Sex-role identity and mental ability

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Abstract

The central concern of this study was to explore the relationship between sex-role identity (measured by a bi-dimensional scale of masculinity and femininity) and field independence and scholastic intelligence. One hundred and forty Australian males and 181 females in grades 11 and 12 completed the Witkin Group Embedded Figures Test, the Otis Higher Test C of intelligence and a shortened version of the Bern Sex Role Identity Questionnaire. The correlation between performance on the Witkin and Otis was 0.53. Males performed significantly better on the Witkin and Otis than females. Males with lower masculinity scores scored better on the Otis than those with higher scores on masculinity. Females with low femininity scores performed higher on the Witkin and Otis than females with high femininity scores. When subjects were allocated by sex into one of four sex-role identity groups (high masculine-high feminine, high masculine-low feminine, low masculine-high feminine, low masculine-low feminine) significant differences in intelligence (Otis) among sex-role groups were found for females. The most significant difference in intelligence was obtained between the high masculine-low feminine and low masculine-high feminine groups of females. Results are discussed in terms of previous findings.
Introduction

Since Thurstone (1944) in his early work isolated spatial ability as a distinct factor in mental ability, numerous studies have employed a variety of visual-spatial measures in examining individual differences in spatial ability and, in particular, sex differences. Stanley & Benbow (1986) summarized a number of studies showing a general superiority of males over females in spatial ability (cf. Dielman & Barton, 1983). Maccoby & Jacklin (1974) concluded that a male advantage in spatial ability emerges in adolescence and is maintained into adulthood.

Cognitive style has been examined as a dimension of intellectual ability related to perceptual functioning. Witkin, Dyk, Faterson, Goodenough & Karp (1962) elaborated the concept of cognitive style to explain the extent to which a surrounding visual-spatial contextual field dominated perception of an object within the field. Witkin et al. developed a test of cognitive style, the Embedded Figures Test (EFT), which assesses the ability to perceive distinctive figures embedded in a complex surrounding field (field-independence).

Witkin et al.’s (1962) work on cognitive style has indicated that males generally have greater ability to separate figure-ground relationships than do females. Various studies have since confirmed this sex difference in performance (cf. Sherman, 1980). Maccoby & Jacklin (1974) suggested that it may be the spatial component in tests of field-independence that explains the observed superiority of males. However, wide individual differences within each sex have been found. Not only do males and females as intact groups manifest substantial
variability in performance, there is a significant overlap in the scores of male and female groups (e.g. Arbuthnot, 1975).

Sex-role identity has been found to account for a large amount of within-sex variability on tests of field-independence (e.g. Arbuthnot, 1975). Ss with masculine sex-role identities, regardless of sex may demonstrate greater field-independence. Conversely, sex-reversed sex-role identity may be a factor associated with performance on tests of field-independence. Males with high femininity scores and females having high masculinity scores on measures of sex-role identity have shown greater field-independence. This view of sex-reversed sex-role identity as a determinant of field-independence has been attributed both to environmental factors such as the more flexible role-taking opportunities of sex-reversed sex-role identity subjects (Arbuthnot, 1975), and to genetic factors such as hormones (cf. Petersen, 1976) and hemispheric dominance (cf. Geshwind & Behan, 1982). The role of environmental and genetic factors in explaining sex differences in spatial ability has recently been discussed by Benbow (1988).

Bi-dimensional scales of sex-role identity that ascribe to the individual both masculine and feminine characteristics are viewed as more appropriate tests of sex-role identity than unidimensional scales which measure either masculinity or femininity insofar as they take into account the range of possible sex-role identities (Constantinople, 1974). Bern (1975) has developed a sex-role inventory (BSRI) which defines sex-role identity as the difference between an individual’s masculinity and femininity scores on separate scales. Spence, Helmreich & Stapp (1975) have identified four distinct categories of sex-role identity: high masculine-high feminine; high masculine-low feminine; low masculine-high feminine; low masculine-low feminine, ratings within each sex. High and low ratings are
obtained by splitting the scores for both masculinity and femininity within each sex at the median. The extent to which these four categories of sex-role identity can be used to differentiate within-sex performance on tests of general mental ability and cognitive style constitutes a central focus of the present study.

A concern of this study was to take into account the reported findings of a relationship between measures of general intelligence and field-independence (Dielman & Barton, 1983; Satterly, 1976). Tests of field-independence and general intelligence may be viewed as tasks that sample mental abilities and test-taking skills that to some extent overlap. Both spatial reasoning and higher general intelligence have been found to be associated with sex-reversed sex-role identity (e.g. Maccoby & Jackling, 1974).

The two central research questions in the present study are as follows: (a) What is the extent of the relationship between masculinity and femininity as measured by a bi-dimensional scale of sex-role identity and field-independence and intelligence? (b) Do males and females who demonstrate different sex-role identities (high masculine-high feminine; high masculine-low feminine; low masculine-high feminine; low masculine-low feminine) as measured by a bi-dimensional scale of sex-role identity, differ in field-independence and intelligence?

**Method**

**Subjects**

The sample comprised 321 Australian high school students (140 males, 181 females) aged between 15 and 19 yrs, with 63% in Year 11 and 37% in Year
12. Students were of Anglo-Australian background, slightly above average in general ability, and from families within the lower middle income bracket.

**Materials**

Witkin's Group Embedded Figures Test (GEFT) was used as a measure of field-independence. The GEFT was adapted from the original Embedded Figures Test (EFT), with 17 of the 18 complex figures taken from the EFT.

The ACER Otis High Test C designed for use with adolescent and adult groups was used as the measure of intelligence. It was composed of verbal items, such as analogies, classifications, word meanings and proverbs. In addition, there were some items involving arithmetical reasoning and number series.

A shortened version of the Bern Sex Role Identity Questionnaire (BSRI) which had been normed on an Australian high school population was employed as a bi-dimensional measure of sex-role identity. In a pilot study, items from the BSRI were administered to 600 senior high school students. Ten masculine and 10 feminine items were selected for inclusion in the modified BSRI. These items all had item remainder coefficients >0.30.

**Design and procedure**

On the basis of performance on the shortened BSRI, Ss of each sex were assigned to one of the following sex-role identity groups: high masculine-high feminine; high masculine-low feminine; low masculine-high feminine; low masculine-low feminine. High and low classifications were based on whether an individual's score was above or below the median on masculinity and femininity for his or her sex. A 2 x 4 factorial design was employed with four levels of sex-
role identity (high masculine-high feminine; high masculine-low feminine; low masculine-high feminine; low masculine-low feminine) nested within each sex. Students were administered the Otis Higher Test C Intelligence test. On the second session 2 weeks later they were administered the GEFT, followed by the shortened BSRI.

Results

Results of a multivariate analysis of sex differences indicated that males performed significantly better than females on the GEFT and Otis, $F_{(2,318)} = 4.83$, $P < 0.01$. The univariate analysis of GEFT and performance was significant, $F_{(1,319)} = 5.83$, $P < 0.05$. However, the second order stepdown analysis revealed that, when the variance associated with intelligence was accounted for, the difference between the sexes was not significant. The univariate analysis of Otis performance revealed a significant effect for sex, $F_{(1,319)} = 8.61$, $P < 0.01$. The second order stepdown analysis indicated that, when the variance associated with GEFT was accounted for, the sex effect remained significant, $F_{(1,319)} = 115.88$, $P < 0.01$. The correlation between performance on the GEFT and the Otis was found to be 0.53, $P < 0.01$.

Research question I

The relationship between masculinity and femininity and performance on the GEFT and Otis was examined employing a multiple regression analysis (see Tables 1 and 2). As indicated in Table 1, when the Otis as an independent variable was removed from the analysis, masculinity was not significant in accounting for GEFT performance. Table 2 reveals that masculinity as a main effect was also not
significant in explaining performance on the Otis when the GEFT as an independent variable was removed from the model. However, the interaction of sex by masculinity was significant.

Post-hoc analyses of this result were undertaken using separate multiple regression analyses for male and female performance on the Otis. Masculinity for males on the Otis was found to be significant. A similar though non-significant result was observed for females. Males with lower masculinity scores performed better on the Otis than those with higher scores on masculinity. Of the males in the sample, 47.14% obtained scores on masculinity that were within the region of significance as determined from the Johnson-Neyman analysis. Although the regression analysis for female masculinity scores and Otis was not significant, lower masculinity scores tended to be associated with lower scores on the Otis. Table I indicates that femininity as a main effect in performance on GEFT was not significant.

However, the interaction of sex with femininity was significant. Post-hoc analyses were undertaken using separate multiple regression analyses for male and female performance on the GEFT. This was used to identify the significance of the interaction effect, sex by femininity. Results of the separate analysis for males on GEFT indicated that femininity was not significant. Femininity was significant in explaining female performance on GEFT. Results indicate that femininity was inversely associated with GEFT performance. Of the females in the sample, 75% had femininity scores that were essentially significant.

Examination of femininity and performance on the Otis revealed a significant relationship (Table 2). However, the interaction of sex with femininity was also significant. Post-hoc analyses of this interaction effect showed similar
results to those obtained for GEFT. Femininity was not significantly related to performance of males on the Otis Higher Test C Intelligence test. However, femininity was significant in accounting for differences in performance of females. Results indicated that females who obtained lower femininity scores performed better on the Otis Higher Test C Intelligence test compared with females with higher femininity scores. Higher femininity scores were associated with poorer performance. Females had 82.32% of their scores in the upper region of significance. Although the regression analysis for males was not significant, higher femininity tended to be associated with higher performance on the Otis Higher Test C Intelligence test.

**Research question 2**

Table 3 presents the mean performance for males and females within each of the four sex-role categories (HH, HL, LH, LL) on the Otis Higher Test C
Intelligence test and GEFT. The unequal number of Ss within each sex-role group was due to a large number of Ss attaining the same median score.

There was no significant relationship between the male sex-role identity groups and performance on either the GEFT or the Otis Higher Test C Intelligence test. The separate univariate analysis for each test also failed to show a significant result.

Using the stepdown second order analysis, where females were equated on GEFT, the difference in intelligence scores among the four sex-role groups was not significant. This indicates that differences in performance on the Otis Higher Test C Intelligence test among the four sex-role groups may be partially explained by differences in performance on GEFT.

As the univariate analysis of female performance on the Otis Higher Test C Intelligence test was significant, post-hoc Scheffé comparisons of the means of the four sex-role groupings were performed. The most significant differences in intelligence were obtained between the high masculine-low feminine and the low masculine-high feminine groups of females. In addition, the high masculine-low feminine group differed significantly from both the low masculine-low feminine group and the high masculine-high feminine group.

**Discussion**

Use of a bi-dimensional scale of sex-role identity provides for an additional level of analysis in determining whether higher performance on a test of field-independence and intelligence is more strongly associated with masculinity irrespective of sex or with the sex-reversed sex-role identity. The previously found contradictory findings concerning this relationship may be due, in part, to the use
of unidimensional measures of sex-role identity which, by design, preclude an individual from being categorized simultaneously along the independent dimensions of femininity and masculinity.

In contrast to Arbuthnot's (1975) findings the present results indicate stronger effects for females. Low femininity in females was associated with higher performance on the Otis Higher Test C Intelligence test. Results indicating an inverse relationship between femininity of females and performance on the GEFT support the view that field-independence is more pronounced among females who have low femininity ratings.

Low femininity by itself did not ensure high task performance. The performance of the four female sex-role groups on the Otis Higher Test C Intelligence test indicates that it is low femininity in combination with high masculinity that is associated with higher performance on a cognitively demanding task such as the Otis Higher Test C Intelligence test. Examination of the mean scores of the four female sex-role groups on the GEFT reveals a similar advantage in favour of the high masculine-low feminine group. Females who not only viewed themselves as independent, forceful, and logical, but who also saw themselves as lacking warmth, sensitivity, and concern for the feelings of others were the higher performers. Females who were both highly masculine and highly feminine did not perform as well.

The findings that highly androgenous (high masculine-high feminine) females did not perform as well as high masculine-low feminine females was an unexpected and distinctive finding. Whether the Otis Higher Test C Intelligence test or GEFT elicit in feminine females feelings or behaviours (e.g. anxiety, low frustration tolerance, negative self-statements, poor self-evaluations) that are
incompatible with task performance, or whether feminine females lack specific cognitive skills or style that are necessary for effective cognitive performance, cannot be ascertained from the present study. Perhaps, the feminine characteristics of females have resulted from a reinforcement history that devalued academic and intellectual achievement in favour of interpersonal and social concerns and proclivities. The lack of reinforcement for the successful completion of intellectual tasks may contribute to the relatively poorer performance of the feminine female. Poorer performance of highly feminine females also may be partially explained by the content of task items. It is possible that the testing situation may interact with the characteristics of sex-role identity.

The results for males are not as conclusive as those for females. The finding that lower masculinity was associated with higher performance on the Otis suggestive of a positive relationship between femininity and performance tentatively support a sex-reversed sex-role identity hypothesis. The studies of Silverman, Buchsbaum & Stierlin (1973) show no relationship between the sex-role identity of males and field-independence. What can be said is that males who have not embraced the traditional sex-role stereotype regarding role behaviour, demonstrated higher levels of intelligence relative to sex-stereotyped males. Perhaps an interaction explanation is required to explain why it is that only certain non-masculine males have above average ability, and why it is that a proportion of males of above average ability have not accepted the traditional sex-role stereotype.

The differences in performance of the female sex-role groups on the Otis Higher Test C Intelligence test does experimentally validate the theoretical utility of the Spence et al. (1975) categories of sex-role identity and does extend our
knowledge concerning the relationship between the psychological characteristics of masculinity and femininity and mental ability. The decision to employ an alternate framework and methodology of measurement to describe sex-role identity does appear warranted and is in accord with the views of Constantinople (1974), and Bern (1975).

Further research is needed to identify those specific behaviours and attitudes that may be inhibiting the performance of feminine females. A more detailed study of the psychological and intellectual background and make-up of females who are high in masculine and low in feminine sex-role orientation may provide valuable insights as to the social, biological, or other conditions which contribute to their effective performance. The relationship between hormonal differences among different sex-role groups and mental ability may also need to be explored (cf. Bradshaw & Nettleton, 1983).

References


