

GENDER AND CULTURAL PERFORMANCE DIFFERENCES ON THE STROOP COLOR AND WORD TEST: A COMPARATIVE STUDY

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This study primarily aimed at determining gender and cross-cultural performance differences among Kuwaiti and British male and female subjects on the Stroop Color and Word Test. A total of 210 university students, 140 Kuwaiti and 70 British, participated in the study, and were subjected to the Stroop Color and Word Test. The study sought to validate the hypothesis that females by and large displayed more differential interference than did males across cultures. Our study revealed Kuwaiti college students displaying and achieving greater interference than did their British counterparts, with no gender differences observed on Stroop interferences. Based on these findings, it was concluded that though Stroop interference had no gender correlation, it showed potential predilection to cultural variables in cognition.

The Stroop Color and Word Test was introduced in American literature in 1935. Essentially, it comprises three cards, the first bearing color patches, the second color words printed in black, and the third with color words printed in incongruent ink colors. The test required the subjects to name the colors on the

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first card, the words on the second card, and ink color on the third card without taking into account the printed words. Invariably, the completion time taken differed for each card, being consistently faster for the first than the second card, which in turn was relatively faster than the third card. The major interest in the Stroop Test concerned the subject's behavior with respect to the card where color words were printed in nonmatching colored inks. On being asked to name the color of the ink, rather than read the word, the time taken by subjects to complete the card was almost 50% more than they took to name the colored ink printed in the form of rectangles. This significant increase in the color-naming time was scientifically referred to as the *color-word interference effect*.

Two contrasting approaches best explain the Stroop phenomenon in terms of perceptual conflict and response competition. Perceptual conflict conceptualizes the proposed overloading of our limited processing capacity by word and incongruent color. The limited capacity is used to process both relevant (color) and irrelevant (word) information, resulting in observed delay in total processing time. The response competition hypothesis, by contrast, suggests that during the response initiation stage, two competing responses attempt to use a single response channel, with the color stimulus requiring transformation from a perceptual to a verbal code, and the word stimulus requiring no such transformation. As a result, the irrelevant word information reaches the response initiation stage faster than the relevant color information, leading to the interference apparent in the Stroop task (Doehrmann, Landau, & O'Connell, 1978). Both these approaches have received wide empirical support (e.g., Doehrmann, Landau, & O'Connell, 1978; Wheeler, 1977; Williams, 1977).

Several comparative studies on the Stroop Color and Word Test tend to demonstrate that people from diverse cultures respond differently to the Stroop Color and Word Test. A study on the Stroop Color - Word performance of African Americans, conducted by Strickland, Elia, James, and Stein (1997), showed significant gender difference on total time taken to complete the Color Naming and Word Reading cards, with the performance of women being better than that of men. The study showed no significance in terms of slower Word Naming time for the African American group, while Armengol's (2002) study of the Stroop Test on 349 subjects from two Mexican schools showed no significant gender difference. The only significance that he found was based on Stroop x Age x School, with the private school children being faster than those in the public school. Armengol's study also showed the normative data replicating the Stroop effect with monolingual Spanish-speaking Mexican children exhibiting a similar developmental trend to that observed in the study by Comalli, Wapner, and Werner (1962).

Several studies also demonstrate that in each culture and language, emotional nuances and utterances play a dominant role in the formation of figurative

meanings (Sperber & Wilson, 1986). In this regard, Kitayama and Ishii's (2002) study examined the hypothesis that the processing system, having a bearing on the comprehension of emotional speech, is primarily attuned to word evaluation in low-context culture and language (i.e., in English), but to vocal emotion in a high-context culture and language (i.e., in Japanese). These results were supportive of their hypothesis, for in Stroop-type interference, a reliable interaction between vocal emotion and word evaluation was observed. However, in the context of United States subjects, a strong interference effect in vocal emotional judgment was evident, but no such effect was observed for word evaluation judgment, a pattern that was reversed in Japanese subjects. Although Stroop-type interference was significant in word evaluation judgment, the effect showed only marginal statistical significance in vocal-emotion judgment.

Ishii, Reyes and Kitayama (2003) also carried out an experimental study on similar lines to examine rather stringently cultural difference in attention. Their results revealed that Japanese subjects had greater interference for word-meaning judgment than for vocal-tone judgment, implying that Japanese people paid more attention to vocal tone than to word meaning. Americans, on the other hand, were found to pay more attention to verbal content than to vocal tone. This indicates that the interference found in vocal-tone judgment was significantly greater among Americans than among Japanese, while interference concerning the word-meaning judgment was higher among Japanese than it was among Americans.

There also existed a widespread agreement among researchers that females, by and large, tend to have shorter latency on the color card, while males and females performed almost equally on the word card. Ligon (1932) found significantly shorter latency for females on the color card among subjects in the age range of 6-16 years. Stroop (1935) reported a similar difference for college student subjects, while a significant correlation between sex and performance on the color card in favor of females was reported by Jensen (1965). On the color - word card (interference), most studies reported no significant difference between males and females (e.g., Al-Ansari, 1990; Ben-Tovim, Walker, & Douras, 1993; Bone & Eysenck, 1972; Gardner, Holzman, Klein, Linton, & Spence, 1959; Naish, 1980; Peretti, 1969; Singh, 1991; Stroop, 1935; Waber, 1976). Several studies have reported a significantly greater interference for females (e.g., Dash & Dash, 1987; Golden, 1974; Pati & Dash, 1990; Peretti, 1971), while conversely, Joregensen, Davis, Opella and Angerstein (1980) and Sarmany (1977) have reported a significantly greater interference for males 5 times in succession. No conclusive experimental evidence exists for the gender variable in Stroop interference effects. Our study marks an initial attempt to examine gender differences across cultures.

The question of cultural differences on Stroop Color - Word (CW) Card (interference score) has been the subject of considerable research, and literature

abounds in studies addressing this issue. Biederman and Tsao (1979) found greater interference on the Stroop task for Chinese-speaking subjects than for English-speaking subjects. Toma and Tsao (1985) found similar differences for a college student population. Morikawa (1981) found greater interference on the Stroop task for Chinese-speaking than for Japanese-speaking subjects. Dyer (1973) showed that Spanish-speaking subjects displayed greater interference than did English-speaking subjects. Magiste (1985) reported greater interference for Swedish-speaking subjects than for German-speaking subjects. Preston and Lambert (1969) reported a greater interference for German-speaking than for English-speaking subjects, greater interference for English-speaking than for French-speaking subjects, and a greater interference for Hungarian-speaking than for English-speaking subjects. Alford and Budayr (1966) reported a greater interference for Arabic-speaking subjects from Lebanon than for English-speaking subjects. Kiyak (1982) reported a greater interference for Turkish-speaking than for English-speaking subjects. Overall, the cross-cultural contribution to Stroop interference is substantial. Furthermore, certain languages, such as Arabic, may be more vulnerable to interference than others. This study attempts to extend this line of research by focusing on Arabic and English populations.

The study primarily aims to compare a select sample of male with female students from different cultures by focusing on their performance on the Stroop Color and Word Test. It is assumed that females as compared to males would display differential interference on the Stroop task across British and Kuwaiti cultures. In addition, the study also examines cultural differences on the Stroop task. It was pertinent to assume here that since the Arabic language with its words, spelling, and pronunciation did not match the English language, one would expect Kuwaitis to achieve a greater interference on the Stroop task when compared to British subjects.

METHOD

SUBJECTS

In all, our study included 210 subjects. Of these, 70 (36 males, 34 females) were British undergraduate students at Aberdeen University in Aberdeen, Scotland. Their average age was 20.64 year, with a standard deviation of 3.32. The Kuwaiti sample comprised 140 (60 males, 80 females) undergraduate students of Kuwait University, Kuwait, with the average age of 21.20 years, and a standard deviation of 2.67.

MATERIALS AND EXPERIMENTAL DESIGN

The version of the Stroop Test employed in our study was similar to the second

Stroop version by Golden (1978). The test consisted of three pages. Each page had 100 items, presented in 10 columns, of 10 items each. The first page had the words "BLUE", "GREEN," "YELLOW," "RED," and "PINK" arranged randomly printed in black ink on a white 30 x 21 cm card, with a restriction that the same color name was not repeated next to itself. This page was to test the word score. The score is based on the time taken in seconds to name the words. The second page consisted of 100 items, all written as "00000," printed in pink, green, yellow, blue or red. The five colors appeared in a random sequence, and were repeated 20 times, with no color ever appearing in successive items. This page yielded the color score. The score was based on time taken in seconds to name the colors. The third page consisted of the words printed on the first page, but printed in the colors of the second page. The two pages were blended, item by item: Item 1 on page 1 was printed in the color of Item 1 on page 2 to produce Item 1 on page 3. Care was taken to ensure that no word matched the color it was printed in. This page yielded the color-word score. The score was based on time taken in seconds to name color when printed in a contrasting word (interference score). An Arabic version of the Stroop Color and Word Test, corresponding to the English version, was also developed by the researcher in the departmental workshop.

PROCEDURE

All subjects were tested individually in a quiet, small room in the Psychology department of the university. Each subject attended an evaluation session of 10 minutes. Prior to beginning the formal testing, the subjects were asked whether they were color blind, dyslexic or if they had ever taken the Stroop test before. None of them answered "yes" to any of these questions. Prior to their inclusion in the study, they were informed that the purpose of the evaluation session was research. Specific instructions were provided on the first page of the study, explaining that this was a test of how quickly they could read the words on the page. They were required to read across the rows, as soon as the "Start" signal was given by the researcher. The subjects were then required to read the first left column until they completed it, and then to continue "without stopping" reading the remaining rows in order. When they finished all rows, they were required to say loudly "Finish." Once the test started, they were not expected to stop reading until they finished and to read out loud as quickly as they could. On making a mistake, the researcher said "No" so that the subjects could correct their error, and continue without stopping. The researcher also resolved any queries from subjects. As they started the test, the examiner started the stopwatch, and when the test was over, the examiner immediately stopped the stopwatch.

The instructions for the rest of the test pages were basically the same, with the "naming of the color of the ink" substituted for reading of the word. The subjects

were allowed as long as they needed to complete each page. The British sample was administered the English version of the Stroop test, while the Kuwaiti sample attempted its Arabic version.

STATISTICAL ANALYSIS

The data were analyzed using BMDP (Bio Medical Data Processing). This program is a comprehensive library of statistical routines from simple data description to advanced multivariate analysis, and is backed by extensive documentation. Each BMDP subprogram is based on the most competitive algorithms available and has been rigorously field-tested. It is run on mainframe. Comparative data regarding gender and cultures were tested by using *t*-test, one-and-two-way test of variance (ANOVA).

RESULTS

GENDER DIFFERENCE IN THE STROOP TASK

Mean and standard deviation were determined by gender for each variable. The statistics, as well as *t*-test between sexes, for each page of the Stroop Test, and for each culture, are presented independently in Table 1.

TABLE 1
MEANS, STANDARD DEVIATIONS, AND *T*-TEST FOR MALES AND FEMALES WITHIN THE TWO CULTURES SEPARATELY

Variable	British Sample (N=70)				Kuwaiti Sample (N=140)							
	Male (n=36)		Female (n=34)		<i>t</i>	<i>p</i>	Male (n=60)		Female (n=80)		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Word	30.03	6.35	35.35	4.98	0.57		42.95	7.45	40.83	5.08	2.04	.05
Color	59.19	9.06	53.29	7.31	2.97	.01	62.81	12.78	64.72	15.10	-0.74	
Color-word (Interference)	93.31	16.21	88.91	15.31	1.17		99.88	18.73	102.25	22.28	-0.60	

The table shows the prevalence of significant differences between sexes on the color card for the British sample, which indicated that females performed more quickly than the males did. In addition, the Kuwaiti females performed significantly more quickly than did the Kuwaiti males on the word card. However, no significant gender difference was observed for the Color-Word (Interference) card in the two cultures.

CULTURAL DIFFERENCE IN THE STROOP TASK

Cultural difference in the Stroop Test was assessed on the basis of scores on each variable, which were analyzed with a completely randomized unweighted mean analysis of variance (Table 2).

TABLE 2
MEAN, STANDARD DEVIATION, *T*-VALUE, AND *F*-VALUE FOR THE BRITISH AND KUWAIT CULTURES

<i>p</i>	<i>f</i>	<i>t</i>	Kuwaiti Sample (<i>n</i> =140)		British Sample (<i>n</i> =70)		Variable
			<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	
.01	45.86	6.77	6.62	41.72	5.69	35.70	Word
.01	16.88	4.11	14.26	63.91	8.72	56.33	Color
.01	12.72	3.57	20.82	101.25	15.82	91.17	color-word (Interference)

The results showed significant difference between the British and Kuwaiti College students vis-à-vis all variables, with the Kuwaitis showing higher absolute scores than the British students did, indicating that the British subjects performed more quickly on word and color naming, showing less interference than the Kuwaitis. Overall, sex and cultural differences were calculated on the basis of two-way ANOVA test in terms of gender (male, female) and culture (British, Kuwaiti), as independent variables, and the Stroop Test being the dependent variable. The effect of culture was found to be highly significant ($F=48.71$, $df=208$, $p>.01$) for the word card, ($F=16.65$, $df=208$, $p>.01$) for the color card, and ($F=12.27$, $df=208$, $p>.01$) for the color-word cards. No significant gender effect was found on the Stroop cards ($p>.10$). A significant interaction effect occurred only with respect to the color card ($F=4.48$, $p>.05$).

DISCUSSION

The results of this study on gender and cultural performance differences between Kuwaiti and British subjects on the Stroop Color and Word Test corroborate the hypothesis of Ambady, Koo, Lee, and Rosenthal (1996); Hall (1976); Kitayama (2000), and Markus and Kitayama (1991) that despite many independent cultures, such as Western and European cultures, and the use of many languages, a greater proportion of information is conveyed by verbal content than by contextual cues. Conversely, in Asia, due to the interdependency of cultures and languages used, for instance in Japan, Philippines, Korea, and China, since the proportion of information conveyed by verbal content is relatively small, nonverbal cues assume significance and are likely to play a relatively larger role. Our findings tend to further support this hypothesis.

Moreover, the results are clearly indicative of a significant gender difference in color-card only for the British sample, basically due to the females' faster color-naming ability, rather than to their significantly better performance in overcoming the interference of the last Stroop Card. These results support the conclusive findings of Golden (1974), Jensen (1965), Ligon (1932), and Stroop (1935) that females have superior color-naming skill. However, our results on interference measure (color-word card) do not replicate those of Dash and Dash (1987), Golden (1974), Pati and Dash (1990), Peretti (1971), and Sarmany (1977), as they found females showing less cognitive interference than males did. However, the current findings do replicate the findings of some of the earlier studies (e.g., Al-Ansari, 1990; Ben-Tovim et al., 1993; Bone & Eysenck, 1972; Gardner, Holzman, Klein, Linton & Spence, 1959; Naish, 1980; Peretti, 1969; Singh, 1991; Stroop, 1935; Waber, 1976).

On gender grounds, the distinctions between males and females, in general, did not yield consistently significant statistical difference across the two different cultures. It is, however, unclear why this finding has not received much attention in terms of gender differences on Stroop performance. It seems that the findings, by and large, reflect individual rather than gender differences in cognition, and hence are explainable in terms of biological, attitudinal, genetic, and cultural factors affecting gender performance on the Stroop task.

The researcher believes these results could be misleading and should be treated with caution, based as they are upon a single interference score, a single Stroop test with a single test and administration, a single cognitive style measure and a single limited population. It may, therefore, be necessary to conduct further research that takes into account these limitations, providing a new direction in research methodology for future research. The results also clearly indicate a significant cultural difference in performance on the Stroop Color and Word Test. The results support the hypothesis that Kuwaiti subjects manifested higher interference (derived from the lower reading speed on the Stroop Test) as compared to the British subjects. This finding is consistent with the study of Alford and Budayr (1966) in which they found Arabs displaying greater interference than English subjects did. Our findings also replicate the previous findings of Biederman and Tsao (1979); Dyer (1973); Kiyak (1982); Morikawa (1981); Preston and Lambert (1969); and Toma and Tsao (1985) who reported cultural differences in performance on the Stroop Task.

A number of alternative explanations are possible for the differences obtained in the Stroop Task between the British and Kuwaiti subjects. One such explanation may relate to the differential language structure of Arabic and English; perhaps the Arabic language is more vulnerable to interference than English. In Arabic words have at least two, and often more, pronunciations. This fact suggests the interpretation that the higher interference observed for Kuwaitis

was essentially the result of competition in the pronunciation-response process. Moreover, the word-spelling condition of Arabic colors was longer than those of the English colors, which led the Kuwaitis to read more slowly than the British. Another possible explanation relates to the biological and attitudinal factors affecting performance on the Stroop task for each culture. Overall, the fact that cultural specificities may have produced differences in the results of the two studies is indeed interesting, and suggests the desirability of comparative cross-cultural studies.

CONCLUSION

The findings of this study do not substantiate the prevalence of marked difference in Stroop interference between males and females. Although females may be somewhat faster, especially in naming colors, this probably relates to general response speed (Jensen, 1965), and not to the derived measure of interference (Macleod, 1991). The cross-cultural contribution to Stroop interference is nonetheless substantial, as shown by our findings. These results, however, corroborate the findings of other studies carried out to examine the performance among different cultures on Stroop interference.

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