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**GENDER DIFFERENCES IN OCCUPATIONAL PERFORMANCE**

Asdrubal Briceno and Klaus Jaffe

Departamento de Biología de Organismos

Universidad Simón Bolívar

Apartado 89000, Caracas 1080A, Venezuela

e-mail: [kjaffe@usb.ve](mailto:kjaffe@usb.ve)

## ABSTRACT

We tested the assumption that labor organizations possess structural arrangements that may favor specific individual ability based on neurophysiological characteristics. As some basic abilities vary between sexes, so will the occupational performance of individuals, according to the labor organization they work for. We assumed that:

- 1- Females possess a higher perceptual sensibility (perceptual speed and accuracy), which allows them to discriminate rapid apparition events and fine changes in the environment, in contrast to males who have a greater ability to manage spatial relationships.
- 2- Organizations with a functional structure require more fine perceptual abilities and these requirements are stronger at higher levels of the hierarchy.
- 3- Occupational performance is related to basic abilities required for a specific task, leading women to have higher occupational performance than men in labor organizations with a functional structure. By studying the technical and administrative staff of the Universidad Simon Bolivar (Venezuela), we present evidence that women have a greater capacity for perceptual discrimination, that this capacity relates to occupational performance in a labor organization with a functional structure, and that this relation is stronger at higher levels in the hierarchy.

## INTRODUCTION

It is well recognized that behavior is, to some extent, influenced by sex. There are a variety of psychological variables (Marccoby, 1988), and social variables (Guttek and Morasch, 1982; Kanter, 1977) which are affected by sex. From the biological perspective, sex-related differences in behavior constitute an adaptive resource and thus should possess some discernible advantage for each sex (Gouyon et al. 1993). The most important implications of the biological perspective on sex-related behavioral differences are the existence of different reproductive strategies (Jaffe et al., 1993 for example), differences in mate choice (Buss 1989, Jaffe and Chacon, 1995) and the specialization of social tasks (Gouyon et al., 1993). Some authors postulate that the differentiation in the tasks performed by each sex during their evolutionary history produced the consequent specialization in the development and use of given abilities (Kimura, 1992). Accordingly, it has been shown that women preserve a relatively finer perceptual discrimination capacity, while men possess a higher capacity for managing spatial relationships (Nagae, 1985; Hampson, 1990; Williams et al. 1990; Kerns and Berenbaum, 1991, Hedges and Nowell, 1995).

These differences, if purely cultural in origin, should not exist in modern societies with a different assignment of roles for the sexes. Actual data though show that sex differences in performance of a mental rotation test and perceptual speed and accuracy tests, remain unaltered. That is, women excel in tests measuring perceptual speed and accuracy, whereas men excel in tests measuring the establishment of spatial relationships (Hanske and Chen 1985, Nagae 1985, Allen et al. 1991, Kerns and Berenbaum 1991, Kimura 1992). At the same time, other abilities do change due to changes in cultural environment (see Hyde 1990), suggesting that some human abilities are adaptive. Thus, a continuing adaptive value for persisting sex differences in certain individual abilities seems likely.

The working environment is a social environment that could reflect the adaptive importance of these sex differences. People spend a significant amount of their time at work, and work is understood to relate to the cognitive and behavioral patterns of individuals (Walker and Lorsch in Litterer, 1980). There are two well-recognized basic organizational structures affecting the working environment. The Functional

structure and the Product structure (Litterer, 1980; Reitz, 1987).

Functional structures are horizontally differentiated and have a prevalence of collateral relations between the parts; therefore, the hierarchical structure acquires a pyramidal shape. The horizontal differentiation in functional structures is based on working units formed by persons with similar abilities or expertise coordinated by a supervisor (Litterer, 1980; Reitz, 1987; Melinkoff, 1990). Consequently, under these structures, more social interactions are possible between members with similar interests. The bulk of the responsibilities and conflict solving is coordinated and handled from the top of the structure. Since collateral relationships predominate, and since each functional work group is coordinated from the top, management must orient its actions towards the short term, concentrating on rapid apparition events (Reitz, 1987; Walker and Lorsch, in Litterer, 1980). Accordingly, under a functional structure, those with greater abilities to affront rapid apparition events and fine perceptual abilities to foresee inconspicuous changes in working conditions will be the most successful.

Product structures are characterized by a vertical differentiation of the organization with an emphasis on vertical relations. Social contacts between individuals of different abilities or experience are common. The supervisory responsibilities are divided and distributed between management levels forming a linear relationship between individuals (Litterer, 1980; Reitz, 1987; Melinkoff, 1990). In product structures, decisions and conflict resolution are shared with the lower levels of the organization, and management is more related to strategic planning (Reitz, 1987). Top management in these organizations is more oriented to long-term monitoring of changes in the external environment. Here, individuals with well-developed, spatial-temporal analytical abilities are more likely to be successful.

These structural arrangements may have a direct influence on the individual's success through certain cognitive-behavioral variables. Therefore, if some individual abilities are influenced by sex, and if these abilities are differently correlated to success in the two organizational structures, we might expect that in a vertical organization based on product structures males will dominate the managerial levels, whereas in horizontal organizations based on functional structures, females may perform better in managerial

levels. Culture will interfere with these patterns and so men are found to dominate in certain areas despite the fact that women could perform better. If biological parameters still prevail, it should be possible to demonstrate a better performance of women in a functional structure, despite the fact that they do not dominate.

Data from different countries support these predictions. That is, most vertically organized institutions are male-dominated (Acevedo et al., 1993; Kanter, 1976), an extreme example being the military. As society as a whole is thought to be male-dominated, or evolved from a male-dominated society, confirmation of male dominance in organizations with a product structure is not convincing proof for sex-related occupational performance based on differences in individual abilities. However, evidence for female dominance in functional structures, may help to support our hypothesis.

Individual ability-related performance in an organization may not be uniform. Moreover, different levels of organization may require different expertise and abilities (Melinkoff, 1990). In organizations with a functional structure, the higher levels of hierarchy have to solve day-to-day problems, making decisions about unexpected problems of high priority; whereas in the lower levels the tasks are not necessarily related to decision making. Therefore, higher levels of hierarchy rather than the lower ones, should be more affected by the type of organizational structure (Perrow 1970; Walker and Lorsch 1980; Reitz 1987). We studied the relation between sex-related individual abilities and occupational performance at various levels of hierarchy in order to detect a possible social effect of sex differences on individual aptitudes.

We predict that there are sex differences in occupational performance in organizations and that this polarization of performance is related to the hierarchical structure of the organization. If some differences in occupational performance are related to basic individual abilities dependent on sex, we might predict that in environments where individuals are exposed to rapid apparition stimuli, those individuals with high perceptual sensibility (as measured by better performance in tests measuring perceptual speed and accuracy), will possess better occupational performance. The female/male

performance difference due to these abilities should also be stronger the higher we climb in the organizational hierarchy. Occupational performance and perceptual speed and accuracy should be significantly correlated in a functional structure, whereas individual abilities in establishing spatial relationships should not correlate with occupational performance nor with the hierarchical level in a functional structure. That is, in organizations with a functional structure, women should excel.

## METHODS

Subjects for the study were members of the technical and administrative staff from all hierarchical levels of the Universidad Simón Bolívar (Venezuela). This organization possesses a clear functional structure as derived from the organizational normative and from a geometrical analysis of the organization chart (Melinkoff, 1990). There is a predominance of collateral relationships over linear relationships, where horizontal differentiation prevails over vertical differentiation.

The levels of this organization are: Supervisory (level 4), which includes the staff that fulfills supervisory and coordinating functions of offices, departments, units, areas, sections, etc.; Professional (level 3), which includes technical personnel with university degrees working in administrative areas; Administrative (level 2), including accountants, auditing personnel, assistants of budget staff, secretaries, typists, archivists, etc.; and Technical (level 1), including personnel specialized in technical areas, maintenance and laboratory technicians, audiovisual support staff, sport trainers, and personnel with a technical degree.

Occupational performance of employees was estimated by using the standard procedure adopted by the organization, which relies on an instrument specially developed by the University called Instrumento de Evaluación de Desempeño Laboral (IEDL) (USB, 1990). The reliability of IEDL was estimated by a test-re-test in consecutive years. The Pearson correlation coefficient for the scores of 519 employees with a complete data set for the period 1990-1994 were: 0.505 for 1990-1991 comparisons, 0.644 for 1991-1992, 0.559 for 1992-1993 and 0.565 for 1993-1994 comparisons (all significant at  $p < 0.0001$ ). Each year, employees with the highest scores got promotion or a salary increase.

Individual occupational performance (OP) was expressed as the total score obtained by the subjects in the IEDL. The total score on IEDL is the sum of the numerical qualifications, equivalent to the qualitative appraisal given by the various supervisors for each factor. The factors were adjusted for each level in order to secure the same maximum total score possible for evaluations at every organizational level, despite the different responsibilities of each level. The factors for levels 4 and 3 were: planning, organization, coordination, knowledge, liability, initiative, decision making, efficiency, personal relationships, communication, control, advice, capacity to direct (only for level 4) and assistance (only for the level 3). For levels 2 and 1, the common factors were: organization of the work, knowledge, liability, presence (punctuality, permanency, assistance), personal relationships, materials and equipment conservation, communication. Level 2 included quantity and quality of production, and attention to the user. Level 1 included efficiency, decision making, initiative, advise.

The following individual abilities were measured: 1) the facility to mentally construct a three-dimensional figure and to visualize it from different perspectives (Spatial Relationships), and 2) perceptual speed and accuracy of response (Speed and Accuracy). We used the raw score of the Spatial Relationships (SR) and Speed and Accuracy (SA) tests belonging to the Differential Aptitudes Test validated elsewhere (Bennett et al., 1967).

The scores for OP were obtained from the University. The ability tests (SR and SA) were applied according to the specifications in Bennett et al. (1967). The difference between SA and SR scores was calculated by subtracting the raw score of SR from SA (both scores had a maximum potential value of 100).

The data from the total population of employees working in the institution in October 1992 included information about sex, hierarchical level and occupational performance for each employee (n = 639). Data on scores in spatial relationships and in speed and accuracy were not available and thus we had to obtain it by testing a sample of 93 individuals. These individuals were chosen using a stratified random

sample design. That is, subjects for these tests were chosen randomly but based on a criteria for minimal sample size for each group defined by their level in the organization (at least 10 % of the total in that category), range of occupational performance and sex. The desired sample size for each strata was not always achieved because of resistance of the selected employees, but no new individuals were included in the sample to reduce sampling bias.

Statistical analysis was performed using the computer package SPSS and consisted of a stepwise multiple regression, Pearson's correlation, Anova, Kruskal-Wallis (KW) Anova and Student t test.

## RESULTS

The data of occupational efficiency of all administrative and technical personnel of the University (Table 1) showed that the average OP scores were higher at higher organizational levels. This correlation was statistically significant (Pearson correlation coefficient  $r = 0.34$ ,  $p < 0.0001$ ). The data also showed that women had in average higher scores than males (Chi-square = 10.27,  $p < 0.0014$ ). More women than males were employed in all levels except level 1. Thus, we designed a stratified sample for this study trying to reach similar numbers of males and females for each level, covering the largest range of OP scores possible.

The data from the sample for which we obtained SA and SR scores is given in Table 2. A stepwise multiple linear regression analysis of the data revealed that 12 % of the variance of OP (multiple  $R = 0.35$ ) can be predicted with hierarchical level ( $r = 0.211$ ,  $p = 0.04$ ) and SA ( $r = 0.209$ ,  $p = 0.04$ ) with a very high probability ( $p = 0.004$ ). That is, at higher levels, occupational performance will be better and performance is related to fine perceptual abilities and perceptual speed and accuracy, but not to spatial abilities. Alternatively, a one way Anova showed no relation between sex and level or OP, as predicted from the stratified sampling method used, but showed a significant higher OP ( $F = 6.14$ ,  $p = 0.01$ ) and SA score ( $F = 6.05$ ,  $p = 0.01$ ) for females, a direct relationship between OP and SA ( $F = 7.32$ ,  $p = 0.008$ ), but no relation between OP and SR ( $p > 0.7$ ).

The data (Table 2) also showed that SA scores of women outperformed those of men in all occupational levels except level 2 (Chi-square = 10.27,  $p = 0.0014$ ). The sex difference between scores in the SA test were statistically significant for levels 4 and 3 (Student's t-test;  $t = 3.21$ ,  $p = 0.003$ ), but not for levels 2 and 1. Men maintained higher scores in SR than women in all levels except level 4 (ANOVA:  $F = 6.09$ ,  $p < 0.001$ ). Scores of SR test showed significant differences between the hierarchical levels for both sexes (ANOVA: males:  $df = 3/30$ ,  $F = 3.21$ ,  $p = 0.037$ ; females:  $df = 3/54$ ,  $F = 8.56$ ,  $p < 0.0001$ ), though variation of the scores between levels was greater for women. In occupational level 1, both sexes showed the best scores in SR. The differences between the aptitude scores were always greater for females compared to males. This is consistent with the fact that females scored higher in SA and that SA was better than SR in explaining the positive correlation between hierarchical level, OP, and sex.

A similar analysis, pooling data from similar levels to increase sample sizes (Table 3), confirmed the results given above. OP did not correlate with neither sex, SA nor SR ( $p > 0.5$ ) in data from the pool of levels 1 and 2, but correlated significantly with sex (Pearson correlation:  $r = 0.34$ ,  $p = 0.02$ ) and SA ( $r = 0.37$ ,  $p = 0.01$ ) in data from the pool of levels 3 and 4.

## DISCUSSION

The results suggest, as have previous studies, that significant sex differences in psychological abilities exist, as assessed by SR and SA tests. The results are compatible with the hypothesis that, in a functional structure, abilities related to perceptual speed and accuracy are more pronounced in individuals working in higher levels of the hierarchy and are correlated with better occupational performance. These abilities (and possibly others) are asymmetrically distributed between sexes, explaining, at least partially, why women outperform men in numbers, in position in the hierarchy and in occupational performance. Spatial abilities, prevalent in males, do not seem to influence the position in the hierarchy in organizations with a functional structure, nor do they affect occupational

performance. In occupational levels directly related to technical labor, abilities in establishing spatial relationships are prevalent in both sexes.

The structure of an organization constrains the potential performance of the employees and may affect the performance of individuals differentially by sex. We predict that, in a product structure, the performance of individuals should be correlated with abilities in establishing spatial relations, thus favoring males in reaching the upper levels of the hierarchy. Support for this last prediction is difficult to obtain, given that a similar outcome may be expected for any organization operating in a male-dominated environment. We argue that the demonstration of the opposite tendency, i.e. females outperforming males in a functional organization, as done here, is more appropriate as it is not predicted by existing theories. In conclusion, we believe that we have presented an example where basic biological and psycho-physiological characteristics influencing individual behavior affect complex socio-cultural expressions.

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Table 1: Mean and standard deviation for scores in occupational performance (OP) of the total population of technical and administrative staff of the Universidad Simon Bolivar.

LEVEL	Mean OP	n	%	SEX	Mean OP	sd
(1-4)	399	639	54	Male	380	75
				Female	416	61 **
4	453	29	59	Male	414	63
				Female	449	29 *
3	428	118	59	Male	413	75
				Female	438	53 *
2	399	328	71	Male	373	70
				Female	409	66 **
1	376	164	18	Male	371	79
				Female	401	55

\* and \*\* indicate that data for males and females differ significantly at  $p < 0.05$  and  $< 0.001$  respectively as given by a Student's t-test.

#### ANOVA :

Variable	df	Mean square	F	p
Sex	1	4885	27.09	<0.0001
Level	21	874	4.85	<0.0001
Explained	22	1079	5.99	<0.0001
Residual	618	180		
Total	639	204		

Table 2: Mean and standard deviation of scores in personal abilities of the sample: Speed and perceptual accuracy (SA) and spatial relations (SR)

LEVEL	SEX	OP		SA		SR		SA-SR		n
		Mean	sd	Mean	sd	Mean	sd	Mean	sd	
4	Male	406	63	48	9	35	19	13	15	6
	Female	449*	28	58*	10	35	16	24	13	16
3	Male	410	61	50	9	42	28	8	24	10
	Female	436	46	59*	11	32	15	28*	22	13
2	Male	396	64	44	9	25	19	19	14	10
	Female	404	73	44	11	13*	13	31*	15	20
1	Male	398	80	45	11	56	17	-11	13	8
	Female	385	82	52	19	39	22	13**	15	9
All	Male	409	64	47	9	39	23	8	17	34
(1-4)	Female	421	62	53*	13	27*	18	26*	16	59

KW Anova by sex

Chi-square 1.90 6.05 6.14 14.49

p 0.16 0.014 0.013 0.0001

\* and \*\*\* indicate that data for males and females differ significantly at  $p < 0.05$  and  $< 0.001$  respectively as given by the least significant difference test.

Table 3: Mean and standard deviation of scores in the sample: Occupational performance (OP), Speed and perceptual accuracy (SA) and spatial relations (SR).

LEVEL	SEX	OP	SA	SR	SA-SR	n
3-4	Male	409±59	49±9	39±24	10±21	16
	Female	443±36	58±10	33±15	25±17	29
r	-.34	.37	-.06	.25		
p	.02	.01	.69	.09		
1-2	Male	397±69	44±10	39±23	6±20	18
	Female	398±75	47±14	21±20	26±17	29
r	-.01	-.10	.01	.04		
p	.94	.50	.93	.76		

r = Pearson correlation coefficient between OP and the corresponding variable  
 p = probability for the correlation to the 0