Using the NIH-Toolbox in Cognitive Development Neuroscience Research

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STTAR
STUDY OF TODDLER TO TEENAGE
ANXIETY AND RESILIENCE

Introduction

NIH Toolbox Tasks

- Picture Vocabulary Test Age 3+ v2.1
- Dimensional Change Card Sort Test Age 12+ v2
- Pattern Comparison Processing Speed Test Age 7+ v2.1
- They are administered in that order.
- Instructions are given before each task and are read to participants (as written on an iPad screen)

Objectives

- These tasks work together to test cognitive and behavioral function
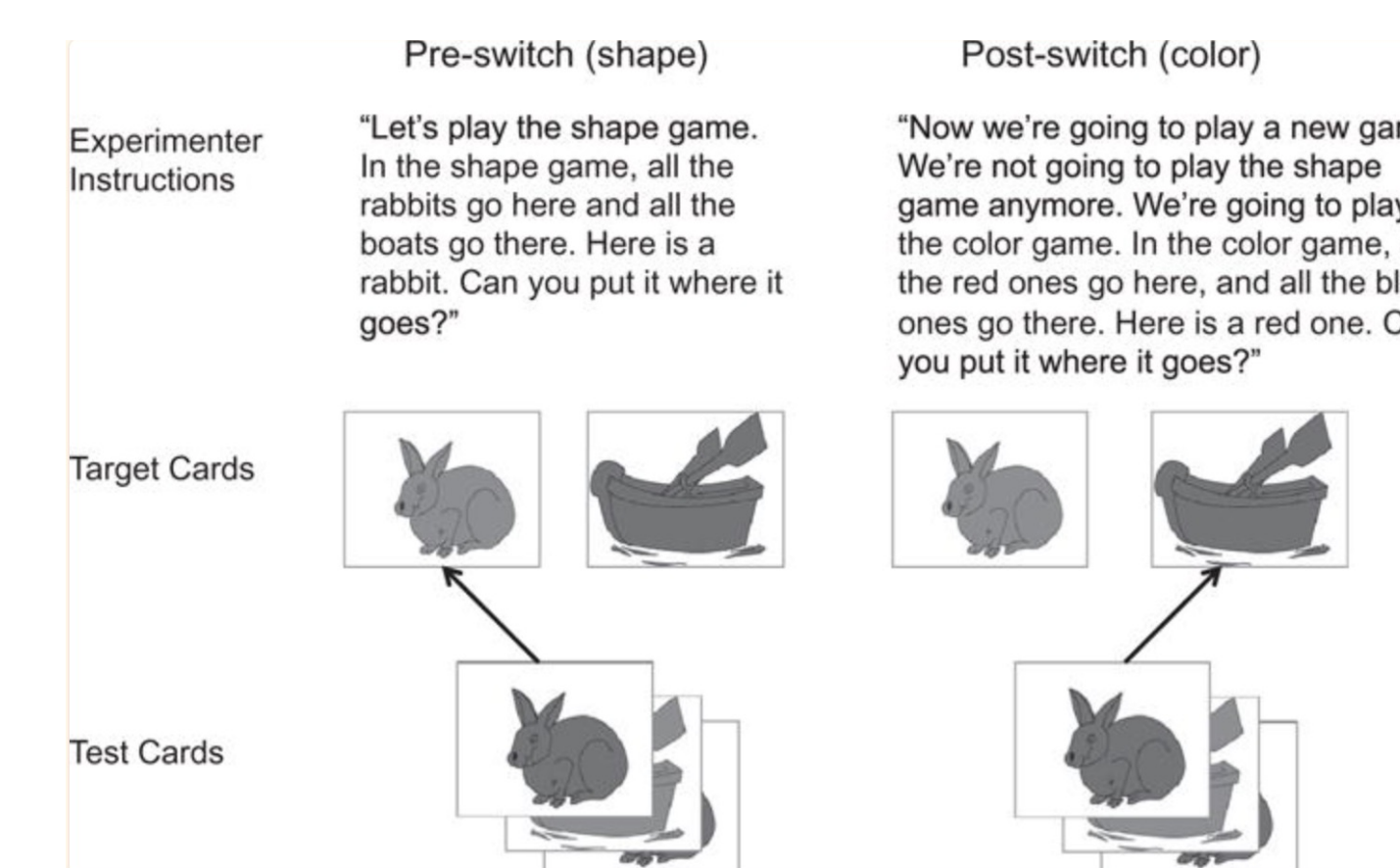
Tasks

Picture Vocabulary Test

FIGURE 1. Toolbox Picture Vocabulary Test Sample Item.

- Vocabulary assessment takes into account the highest level of education the participant has received
- Tests receptive vocabulary knowledge without the use of comprehension and writing, alleviating pressure on literary developing adolescents

Dimensional Change Card Sort Test

FIGURE 2. Sample stimuli and instructions used in the standard version of the DCCS, based on Zelazo (2006).

- Three-part assessment of the ability to task switch
- Measurement of executive functioning, regarding visual spatial attention
- Test scores are based on a weighted combination of reaction time and accuracy.

Pattern Comparison Processing Speed Test

FIGURE 3. Examples of types of discrimination on the NIH Toolbox Pattern Comparison Processing Speed Test.
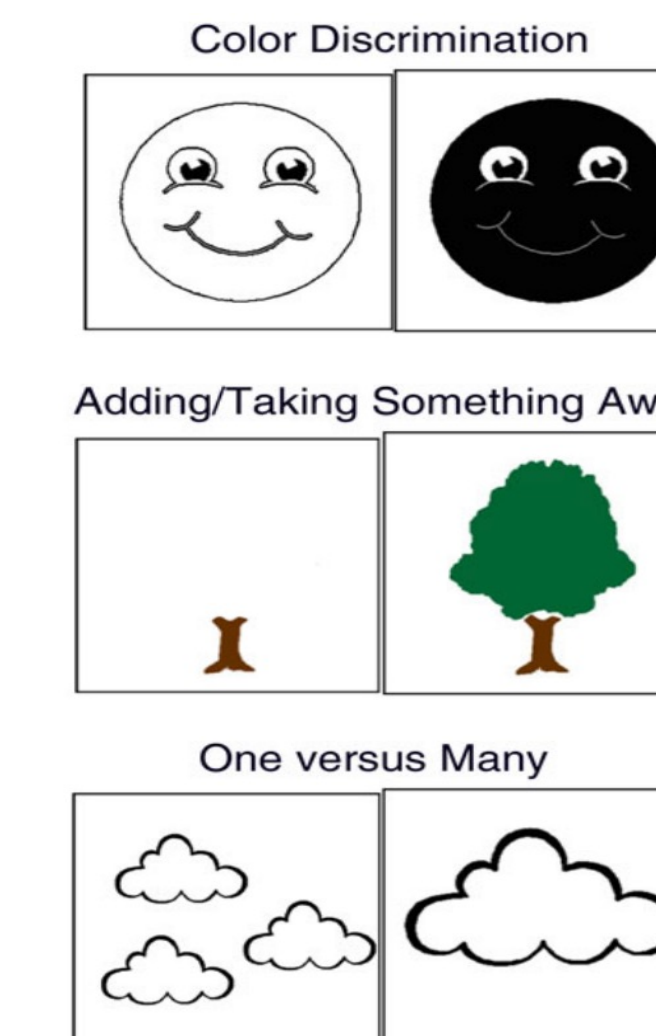
- Assessment of processing speed (i.e the amount of time to complete a task)
- Three possible dimensions: color (presented to all ages), adding/taking away (presented to all ages), one versus many (one presented to ages 3-15)

Methods

DEMOGRAPHICS

- Tests validated for participants 3-85 years
- Tasks administered to adolescents and adults (ages 15 – 22 years)

TASK ADMINISTRATION

- Picture Vocabulary Test Age 3+ v2.1
  - Participants select which of four pictures best represents a word presented via audio
  - High correlation with general measures of IQ
- Dimensional Change Card Sort Test Age 12+ v2
  - Participants match a series of pictures pair to a target picture
- Pattern Comparison Processing Speed Test Age 7+ v2.1
  - Participants identify if two visual patterns are the "same" or "not the same"

Discussion

- The NIH Toolbox is increasingly establishing a standard approach to assessing emotional, cognitive, motor, and sensory function
- Use of the NIH Toolbox has been found as an effective measure in the Adolescent Brain and Cognitive Development (ABCD) study (Vedechina et al. 2023)
- The Toolbox is an adaptive measure that does not compromise the continuity of data collection
- Global adaptation of the NIH Toolbox is yielding promising results (Duffey et al. 2021)

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References

Carlozzi, N. E., Beaumont, J. L., Tulsky, D. S., & Gershon, R. C. (2015). The NIH Toolbox Pattern Comparison Processing Speed Test: Normative Data. Archives of clinical neuropsychology : the official journal of the National Academy of Neuropsychologists, 30(5), 359–368. https://doi.org/10.1093/arclin/acv031

Duffey, M. M., Ayuku, D., Ayodo, G., Abuonji, E., Nyalumbe, M., Giella, A. K., … McHenry, M. S. (2022). Translation and Cultural Adaptation of NIH Toolbox Cognitive Tests into Swahili and Dholuo Languages for Use in Children in Western Kenya. Journal of the International Neuropsychological Society, 28(4), 414–423. doi:10.1017/S1355617721000497

Hodes, R. J., Insel, T. R., Landis, S. C., & NIH Blueprint for Neuroscience Research (2013). The NIH toolbox: setting a standard for biomedical research. Neurology, 80(11 Suppl 3), S1. https://doi.org/10.1212/WNL.0b013e3182872e90

Zelazo P. D. (2006). The Dimensional Change Card Sort (DCCS): a method of assessing executive function in children. Nature protocols, 1(1), 297–301. https://doi.org/10.1038/nprot.2006.46