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|  | **Early Primary Research Group****THINKPIECE –** **DIFFERENT TESTS FOR INHIBITORY CONTROL** |  |

1. **GO / NO GO TASK – try this test and see how you get on!**

**http://cognitivefun.net/test/17**

1. **Stroop Tasks – from**

**Age-related differences in inhibitory control in the early school years**

**Jacqui A. Macdonald et al 2014**

Among adolescents and adults, the Color-Word Stroop task is arguably the most widely used measure of inhibition.

The “Stroop effect” relies on the well-learnt, automatic tendency to read a word

being stronger than the tendency to name its printed color. The Golden (

2002) version of the Color-Word Stroop task has three conditions. In the first, participants name Color words (red, green, yellow, and blue) printed in black and white. In the second, participants name the ink colors of either “XXXX” or rectangles. Response times slow considerably in the inhibition condition where participants name the ink color of an incongruent word

(e.g., the word red printed in blue ink). The effect is one of asymmetry where the meaning of the word interferes with the naming of the ink color, but the ink color has little effect on the naming of the word. Cohen, Dunbar, and McClelland (1990) argue that when an individual is confronted with competing stimuli, parallel processing pathways are activated. The strength of each pathway is determined both by how automatic or well learnt the response is and its associated processing speed. In the case of words and colors, fluent readers have repeatedly shown word-naming to be a faster response than colornaming

(MacLeod,1991). However, the original Stroop task requires a level of reading proficiency not yet acquired by many early school-aged children. Studies have shown that children just learning to read do not experience the interference from written words but that interference peaks around the ages of 7 and 8 years, once reading at the level of color names has become automatic (Comalli et al.,1962; MacLeod,1991). While some normative data are available for the original Stroop task in children younger than 8 years, fluent reading is a prerequisite (Baron,2004).

The benefit of a Stroop task over numerous other measures of inhibition is that it

theoretically isolates the cognitive component of inhibition (suppression of a prepotent mental representation allowing for selection of an alternative) without drawing on behavioral or motor responses, which may correspond more closely with the self-control aspect

of inhibitory control (Diamond,2013). Other tasks measuring inhibition in children, suchas the Go/No-Go task and Luria’s Tapping task, require a motor response, which may bepreceded by an unspoken verbal response. Debate also ensues over whether complex rulesin some tasks, such as the Dimensional Change Card Sort (DCCS; Zelazo, Muller, Frye,& Marcovitch,2003), rely too heavily on other executive functions (Kirkham, Cruess, &Diamond,2003; Zelazo & Frye,1997).

Various pictorial Stroop-like tasks have been designed for young children as alter-

natives to the Color-Word Stroop, but few comparative studies assessing their validity,particularly with children aged between 5 and 8 years, have been reported .

The aim of this study was to examine the maturation of inhibitory control in early

school-aged, typically developing children using three pictorial Stroop-like tasks: Big-

Small Stroop, Fruit Stroop, and Boy-Girl Stroop. The Big-Small Stroop is the ExpressiveAttention subtest from the Cognitive Assessment System (CAS; Naglieri & Das,1997)and has norms for children aged 5:0 to 7:11 years. The Big-Small Stroop task has existingnorms and was selected as a standardized comparative measure to the stand-alone measuresof inhibitory control in which norms are lacking. The Fruit Stroop (Archibald & Kerns,1999) is a modified version of the Fruit Distraction Task of the Cognitive Control Battery(Santostefano,1988). The Fruit Stroop showed promising age-related differentiation in astudy of children aged 7 to 12 years, but no normative data for younger children exist. The

Boy-Girl Stroop (Kerns & McInerney,2007

; adapted from Diamond, Kirkham, & Amso, 2002

) is a computerized measure designed for preschool children but has not been tested

on school-aged children. A benefit of computer-based measures is that they offer greater precision in response latency scores and they may also provide opportunities for remote assessment. There is also some evidence that computerized Color-Word Stroop tasks canbe more sensitive than standard paper tests and they have a lower likelihood of distraction from additional stimuli

Each of the three tasks require less than 10 minutesto administer, which is favorably short for young children compared to the Animal Stroop,

reported to take up to 25 minutes to complete.

No gender difference intask performance was expected. It was also predicted that despite differences across thedifferent pictorial Stroop tasks, performance indicators would be correlated.

1. **The Shape School (****[Espy, 1997](https://search-proquest-com.plymouth.idm.oclc.org/docview/1122563894?OpenUrlRefId=info:xri/sid:primo&accountid=14711" \l "REF_c23)) from**

**Charting early trajectories of executive control with the shape school**

[**Clark, Caron A. C.**](https://search-proquest-com.plymouth.idm.oclc.org/indexinglinkhandler/sng/au/Clark%2C%2BCaron%2BA.%2BC./%24N?accountid=14711)**; 2013**

Inhibitory control and cognitive flexibility were assessed at each assessment using a computerized version of the Shape School,[[  1  ]](https://search-proquest-com.plymouth.idm.oclc.org/docview/1122563894?OpenUrlRefId=info:xri/sid:primo&accountid=14711" \l "fn1) programmed using [E-Prime (Version 1.1)](https://search-proquest-com.plymouth.idm.oclc.org/docview/1122563894?OpenUrlRefId=info:xri/sid:primo&accountid=14711" \l "REF_c57). As part of a cover story to enhance interest, children were shown a screen depicting colorful cartoon characters playing in a schoolyard. Three basic character templates, differing only slightly in facial features and the positioning of their feet, were repeated randomly through all task conditions. Characters did, however, vary on the dimensions of color (red; blue) and shape (circle; square) and according to particular cues (happy/sad facial expression for Condition 2 and hat/no hat present for Conditions 3 and 4). Prior to each condition, children completed six practice trials, where they were provided verbal feedback on their performance. No feedback was provided during test trials. In Condition 1, *baseline color naming*, children were advised that the characters’ names were their colors and were asked to name 12 characters with neutral expressions as quickly and as accurately as possible as they appeared sequentially on the computer screen. Condition 2, *inhibit* (six inhibit and 12 noninhibit trials), assessed children’s inhibitory suppression of a prepotent verbal response. Children were instructed to name only the colors of characters with happy faces and to remain silent for characters with sad faces. In Condition 3, *blocked switch* (12 trials), characters were depicted with neutral expressions and wearing hats. Children were instructed to name characters with hats by their shape. In Condition 4, *mixed switching* (10 switch and five nonswitch trials), neutral characters both with and without hats were presented and children were required to flexibly shift their responses between dimensions of color and shape as cued. Children were allowed an unlimited time window in which to provide verbal responses. If children were unable to complete practice trials or name any stimuli, the task was terminated and a 0 score was allocated for remaining conditions (*n* = 15 at age 3, *n* = 2 at age 3.75).

Digital video-recordings of children’s Shape School performance were coded for accuracy, response times (RTs), and error type in random order by trained research staff who were blind to study hypotheses (interrater agreement = .93 for 20% of sessions that were independently coded; range across age groups = 93%–96%). Internal reliabilities for accuracy ranged from .75 to .95. For RTs, internal reliability was generally acceptable (α = .66–.84), although it was lower for the switching conditions at 3 and 3.75 years (.47–.69), reflecting less RT consistency at younger ages. Errors were coded as *inhibit* errors, meaning that children named the character where the response ought to have been suppressed; *switch* errors, where children responded with the opposite dimension to that required, for example, by naming color rather than shape; *within-dimension* errors, where children said the opposite shape/color to that required; *distractor* errors, where children named another pertinent characteristic of the stimulus, for example, saying the cue “hat” or “happy”; and *other errors*, including unrelated responses such as naming an arbitrary color.