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DOES AGE MATTER ON STROOP TASK ?

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Abstract :

Stroop (1935b) described a series of colour world interference. The most popular his observation is that it takes much longer to name the colour of incongruently coloured colour names than to name the colour of coloured squares. Comalli, Wapner, and Werner (1962) while testing subjects from ages 7 to 80 years, they observed greatest interference in the young children; interference declined into adulthood and then increased again with advanced age. They saw young children and older adults as having relatively more difficulty in screening out interfering stimuli. In line with this in the current research the stroop task was administered to various age groups. The researcher observed significant difference between the age groups selected on the stroop tasks. It can be suggested that interference begins early in the school years, rising to its highest level around Grades 2 to 3 as reading skill develops. With continued development of reading, interference declines through the adult years until approximately age 60, at which point it begins to increase again. Virtually everyone who can read shows a robust Stroop effect from an early age.

Keyword : Stroop task, interference, developmental age

The development of color and word-form processing with age was of interest before the Stroop task was created (Ligon, 1932). Basically, more recent studies make similar points. Thus, Cramer (1967) supported Ligon's claim that form processing dominates over color processing, although preschoolers may show the reverse preference (Arochova, 1971), having not yet learned to recognize letter forms very well. Interest in development with regard to the Stroop task itself did not arise until the mid-1960s. There are some three dozen pertinent studies, the first being a life-span study by Comalli, Wapner, and Werner (1962). Testing subjects from ages 7 to 80 years, they observed greatest interference in the young children; interference declined into adulthood and then increased again with advanced age. They saw young children and older adults as having relatively

more difficulty in screening out interfering stimuli. Ehri and Wilce (1979) produced an experimental analogue of this result by training first and second graders on a set of words to be used in the picture word task. Initially, as the subjects were learning to read the words, interference increased; however, once the words were learned and further training simply improved response speed to the words, interference decreased. Schiller (1966) helped to clarify the non-monotonicity in interference with age in children. Interference was minimal for children in Grade 1, younger than the youngest subjects in the Comalli et al. (1962) study. Interference then became maximal in Grades 2 and 3 (Comalli et al's youngest subjects), and dedined thereafter. The strong suggestion is that this early rise and then fall in interference reflects the onset of reading skills. Dash and Dash (1982) confirmed Schiller's result (see also Friedman, 1971). Using the picture-word task, Ehri (1976) showed a similar pattern, except that poor readers in the second grade did not show interference, behaving rather like normal first graders in the other studies. Attempts to create Stroop-like situations for younger, prereading children have not been very informative (Cammock & Cairns, 1979). Furthermore, attempts to categorize subgroups of development in the task have not been successful (Schiller (1966)Dash and Dash (1982)Ehri (1976) Silverstein & Franken, 1965). The decrease in interference through adulthood and before the age of 60 that Comalli et al. (1962) observed has been confirmed (e.g., Wise, Sutton, & Gibbons, 1975), as has the increase in interference for adults older than 60 years. There may be exceptions (e.g., Baumler, 1969), but even studies of aging twins reveal the increased interference with age greater than 60 years (Jarvik, Blum, & Varma, 1972), together with the suggestion that identical twins show more similar interference than do fraternal twins. Attempts at remediation of the exaggerated interference shown by older adults have not been notably successful. Many of the developmental Stroop studies focus on reading skill (Ludwig & Lazarus, 1983). The Corbitt (1978) dissertation provides a good example. He showed that reading ability and interference were closely related: Intermediate and good readers read words faster than they named colors, and showed a Stroop effect without a reverse Stroop effect. Poor readers named colors faster than they could read words and showed the opposite pattern. How about reading comprehension? Using the picture-word task, Golinkoff and Rosinski (1976) showed that good versus poor comprehenders in Grades 3 and 5 did not differ in the degree of interference shown in naming pictures containing single words. Similar findings were reported by Ehri (1977). Rosinski (1977) showed that the semantic gradient for words that differentially relate to colors was also consistent from Grade 2 through college. Merrill et al. (1981) went on to show that, with sentence contexts, good comprehenders in Grade 5 displayed interference only for targets appropriate to the context, whereas poor comprehenders

showed interference regardless of context appropriateness. A study by Kareev (1980) further investigated development of sentence encoding in children using the color-word task. Interestingly, children with reading disabilities often show robust Stroop interference. Recent work by Ellis, Woodley-Zanthos, Dulaney, and Palmer (1989) suggests that automatic word reading may be even harder for retardates to control than it is for normals, causing greater interference in retardates. The overall picture of development, then, can be summarized fairly concisely by the Comalli et al. (1962) result. Here is the conclusion: Interference begins early in the school years, rising to its highest level around Grades 2 to 3 as reading skill develops. With continued development of reading, interference declines through the adult years until approximately age 60, at which point it begins to increase again. Virtually everyone who can read shows a robust Stroop effect from an early age.

In the present study the researcher aimed at a careful characterization of stroop effect in relation to increasing age. I therefore presented a large sample ranging from 6 to 50 years.

Methodology

Participants : Eight groups of participants, like this 240 participants in the age range of 6 years to 50 years participated in this study. Thirty one participants (M=7.20, SD=1.39), thirty two participants (M=10.61, SD = 0.64), thirty four participants (M=14.10, SD=0.72), twenty seven participants (M=17.08, SD=0.72), twenty six participants (M=20.13, SD=0.61), thirty one participants (M=25.64, SD=2.64), thirty participants (M=34.79, SD=2.74), and twenty nine participants (M=45.35, SD=2.70) were the subjects in this experiment.

Data collection was done in the month of November. The inclusion criteria was that the participants

1. to have exposed to Marathi language since birth
2. not to suffer or have suffered from any neurological or psychiatric problem
3. to have normal or corrected to normal visual acuity and normal colour perception. All the participants underwent the colour naming task and the word reading task.

Material and Procedure :

The researcher examined the stroop effect with growing age and reading practice. Here the colour reading and word reading task was compared with respect to time and errors. A standard material with thirty coloured blocks and incompatible 30 coloured words were used. the basic task is to name the ink colours and performance in this condition is compared with performance on

naming the ink-colour of colour words under conditions where word meanings and ink colours mismatch or are incongruent (e.g., the word *red* printed in green ink).In the part one as soon as the participants were given start signal they were to turn the card and start reading the colours in the boxes. Where as in the part two of the experiment the participants were to turn the card and start reading ink colours of the printed letter. The time and errors in both the conditions were recorded carefully. In this experiment I examined the effect of incompatible ink colours on reading words aloud. The participants were from various age groups ranging from6 years to 50 years.

Results and discussion:

The time taken to read colours in 30 boxes and incongruent colour letters by all the 240 participants were recorded carefully. The main aim was to study how stroop effect occurs as a result of age and practice in reading was studied here. The critical dependent measures were the time (in seconds) spent on by each subject as the number of reading and naming errors. Errors were rare. As expected, most of the errors were made in the incongruent condition. Hence they were not taken for any further analysis. Each subject's recorded time card was divided by 30, the number items on the card, to yield the time-per-item. The scores that were used for all subsequent analysis. As discussed elsewhere (Graf, Uttl, & Tuokko, 1995), time-per-item scores are useful because they allow direct comparison with other investigations that used instruments with either more or fewer items.

Thirty one participants (M=7.20, SD=1.39), thirty two participants (M=10.61, SD = 0.64), thirty four participants (M=14.10, SD=0.72), twenty seven participants (M=17.08, SD=0.72), twenty six participants (M=20.13, SD=0.61), thirty one participants (M=25.64, SD=2.64), thirty participants (M=34.79, SD=2.74), and twenty nine participants (M=45.35, SD=2.70) were the subjects in this experiment.

Table 1 Color - Word Stroop Test Performance (in seconds per item) by Mean Age groups

		Mean Age							
Avg. Time (Sec)		1 7.20 (31)	2 10.61 (32)	3 14.10 (34)	4 17.08 (27)	5 20.13 (26)	6 25.61 (31)	7 34.79 (30)	8 45.35 (29)
Colour Reading	M	2.49	2.15	3.32	2.17	4.97	1.73	0.75	6.65
	S.D.	0.97	1.90	3.33	1.68	1.31	0.88	0.25	3.11
Incongruent Colour word reading	M	5.63	2.60	3.43	2.61	7.78	2.06	2.92	8.90
	S.D.	2.04	2.17	3.25	1.32	2.30	1.01	1.41	2.52

Above table indicates that the mean time taken for colour reading and incongruent colour word reading task is maximum for group no.8 i.e. 40 to 50 years.

An analysis of variance showed that the age-wise difference in time taken was significant $F(7,232)=26.69$, $p=.000$ for colour reading task where as $F(7,232)=39.54$, $p=.000$ for incongruent colour word reading task.

Table 2 shows post hoc analyses using Tukey's HSD post hoc criterion of significance for colour reading task. It has indicated that there is significant difference in the time taken to read the colours. The difference is maximum between age group 7 and 8.

Table 2 Mean difference between different age groups on Tukey's Post-Hoc test for colour reading task

Age groups Vs Mean difference	1 7.20 (31)	2 10.61 (32)	3 14.10 (34)	4 17.08 (27)	5 20.13 (26)	6 25.61 (31)	7 34.79 (30)	8 45.35 (29)
2	.34	-	-	-	-	-	-	-
3	.83	1.17	-	-	-	-	-	-
4	.32	.017	1.15	-	-	-	-	-
5	2.47**	2.81**	1.64*	2.80**	-	-	-	-
6	.76	.42	1.59*	.43	3.24**	-	-	-
7	1.74**	1.40	2.57**	1.42	4.22**	.98	-	-
8	4.15**	4.49**	3.32**	4.47**	1.67*	4.91**	5.89**	-

***p<0.01, *p<0.05*

Table 3 shows post hoc analysis using Tukey's HSD post hoc criterion of significance for incongruent colour letter reading task. The maximum mean difference is found between group number 6 and 8 which is significant at 0.01 level.

B. Uttl & P. Graf (1996). They concluded that age-effects in Colour word stroop task interference are most parsimoniously explained by global slowing, that Stroop interference does not constitute evidence for a selective, qualitatively different type of age related change in processing.

Table 3 Mean difference between different age groups on Tukey's Post-Hoc test for incongruent colour word reading task

Age groups Vs Mean difference	1 7.20 (31)	2 10.61 (32)	3 14.10 (34)	4 17.08 (27)	5 20.13 (26)	6 25.61 (31)	7 34.79 (30)	8 45.35 (29)
2	3.03**	-	-	-	-	-	-	-
3	2.20**	.82	-	-	-	-	-	-
4	3.02**	.01	.81	-	-	-	-	-
5	2.14**	5.17**	4.35**	5.16**	-	-	-	-
6	3.57**	.54	1.36	.55	5.71**	-	-	-
7	2.71**	.31	.50	-.30	4.86**	.85		-
8	3.26**	6.30**	5.47**	6.29**	1.12	6.84**	5.98**	-

***p<0.01, *p<0.05*

In light of the small influence due to age, the most parsimonious explanation of the findings is that age effects in Stroop interference are due to age-related slowing (which is also indexed by colour naming and by word reading) primarily; they do not provide evidence of a qualitatively different kind of processing (i.e., processing capacity as opposed to processing speed) that declines with age.

The overall picture of development, then, can be summarized fairly concisely by the Comalli et al. (1962) result. Here is the conclusion: *Interference begins early in the school years, rising to its highest level around Grades 2 to 3 as reading skill develops. With continued development of reading, interference declines through the adult years until approximately age 60, at which point it begins to increase again.* Virtually everyone who can read shows a robust Stroop effect from an early age.

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