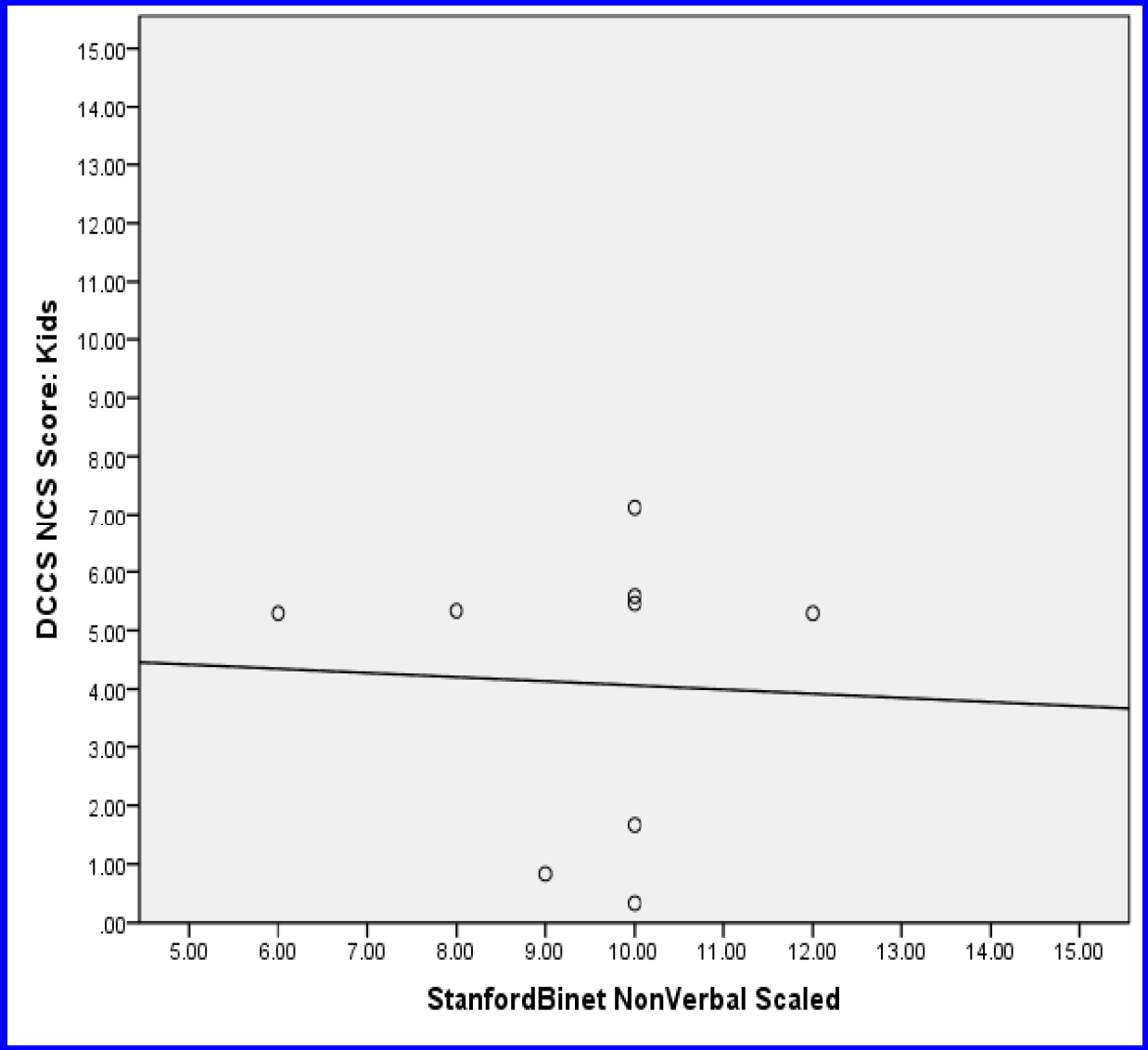
Covariation with Parent EF

- Parent and child EF scores related



Divergent Validity

- EF scores unrelated to age-corrected scores on Stanford Binet routing tests



Children's Behavior Questionnaire

- Adapted in consultation with Mary Rothbart and Samuel Putnam
  - Clarified the language used on the CBQ-VSF (36 items) for accessibility (removed double negatives & adjectives; replaced confusing item)
  - Wrote pool of 14 new items to expand the assessment of EF beyond effortful control and attention focusing **(**e.g., "Can take turns in a game even when excited.")

- Promising results
  - Teacher CBQ-EF scores correlated w/ Flanker (*r* = .41) and DCCS (*r* = .55)

Conclusions

New measures are very promising:

- Usability, time burden, appeal
- Continuity with Toolbox measures
- Inclusiveness for low-skill children

Next Steps

Phase 2: Validity study (*N* = 150)

- Assess construct validity for child EF in relation to EF measures (new tests; Peg Tapping; Forward-Backward Word Span), school readiness (WJ Applied Problems, Bracken), traditional IQ subscales (Stanford Binet; Early SB5)
- Assess test-retest reliability, time burden, appeal
- Develop training materials

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