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Can Developmental Changes in Task Switching be Explained by Age Alone?

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Until recently, task-switching (TS) studies have focused on performance costs incurred when adults switch between tasks. Switch costs appear to decrease throughout childhood and adolescence (Cepeda, Kramer, & Gonzalez de Sather, 2001), perhaps reflecting the development of executive functioning (EF). Efficient switching relies on two EF processes: inhibition and switching. Rogers and Monsell (1995) describe switch costs as the reconfiguration necessary for new task sets, whilst Allport, Styles and Hsieh (1994) suggest a deactivation of prior task sets. The relative contribution of EF across development remains unclear in respect to the TS paradigm. In addition to expecting age-related differences in inhibition, switching and TS performance, the focus of this study was to identify whether performance differences evident in an arithmetic TS experiment were mediated by factors other than developmental changes, i.e., switching and inhibition performance (Bull & Scerif, 2001).

Method

TS and EF tasks were completed by 141 participants in four age groups: 6- to 7-year-olds (*M*=6.90 yrs., *SD*=3.99); 9- to 10-year-olds (*M*=10.03, *SD*=3.57), 12- to 13-year-olds (*M*= 12.68, *SD*=3.12) and adults (*M*=22.90, *SD*=62.80). Switching and inhibition were measured using an extended version of Shape School (Espy, 1997). A computer-based arithmetic TS experiment comprised addition and subtraction equations, e.g., 5 + 3 =__, presented across four blocks of 25 trials each (Pure-Add, Pure-Subtract, Switch & Alternating Runs; see method in Ellefson, Shapiro, & Chater, 2006).

Results and Discussion

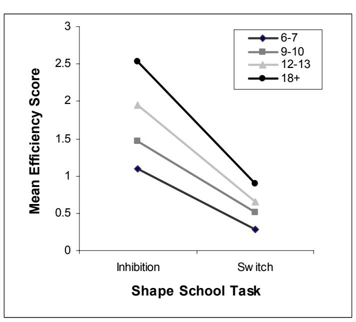

Figure 1. Mean efficiency scores for the Shape School tasks.

For Shape School, there were effects of age, *F* (1,138) = 109.45, *p* < .0001, and task, *F* (1,138) = 94.55, *p* < .0001. Performance improved with age on all tasks; inhibition was significantly higher than switching (see Figure 1). An age × task interaction, *F* (3,138) = 2.15, *p* < .0001, indicated unexpected increases in the decline of performance between inhibition and switching with age. TS performance improved with age for both accuracy, *F* (3,138) = 13.23, *p* < .001, and RT, *F* (3,138) = 50.44, *p* < .001. Stepwise multiple regression analyses indicated that switching efficiency was the sole significant predictor of overall accuracy, accounting for 16% of the variance. Both inhibition and age predicted RT, accounting for 22% of the variance. (Models A^1 and A^2, respectively, see Table 1). These results seem to indicate that switching is important for responding correctly and inhibition for a quick accurate response.

Table 1. Stepwise regression analyses for overall accuracy and RT.

Model	Variable	Step	R^2	R^2 Change	F
A^1	Shape School Switching Efficiency	1	.16	.16	27.35*
	Age (years)	2	ns	ns	ns
	Shape School Inhibition Efficiency	2	ns	ns	ns
A^2	Shape School Inhibition Efficiency	1	.21	.21	80.09*
	Age (years)	2	.22	.01	44.00*
	Shape School Switching Efficiency	3	ns	ns	ns

* *p* < .001
Note: Consistent results were found when separating switch and repeat trials; only overall data reported here.

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